The Book of ALTERNATIVE PHOTOGRAPHIC PROCESSES

THIRD EDITION

Christopher James

"*The Book of Alternative Photographic Processes*, Third Edition, is extraordinary. Not only in its scale, depth of research and richness of information, but in the way it is written. It makes complex information about chemistry and process spellbinding and weaves social and photographic history into a captivating read that is simultaneously entertaining, accessible and richly informative. This is no mean feat. As somebody who does not take photographs, it has given me even more of an appreciation for those who used (and continue to use) these methods and a fuller understanding of the beautiful magic of traditional and contemporary alternative processes of photography."

Susan Bright
Author, Educator, Assistant Curator of Photography,
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"Christopher James' new edition has expanded right alongside the boom in older techniques, as contemporary artists reach backward to look forward. Covering processes from the discoveries of the 1830's to the latest inventions and re-inventions, Christopher's book includes an astonishing breadth of work and a wide range of artists that show just how rich this field has become. If you need any proof that handmade photography is alive and well in the digital age, here it is, in spades."

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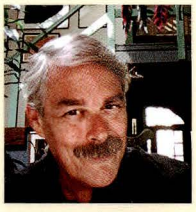

Christopher James is an internationally known artist and photographer whose photographs, paintings, and alternative process printmaking have been exhibited in galleries and museums in this country and abroad. His work has been published and shown extensively, including exhibitions in The Museum of Modern Art, The Metropolitan Museum of Art, The George Eastman House, and the Philadelphia Museum of Art. The first two editions of his book, ***The Book of Alternative Photographic Processes***, have received international critical acclaim and are universally recognized by artists, curators, historians, and educators as the definitive texts in the genre of alternative process photography and photographically integrated media and culture. This new third edition has been significantly expanded with many new processes and over 700 images. Christopher, after 13 years at Harvard University, is presently University Professor and Director of the MFA in Photography program at Lesley University College of Art and Design. His web site is www.christopherjames-studio.com

The Book of Alternative Photographic Processes

Third Edition

Christopher James, *Kassi*, Mexico, #10, 2007
(Courtesy of the Artist/Author)

Christopher James

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Christopher James, *Writing is Difficult*, 2007
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THE BOOK ARTIST'S WEB SITES

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F

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G

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J

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K

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M

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Scott McMahon	http://www.scottmcmahonphoto.com
Cotton Miller	http://www.cottonmiller.com
Daniel Baird Miller	http://www.danielbairdmiller.com/home
Wolfgang Moersch	http://www.moersch-photochemie.de
Beth Moon	http://www.bethmoon.com
Phillipe Moroux	http://www.xs4all.nl/~moroux
Colleen Mullins	http://www.colleenmullins.net

N

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O

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P

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Luis Gonzalez Palma	http://www.gonzalezpalma.com
Tom Persinger	http://www.tompersinger.com
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Michelle Pritzl	http://www.michellerogerspritzl.com
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Molly Rapp	http://mollyrapp.carbonmade.com
Eric Renner	http://www.pinholeresource.com
Holly Roberts	http://www.hollyrobertsstudio.com
Michele Robins	http://www.michelerobinsphotography.com
Mike Robinson	http://www.centurydarkroom.com
Lindsay Rogers	http://www. LindsayRogersStudio.com
Ernestine Ruben	http://www.ernestineruben.com
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Laurie Snyder	http://www.lauriessnyder.com
Leah Sobsey	http://www.leahsobsey.com
Jess Somers	http://www.jessicasomers.com
Lucy Soutter	http://www.lucysoutter.com
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Nancy Spencer	http://www.nancyspencerphoto.com
Keliy Anderson-Staley	http://www.andersonstaley.com
Rachel Brace Stille	http://www.rachelbracestille.com
Linda Stemer	http://www.blueprintsonfabric.com
Joni Sternbach	http://www.jonisternbach.com
Jane Alden Stevens	http://www.janealdenstevens.com
S. Gayle Stevens	http://www.sgaylestevens.com
Craig Stevens	http://www.craigstevens.me
Jerome Sturm	http://www.jsturmphotography.com
Dick Sullivan	http://www.thecarbonworks.com/blog
Bob Szabo	http://www.robertszabo.com

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Lisa Wiltse	http://www.lisawiltse.com
Kelly Wrage	http://www.kellywrage.com

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DUBLIN STUDIO WORKSHOPS

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If you are seeking a personal and customized workshop experience, where you decide on the number of days you would like, the type of process, or processes, that you wish to work with, and the specific scope of what you would personally like to learn while working with me, (without the crowding that comes with a larger workshop experience), consider exploring this opportunity by taking a customized and private 1 to 3 person workshop with me in my Dublin, NH studio. Dublin is in the southwest corner of the state, near New York, Massachusetts, and Vermont, and has been an artist's colony and summer destination for travelers for well over a century. Located near The MacDowell Colony, Dublin features a perfect New England environment, great hiking on Mt. Monadnock, a deep-water swimming lake, and outstanding diversity in dining and local B & B and motel lodging. Manchester International Airport is 45 minutes away and Boston is an hour and 40 minutes by car.

INTRODUCTION

Thinking While Writing: March 2014

Six months ago, my wife, Rebecca, sent me an email (which was odd considering she was laying next to me in bed) after reading a new reader's Amazon review for the 2nd edition of my book. The generous reviewer had written, ". . . James' book revives the discussion about "Imperfection" and its artistic merit. Every alternative print is unique and often imperfect. For the ancient Greeks, perfection was a prime requisite for high art and beauty, and this concept was revived during the Renaissance in art and in architecture. The question is whether artists today "want" to achieve perfection. The very beauty of alternative processes is its imperfection and unpredictability, and therein lies the beauty of such images. And each image is unique and irreproducible. There is also the great appeal of a haptic (referring to the sense of touch) approach that is missing in digital photography and in so many other high technology fields."

Rebecca, who is inclined to see all things within their relationships to the natural world, wrote, "The beauty of alternative process **IS** the imperfection of these images . . . and our desire for it today stems from the cultural erosion of our connections to nature."

This example of a dialogue, in which a discussion of syntax instigates a philosophical conversation about important things that are lost, or missing, is of huge interest to me . . . and especially true when considering the hand-made alternative photographic image and our emotional connections to the unique and imperfect beauty of those processes and their artifacts.

Six months after Rebecca's bedtime email, I was doing some research on critical thinkers who had been engaged with the brand new medium of photography during the mid 1800s. I spent a few hours considering their unique experiences with this amazing invention as they were not only seeing the first images from the new medium, they were having dinner with the people who were making them. I began to make some notes on what I had been reading and thinking . . . and as I wrote, working on the laptop in my Dublin, NH studio at the end of summer, this exposition began to take shape and turned into this piece that I am offering to you now.

* * * *

The more perfectly you render an imperfect thing, the more inevitable the imperfections of that thing must be acknowledged. In the case of photography, where the primary intention was to reflect the perfection of nature, it is a feeble endeavor. One of the big questions on the table in the mid-1800s, being discussed by athletic and agile intellects such as Lady Elizabeth Eastlake, Sir William Newton, and Peter Henry Emerson, was whether the imperfections of photography were actually closer to our aesthetic feelings for art because the imperfections represented our personal experiences with nature, rather than nature itself . . . in a manner similar to representational painting.

In 1857, Lady Elizabeth Eastlake surmised that beyond mere light and appearance, which are the perfect scientific abilities of the medium, are found the beautiful conditions of photography that reflect the viewer's imagination and personal life references. From this vantage, when greater precision and detail are added to the image (she used the word *superadded*) the eye will miss the personal truths that function as the visual connective and emotional tissue between the viewer and the work.

Sir William Newton created a great scandal within the Royal Photographic Society by uttering aloud his personal opinion that pictures taken slightly out of focus, with uncertain and ill-defined forms, were more artistically beautiful than perfect still life reflections in the manner of a 17th century Dutch painting; those lovely and warm renderings of dead game, hanging root vegetables, and bowls of fruit of what was on the tables owned by the painter or painter's patron at the time.

Newton essentially offered the conflicting proposition that the worse photography performed its assigned job, the more successful it was at representing the ideals of art. Newton's hypothesis, along the lines of

Emerson's great torment over whether photography could be enjoyed as an art or a science, created one of the first photo-critical firestorms. Sir Newton's argument was met with a lazy response that the possibility of capital "A" Art in the midst of all this perfect science was heresy. A simple example of how to see this conflict is to compare a reproduction of a saint named St. Matthew on a museum greeting card rack to one on a plaster panel painted in full-blown mystery by Caravaggio. Emerson insisted that photography ranked as the lowest of all the arts because the individuality of the artist had no room within the science to show itself. He was wrong of course. When the contextual mystery is missing, so too is the human experience and its connection to life . . . which is always a mystery.

If I may, there is an equivalent reference in the mammoth color photographic prints that are so currently in vogue in graduate schools, museums, and "cutting-edge" galleries. These humungous images strip the human experience away and amplify the premise that photographic science and reproduction technology is capable of enhancing and shocking your aesthetic experience by showing you a pimple as large as a manhole cover . . . big deal.

Let's begin . . .

From its inception, photography has never been a single, identifiable, technology or process. Throughout its evolution, the medium has been a slowly moving glacier of change, adaptation, and obsolescence followed closely by another metaphorical glacier influenced by the heat of science, industry, technology, aesthetics, and cultural. I think of these separate entities as I do the boulders I find in the woods near my studio . . . evidence of the glacier's melting. Each of these transformations, the great majority of them overlapping, has ushered in an ever-greater democratization of photographic image making and resulting public adoption and adaptation. Each of these cycles have had the same family name regardless of how odd the offspring appeared . . . and they have always shared the genus, in a philosophical sense, a class of things that share common characteristics, and DNA of photography . . . that of making marks with light.

In 1829, in a letter to Nicéphore Niépce, Louis Daguerre wrote the well known sentiment that he was *burning with desire* to see Niépce's experiments from nature. Not a great deal has changed since that sentiment was expressed except for the way in which the desire to make and look at photographs is satiated. In the midst of our current photographic and digital revolution there is the unlimited potential of integrating it all under the proverbial big-tent of alternative photographic practice and possibly making this the most exciting time in the photographic arts in over a century.

Photography was set free from the yoke of representation several decades ago. It is unnecessary, and ultimately counter-productive, for an artist using the language of photography to be required to choose one style of image making over another. The most constructive strategy is to take the parts that work for you, from every discipline that interests you, and to incorporate them into your photographic vision and workflow. I love that I can make pictures on my iPhone and send them to you. I feel very differently about my wet collodion ferrotypes and ambrotypes. My personal investment in learning to make them gracefully was quite different. As a result, the investment of time bestows a greater value and meaning upon them for me.

When I make a wet collodion plate, I make it forever. When I make a picture with my iPhone, I make it for the moment. Philosophically, it is the difference between making your Eggplant Parmesan with a hand-made sauce that has been simmering for 24 hours and buying you a frozen version of the same meal that I'll heat in a microwave oven. They are both Eggplant Parmesan, but they are both not Eggplant Parmesan. One you will talk about each time you visit, the other you will easily forget.

The invention of photography, and its ultimate mass democraticization, as represented in the inexpensive and easily procured tintype and ambrotype, changed the role of the painter in society. For the first time, it was not a requirement to be wealthy or powerful, as an individual or institution, to commission a painter to depict a likeness of oneself . . . or of one's theology or position. Faced with this reality, painters were excused from the obligation of representing the way a subject actually looked and were compelled to explore the way it felt, what the subject might represent metaphorically, how the artist's perspectives could be discussed conceptually and figuratively rather than objectively, in harmony with the unique impressions that the artist expressed with her paint.

Where a photograph's task once was to relentlessly recreate perfection, often more perfect than the human eye could ever hope to experience, with the exception of the accidental *artifact,* it lacked the element of *gesture* that a painter, faced with the task of pleasing the vanity of others, could inject in a representational painting. My grandfather, Alexander James, a gifted painter and studio partner of John Singer Sargent, used to solve the problem when painting *pot-boiler* (because they kept the soup-pot full) portraits of admirals, and wealthy patrons, with a bold stroke of red or green as a highlight on an ear, edge of a nose, or on the arch of an eyebrow . . . . his personal tip of the hat to the artist within.

This simplicity of gesture, so prevalent in the earliest days of the medium, became an identifiable strength that was associated with the adventure that reflected the beginning of photography. This would continue into the early 1900s in the hands of photographic artists using commercially produced flexible film and silver gelatin paper. Often, the emotional reflection of that spontaneity was the result of a movement unfrozen, or chemical aberration, fortuitous accident, or post-print manipulation . . . enchanting qualities found in most hand-made alternative process work.

From this perspective, as digital imaging absorbs the roles of photography and adopts the attributes and qualities of photographic representation, is it possible to tell the difference between the original analog and the new digital? Wasn't that the point? Is photography now free to become, as painting did, something entirely new?

I believe it is.

In 1859, Charles Baudelaire wrote, "If photography is allowed to supplement art in some of its functions, it will soon have supplanted or corrupted it altogether." I wonder if he ever considered the implications of being wrong? And what would he think about the state of the medium today?

I am inclined to believe, especially in an academic sense, that photography may no longer need to insist that it be curated and studied as an exclusive medium. It's entirely possible that its greatest opportunity lies in being integrated with, and layering its influences upon, all of the arts... and not being subject to the visual theologies that fracture the discipline into "schools" of disciples who think and see what is often simply nothing more than a new set of party clothes for the Emperor.

Regardless, many are still in a defensive crouch about "their" medium and concerned with many of the same issues that permeated through the salons of the mid-late 1800s and the Photo Secessionists . . . where critical judgment was evaluated by the expected perfection of process and not by its artistic expression or the beautiful conditions of imperfection that reveal the artist's, and the viewer's, personal life references and imagination.

To me, photography is unquestionably evolving into a medium that will soon require a new definition. From an alternative process perspective, one that I believe is the spear tip in this new adventure, the flexibility of these processes present a perfect marriage partner to almost all of the arts that are willing to see what will happen if they take the proverbial plunge. To the upcoming generations of photographic artists, schooled with the pixilated imagery and battery-dependent tools of digital imaging, using one's hands to make an image is a persuasive argument simply because it is almost always imperfect . . . and as a result, a profound and precise reflection of us all.

About the Third Edition

If you take a moment to consider the things that you do best, you will come to the reasonable conclusion that your unique talents are ones that you taught yourself. This is the truth of how the animal kingdom learns . . . it is called *play.* It is play that has guided my teaching. It is play that delights the mind and propels the process of teaching yourself just for the joy of it. And that joy is the philosophy of this book.

This third edition of The Book of Alternative Photographic Processes represents a significant part of my evolution as an artist and author . . . and as a teacher and mentor of artists. For the last four decades I've been modifying, editing, and adding to, this body of alt process knowledge and long before the publication of the first edition, in 2001,

most of the ideas in this book were photocopied and handed out to my students as working notes. One day, as I was waiting for my next seminar to begin, Tom Schin, from Delmar Thompson, unexpectedly dropped in to my office at The Art Institute of Boston, introduced himself, and asked me if I thought I had a book in those notes. I said, "yes, I did" which validated one of the prime tenets of my teaching . . . that you had better be ready when you get lucky.

The writing has a greatly expanded historical and personal narrative now and aside from the hundreds of reproductions and illustrations, the three editions represent what "we" have learned together; pertinent and peculiar observations, techniques, anecdotes, and a solid dose of interesting, and often irreverent, history to give perspective on where it all came from.

There are also a lot historical rumors, to enhance the connections between the processes and the people that were "burning with desire" about them. The writing represents the philosophy of how I teach alternative processes, always encouraging my students to be confident in their craft but never at the expense of their inspiration or ideas. I encourage perfect imperfection and playing with ideas about how photography can be integrated with all forms of visual expression and communication. To paraphrase Mark Twain . . . it hardly matters when your technique is great if your imagination is out of focus.

As always, I've organized this book to equally meet the needs of several different audiences. For teachers, the book is designed to be flexible and compatible with individual teaching styles. I have done my best to make the contents interesting, clear, and accessible to high school and college-age students, as well as professional artists. As well, a significant percentage of the illustrations in this book were created by students and their teachers, and the images are easily integrated with historical archetypes. This comparative collection "sets the bar" and demystifies the critical and historical judgments of what is good, and what is not so good.

For the student, this edition is designed to be fun and to work as a comprehensive, inspirational and technical resource, addressing historical and interdisciplinary connections from the beginnings of photography to its present. The word "student" applies to all of us and encourages the embrace of serendipity and accident as a way to avoid the cliché. Far too often, alternative process work is all about someone's ability to get a decent print instead of showing that the process has been used to illuminate a great and creative concept. It is my intention, through the illustrations, to celebrate the art instead of the surface.

This third edition is a resource for photographers and artists of all abilities, in any medium, where marking with light is in play. It is increasingly clear that nearly all graphic disciplines, and media, can be accommodated by the integration of alternative processes. In essence, much of the book documents the marriage of 19th and 20th century handcraft, science, and romanticism, with 21st-century technologies and critical theory.

New to this edition . . . a major re-write of the last two editions, with significantly extended chapters packed with new imagery and information, condensed chapters that mirror changes in the genre, and many more interesting historical characters and stories to make the learning real. I've made every effort to avoid a "this is the only way it can be done" pedagogical model and I've written the text as though you were working right next to me and we are in the midst of a conversation. If you are old enough, we are having our second beer and laughing about how much fun this is.

The first thing I tell my students when I meet them for a class, seminar, or workshop is, "I love this shit." The next time we meet, it is what they tell me! Success in alternative processes blossoms from a willingness to enjoy image making for the pleasure of the process rather than the product. We play. We learn to hunger for the accidental and consider quirky outcomes as opportunities for greater self-expression! Much of what the reader discovers will emerge as a result of play and if you don't embrace the concept of play you probably won't learn a lot about anything in life.

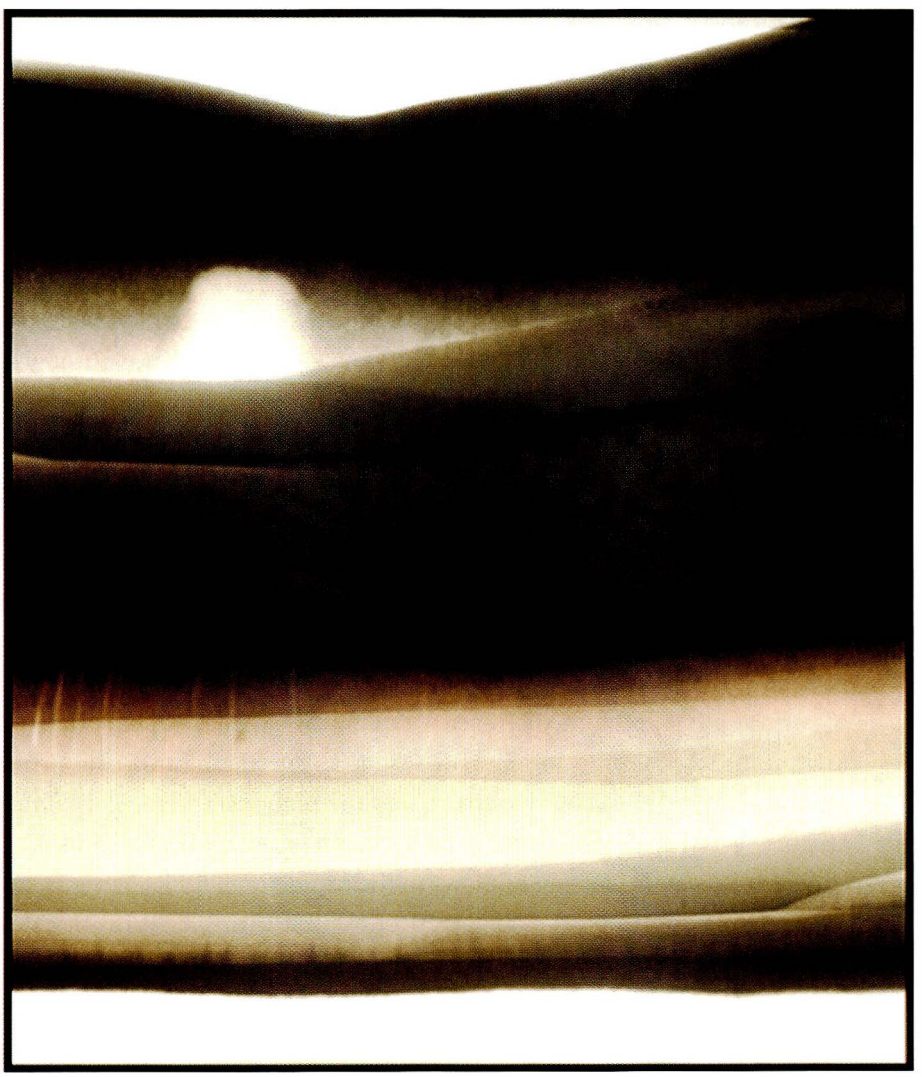
Enjoy!

Christopher James 2014

www.christopherjames-studio.com

The Book of Alternative Photographic Processes

Third Edition



Christopher James, *Solargraph* #30, 1970 (Master's Thesis, RISD, 1971)
(Courtesy of the Artist/Author)

Making Art with a Box of Air: The Pinhole & Camera Obscura

OVERVIEW & EXPECTATIONS

As this is the first chapter, it's the perfect time to introduce you to my book's personality and to offer you a pretty clear idea of what you can expect on your way through it. Most people consider my writing style to be reader-friendly and conversational, pretty much the way you would experience having a conversation with me. I flinch when language that is supposed to make you fall in love with the subject of the words disguises itself in academic buzz-speak . . . such as *paradigm* or *pedagogy* or hearing politicians say, "at the end of the day" . . . so I will do my very best to stay reader-friendly so that your experience is an enjoyable one. My intention is to entertain you, educate you, and to make you fall in love with alternative process image making.

It may seem a bit odd to begin a book on alternative processes with a chapter about a piece of equipment, but there is a reason for it. I needed a place to give you a compressed overview of our pre-photographic experience with light-based images, some early photographic history, and an initial look into the myriad scientific, social, cultural, and artistic connections that revolved around the camera obscura and the pinhole camera. This is the first of the A Little History sections, and although it may appear to be extensive, it is this pre-history that sets the stage for a great deal of what follows in the book. You'll find A Little History beginning nearly every chapter, and I have made an effort to fill it with salient historical references as well as the odd, ironic, and silly things that permeate most human endeavors. Everyone enjoys a good story, and the characters who created this medium were responsible for some great ones.

You'll also get a little science that briefly explains how the pinhole camera works and instructions on how to make one. You'll learn how to test your pinhole camera and how to use it. Also included are easy solutions for those of you who are "handmade impaired," which direct you to resources, images, and Internet sites for more information on this wonderful and idiosyncratic way of making images.

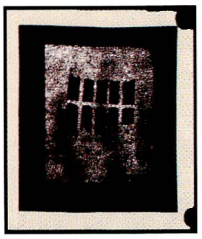
As in every chapter in the book, you will get an abundant number of historical and contemporary images to make the visual connections and to inspire you to make your own contributions to this history.

Figure 1–1

Christopher James, *Kafka-Man, Venice,* 1987

I made this image using a Diana plastic toy camera that I modified with a Kershaw 450 shutter (keeping the single-element plastic lens of course). The 120mm negative was then projected to a direct duplicating film (no longer made), which was used as a contact negative for this palladium print.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

The Dark Room Conception

First the legends: the earliest records regarding the camera obscura (meaning "dark room" in Latin) were written in the fifth century BCE (before common era) diaries of Chinese philosopher Mo Tzu. In his journals, he contemplated the effects and nature of light and the reflection presented by an inverted image when light, and the image carried within it, passed through a small hole and landed upon an opposing flat surface upside down. Mo Tzu also advocated a philosophy that was based on the principle of loving everything . . . a fifth century BCE hippie. Just for the record: Mo Tzu, in many writings about pinhole history, is incorrectly identified as the philosopher Lo Tzu (Ti).

Much later, somewhere in the vicinity of 350 BCE, Aristotle (384–322 BCE) witnessed corresponding phenomena during an eclipse and included the concept of a camera obscura in his curriculum and syllabus. Evidently the next time someone thought the optical magic of the camera obscura was worthy of investigation was nearly 1,300 years later when the renowned Arabian mathematician and physicist Ibn al-Haitam (c. 965–1040) used a pinhole aperture, as had his hero Aristotle, to view an eclipse.

Ibn al-Haitam (also known as Ibn al-Haytham, al-Hazen, al-Basri, and al-Misri) was a big fan of the third of the big-three Greek philosophers (Socrates, Plato, and Aristotle) and it was Aristotle's writing that persuaded al-Haitam to abandon his dedicated philosophical religious studies in order to adopt a life in pursuit of science and corroborated truth. Al-Haitam is reputed to have penned nearly 100 separate works (of which only fifty-two are known today) explaining diverse inquiries into subjects, such as optics, the linearity of light, and the "squaring of a circle," a term applied to one of the three great problems of classical geometry and the basis of the phrase meaning "doing the impossible." See Da Vinci's *Vitruvian Man* for an example of a 99.8% attempt.

In al-Haitam's experiments with candles and paper screens punctured with small apertures, he described

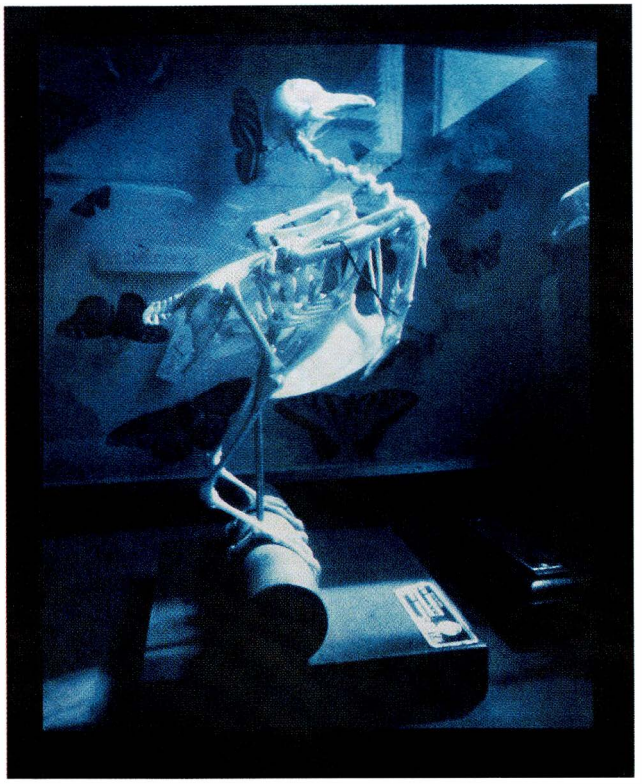


Figure 1–2
Jesseca Ferguson, *Bird Skeleton*, 2005
Boston artist Jesseca Ferguson has been an influential force in the teaching of alternative processes for decades. Here is an example, among several in the book, of a pinhole cyanotype.
(Courtesy of the Artist)

the linear propagation of light and how a light-image, traveling through his tiny paper apertures, became more focused as the aperture was made smaller . . . like going from *f.* 1.5 to *f.* 64. Al-Haitam expressed his amazement over this observation in his book, *On the Form of an Eclipse,* in 1038. The dissemination of this work may have led to the following story regarding the practical applications of the camera obscura.

A thousand years ago (give or take a few years), nomadic tribes in the deserts of the Middle East were fully aware of the wonder of light-writing images. In the beginning, so the story goes, these wanderers would generally rest during the intense heat of the day and travel at night when the conditions were less difficult for man and beast. In their tents, protected from the sun, they could rest and gaze out of their tent openings, scanning the horizon for possible problems—relatives, perhaps, who might come from that general direction. Occasionally, they would take a glance at a shimmering, upside-down

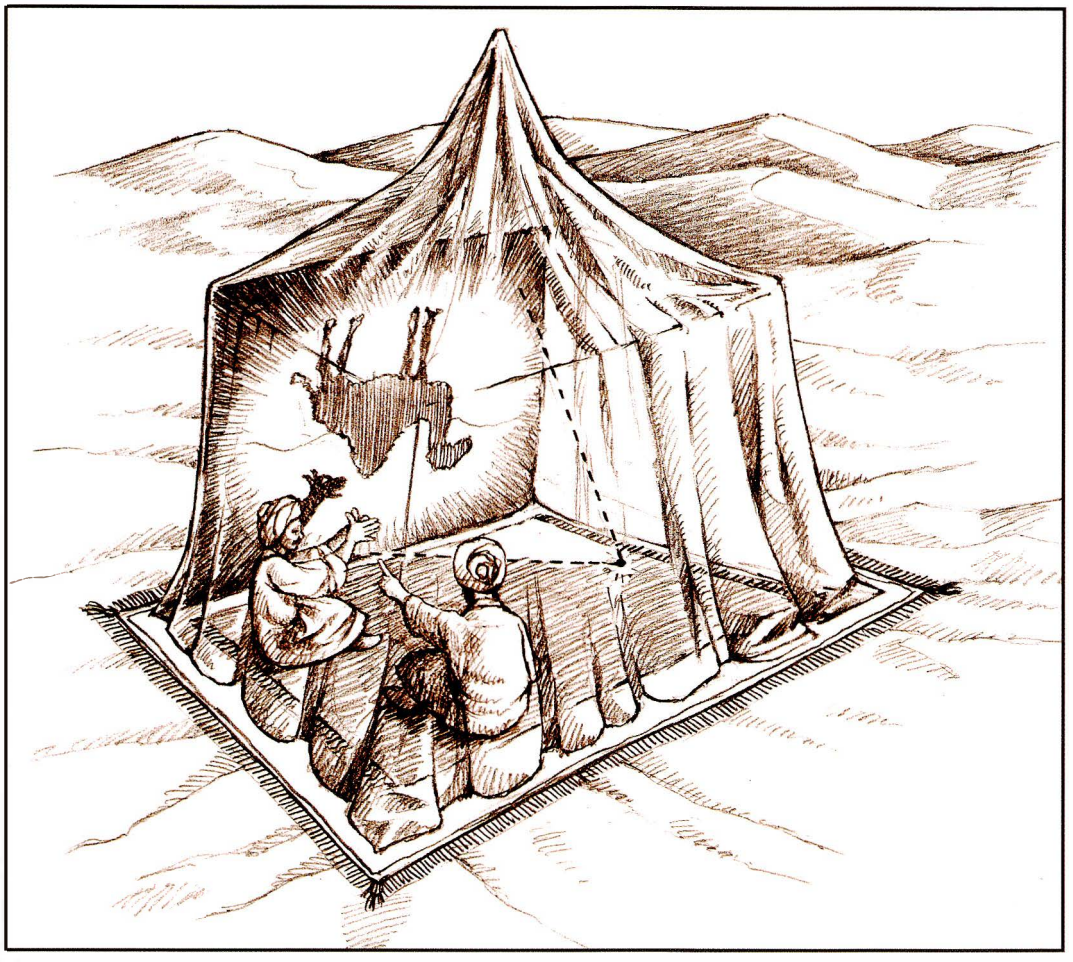


Figure 1–3

Joe Boyle, *Finger Puppeteer in Camera Obscura Tent*

My illustrator, Joe Boyle, is a graduate of The Art Institute of Boston (now the College of Art and Design at Lesley University). Joe is working as a professional illustrator, and I hired him to do the icons and illustrations in this book. This is one we came up with after discussing how you might pass the time in a camera obscura tent in the desert during the heat of the day . . . . Making up finger puppet stories seemed like a good idea.

(Courtesy of Joe Boyle)

"shadow picture" of the view from the other direction . . . the one behind the tent. This image was projected upon the solid wall of the tent. To make this inverted image, they would poke a small hole (the aperture) into the wall of the tent that was at their backs. The landscape of that view, illuminated by the intense reflections of the sun and sand, would, as in a camera, flip and project an upside-down version of that scene on the tent wall opposite the hole. Lots of holes, lots of views, as long as the tent was somewhat dark, and the resting nomads could relax knowing that they were alone and free of company. Thus, the basic principles of photographic optics were exploited for purely practical reasons. Perhaps this was the knowledge that launched al-Haitam's inspiration.

Officially, however, historians give the credit to the remarkable Greek mentor–philosopher, Aristotle, who noticed that light rays converged in order to pass through small holes that had been punched out of opaque objects. Aristotle also noted that these same light rays diverged on the backside of the opaque plane in exactly the same way they went through the front in straight lines. As a result, the image illuminated was seen upside down and in proportion to the original. Aristotle's experiments also demonstrated that the shape and proportions of the camera obscura, such as the focal length (distance from the aperture to the wall of the camera opposite the aperture) had a direct relationship to how the image was seen on the final

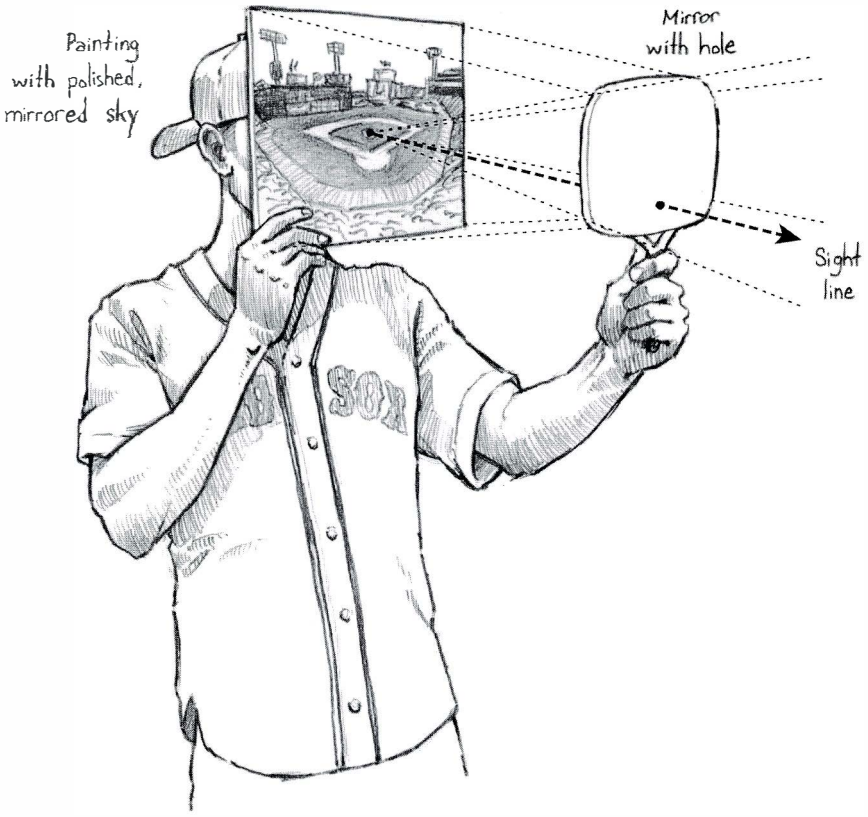


Figure 1–4
Joe Boyle, *Brunelleschi Perspective Demo at Fenway Park*
According to Brunelleschi's biographer, Antonio di Tuccio Manetti, in his book The Life of Brunelleschi (1970), in order to constrain the viewer to place his eye at the center of projection, Brunelleschi *". . . had made a hole in the panel on which there was this painting; . . . which hole was as small as a lentil on the painting side of the panel, and on the back it opened pyramidally, like a woman's straw hat, to the size of a ducat or a little more. And he wished the eye to be placed at the back, where it was large, by whoever had it to see, with the one hand bringing it close to the eye, and with the other holding a mirror opposite, so that there the painting came to be reflected back; . . . which on being seen, . . . it seemed as if the real thing was seen: I have had the painting in my hand and have seen it many times in these days, so I can give testimony."* *(Courtesy of Joe Boyle)*

projection surface. What Aristotle could never figure out, however, is why the image from a geometrically squared aperture would result in a circular image. In any event, there was no concept of saving the image; it was just interesting to look at and trace.

In the early 1400s two Italian gentlemen had a significant influence on the way artists would observe and record three-dimensional objects and space on a flat two-dimensional plane, such as paper, canvas, or a wall destined to become a fresco. In the first decade of that century, Italian architect Filippo Brunelleschi (1377–1446) was a prominent exponent of one-point perspective**, which** seemed suddenly to be a topic of conversation everywhere in Europe. Brunelleschi's visually odd, photographically rendered architectural tracings from the camera obscura solidly support this historical impression. Brunelleschi, by the way, won a major architectural competition to design the prominent and iconic dome of Florence's Santa Maria del Fiore.

Coincidentally, the famed Italian astronomer Paolo Toscanelli (1397–1482) installed a bronze plate with a pinhole aperture in a window of Santa Maria del Fiore, and on sunny days, a projected image of the sun can be clearly seen on the floor of the church as a notation of time. A wonderful book on Brunelleschi and his dome written by Ross King is well worth reading: *Brunelleschi's Dome: How a Renaissance Genius Reinvented Architecture.*

Brunelleschi had solved the great conundrum of how to make elements in a painting look real. In a well-noted observation, he used highly polished reflective mirrors, each with a single eyehole for linear sighting and one with the primary subject painted upon it, to calculate the scale of objects within the painting so as to be in perspective harmony. According to Brunelleschi's biographer, Antonio di Tuccio Manetti, in the late 1400s, Brunelleschi *". . . had made a hole in the panel on which there was this painting; . . . which hole was as small as a lentil on the painting side of the panel, and on the back it opened pyramidally, like a woman's straw hat, to the size of a ducat or a little more. And he wished the eye to be placed at the back, where it was large, by whoever had it to see, with the one hand bringing it close to the eye, and with the other holding a mirror opposite, so that there the painting came to be reflected back; . . . which on being seen, . . .*

Figure 1–5
Reinerus Gemma-Frisus, *Solar Eclipse,* 1544 (camera obscura)
Reinerus Gemma-Frisius witnessed an eclipse of the sun at Louvain on January 24, 1544. In his book, *De Radio Astronomica et Geometrica* (1545), Gemma-Frisus used this illustration to document that event. According to John H. Hammond's book, *The Camera Obscura, A Chronicle,* it is considered to be the first published illustration of a camera obscura.
(Photography Collection / Harry Ransom Center / The University of Texas at Austin)

it seemed as if the real thing was seen: I have had the painting in my hand and have seen it many times in these days, so I can give testimony."

The second influential gentleman was Leon Battista Alberti (1404–1472), literally the "point-man" for the illumination of Renaissance artistic theory. In his 1435 treatise, de Pictura, "*On Painting*" (dedicated to Brunelleschi, by the way), Alberti—the dashing eternal prototype of the universal Renaissance Man—described how the perspective idea worked, illustrating the concept of the theoretical, and real, window of the camera obscura and what possibilities that optical instrument offered to the artist on its glass-tracing surface. Alberti called the drawings that came from his own camera obscura "miracles."

In 1490, Leonardo da Vinci (1452–1519) supposedly made the first recorded drawing of a camera obscura and its operation in his *Codex Atlanticus* (1478– c. 1518). He was presumably aware of how an artist could use this contraption in order to chronicle real life by drawing the image projected by the camera obscura. However, because da Vinci wrote with his less dominant hand and backward, it took about 300 years before anyone managed to decode his inspirations and confer proper credit for them. When his thoughts were finally deciphered, it turned out that his words were as beautiful as his paintings and works in marble. He wrote of the camera obscura, "*Who would believe that so small a space could contain the image of all the universe? O mighty process!*"

Shortly thereafter, in 1558, Giambattista della Porta (c. 1535–1615) began writing about the focusing abilities of differently shaped pieces of glass in what would eventually become his published four-volume *Magiae Naturalis,* a major work that he began at the age of 15! There was, however, a problem with the della Porta attribution . . . no one was ever able to verify that

the idea was originally his. This is due to della Porta's politically inspired habit of assigning credit for his discoveries to others who were more socially or politically powerful. For his work on the telescope he gave credit to Frederico Cesi, the president and founder of the Academy of Lynxes, an association for the advancement of science, to which both he and Galileo belonged.

The first person actually credited with placing a lens for the sole purpose of focusing a camera obscura was the infamous mathematician, Girolamo Cardano (1501–1576) in 1550. Cardano was a brilliant individual, but he had a reckless weakness for gambling and socially questionable nightlife activities. His extensive analysis of the "theory of probability" greatly assisted his gambling addiction, but it got him into an incredible amount of trouble with his family and associates.

Cardano's brainstorm of placing a lens on the camera obscura was described quite clearly in 1568 by the Venetian Daniele Barbaro (1513–1570) in his book *La prattica della perspettiva.* Here Barbaro wrote of "*the magic, clouds, water twinkling and flying birds,*" and noticed that one could actually record this magical life by means of tracing, as long as the user moved the tracing paper toward and away from the lens in order to achieve focus. Other historical accounts give credit for the first lens, in 1583, to Giovanni Benedetti, curtly describing his invention as simply attaching a "*solid hunk of non-moveable glass*" to the camera obscura.

Honestly, giving credit for the idea of moveable lens focus is pretty difficult because no one really knows the exact facts of the matter. This is also true when attempting to attribute the first discovery of other related inventions partly because, as the axiom goes, the "winners" write the history. A good example of this, if I may offer you a short detour, is the invention of the telescope, the microscope, and heliocentric theory.

Connections: The Telescope, the Microscope, and Heliocentric Theory

Credit for the telescope had been demanded by several gentlemen, including Hans Lippershey (1570–1619), an eyeglass maker in Holland who, in 1608, came up with the idea of a telescope by watching two children play with discarded convex and concave glass lenses on the floor of his optical shop. Coincidentally, Jacob

Figure 1–6
Jesseca Ferguson, *The Moon*, 2010
This is an example of Jesseca's recent work utilizing a pinhole camera, translating the pinhole negative with Mike Ware's cyanotype process, and then integrating it with found gilded wood, paper, and book boards. *(Courtesy of the Artist)*

Metius of Belgium filed for his own patent rights to the telescope. Although Metius's extensive work with convex and concave optics was well known, his proprietary rights over Lippershey could not be established, and for political and financial reasons, Metius decreed that all his notes and tools be destroyed upon his death.

A parallel anecdote from 1609 described a tale in which Galileo Galilei (1564–1642) got wind of Lippershey's optical invention, while Hans was on his way to Italy to present a show and tell and hopefully sell his new telescope to the Venetians, who were always enthusiastic about owning great art and ideas. According to this story, Galileo quickly reasoned that his appropriation of Lippershey's wonderful idea might be a perfect way to extricate himself from a chronic state of debt, which is always an irksome distraction

Figure 1–7
John A. Whipple (1822–1891), *The Moon*, 1852
This image is reputed to be the first daguerreotype of the moon, although there is some evidence that Jean Claudet made the first in 1845. He was also the first to produce images of stars other than the sun (Vega and the double star Castor and Pollux). This image was exposed at the 15-inch refractor of the Harvard College Observatory, Cambridge, Massachusetts, on February 26, 1852. Prints were made from Whipple's glass plate, albumen sensitized, cyrstalotype process and glued into the world's first photography magazine, *The Photographic Art-Journal* (1853).
(© Harvard College Observatory)

for intellectuals, and Galileo was no exception. Within days, Galileo constructed a telescope, presumably using della Porta's *Magiae Naturalis* book on refraction as his guide, and beat Lippershey to Venice; this nasty bit of industrial espionage proved to be, both historically and personally, a lousy idea. Here's why . . ..

Galileo was an ardent disciple of Polish astronomer Nicolaus Copernicus (1473–1543), who had developed a *heliocentric theory* (*helio* meaning *sun,* and *centric* meaning *center*) declaring that the sun, and not the earth, was at the center of all planetary movement in the universe. While not at all radical as a concept now, Copernican theory was absolutely counter to the ancient and accepted theological view of the Greek astronomer Ptolemy (127–151) that placed the earth at the center of the universe—a concept that later appealed to the mother church in Rome.

Ptolemy had created a system in which all heavenly bodies could be tracked through an indecipherable application of cycles. Better still, Ptolemy had actually determined the latitude and longitude of all 1,022 stars in the sky. You read that correctly: all one thousand and twenty two of them. It is interesting to note that Copernicus's idea about the heavens was originally that of Aristarchus of Samos (310–230 BCE), who had attempted to figure out the distances between the sun, the moon, and the earth with his good friend Eratosthenes of Cyrene (276–195 BCE).

In 1632, the Catholic Church decreed that it had had enough of this Copernican nonsense and reacted rather petulantly when Galileo aimed his telescope at the heavens and publicly proclaimed, approximately 2,000 years after Aristarchus and Eratosthenes and 118 years after Copernicus, that the earth did indeed move around the sun.

As they say, "Heaven forbid," the church, never an institution to adapt quickly to scientific revelations concerning the heavens, officially proclaimed Galileo's announcement as heresy and promptly threw him in the holy jail, where he metaphorically remained guilty of sin until 1992, 360 years later, when the church decided to forgive and forget. As an aside, Galileo is often given credit, along with Anton van Leeuwenhoek (1632–1723) and Robert Hooke (1635–1703), for inventing the microscope.

Leeuwenhoek constructed and used single-lens microscopes and made the landmark discovery of bacteria by bravely examining plaque in the mouth of an old man who, in his entire life, had never cleaned his teeth. Hooke also constructed a lens that he called a "compound" microscope and in 1665 wrote *Micrographia,* one of the most influential biology texts in history. None of these distinguished scientists, however, was responsible for the microscope. The actual inventors were the father and son collaborators Hans and Zacharias Jansen of Middleburg, Holland, who, in 1595, crafted a small working instrument that they christened "the Royal Jansen."

Figure 1–8
Eric Renner & Nancy Spencer, *Evolushin, "on deaf ears"* series, 2001–2006 (Type C pinhole from 4 × 5 negative)
The pinhole images in *on deaf ears* are the result of a collaboration between Eric Renner and Nancy Spencer, . . . the operators of Pinhole Resource. Sixteen years ago they began constructing assemblages, many of which dealt with social issues of human rights, religion, sexuality, and stereotypes. In the summer of 2001, they began photographing segments of their assemblages with a pinhole camera, realizing there was the possibility of an altered context in making 6- to 8-minute exposures of three-dimensional assemblages.
(Courtesy of the Artists)

With the advent of the telescope and the ability to craft and work glass into tools of magnification, scientists placed multiple, and differently shaped, lenses on their small camera obscura holes. They then noticed that, depending on the distance between the aperture hole and the plane where the image landed (the image distance), they could focus and alter the effects of the image.

In 1604, mathematician and father of modern optics Johannes Kepler (1571–1630) worked out a formal relationship between mirrors, lenses, and vision. Five years later, in 1609, Kepler wrote a book titled *Astronomia nova* that had a profound influence on the way scientists thought about light; he was the first to describe the "ray theory of light" to explain vision and what our eyes are able to see. One of the strongest reactions to Kepler's work was seen in the writings of Isaac Newton (1643–1727), who in 1675 demonstrated with a prism that white light wasn't really white at all—it was actually an entire spectrum of colors. Kepler, by the way, is credited with being the first to use the words "camera obscura" together to describe the instrument.

The evolution of these early cameras, which worked nicely as drawing aids for painters, is fairly well documented. But for the advent of photography itself, some chemical discoveries also had to happen. In 1725,

Johann Heinrich Schulze discovered the darkening effects of light on silver salts when he mixed silver-contaminated nitric acid with chalk, creating silver carbonate that reacted to sunlight by turning the compound a dark violet. A very short time later, Swedish chemist Carl Wilhelm Scheele published the book *Chemical Observations and Experiments on Air and Fire*, in which he described how the blue-violet end of the spectrum had a noticeable impact on a compound of silver and chlorine (silver chloride) through the chemical act of reduction, that is, salt to metal.

The camera obscura, however, was still strong and ever influential to the painting and scientific community. Count Francesco Algorotti suggested in his book *Essays on Painting* (1764) that many Italian painters were presumably using the "contrivance," for how else to explain the realism of their drawings. This realism was especially demanded for portraiture, and in 1786, the camera obscura took its turn at providing the wished-for reproducible reality, through the invention of the *Physionotrace* by Frenchman Gilles-Louis Chrétien (1754–1811). If you really wanted to stretch a connective association, you could say that the Physionotrace instrument heralded the beginning of modern art. They didn't know it yet, but painters around the world were about to be set free from the task of forever painting the likenesses of those who could afford it. A photographic likeness, however, was required to guarantee the change.

Mrs. Elizabeth Fulhame's Heavy Metal Party Dress: Catalysis

Afterward something really important happened. In London, on November 5, 1794, Mrs. Elizabeth Fulhame self-published a book with the modest title *An Essay on Combustion, with a View to a new Art of Dyeing And Painting, wherein the Phlogistic and Antiphlogistic Hypotheses are Proved Erroneous*. This grandiose heading described a tedious series of experiments that began in the summer of 1780 because Mrs. Fulhame wanted to devise a way of staining fabric for her dresses with heavy metals such as silver and gold. She hypothesized that this might be possible with the influence of water and light, and her research led her to conclude that water played the major role in catalytic reactions as both the *reducing* and the *oxidizing* agent. She also noted that after those reactions had occurred, the water invariably returned to its original state.

Figure 1–9
Joseph Nicéphore Niépce, *Cardinal d'Amboise*, 1827 (heliograph/sun drawing)
Although Niépce had made salted prints using a camera obscura as early as 1816, he was unable to preserve them. In 1817, he turned his attention to *guaiacum*, a resin produced by a small evergreen from the tropical Americas that would change color and harden upon exposure to sunlight. Niépce also experimented with bitumen of Judea and by 1822 had successfully produced a copy of an engraving. Niépce applied varnish to an etching, making the paper translucent. Once dried, he placed the paper in direct contact with a pewter, copper, or tin plate coated with a thin layer of the bitumen of Judea. The plate was then exposed to direct sunlight in contact with the varnished engraving, hardening the bitumen in proportion to the degree of exposure. Niépce subsequently immersed the plate in a bath of oil of lavender, thinned with a white kerosene solvent, that dissolved the un-hardened/un-exposed bitumen of Judea. *(Copyright © National Media Museum / Science & Society Picture Library)*

More than one photographic historian has suggested that Elizabeth Fulhame's great achievement, the discovery of *catalysis*—the acceleration of a chemical reaction due to a catalyst (from a Greek word meaning to *dissolve*)—was the beginning of photography as an art based on a foundation of scientific and chemical principles. Elizabeth Fulhame's social position as

the well-to-do wife of Dr. Fulhame, her status as an amateur scientist, and her gender resulted in her thesis being ignored by the scientific and academic community.

This quasi-official reaction didn't seem to temper her zeal or curiosity. In a response to the insult she wrote, "*. . . censure is perhaps inevitable; for some are so ignorant at the sight of any thing, that bears a semblance of learning, in whatever shape it may appear; and should the spectre appear in the shape of a woman, the pangs which they suffer, are truly dismal.*"

What Happened . . . Niépce

Nicéphore Niépce (1765–1833) was experimenting with ways to secure optical images as early as 1793, and in a letter to his sister-in-law in 1816, he indicated that he had possibly achieved a solution to the problem by using a very stinky Dippel's Oil (a.k.a., pyridine or bone oil [oil from the bones of animals]) and oil of lavender, also called "spike," which is sold these days as a scent that instills feelings of love and peace. That same year he attempted the second camera obscura–based images by making salted paper (silver chloride) negatives.

As an aside, Thomas Wedgwood, with assistance from Humphry Davy, provided documentation of the first silver chloride images using a camera obscura in the 1790s in a paper for publication in London's *Journal of the Royal Institution* in 1802 and titled it *An Account of a Method of Copying Paintings upon Glass, and of Making Profiles, by the Agency of Light upon Nitrate of Silver. Invented by T.Wedgwood, Esq.* The document was not distributed to any great degree and only describes successful contact prints obtained by pressing leaves, insect wings, etc., upon sensitized white leather and paper and subsequent exposure to strong light. These images were fugitive, as Wedgewood and his friend Davy had not figured out a way to "fix" the "heliotypes/sun pictures" for public viewing.

These first experiments with a camera obscura, by Niépce and his brother Claude, were designed to be used with a unique hot air, engine-powered, lithography press that the brothers had designed together. Their first results yielded negative images that Niépce was only partially able to preserve. In 1817, he turned his attention to gum *guaiacum,* a resin produced by a flower-bearing tree indigenous to the tropical Americas. The resin of Guaiacum officinale, also called lignum vitae or tree of life, was used as a homeopathic remedy and was known for its reaction to sunlight, in which it would change color and then harden and become insoluble. Still frustrated at not being able to capture an image using a camera obscura, he began investigating the possibility of using bitumen of Judea, which exhibited similar light-sensitive attributes.

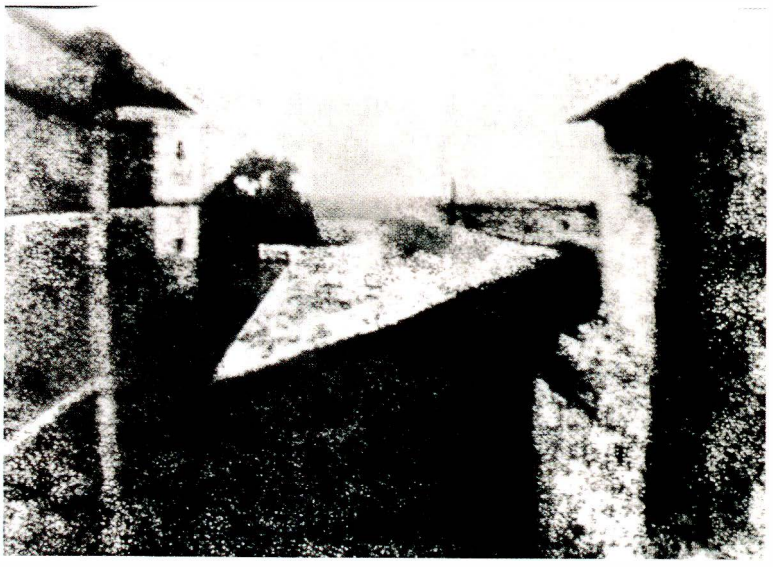
Herschel Describes Chaussier's Fixer, 1819

Curiously, and concurrently, on January 8, 1819, in the *Edinburgh Philosophical Journal,* Sir John Herschel (1792–1871) wrote, "*Muriate of silver* (silver chloride),

Figure 1–10

Joseph Nicéphore Niépce (1765–1833), *"Point de Vue du Gras"/View of the Window & Courtyard at le Gras,* 1826 (heliograph)

This image, by almost unanimous agreement, is the first camera-generated photographic image ever made and is in the care of Roy Flukinger, a guest artist/scholar in my MFA program and senior curator at the Harry Ransom Research Center, University of Texas in Austin. Niépce's original exposure took 8 hours. A year later, Niépce took his results to England, where his discovery was met with a royal rejection by the Royal Society because his process had too many "secrets." In response, Niépce left his examples behind with the scientist Francis Bauer and returned to France to see if he could improve upon his results. According to Roy, Niépce's obscurity overwhelmed him, and he died before realizing just how monumental his work would become in the history of the medium. *(Photography Collection / Harry Ransom Center / The University of Texas at Austin)*



newly precipitated, dissolves in this salt [referring to hyposulphite of soda, discovered by François Chaussier in 1799] *almost as readily as sugar in water*." Herschel's discovery was the foundation for his announcement in 1839, twenty years later, that he could fix a *photograph* . . . a word he is given credit for coining.

Back to Niépce

By 1822, Niépce had successfully produced a copy of an engraving by exposing a glass plate coated with bitumen of Judea that he had placed in contact with an engraving on paper. Bitumen of Judea is a photosensitive agent (light hardens it) that is natural asphalt, like tar. Known since antiquity, it was gathered from the Dead Sea (also known as Asphalite Lake), where it floated, on its own, to the surface from the seabed. The Egyptians used this unique material to embalm the dead before entombment and as a caulking for waterproofing ships. It was also employed as a weatherproof construction material for the tiles and terraces of Babylon. By the nineteenth century, the process for extracting bituminous tar from rock was well known, and it was this generic material that Niépce used, not the exotic type from the Dead Sea.

In 1824, Niépce put a lithographic stone, coated with bitumen of Judea, inside his camera obscura, and after a rather lengthy exposure made the very first "fixed" continuous tone image . . . a landscape. Unfortunately, this image was immediately lost when Niépce attempted to etch the stone for lithographic printing.

The first successful positive photographic image was made by coating a pewter (also silver-coated copper) plate with the light-sensitive asphalt dissolved in lavender oil. The asphalt layer, upon exposure to ultraviolet (UV) sunlight, became less soluble. This is essentially a polymer process similar to the one that occurs in the gum bichromate process when a dichromate is added to a solution of gum arabic, water, and paint, and is then exposed to UV light.

Niépce applied varnish to an etching, making the paper support translucent. Once the oiled paper had dried, he placed it in direct contact with a pewter, copper, or tin plate coated with a thin layer of bitumen of Judea, which he gently heated to cure the coating. The plate was then exposed to direct sunlight in contact with the varnished engraving for 4–5 hours and subsequently immersed in a bath of oil of lavender thinned with an oily, white, flammable solvent known in Europe as *paraffin*. The bitumen that had been protected from light under the lines of the engraving then dissolved, revealing the un-exposed metal. The resulting plate was a negative version of the engraving, but one that could be etched with a Dutch mordant to produce positive prints on a press. He called the process Heliography, and he called the images he made "retinas."

Note: Dutch mordant is a metal-dissolving solution used prior to etching with nitric acid in printmaking for cutting into metal plates. Its recipe is 1 liter water, 125 ml hydrochloric acid, 25 g potassium chlorate, and 25 g sodium chloride. Hydrochloric acid mixed with potassium chlorate makes a highly toxic chlorine gas. It is safer to make your Dutch mordant with ferric chloride, that is, a stock solution of 2 parts water to 1 part ferric chloride. Please consult an expert printmaker for advice and safety concerns before attempting to make a Dutch mordant solution for yourself.

Making a Heliograph in 1824 with a Camera Obscura: A Simple Overview

Step 1 Make a 5% stock solution. Dissolve powdered bitumen of Judea (easy to find in a good art supply or online) in oil of lavender until it gets the consistency of maple syrup. This doesn't work well for the first week or two after it's made, so be patient. Howard Efner, who does a good deal of experimenting with Dick Sullivan in Santa Fe, reports using a 2.5%–5% stock solution of asphalt in xylene. You can substitute xylol, which is fairly simple to find in most hardware stores, for the xylene. If the coating is too thick you'll get flaking during development. The 5% solution is easier to prepare. Store the solution in a dark glass bottle for a week or two, and decant through a filter before using.

- 5 g asphaltum or bitumen of Judea thinned with oil of lavender
- 100 ml xylene or xylol

Asphaltum, asphalt, and bitumen of Judea are all the same thing: the heavy residue from crude oil. Oil of lavender is a solvent, common in Niépce's day, and may be replaced by xylene (a.k.a, xylol). Petroleum-based solvents were, as you might expect, not common in 1824.

The easiest way to prepare the asphalt stock solution is to dissolve the asphalt in xylene, let it stand overnight, and then filter to remove any solids. Roofing asphalt, the stuff that comes in 100 lb cardboard kegs, works just as well as asphaltum from the art store, and you can get a chunk of it for free at a big box home store or a roofing supply company.

Step 2 Meticulously clean a metal or glass plate, rinse it with paint thinner, and allow it to dry. I would surmise that a standard ambrotype glass preparation with Everclear and sodium carbonate/whiting will work perfectly as well.

Step 3 Using a pipette or eye dropper, take several ml of your 5% stock solution and dilute it with an equal volume of xylene or xylol. This will give you a 2.5% solution. You will quickly learn how much stock you need to coat the size of the plate you're using.

Warm your substrate (glass, tin, copper, etc.) and pour on the solution, moving the plate around until the excess has flowed off. Try applying it as you would wet collodion. Allow it to dry flat, or heat the bottom of the substrate, and let the solution evaporate more quickly. By hot drying the plate you will end up with a glossy plate that is dark cherry red in color. If you are using a silver plate, the color will be yellow.

Note: The original technique for thick coatings used in the acid-etched plates was with a miniature paintbrush known as a *pencil*. The asphalt was painted on in thin overlapping stripes that evened out when the plate was heated. The technique for applying thin coats for direct positives was with a leather dauber . . . like those used to apply ink to hand-set type in a chase in the old days.

Step 4 Load this plate into a view camera and expose it to a subject illuminated by UV light for about 8–10 hours. This task will be much easier if you have a camera that has been adapted to accommodate wet or dry plates. You may also use an adapted conventional plate holder that is described in the Wet Plate Collodion chapter. You can buy one from Niles Lund or Jody Ake or make it yourself, which will take you about 30 minutes if you have the right tools. If you are in a hurry, you can make a contact positive in a mechanical UV exposing box. A UV box exposure will take 1–4 hours. It is important to remember that heat will harden the asphalt, so you need a combination of the brightest light with the least amount of heat.

Step 5 After the exposure, you won't see much of anything. Have faith.

Step 6 Immerse the plate in a glass, metal, or enamel tray of kerosene with a little oil of lavender, and the un-exposed/un-hardened bitumen of Judea will dissolve and fall off the plate. You may also use an alternative developer consisting of 25 ml xylene and 75 ml naphtha . . . , also known as paint thinner or mineral spirits and found in almost any hardware store. A 100 ml mix will be adequate for developing an 8 × 10. The more the dissolved asphalt in the solvent, the more control you will have over your development. To remove all of the softened asphalt, you will need to very gently immerse the plate in temperate water. Be careful not to add too much xylene to the solvent mixture, as that may dissolve more of the image than you want to.

Step 7 The image you will see will be a negative.

Step 8 One way that Niépce made positives was to under-expose the plate that had been coated with a matte (or waxed) varnish. If the asphalt coating was thin enough, you may look at the plate at a low angle, and in dim light, you see a positive. This is what you see when you under-expose or under-develop film and hold it up against a dark background.

Step 9 The other way of getting a positive is to use a highly polished silver plate as a substrate. This technique requires a thicker coating and careful development to create a relief image. Once the exposure has been completed, *and this may take days,* develop the plate and place it in a closed box with crystals of iodine. Within a short time, the fumes will penetrate the asphalt layer in proportion to the exposure in the camera obscura. For a line-art image, the silver portions of the plate, un-protected by the varnish, will be iodized, creating a *silver-iodide* compound. When the varnish is removed with a solvent, the silver iodide will blacken when exposed to light . . . , creating a positive image.

Figure 1–11

K. K. DePaul, *In the Third Row*, 2009

This may seem like an odd image to include in a chapter titled *Making Art with a Box of Air,* but I'm thinking about this piece that hangs on the wall of my studio, more metaphorically than technically, as it represents, for me, the meaning of camera obscura. Kim writes, *"This is a composite photo-booth frame of my mother at 20 and one of myself at 20, superimposed. It's about how women try their whole lives to be different from their mothers, but one day you realize that you are actually a version of the same woman."*

(Courtesy of the Artist)

Niépce Delivers a Secret to the Royal Society, 1827

Niépce began experimenting with the goal of setting optical images as early as 1793. Some of his early experiments resulted in images, but they faded quickly. Letters to his sister-in-law around 1816 indicate that he found a way to fix images on paper, but again he was not able to prevent them from deterioration in light. The earliest known surviving example of a Niépce photograph (or any other photograph for that matter) was created in 1825 and is presently housed in a unique public viewing chamber at The Ransom Center and in the care of Roy Flukinger at the University of Texas in Austin. Niépce called his process *heliography,* which literally means, "sun writing."

By 1826, Niépce began exposing scenes directly in the camera and created what is considered to be the first photographic image: *View From the Window at Gras, 1826*. In 1827, Niépce took his discovery to England with the ambition of presenting it to the Royal Society and getting a little credit for his years of dedicated work. Niépce, however, was unwilling to reveal all of his formulas and technique, and this proved to be a significant stumbling block, as that documentation was a requirement of the Royal Society for acceptance. According to an article written by Lady Elizabeth Eastlake ("Photography," *London Quarterly Review,* 1857), Niépce intended to render homage of his discovery to the Britannic Majesty and forwarded actual specimens of his images to George IV.

Unfortunately, for M. Niépce, the Royal Society had a rule that it would not entertain documentation of any discovery that involved a "secret," and this prevented the introduction of his brilliant discovery. Dr. William Hyde Wollaston, the gentleman who invented the camera lucida that befuddled Fox Talbot and discovered that gum guaiacum reacted to UV light, was the only person of sufficient scientific knowledge who took the time to look at Niépce's work and left no written evidence that he was impressed. M. Niépce returned to France convinced that the English were profoundly ignorant of photographic knowledge, or worse, curiosity.

Meanwhile, that same year, Niépce and Louis Jacques Mandé Daguerre (1787–1851) were introduced to one another by an optician named Charles Chevalier. (In some historical accounts, an engraver named Lemaitre initiated their introduction). Daguerre was widely known as an engaging entrepreneur and the proprietor of the famous Parisian Diorama, a spectacularly lit, theater-like experience likely based on Robert Barker's *Panorama* from 1794.

In December of 1827, Niépce was called to England to attend to his brother Claude who had become quite ill. Niépce's travel plans went badly, and so he took the opportunity to arrange a meeting with Daguerre. Some accounts place the meeting in Paris, while other versions put them in a carriage on a train or coach. Put them anywhere and you have the beginning of a really interesting story. Apparently, the two men got along well.

Niépce was transfixed by Daguerre's theatrical Diorama and very much engaged in the idea of capturing the effects of Daguerre's theater with a camera obscura. Daguerre had tried saving an image within a camera obscura with a plate coated with phosphorescent powders. He did indeed manage to record a light-induced image, but it only lasted a very short time, slowly fading from sight, as he, like Wedgewood and Davy or James Wattles and his solar picture drawings in 1828, was unable to fix the image. Essentially, each of the men had interests and abilities that greatly impressed the other, and they agreed to exchange letters. By 1829, after much correspondence, Niépce suggested a partnership in order to finish his work on the heliograph. By 1832, a year before Niépce died, they worked together at Niépce's estate at Gras, inventing a new process called the physautotype.

The Physautotype

The physautotype (fizz–auto-type, from the Greek meaning "a copy of nature herself") can be explained simply. Niépce and Daguerre evaporated oil of lavender or *colophony* (a.k.a., rosin) by heating it until they could harvest the dry and brittle residue that was the byproduct of the evaporation. This was the most difficult part of the process. The byproduct was a dark brown tar-like substance that was both hard and brittle. By dissolving a small chunk of this substance in alcohol and then pouring it over a highly polished silver plate, a uniform photo-sensitive, super-fine, powdery white residue would remain on the plate's surface when the alcohol evaporated. The plate was then loaded into a camera

obscura and exposed to bright sunlight for, well, a very long time. I have heard reports of a few hours for the exposure, while others have recommended going on a vacation after beginning the exposure.

After exposure, the plate is placed upside down in a tray filled with white petroleum/kerosene. Smaller plates can be developed face up, and if you can't easily acquire kerosene, paint thinner can be used as a substitute. The kerosene fumes made the un-exposed areas of the white residue turn clear. The process delivered direct positive images as the white residue remained where it was hardened by light. Depending on how you look at the plate, it can be seen as both a positive and a negative image. This is, according to some, nearly identical visually to a daguerreotype. In my experience, it looks pretty unimpressive, like a faint frozen image on a mirror of rime. In case you're wondering why I haven't put an example of a physautotype in this chapter, it's because I couldn't find one that I liked.

After Niépce died in 1833, his son Isadore succeeded him as a partner in the business with Daguerre. Isidore was a pleasant fellow, but he had not inherited his father's abilities and was unable to produce acceptable results from the processes that his father had developed . . . both alone and in his partnership. Daguerre, feeling very much on his own since Niépce was gone, went to work and found significant ways to improve on the physautotype method.

By 1837, Daguerre had discarded the use of bituminous varnish and substituted highly polished tablets of silver while introducing iodine into the workflow, greatly increasing the sensitivity of the prepared plate and reducing the exposure time from hours to minutes. The images on the plates were latent and were brought to realization by being subjected to the fumes of heated mercury. These toxic mercurous oxide fumes formed minute molecules of highlight and mid-tone values upon those portions of the iodized silver tablet darkened by the light, while the silver ground supplied the shadows.

This was followed by a cessation of the development with a strong solution of sodium chloride (later sodium thiosulphate after Herschel had shown Fox Talbot the fixing ability of this chemical during an afternoon tea) that removed those portions of the image that would have otherwise continued to develop and darken. Another strategy involved sensitizing the silver plates with iodine and exposing them in-camera long enough to print out negative images that could be made positive by wiping the plate and re-exposing.

By 1837, Daguerre possessed a complete process that could render photographic images in minutes. Daguerre had, by then, decided that the invention of "photography" was solely his and began referring to his images as *daguerreotypes*.

Curiosity Cabinets

Daguerre's first truly successful images depicted small tableaus, or curiosity cabinets (a.k.a., *wunderkammern* and *wunderkabinette)* of plaster casts and other odd things he had in the studio. Daguerre titled this series of images *Intérieur d'un Cabinet Curiosité* as a homage to the significant role, these constructed collections played between the sixteenth and eighteenth centuries and their important role in the formal establishment of the public museum. They were, in a sense, a combination of a miniature museum and an intellectual treasure hunt.

These cabinets were filled with marvelous objects of all types intended to stimulate conversation and thought. Each object, natural or man-made, related to another. The riddle of their meaning would be revealed to those who could solve the puzzle of the associations. The cabinets were presented for both entertainment and educational purposes. In a very real way, the curiosity cabinet is a perfect metaphor for the era, akin to the camera obscura (with its interior filled with light curiosities) in its merger of nature, culture, and science.

On January 7, 1839, the exceedingly well-connected French physicist and director of the Paris Observatory, Dominique François Arago, introduced and demonstrated Daguerre's discovery to the French Académie des Sciences in Paris. On September 5, 1839, M. Arago presented Daguerre's manual, *Historique et Description des Procédés du Daguerréotype et du Diorama*. The publication, which became available to the public that month, described the process for the first time, resulting in a state pension for M. Daguerre, thanks to M. Arago's sponsorship of 6000 francs. At that moment, the secret was released, and the daguerreotype became the property of the world.

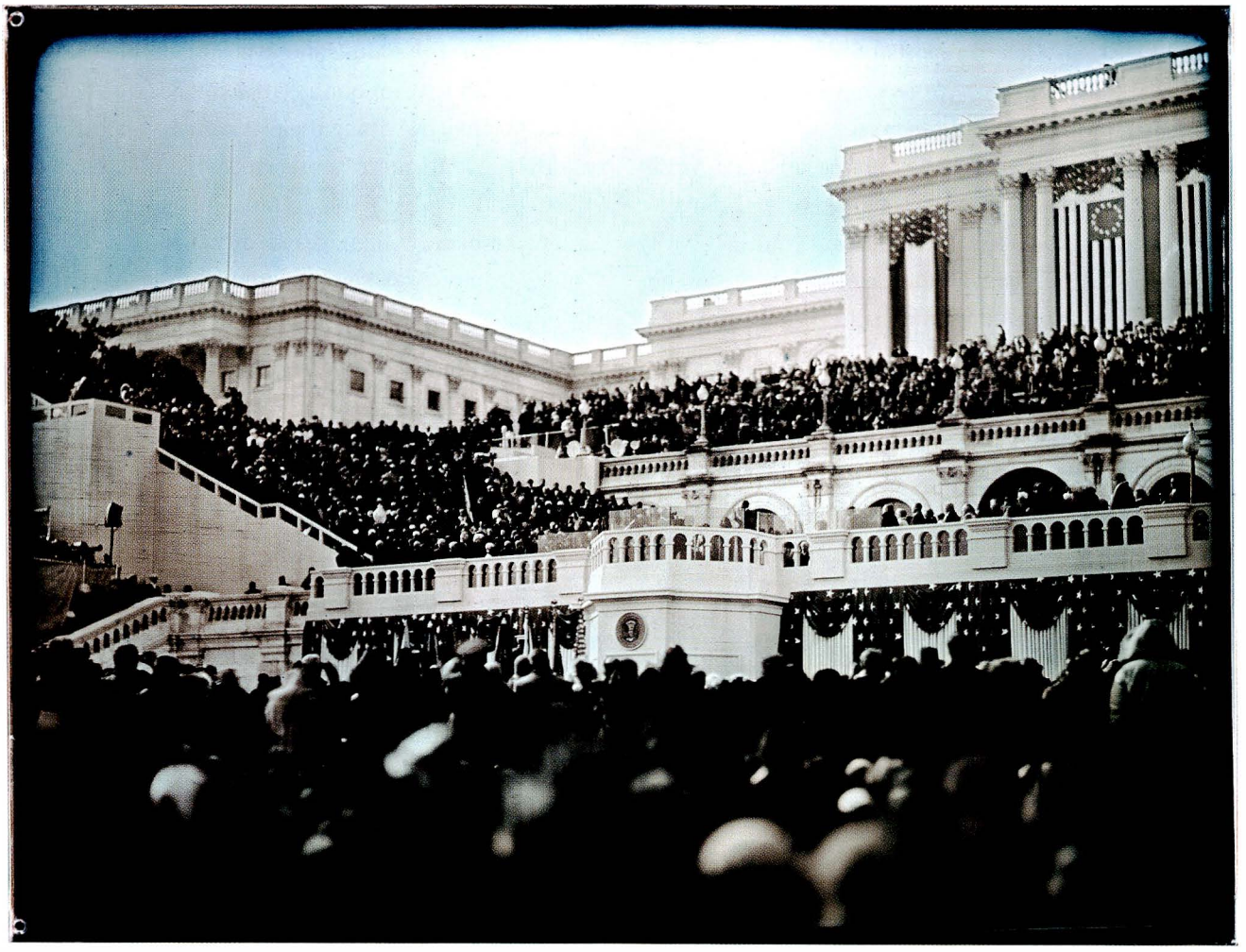


Figure 1–12

Jerry Spagnoli, *Obama Inauguration, Washington,* DC, 2008 (daguerreotype)

Jerry Spagnoli is a contemporary daguerreotypist living and working in New York City and is widely regarded for his technical ability and for seizing the perfect moment to make history with a historic process. This is his daguerreotype of President Obama's 2008 inauguration. *(Courtesy of the Artist)*

Traditional Mercury Developed & Becquerel Daguerreotypes

First, it is important that you do not perform the traditional daguerreotype procedure without some expert advice and training . . . a Jerry Spagnoli workshop in the process perhaps. Daguerreotypes are developed with the fumes of mercury that has been heated to a high temperature . . . —a dangerous mercuric oxide gas that can be detrimental to your health, especially your kidneys. The process also requires you to have an iodine box, a grinder, a hand polisher, a gilding stand, a blow-torch, and (like wet plate collodion) a lot of other very exotic, technique-specific gear and chemistry. This process tops them all in this demand, and it is really best if you are skilled in a woodshop because you are going to have to make some of your hardware. The sheer complexity of the equipment is one of the reasons that this process doesn't have its own chapter.

That said, if you sincerely want to get into the daguerreotype process, you can use Alexandre-Edmund Becquerel's 1840 technique (appropriately called the Becquerel process), which eliminates the mercury fumes and instead calls for the development of the image by bathing the exposed plate in direct sun light while under the coverage of a amberlith/rubylith filter. An average

Figure 1–13

Binh Danh, *The Crosses of Lafayette*, December 25, 2011 (daguerreotype)

Binh Danh is best known for his extraordinary photosynthesis art pieces that you will learn in the following chapter. Binh is a Vietnamese-born (1977) photographer and artist who immigrated to the United States in 1979. He also has a passion for the daguerreotype process, and this piece is an example. *(Courtesy of the Artist)*

Becquerel process exposure will be in the 30 seconds at *f* 5.6 range. You will need to take into account the color field of the subject you are making a plate of, for example, a landscape with a red house against green trees and yellow flowers will take up to 3–4 additional steps of exposure to account for the inherent insensitivity to warm values such as red and yellow.

Here's how it was described in 1849 by Humphrey and Finleys in *A System of Photography*: *"The plate is iodized and exposed in camera about fifteen times longer than when operating with bromine-water* (more vigorous than iodine). *On taking it thence, it is put into a kind of sheath covered with yellow glass and exposed to direct solar radiation. The proof is withdrawn when it is seen through the glass to have attained the proper point. By this process, views may be obtained of exquisite delicacy of detail, and of a very peculiar tone."*

If you want to learn how to make a daguerreotype using the Becquerel process, I will strongly recommend taking a daguerreotype workshop with Jerry Spagnoli, who routinely offers them at the Santa Fe Photographic Workshops each summer. Jerry also has the gear.

Here's how the original daguerreotype method is done, with just enough information to explain it but not enough to actually do it . . . yet.

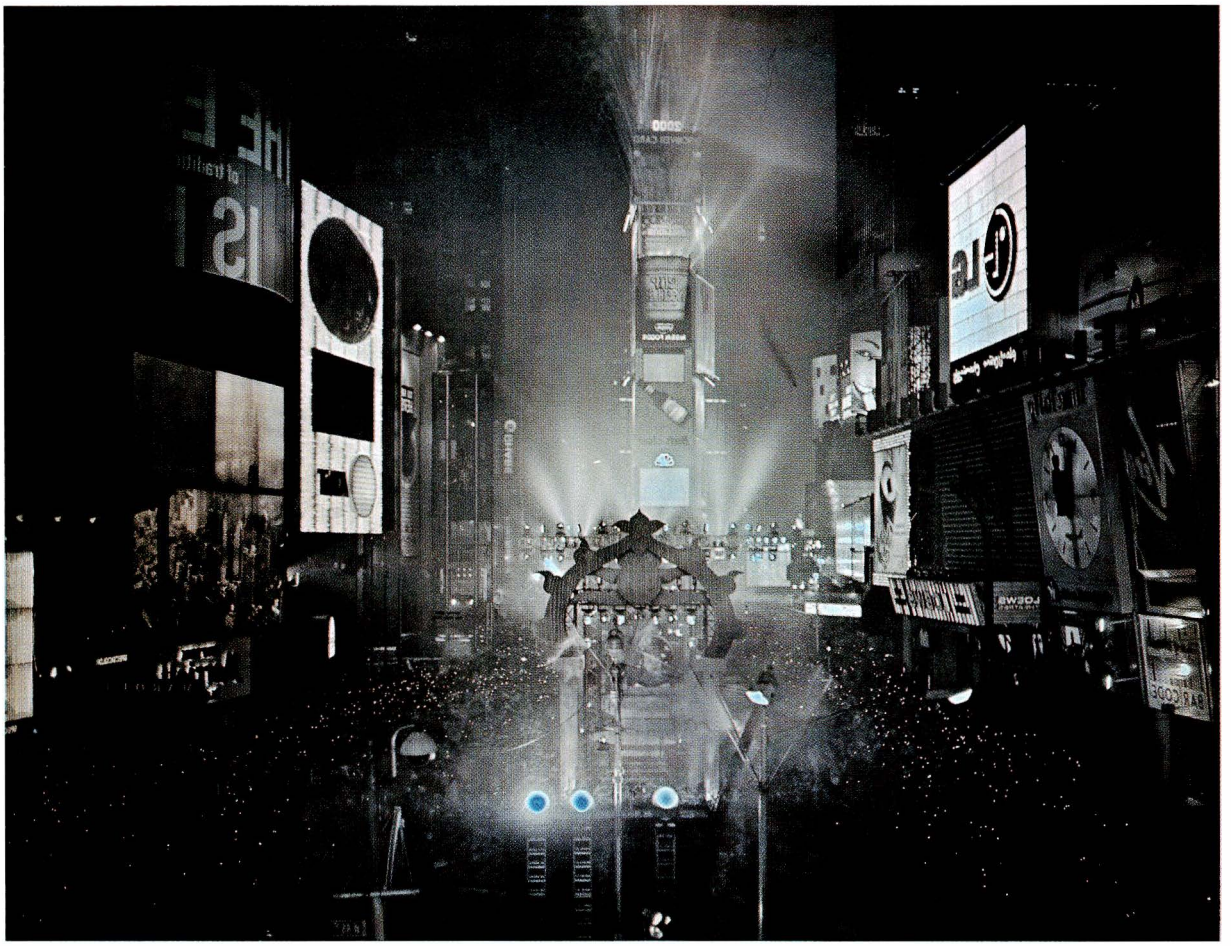


Figure 1–14
Jerry Spagnoli, *11:58 p m - 12:02 am, Times Square,* 1999–2000
This half plate daguerreotype was made by Jerry as a part of his project, *The Last Great Daguerreotype Survey of the 20th Century*. The scene depicts the 4 minutes of exposure needed to make the plate as one century changed into another. The text, you may notice, reads backward because that is how the daguerreotype records life.
(Courtesy of the Artist)

Step 1 Prepare a sheet of copper that has been electroplated with a coating of metallic silver (the Sheffield process) and buff it to a fine mirror-like finish. This, according to those who make daguerreotypes, is the most time-consuming and difficult part of the process. Modern day folks buy the copper plates, prepare the surface, and then send the plates out for electroplating. Then they get to the task of polishing.

Step 2 Place the mirrored metal plate in a light-tight box (called an iodizing box) that contains iodine (and sometimes bromine). In the box, the iodine fumes react with the silver, creating a light-sensitive silver iodide-coated plate. The plate will turn several colors during this iodizing stage from straw yellow to deep yellow, rose, blue, and green. Deep yellow tinged with rose was a typical fuming state of iodine-only daguerreotypes.

Step 3 Under the illumination of candlelight, load this now sensitive iodized plate into an appropriate plate holder, such as a wet or dry plate holder used for wet collodion or a holder made specifically for a daguerreotype camera. Expose it to a subject in bright sunlight. Start with 1-minute of exposure for every f. number, for example, f. 8 = 8 minutes of exposure in full sun. Use less exposure if you're shooting architecture, and more exposure if you're shooting trees and foliage.

Figure 1–15
Hippolyte Bayard (1801–1887), *Self Portrait as a Drowned Man*, 1840
This direct positive, silver-chloride sensitized paper image was created in response to Daguerre's being accredited as the sole inventor of photography in 1839. Bayard had actually shown his photographic images to Dominique Arago, a representative of the Academie des Sciences, three months before M. Arago championed Daguerre as the sole inventor of the process. Bayard, a clerk in the French Ministry, was given a small pension to keep his invention to himself. This tableau-set self-portrait, playing on the well-known Jacques-Louis David painting, *The Death of Marat* (1793), features Bayard as a man made so miserable by the political suppression of his achievement by the scientific and art establishment that he committed suicide by drowning. His image made him an instant luminary in the Paris art community, and this work is considered to be the first conceptually conceived, political protest photograph.
(Collection Société française de photographie (SFP))

Step 4 Following the exposure, develop the plate by suspending it in a fuming box filled with the fumes of mercury that has been heated to 140°F. The story goes that Daguerre discovered this development process by placing an incompletely exposed plate in a cabinet where a broken thermometer had been giving off mercurous oxide fumes and finding a realized image several days later. During this stage, the mercury will, according to this theory, merge, forming an *amalgam* (a word describing a material that is formed by the reaction of mercury with another metal such as silver) with the silver iodide that has been exposed to light.

Step 5 Finally, the plate is washed with a diluted solution of sodium thiosulphate (originally sodium chloride; Daguerre's manual, 1839) and washed with water. The shadows of the image are highly reflective polished silver, and the highlights are white amalgam that scatters light, created by the mercury's effect upon the silver during development. The plate can be gold toned with gold chloride (gilded) and washed. Once dried, it is permanent. One other option, following the final drying step, is the application of color tints followed by a thin wash of gum arabic. When everything is completed, the plate was given a luxurious home in a gilded and velvet-lined case.

It is interesting to note that commerce and marketing began to influence truth at this point. Arago was doing such a spectacular job promoting Daguerre that he blatantly ignored the fact that there was physical proof that Daguerre was not the first person to produce a photographic image. Francis Bauer had informed the press that Daguerre's invention was identical to Niépce's in February 1839 and that he personally had actual images (possibly physautotypes) that had been given to him by Niépce.

A clerk in the French Ministry of Finance, Hippolyte Bayard (1801–1887), had shown his own photographic images to Arago on the twentieth of May 1839, three months before the announcement of the daguerreotype. After Arago announced Daguerre's genius, Bayard reacted to the news by making a self-portrait showing himself as a drowned man and expressing, in sarcastic sentiments, his

Figure 1–16
Rachel Brace-Stille, *Surface,* 2006
This kallitype was made by Arizona artist Rachel Brace-Stille during one of my alternative process workshops in 2006. The image of her niece was made with a pinhole camera and then rendered as a gold-borax-toned kallitype, using a hybrid kallitype developer of sodium acetate/ammonium citrate as a way to eliminate buff-colored tonalities in the highlight areas.
(Courtesy of the Artist)

feelings, that the government had given Daguerre everything . . . that being the case, the wretch had drowned himself and here was the proof. There is much more on Bayard in the Bayard's Direct Positive chapter.

By the late 1800s, the medium had literally exploded into the public consciousness. Following a rapid, often overwhelming, series of photographically related processes and discoveries, the pinhole camera had come into its own. As photographic sensitizers and emulsions became more sensitive, photographers around the world were using both lensless and lens-equipped cameras to make images of everything from Egyptian archeology to romantic Pictorialist expressions.

As the nineteenth century came to an end, commercial enterprise entered the fray and pinhole cameras, such as the "Ready Fotografer" and the "Glen Pinhole Camera" were manufactured and sold worldwide. The Ready Fotografer, according to Jo Babcock, was ahead of its time and marketed as a disposable camera that was pre-loaded with a single glass plate. After exposing the plate, the shooter could then process the plate using the chemistry listed on the camera or simply drop the camera off for processing in San Francisco at J.M. Howe's at 6 Eddy Street.

These inexpensive cameras came with such extras as glass plates, foil lenses, chemistry, and printing frames. All at once, there was a great flurry of activity, as artists and scientists attempted to capture the "fairy pictures" that Talbot had described, the ones that had scooted by their eyes in the camera obscura. Finally, after 2,300 years, everyone was interested.

Figure 1–17
Eric Renner & Nancy Spencer, *Moonrise Over Manifest Destiny,* 2001–2006 (Type C pinhole from 4" × 5" negative)
This is another wonderful image from the *on deaf ears* series that began sixteen years ago as a collaboration between Eric Renner and Nancy Spencer. Their assemblages have been greatly influenced by passages in *The Women's Encyclopedia of Myths and Secrets* by Barbara Walker and by relevant and related social issues. On a lighter note, they also made assemblages dealing with Mickey Mouse, Elvis, Marilyn, and our own curious relationships.
(Courtesy of the Artists)

A LITTLE SCIENCE

The Thumbnail Principle

To comprehend the essence of a pinhole camera, take a piece of paper and poke a small hole in its center with the tip of a sharp pencil. Then hold the paper as close to your favorite eye as possible, so close that you can feel your eyelash on the paper, and look through the hole. To give yourself something to look at, keep your eye right up to the hole and hold your thumb and attached thumbnail an inch or two away from the hole. Notice how you can see your thumbnail really clearly and much closer than you could possibly do with your naked eye. Notice as well that the background is also in clear focus. Pull the paper away and your eyesight goes back to being a less than perfect *f* 1. What you just experienced was infinity as it applies to depth of field. It is one of the principle characteristics of pinhole photography.

Regarding Focal Length

Focal length is simply the distance from the lens to the film when focused at infinity. However, since the pinhole camera does not have an actual lens and is always dealing with infinity, this term may be more accurate if described as focal distance or image distance to the far subject. I suspect that everyone reading this book understands focal length easily as the term describing the lens/hole to the film plane, so I'll use the term *focal length*.

A pinhole camera creates an image that varies in size and viewpoint according to the distance between the aperture hole and the film, plate, wallboard, or paper surface the image falls upon. If the pinhole is close to the projected-upon surface it will yield a wide-angle image. If that distance is further away, it will provide an image that is normal to telephoto. This distance is called focal length. If you take a subject and photograph it at the same distance with cameras of various focal lengths, you will find that the longer focal length magnifies the subject, bringing it closer, while the shorter focal length interprets the subject at a smaller size. There is a difference, however. With a longer focal length, the image size increases but less of the subject or scene is covered. With a camera that has a shorter focal length, the image size decreases but the coverage area increases. A simple way to think about this is telephoto and wide-angle points of view.

The "focal length" of a pinhole camera is calibrated in the same manner as a traditional "grown-up" camera: 25 mm = 1". A 3" focal length will cover a 4" × 5" piece of film, while a camera with a 6" focal length will cover an 8" × 10" piece of film. If your focal length is too short, you will make circular pictures just like George Eastman did in his first flexible film roll camera in 1888. This information changes when you do away with the flat film plane and start bending the film or paper inside the camera. If your pinhole aperture is small enough, almost every non-moving subject that you point your camera at will be pretty sharp; remember the trick with your thumb and the hole in the paper. In the end, there is no limit to what form your images can take and how you can alter the concept of the pinhole camera.

Generally, the sharpness of an image will become more acute as the pinhole becomes smaller. If, however, the hole is too small, this gradual increase in definition will eventually deteriorate due to diffraction (the spreading of light at the edges of an opaque object). There are specific proportions considered ideal for particular aperture-to-plate distances. People who take pleasure in being ultra-exact with numerical definitions have worked out these mathematical proportions, and the results of their work can be found in many pinhole texts. Basically, a pinhole of 1/64 inch diameter is quite adequate for focal lengths up to 6 inches. Using the same focal length, a smaller diameter, 1/100 for instance, will provide a nice life-size ratio for detailed pinhole images of close-up objects.

The Math Section: Determining the *f*-Value

Exposure time is dependent on how brightly your primary subject is being illuminated, the size of your pinhole, and the focal length of your camera. This is referred to as the *f*-value. An *f*-value is figured with the following equation: let's say that you have a focal length of 6 inches and a pinhole diameter of 1/64, and you want to know the *f*-value. Simply multiply the focal length (6") by the "reciprocal" of the diameter of the pinhole (the bottom of the fraction, 64) and you will come up with an *f*-value of *f* 384. Simple, huh?

No? OK, let's try saying the same thing in a different way. Exposure time is dependent on the size of

your pinhole (where the light enters the camera) and the focal length of your camera (the distance between the pinhole and the film plane). This combination is referred to as the *f*-value. An *f*-value is figured with the following ratio.

$$f = \frac{\text{Focal length}}{\text{Aperture diameter}}$$

If your focal length is 6 inches, your pinhole diameter is 1/64, and you want to know the *f*-value, we can drop those numbers into the ratio and get this:

$$f384 = \frac{6}{(1/64)}$$

Algebra decrees that dividing by a fraction is the same as multiplying by the fraction's reciprocal, and the reciprocal of 1/64 is . . . ta-dah . . . 64. So simply by multiplying the focal length (distance from film plane to pinhole) 6" by the reciprocal (64), you will arrive at the correct *f*-value of *f* 384. The exposure time is proportional to the square of the *f*-value. Because you are artists, this will be the official end of the math section.

Of course, the available light will also play a large role in determining exposure, and extensive testing of your camera and the film, plate, or paper used within it will provide a guide for subsequent use. There are indeed formulas for determining the exact exposure times for pinhole exposures, but I have found that the variables of the handmade pinhole camera are significant enough, especially the hand-made varieties, to call for individual testing of one's camera rather than a carved-in-stone standard.

Figure 1–18
Ann Hamilton, *face- to-face,* 2001 (process image)
These images are part of an ongoing series titled *face to face*. Making the orifice of language the orifice of sight, a small pinhole camera is placed within the mouth's interior. When Ann opens her mouth, the film is exposed. The resulting image is a trace presence of standing or sitting "face to face" with a person. The subject becomes the pupil in the eye shape created by her mouth, much the same way as one sees a tiny image of oneself in the reflection of another person's pupil. As an aside, the word pupil comes from the Latin *pupilla*, which means "little doll or puppet."
(Courtesy of the Artist)

Figure 1–19
Ann Hamilton, *face- to-face #51*, 2001
In Ann Hamilton's *whitecloth • self-portrait* photographs from 1999, she placed a pinhole camera within the cavity of her mouth to capture her reflection in a mirror. When she opened her mouth, the light was allowed in and the film was exposed. For her *face to face* series, Ann used the same process but directed her focus outward, and as in the earlier works, "the orifice of language becomes the orifice of sight."
(Courtesy of the Artist)

Eric Renner and Nancy Spencer of The Pinhole Resource estimate that there have been more than fifty separate charted formulas defining workable pinhole diameter/focal length perfection. These formulas come with complex mathematical equations that define what happens to your image when numbers are assigned to the diameter of the aperture, the wavelength of the light, and the focal length of the camera. The gist of this is that you can spend a great deal of your time doing equations and seeking pinhole perfection or you can deal with the fact that you are taking pictures with a box of air with a hole punched in it. You can make one in a few minutes, and if it doesn't work, go and make a new one. Get out of the studio, build or purchase a pinhole camera, and go make pictures. If your camera isn't providing you with the sharpness or romanticism that you want, then modify it until it does.

HOW TO MAKE A PINHOLE CAMERA

The Basic Materials

Great pinhole cameras have been made from containers as small as Ann Hamilton's pinhole-mouth camera to as large as the airplane hangar that became the world's largest pinhole camera for the Great Picture Project at the Marine Corps Air Station El Toro in Irvine, California. I've seen images from pinhole cameras made out of bras, bread trucks, and human skulls. There is literally no end to your options because anything that you can make dark on the inside can become a camera obscura. As simple as this sounds, it really is, but the devil is in the details and describing how to make one doesn't really address all of the concerns that may arise in production. It will be essential to keep your sense of humor, play, and invention and do a lot of testing as you go. But if you are a teacher of photography or a student of the art, there is no better way to comprehend the basics of the machine than to build your own camera and make it work.

Here is an elementary set of instructions for constructing your own pinhole camera. There are three types that I'll describe: the standard pinhole camera, the zone plate pinhole, and the camera obscura. For all three you will need a box of air . . . basically a container that can be made totally light tight for exposures but that can also be accessed easily for loading paper or film in a safelight environment.

To prevent light from bouncing around on the inside of your potential camera during lengthy exposures, you will need a can of black matte spray paint to dull the reflective walls of the camera. Spray the

Figure 1–20

Mary Mayer, *Great Picture Project, Hanger* Interior, 2006

On July 12, 2006, Jerry Burchfield, Mark Chamberlain, Jacques Garnier, Robert Johnson, Douglas McCulloh, and Clayton Spada hosted a reception at which they unveiled the world's largest photograph . . . inside the world's largest camera. Mary was one of the volunteers and made this picture of the great camera. *(Courtesy of the Artist)*

interior of the camera with at least two or three coats. If you fail to do this, there is a strong likelihood that your light-sensitive film or paper will fog. You can also use extra plush black velvet as an interior liner if you desire an absolutely zero reflection environment inside the camera.

You are going to need an aperture for light to enter the camera and expose the light-sensitive material inside. This aperture hole in the camera, your lensless lens, can be made with a sewing needle for a small camera or a concentric circle film lens for a zone plate, or it can be a dime- or quarter-sized hole if you are making a room into a camera obscura.

To make the hole smooth and accurate, you'll also want a nice piece of thin metal or plastic to cut into, or puncture, for your pinhole. You can use tin foil, aluminum or copper roof flashing, brass shims, a cut-up soda can, a yogurt container . . . anything thin and sturdy that you are able to punch a needle-sized hole through for your aperture. K & S Engineering Co., Chicago, Illinois, (http://www.ksmetals.com) makes a wide assortment of brass, aluminum, and copper shims that are excellent for pinhole aperture plates. The ideal shim stock can be found in 0.001" or 0.002" thickness, and you can get this, or similar, stock at most well-equipped hardware stores in the painting or door hardware sections.

You can also buy your pinholes pre-made, either as a straight aperture or as a zone plate film lens, from a variety of sources. Pinhole Resource, an outstanding pinhole enterprise run by Eric Renner and Nancy Spencer, makes and sells perfect zone plate film aperture plates that are customized to your desired focal distance (the measurement between your aperture and your light-sensitive substrate) and can be purchased from 38mm to 300mm.

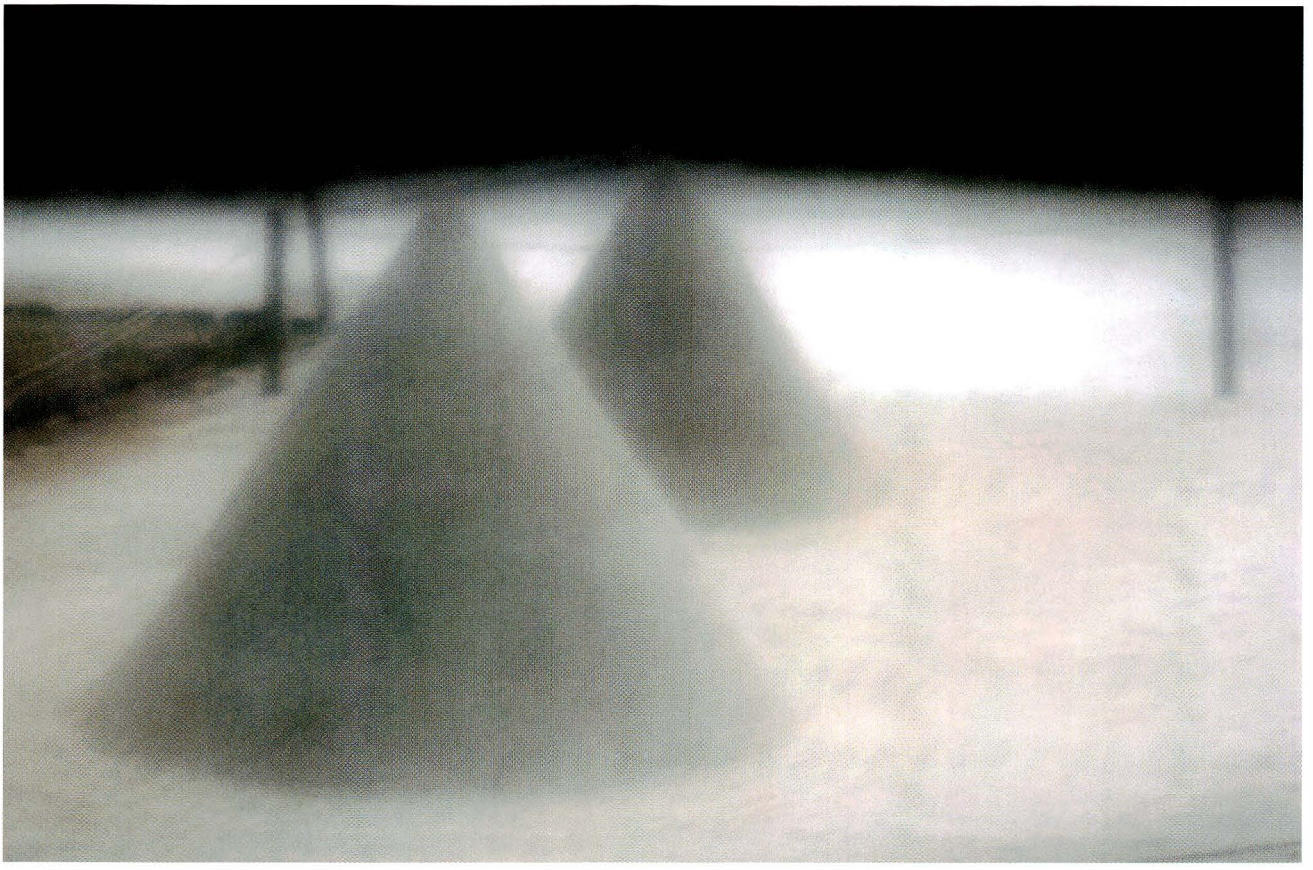


Figure 1–21
Nancy Spencer, *Shinto Shrine*, 2009
Shinto Shrine, Kyoto, Japan from the *Under the Blue* Series was made with a Nikon D50 with a zone plate body cap in place of a lens and handheld at 1/20 of a second.
(Courtesy of Nancy Spencer)

Add to your pinhole toolbox list a pair of scissors or shears that can cut a thin metal shim and a sturdy sewing needle . . . ; a #18 works well. Also, a piece of fine grade sandpaper made for smoothing metal, a pair of needle-nose pliers for pushing the sewing needle through the metal, a simple ruler, a permanent marker, fine emery cloth for a really smooth finish, and a timing device to time your exposures. You may also want some paint and assorted decoration materials for your camera to make friends envious and to inspire children.

The Zone Plate Pinhole: For Fast Exposures and Impressionistic Imagery

In the simplest sense, a zone plate aperture is a piece of film with a clear center bulls-eye circle and an expanded series of concentric rings that mimic an archery target without colors—just alternating rings of black and white. The zone plate can be of any number of zones (a zone is a circle, black or transparent). The greater the number of zones, the fuzzier the images and the faster the exposure time.

The zone plate is different from the conventional pinhole in that it is not a single "pin" hole but a group of concentric bands that allow light to make your exposure. This means that your exposures are much shorter; for example, a pinhole exposure of 30 seconds in bright sun and shade would probably be a 5-second exposure with a zone plate. This also means that you have the option of shooting hand-held pinhole . . . , an image-making strategy that is a lot of fun.

The images made with a zone plate are "Pictorialist" and impressionistic, reminding one of the images made by the Photo-Secessionists in the early 1900s. Best suited for use in high-contrast lighting situations, the zone plate delivers a soft, infrared-like, glowing

Figure 1–22
Pinky Bass, *V. Elizabeth Turk Two-Tasseled Pinhole Camera Bra*, 1989
Pinky Bass made this amazing two-tasseled pinhole camera bra for V. Elizabeth Turk, who teaches alt processes at SCAD in Atlanta and who is also featured in this book.
(Courtesy of the Artist)

image that is best realized when there is a distinctive contrast between shadows and highlights in the subject matter. Be careful with your aesthetic sensibilities; a zone plate-realized image can easily take on the visual sentiments of long walks on the beach, conversations by an open fire, puppies in a basket, and fuzzy kittens.

The best way to have a zone plate experience is to go to http://www.zeroimage.com and take a look at the deluxe 4 × 5 that has a turret, giving you the option of shooting the pinhole or zone plate with a single camera. The company also makes and sells small- and medium-format zone plate and pinhole cameras as well as individual zone plates. You can also go to http://www.pinholeresource.com (Nancy Spencer and Eric Renner's site) and get soup to nuts pinhole stuff. They sell zone plate turrets as well as zone plate body caps for traditional pinhole, film, and digital cameras. I've not seen a zone plate used with a camera obscura room-size pinhole camera but can imagine that although the exposure on something like a silver gelatin mural paper would be much faster, the impressionistic fuzziness would be less than ideal. On the other hand, it could be extraordinarily beautiful.

Simple Pinhole Construction

Select a container and think about what kind of image you want to create. Wide angle, telephoto, macro, multiple pinhole-lens, long and narrow, short and wide, mural size, button-size, impressionistic zone plate, mouth camera, airplane hangar . . . you decide. As an experiment, it might be a fine idea to make several different types of cameras at the same time so that you can shoot the same subject, in the same light, with all of them and see the differences.

Figure 1–23

Jo Babcock, *Ocusan Pinhole Camera*, 2010

Like Pinky Bass, Jo Babcock makes amazing pinhole cameras out of virtually everything. As Joe tells it, his dealer, Steven Wolf, asked him how many pinhole cameras he had made. Joe replied that he had made about 200 and so Wolf asked, "why don't you make 1,000." A few days later, he received an invitation from Ann Jastrab encouraging him to apply for RAYKO's Artist In Residency. Jo wrote a proposal describing his intention to build 1,000 Cameras . . . and this is one of them.

(Courtesy of the Artist)

Begin by measuring your focal length distance between the film plane and the hole and determine what your coverage area is going to be. The shorter your focal length, the wider your angle of view. A good way to see how much coverage you're going to get is to place a mark at the top front, middle, of your camera directly above the pinhole. Draw straight lines from that mark to the back left and right corners. If you follow those lines out to the front of your camera and then continue on out to the horizon, you will get a visual idea of what your coverage area will be. The easiest way to see this is to draw it out on paper with sight lines. Then shorten and extend the distance from the hole to the film plane and re-draw the sight lines. You will instantly see that a shorter focal length will result in a wider angle of view, while a longer focal length will result in a narrower angle of view.

Light rays reflect off of a subject in front of the camera, enter the pinhole, and continue to the light-sensitive paper, or film plane, where they result in a reverse and slightly out-of-focus image. The slightly out-of-focus look, even though you are recording the light at an *f*-stop that is far smaller than any found on a regular camera lens, is due to the refraction of raw light rays as they pass through the hole opening. There is a formula that will help determine the optimal size of the pinhole diameter, in relation to the focal length, that will result in the sharpest possible image. This was designed by Joseph Petzval (the inventor of my favorite style of wet plate collodion camera lenses), later perfected and published by Joseph Strutt (Lord Raleigh) in the 1800s and subsequently published in *Nature* in 1891.

Figure 1–24

Philippe Moroux, *le jour de l'éclipse #1*

This pinhole camera image by Netherlands photographer Philippe Moroux was made on the day of a solar eclipse on the coast of Normandy in France. Philippe used a handmade pinhole camera fitted with a Polaroid back to accommodate 4" × 5" Type 55 Positive/Negative film. He then made multiple exposures, pre-washed the negatives in the sea, and later translated them into prints that are Van Dyke variants utilizing silver nitrate, silver oxide, and sulfamic acid.

(Courtesy of the Artist)

Back to the construction . . . spray several coats of matte black spray paint, or black velvet for the deluxe version, into the inside of your constructed "camera." Note: If you are using a bread truck or your apartment, this may not be the best idea, and you will have to figure out another solution such as black paper or fabric. To make a standard pinhole aperture, take your piece of metal shim and draw an "X" from corner to corner to show you where the exact middle of the metal piece is. Do the same for the front of your camera. This will be where your pinhole aperture in the metal will go. Take your matt knife and cut a small hole in the camera where your piece of brass shim metal will be placed.

Now, very gently, push your needle through the metal material. If you are using tin foil, you are pretty much done, but you have a very fragile aperture that can easily be damaged. If you are using a brass shim then you will want to complete the following steps.

As soon as the needle begins to protrude through the other side of the shim, stop pushing and turn the metal piece over. Gently push the needle back through the same hole and twirl it as you go in much the same manner as an acupuncturist does when inserting needles into a body. Go back to the front side and repeat the penetrating twirl until you have a nice clean hole.

Then, take a piece of fine emery cloth, silicon, or carborundum paper and gently massage both sides to remove any irregularities or burrs. When the hole is smooth, gently push your needle back through it to clear out any metal dust. Check your work with a magnifying loop. Remember, a small hole with rough edges will result in light being diffracted and a blurry image. The Golden Rule of Pinhole: fuzzy holes make fuzzy pictures. There are quite a few formulas and charts to consult on the Internet if you want absolute perfection and sharpness in your pinhole images. That desire, however, seems to me to be antithetical to the whole reason for taking the time to make a pinhole in the first place. You make images with a pinhole camera for the same reasons you use a Holga or children's camera: . . . to embrace the imperfections and to record subjects the way they are remembered and felt rather than just the way they are rendered with a perfect lens.

Putting the Camera Together

Now it is time to put the newly made pinhole aperture into the camera and to create a shutter, also known as a piece of black tape over the hole. First, take your foil or shim with the pinhole and secure it to the front inside or outside of your camera, being sure the pinhole is centered over the small hole you cut out in the camera itself. Make sure that the seal around the pinhole is perfect and light tight.

Figure 1–25
Pinky Bass, *Body Nostalgia 1*, 1991
Pinky Bass made this compelling image with a homemade pinhole that she named *Bible with Two Points of View Pinhole Camera*. The image is a 40" × 32" toned silver gelatin print.
(Courtesy of the Artist)

To make a shutter, take an inch or two of the black tape and stick two pieces of it together (sticky side to sticky side), leaving one of the ends longer than the other. You are going to want to put your shutter somewhere during the exposure, and the best way to manage this is by leaving a sticky end tab on the shutter so that it can adhere to your camera when shooting. When it is time to expose, simply grab the pull-tab, uncover the pinhole, stick the shutter somewhere on the camera, say the magic words "al-Hazan," and make your exposure while consulting your timer. At the conclusion of the shot, cover up the hole again, being positive that the tape is making a tight seal with the pinhole to avoid stray light.

You may wish to construct a system for easily inserting your film or paper into the camera. The easiest solution is to tape the film or RC paper onto the side of the camera opposite the aperture hole. A better solution requiring a little more time but that is worth the effort is to make a channel setup so that you can slide your sheet film or RC paper into permanent interior camera tracks. This is similar to a paper easel or 4" × 5" film holder channel system. In fact, you might want to consider taking a 4" × 5" film holder and making it a permanent rear film plane for your camera. If you intend to use different-sized films and papers in your camera then you must either build different format channel systems or make cameras specifically for the size film or paper you

Figure 1–26
Diana Bloomfield, *Dancer,* 2003 (pinhole cyan over Pt/Pd)
Diana Bloomfield has worked with the pinhole image for years, and her work is known for its dramatic mystery and her skill at creating her images using cross-process applications. In this piece, a pinhole image is printed out in platinum / palladium and then enhanced with a pass of cyanotype.
(Courtesy of Diana H. Bloomfield)

intend to use. Don't forget the information about focal length and image size. Now, figure out a way to be sure that your camera is light tight and that it is easily disassembled for the next loading of light-sensitive material. It is now time to test your creation.

Light-Sensitive Options

A few years ago, in the good old days of silver gelatin emulsions, you could buy a box of Polaroid Type 55 Positive/Negative film and expose contact negatives for all alternative process contact printing instantly. Since Polaroid and Type 55 are now history*, the only way you can make this magic happen is by going to an Internet auction site and paying an "arm and a leg" ransom to someone who put a box of the film in the freezer back in 2008. And then hope that the box of Type 55 didn't spend a summer in the trunk of a car in South Florida in 2009. If you've never used Type 55 before, I would not recommend trying it should you find an overpriced box of it on the Internet because you'll only end up unhappy like the rest of us who miss it so much.

If you are not using Polaroid Type 55 Positive/Negative film, in its perfect light-tight envelope with chemistry and its very own customized Type 55 film holder (OK, I'm finished whining), you'll need a safe darkroom-like environment for loading and unloading your film, photographic paper, or alt pro-sensitized substrate. If you are going to load your camera with

*Please see Chapter 24 for a report on the New55 Project that is actively working on a new positive / negative instant film.

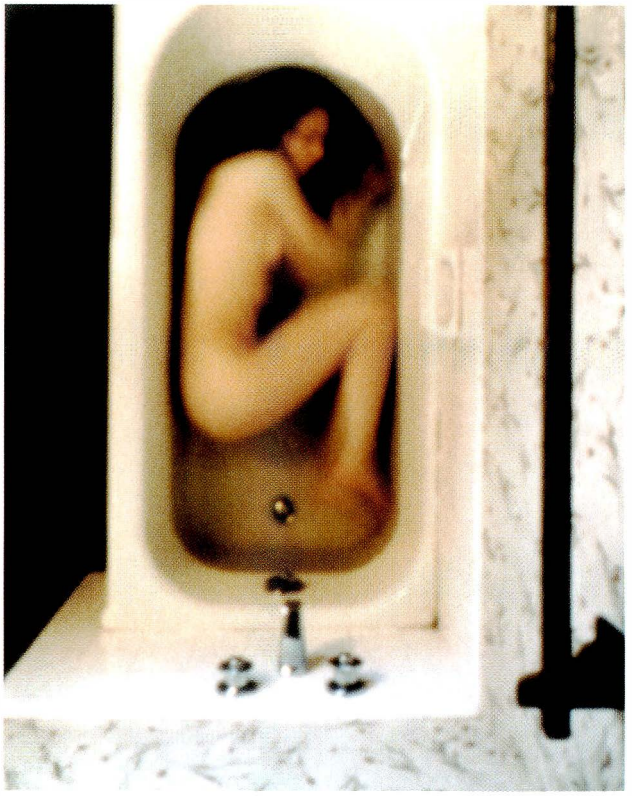


Figure 1–27
Lesley Krane, *BathSelf*, 1991
This image of Lesley's was an hour-long exposure using a homemade, corrugated cardboard pinhole camera built to accommodate 4" × 5" film holders.
(Courtesy of Artist)

photographic paper, you will want an RC (resin-coated) paper without the manufacturer's logo on the back, so that when you contact print it you don't get the logo. RC paper is thin and lacks the paper fibers that make your image less sharp than it will be anyway.

If you are going to load your pinhole camera with film, I recommend that you begin with large sheets of Ilford Ortho Plus film, as it's slow and forgiving. In truth, any light-sensitive film or paper can be tested and calibrated to provide a perfect rendition of the subject. And don't forget that you can always scan your results, drop the scan into Photoshop or Lightroom, clean it up, and print out a beautiful contact or projection negative on Pictorico Ultra Premium OHP digital inkjet film.

In the not-so-distant past, there was a type of photographic paper made by several companies that permitted the option of making positive color prints from positive transparency films. When positive transparencies went the way of the dinosaur, the direct positive color paper fell to the same fate. This paper could be loaded directly into a pinhole camera, exposed, and processed with the correct Ilfachrome or Cibachrome chemistry, and when it was done you had a color positive print. One example is the late 70s work of Willie Anne Wright, who is well-known for her "Beach Series" using 8" × 10" and 11" × 14" wooden boxes fitted with slots for film holders at different focal lengths. Color balance was corrected with an 85 B glass filter behind the pinhole aperture, and her exposures were between 3 and 5 minutes long.

Alternative process exposures in pinholes can be done, but you need the patience of a hero because the sensitizers are so slow. You also need a terrific sense of humor and a lot of free time. Mark Osterman has made daguerreotypes and collodion plates using a pinhole camera and wrote that as long as the distance to the subject was not too great and the subject was illuminated with bright sunlight, it was indeed possible. It would be difficult to use a pinhole with albumen, salted paper, or any process that prints out and that has an excess of silver. However, if you were using a zone plate instead of a traditional pinhole, I don't see why you shouldn't try direct, in-camera exposures with one of the faster processes such as Ziatype or wet plate collodion. In addition, to increase the menu of options, there is also digital pinhole photography using no-dust body caps . . . more on this later in the chapter.

TESTING YOUR CAMERA

You'll want to find out if your camera has any light leaks immediately before you get invested in making your art, so now is the time to test it. Load up your camera in the darkroom with either film or satin finish RC paper. It is faster to test paper, so that should probably be your medium for the light-tight test. Remember that if you are using silver gelatin paper, the shiny or emulsion side faces the lens just like in wet darkroom printing. Testing with silver gelatin paper is easy because you can do it under safelight conditions and actually see what you're doing. If you are using film, hold the film so that your right index finger is on the upper right-hand corner notch code of the film. The emulsion side is now facing you. This side faces the aperture and

Figure 1–28
Willie Anne Wright, *Group at Nag's Head—1980's* (Cibachrome pinhole)
I first saw Willie Anne Wright's pinhole/Cibachrome work when I became an artist represented by Lee Witkin, the Witkin Gallery, on West Broadway in NYC. The images in Willie Anne's series are one-of-a-kind Cibachrome direct positives. The camera had a single focal length, multiple slots for the film holders, and was 16" × 20" in size. Unfortunately, Cibachrome, like a lot of other great toys, is no longer available.
(Courtesy of Artist)

the scene in front of the camera. You will have to load the film in total darkness, which is another very good reason to use paper for the testing. Back to the test.

You will need six separate pieces of paper or film to do a perfect test. Each should fit the dimensions of each of the six sides of the camera's interior. Place a piece of paper or film on each wall of the inside surfaces of the camera. Close up the camera in the darkroom and don't forget to put your shutter (tape) over the pinhole aperture.

Now, go outdoors and place the camera in direct sunlight for 15 to 20 minutes but **DO NOT REMOVE THE SHUTTER.** Every so often, move the camera so that a different side faces the sun. What you are doing, besides heating up the inside of the camera, is testing to see if there are any obvious light leaks that will fog your film or paper later on when you get serious about your exposures.

Figure 1–29
Pinhole Resource No Dust Pinhole cap on a Nikon D50
This is a shot of the Pinhole Resource No-Dust Pinhole Cap. Pinhole Resourse sells a fine selection of pinhole and zone plate body caps ready to use.
(Courtesy of Eric Renner)

Figure 1–30
Martin Novak, *Doppelgänger—Pietà*, 2003 (Holga pinhole and gum)
Martin writes about this Holga pinhole and gum bichromate print, *"When I found pinhole camera photography I was surprised by how such basic photographic equipment could be so effective, as well as having so many creative options. When working with pinhole cameras, the most enjoyable element for me is its unpredictability and the surprising high quality of the images if made properly and with care. My pinhole images often express differing kinds of inner dialogs that I may have, or have just imagined, within myself. All the double exposed images are created on a single piece of film in the camera using time lapse (each photo is about a 10 minute exposure)."*
(Courtesy of Artist)

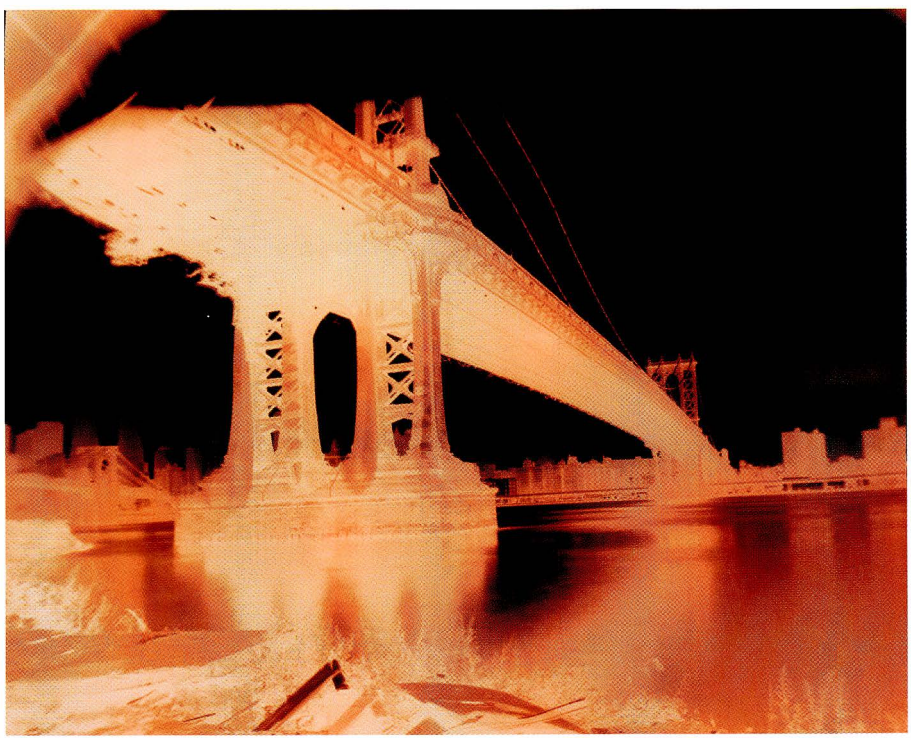


Figure 1–31
Jo Babcock, *Bridge*, #04, 1989
This is a spectacular pinhole camera-generated image from Joe Babcock.
(Courtesy of Artist)

Go back into the darkroom and process the pieces of paper or film and see how you did. Remember to mark or note where the paper or film was inside so that you can track the light leak if there is one. If all of the pieces of paper or film are un-exposed and show no signs of fogging, then you have made a fine camera and you are ready to make pictures. If some or all of your paper has gray or darkly exposed light leaks showing, you will have to figure out where the leaks are and fix the camera with more paint or tape. It is important to understand how the image is coming into the camera. Later on, when you are exposing through your pinhole aperture, your analysis of where the light leak is will be different due to the fact that you are using a pinhole and the image and light will be reversed. For instance, if you have a light leak showing on the top left corner of your paper test, your leakage problem is located at the lower right-hand corner of your camera. Continue the testing process until the light leaks are gone . . . and keep your sense of humor.

Finding the Correct Exposure

It would be numbing to try to provide you with a mathematical set of calibrations to guarantee a perfect exposure with your pinhole camera. I don't know what your camera looks like or how it was made, and there are simply too many variables to keep you interested in the math or to make sane recommendations. The time of year and day, the "real" size of your pinhole, the temperature, the atmosphere . . . nearly anything could make a difference. The wisest procedure with a new pinhole is to work intuitively and to take the time to make a series of exposure tests using film or RC photographic paper. Begin by making exposures in the bright sun with a good intuitive guess based on your previous testing, which is how I've made every pinhole exposure I've ever done. Process the material and go from there. With a pre-constructed Leonardo, Zero Image, or Lensless Camera Co. pinhole and a low ASA film, you can begin with a 1–3 second exposure on a sunny day with a zone plate. With a traditional single punched-out pinhole, begin with a 10-second exposure and add or subtract exposure depending upon the results. Within three tests you should know exactly what your camera is capable of giving you. Conduct further tests under less-than-bright conditions and you will have enough knowledge to use the camera in most light conditions.

Pinhole Camera Aperture/Exposure Table

Calculating specific exposures for your handmade pinhole camera is complicated due to the variables of homemade construction. The Lensless Camera Mfg. Co., however, created the following table of apertures and

Figure 1–32
Diana Bloomfield, *Midway Ripley's Believe It Or Not,* 2004
This wonderful image by Diana Bloomfield is a pinhole-generated negative translated using the platinum palladium process.
(Courtesy of Diana H. Bloomfield)

f-stops for its products. The film format of the camera is irrelevant because only the working aperture and focal length determine the *f*-stop.

Focal Length	Pinhole diameter		*f* -Stop
	(1,000 ths)	*(Fractions)*	
675mm/27"	0.0156"	1/64	*f*/2000
450mm/18"	0.0156"	1/64	*f*/1200
300mm/12"	0.0156"	1/64	*f*/840
225mm/9"	0.0156"	1/64	*f*/630
200mm/8"	0.0156"	1/64	*f*/560
150mm/6"	0.0156"	1/64	*f*/420
100mm/4"	0.0156"	1/64	*f*/280
75mm/3"	0.013"	1/77	*f*/230
50mm/2"	0.013"	1/77	*f*/154

Calculation by The Lensless Camera Mfg. Co., Santa Barbara, CA (The Lensless Camera Mfg. Co).

Most modern light meters will help you in determining the correct exposure of your pinhole camera. I'm going to dispense with the mathematical formulas in this edition, as I have not met a single person who has bothered to use them, as most prefer the seat-of-the-pants approach to pinhole photography. Instead, here's some simple advice. Go to one of the dedicated web sites mentioned in this chapter and in the resource appendix and buy an inexpensive exposure calculator that forces you to spin a dial to find out the exposure. Another option is to use the LightMeter iPhone app and set it for the known or guessed ISO and Exposure Correction and then you'll always be accurate. I use this app for wet plate collodion exposure (ISO 1 and −2.5 Exposure Correction). For more, see the section on this in the Wet Plate Collodion chapter. One other option is to guess at the exposure. I realize this isn't very scientific at all, but it is a lot more fun . . . like opening a present to see what you were given.

Making Images

Select a subject, or create one. Most of the time people photograph things that don't move because of the lengthy exposures. However, many pinhole photographers love the ghostly quality of movement in their images. Leaves blowing in the wind, moving water, parts of bodies, blinking eyes in a portrait—they're all wonderful in the light movement tracks they deposit on the film plane. Think of the mystery of a subject within an image rather than a photographic representation of it, as in a Ralph Eugene Meatyard photograph. Position the camera to begin the exposure and un-tape the shutter. Check your timing device and count each second during the exposure . . . "*one Ansel Adams, two Ansel Adams, three Ansel Adams* . . . ." Keep notes on each shot and begin to calibrate and learn how your camera works.

When your exposure is complete, go back into the darkroom, remove the paper or film from the camera,

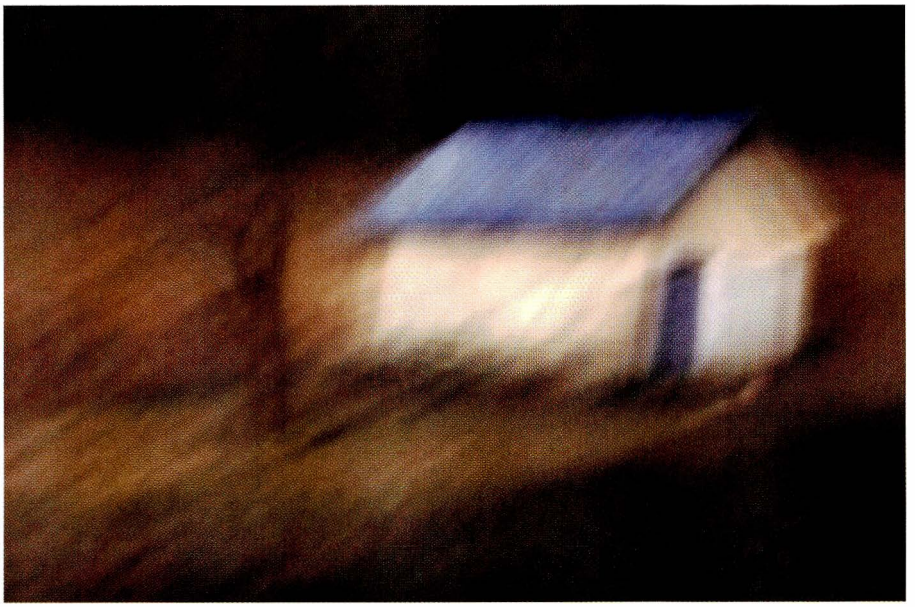


Figure 1–33
Nancy Spencer, *House On the Run*, 2007
Nancy Spencer created a digital pinhole she called House on the *Run, Floyd, Virginia* from her *Under the Blue* series. This is a 20" × 13" archival pigment print made with a Nikon D50 with a zone plate body-cap in place of a lens. The camera was handheld and intentionally moved during the 1/20 of a second exposure.
(Courtesy of Nancy Spencer)

and process it. If you want to process later in the day, you must keep the material in a light-tight box. In the field, you can use a changing bag to remove, load, and store your exposed and un-exposed light-sensitive materials. After processing, you will probably want to make a print or scan the exposed film or paper in Photoshop for more adjustments and to create your subsequent contact-size negative on Pictorico OHP digital inkjet film for alternative process exposures.

If you are using film, then the contact process is as simple as making a contact sheet. If you are using RC paper and printing through it as a paper negative, the best way to make a print is to immerse a fresh piece of RC paper in water and then take your wet negative RC paper and press them together under water so that they are totally merged. The wetness of both papers makes this task easy. To make the exposure, simply place the two sheets in a printing frame, expose to light, and process with silver gelatin chemistry.

DIGITAL PINHOLE

In the last few years, many photographic artists have begun to incorporate digital technologies into their pinhole and alternative process negative workflows. The adaptation is actually quite special and kind of makes up for the loss of Type 55 with all of its potential. It's simple to adapt a digital camera with a no-dust single-hole body cap or a zone plate body cap on any digital camera that has a removable lens. All Nikon cameras and Canon EOS cameras take the same body cap, so getting one to fit is easy. Pinhole Resource makes and sells digital no-dust pinhole body caps and digital zone plate caps that are made of film rather than a punched-out hole. The most important thing to consider here is that these no-dust caps prevent grit, grime, and moisture from getting to the delicate CCD sensors and innards of the camera, saving you from the big headache you would get if you simply made your own with a drill or needle. Dust on your sensors

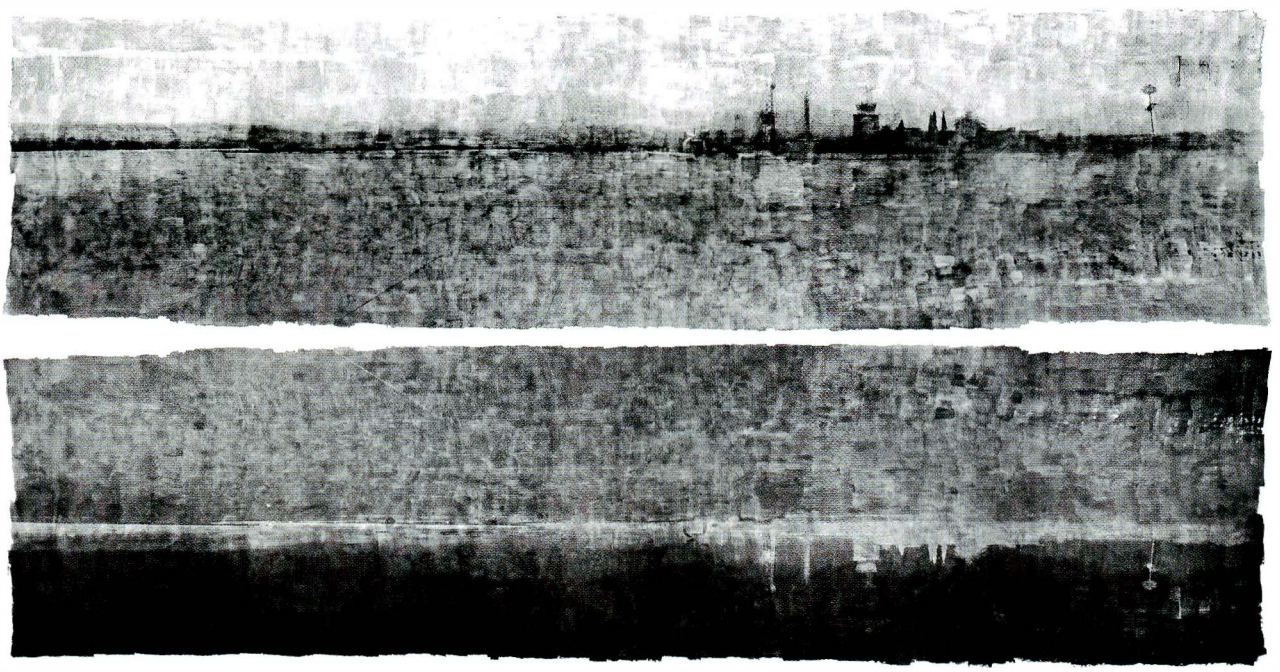


Figure 1–34

***Great Picture Project, el Toro Air force Base, Positive and Negative,* 2006**

In the summer of 2006, Jerry Burchfield, Mark Chamberlain, Jacques Garnier, Robert Johnson, Douglas McCulloh, and Clayton Spada set up shop at the former Marine Corps Air Station El Toro in Irvine, California. Their intention was to transform a giant airplane hangar into the largest functioning camera in the history of mankind. • Camera size: 45' H × 80' D × 160' W • Final size with rigging: 31' 7" × 111'; 3505 sq ft • Image size: 28' × 108'; 3024 sq ft in a single, seamless piece of fabric • Photograph type: B&W negative image with a hand-coated silver gelatin emulsion • Subjects depicted in the photograph: the MCAS El Toro control tower, twin runways, and heart of the future Orange County Great Park, with a backdrop of the San Joaquin Hills and the Laguna Wilderness.

(© The Legacy Project, The Great Picture. Courtesy of the Artists)

will show up as dark spots on your images. Dust is your primary enemy, so be ever vigilant about keeping it out of your digital camera.

Go to Pinhole Resource and get the no-dust pinhole or no-dust zone plate body cap, and when it arrives, test it by setting your camera on *manual*. In the menu, adjust for lighting (e.g., daylight, tungsten, etc.) and set your ISO at a very low setting. Setting it high will result in pixilated artifacts in your images. In the bright sun, make an exposure for 1 second. If you are using a zone plate, make your exposure at about 1/20th of a second. Eric and Nancy at Pinhole Resource caution against the use of zone plate, even though it is faster than a conventional single pinhole, as it often lacks saturation in the colors . . . a look that you may actually be seeking. As always, because it is digital, the saturation can be adjusted in Photoshop after the fact. Where this gets easy is that you don't have to go anywhere to process. Simply check the image on your camera's screen and add or decrease exposure time as needed. Always shoot your files in *RAW* mode so that you have something to work with should you make the image of your life.

THE GREAT PICTURE PROJECT

Now, if you take the instructions in this chapter and apply them to an airplane hangar, you will get the Great Picture Project concept. In the summer of 2006, the late Jerry Burchfield and his friends Mark Chamberlain, Jacques Garnier, Robert Johnson, Douglas McCulloh, and Clayton Spada set up shop at the former Marine Corps Air Station El Toro in Irvine, California. Their intention was to transform a giant airplane hangar into the largest "functioning" camera in the history of the world. These artists are members of the Legacy Project, which has been documenting the transformation of the El Toro Air Station into the Orange County Great Park since 2002.

On July 12, 2006, Jerry, Mark, Jacques, Robert, Douglas, and Clayton hosted a reception at which they unveiled the world's largest photograph . . . inside the world's largest camera. Their photograph measured 31' 7" × 111' and covered a total of 3,505 square feet while showing a panoramic view of a portion of the former Marine Corps Air Station El Toro that became the heart of the Orange County Great Park.

The Great Picture was produced over a two-month period with the assistance of hundreds of individuals, businesses, and sponsors. To give you a sense of it, here are some of the specifics of the project. Really, no different than a Quaker Oats pinhole camera . . . only a whole lot bigger.

Great Picture Fact Sheet

- Camera size: 45 feet high × 80 feet deep × 160 feet wide
- Final size with rigging: 31 feet 7 inches × 111 feet; 3,505 square feet in total
- Image size: 28 feet × 108 feet; 3,024 square feet in a single, seamless piece of fabric
- Photograph type: black and white negative image with a gelatin sizing and a hand-coated silver gelatin emulsion
- Subjects depicted in the photograph: the MCAS El Toro control tower, twin runways, and heart of the future Orange County Great Park, with a backdrop of the San Joaquin Hills and the Laguna Wilderness
- Location: former Marine Corps Air Station El Toro, Irvine, CA
- Camera location: Bldg: #115, a former fighter plane hangar that served as a helicopter hangar for the Sea Elk squadron during its final days
- Materials used to darken the airplane hangar to make it into a camera:

  24,000 square feet of 6-mil black Visqueen plastic sheeting

  200 large cans of spray foam gap filler

  8,000 feet of 2-inch-wide black Gorilla Tape

  40 cans of black spray paint
- Fabric base of the photograph: single seamless piece of unbleached muslin specially ordered from Germany with a total weight (fabric and rigging) of 1,200 pounds, which probably qualifies as the world's heaviest photograph
- Aperture size: one-quarter inch (6mm) pinhole—no lens or optics were used
- Aperture height: 15 feet

- Date of emulsion coating: July 7, 2006
- Emulsion: 20 gallons of Liquid Light—a silver gelatin black and white sensitizer that was handpainted onto the fabric under safelight illumination
- Date of exposure: July 8, 2006, at 11 a.m.
- Exposure time: 35 minutes
- Date of development: July 8, 2006
- Developing materials:

  600 gallons traditional B&W developer

  1,200 gallons fixer
- Developing "tray": 8-mil vinyl pool liner—114 feet × 35 feet × 6 inches
- Sanctioned by the *Guinness Book of Records* as the world's largest camera
- Sanctioned by the *Guinness Book of Records* as the world's largest photograph

CLOSING PINHOLE THOUGHTS

If your ambitions for pinhole photography exceed the instructions in this chapter, then you are in good company. Many artists have taken the pinhole concept and built their entire careers and creative process around it. Included in this group are a lot of people whose work illustrates this chapter. I love their attitude about making images . . . one that has a great deal of compatibility with my own over the last several decades.

There are many artists whose imaginative variations of the pinhole workflow and aesthetic are as vital as the work that identifies them as artists. The primary connections here being the marriage of the syntax they work with and the context of their ideas. One of my former workshop students, Pinky Bass, a great artist and inspiration to all who know her, makes her cameras from bras to bread trucks for the occasion. Emily Hartzell, a former student of mine at Harvard, turned her New York apartment into a pinhole camera and made murals of her New York neighborhood. Another former student, Frank Varney, built a panorama pinhole specifically to record the geysers of Yellowstone National Park. Jo Babcock turned a VW van into a pinhole camera in 1973 and another VW van into a pinhole and lens-equipped camera obscura in 1989 to produce 40" × 50" paper negatives, and then he made an Airstream motor home into a camera in 1990. Philippe Moroux makes beautiful kallitypes with negatives from his custom pinhole cameras, and his interpretations of the coast of Normandy during a full solar eclipse are just extraordinary. And of course,

Figure 1–35
Marilyn Ruseckas, *Family Portrait*, July 1980
A former student of mine, Marilyn Ruseckas, is an accomplished fine artist and world-class bike racer (on the racing circuit she was referred to as the "Beast from the East"). For this image, Marilyn removed the lens from her 35mm camera, placed a metal plate over the space where the lens used to be, and poked a pinhole in it with a needle. She then loaded her camera with infrared film and made beautiful images that would have warmed the heart of any Photo Secessionist.
(Courtesy of the Artist)

Eric Renner and Nancy Spencer, the pre-eminent pinhole authorities, are an endless source of inspiration for the countless number of people who have been affected by their ideas, products, and images.

Another former student of mine, Marilyn Ruseckas, is an accomplished artist. For this image she removed the lens from her 35mm camera and replaced it with a metal shim with a pinhole aperture. She then loaded her camera (in the dark) with infrared film and made beautiful images that would have inspired any Pictorialist. There is simply no end to it . . . in pinhole photography, if it can be imagined, it is possible. Just ask the guys who accomplished the Great Picture Project.

To begin your love affair with pinhole cameras you should really make one first. Once you have done the "rustic" thing, I suggest that you consider purchasing a hand-built camera from one of several outstanding pinhole camera makers. I have terrific pinhole cameras from the Lensless Camera Company and have used my favorite one for over thirty years. I have even packed lunch in it when going out for the day. The Leonardo cameras are excellent and feature rubber and wood cams instead of dowels, and Zernike Au's entire Zero Image product line (see the resource section in the appendices) are some of the most beautiful cameras being made anywhere. I've used all of them for decades, lent them to hundreds of students, taken them on trips around the world, and have never had a single problem . . . after all, what could go wrong with a box of air with a hole in it? As you have seen, in word and image, pinhole photography has an incredibly rich history and is the foundation of the entire medium of photography. It is also an amazing amount of fun. My best recommendation? Go have a little.

The Anthotype & Chlorophyll Process: The Art of Printing with Flowers & Vegetation

OVERVIEW & EXPECTATIONS

This chapter will be short and sweet as the anthotype process is such a profoundly simple method of making images with light. When the last edition came out, there were only a handful of people who actually practiced Herschel's charming process from the early 1840s. This lack of public involvement in the process was not because it wasn't fun or easy to do . . . it is. It was, I think, how long it took to give that instant photographic satisfaction that everyone was used to. Then, when you finally completed an anthotype, sometimes days or weeks after starting your exposure to UV light, it began its inevitable fade. But that was the charm of it all. It is a totally organic process that is truly about the process and not the ultimate "let's put it in a gallery and make some money" photographic or artistic exercise. Without question, the anthotype is the most naturally organic, low impact, and environmentally pleasant process in all of the arts . . .with the possible exception of cave drawing or sixteenth-century Raku ceramics. It all teaches you patience and lowers your blood pressure.

The lack of public embrace as a technique may have also been due to the fact that the anthotype images needed to be handled in a very specific manner, out of light, after they are created if they are to be preserved well. Lately, I've taken to making them, scanning them into Photoshop, and re-printing them with archival, carbon-based inks and lovely Japanese rice papers—you should try it. In editing this chapter I decided to unwrap a piece of work (*Dressing Gown in Pokeberry,* 1999) by my former Harvard student, Dan Estabrook, to see if it had survived 14 years in an archival folder in total darkness. It did . . . sort of . . . although it had faded on its own without benefit of light.

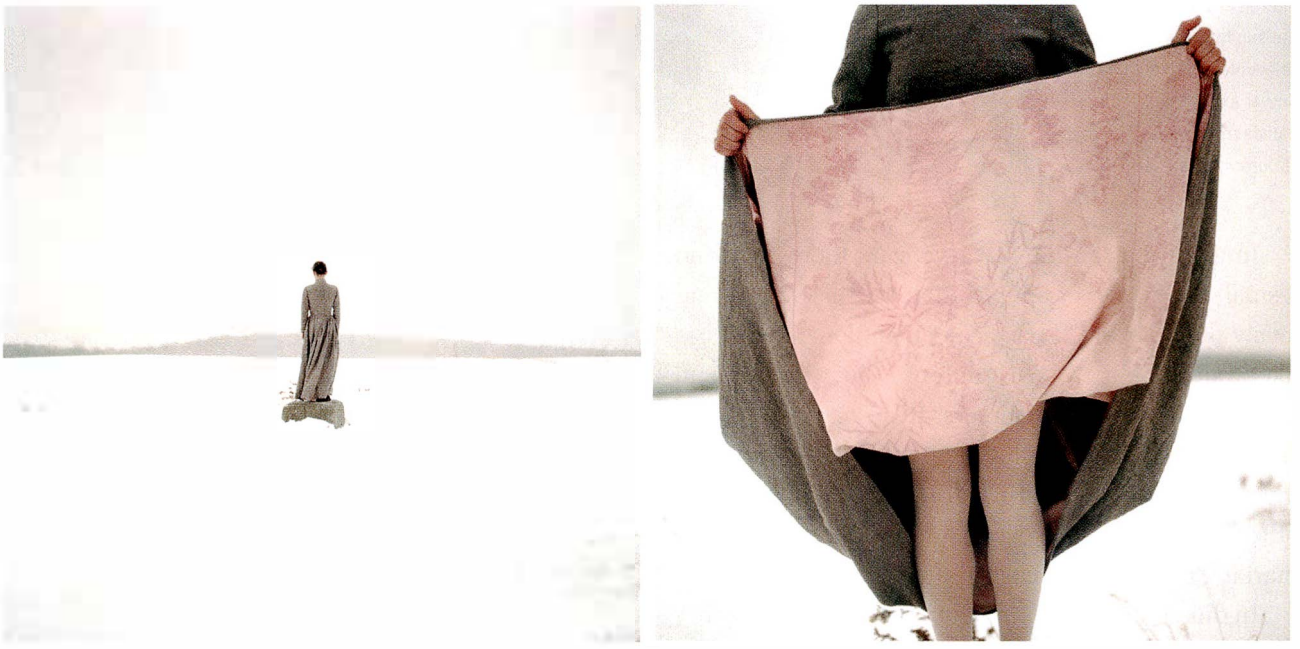


Figure 2–1

Christine Elfman, *Anthotype Dress,* 2011

Christine writes, "*While studying 19th century photographic processes in Rochester, I learned of The Fading Committee, which was founded in 1855 in hopes of discovering a permanent photographic print, as the albumen print was already showing signs of instability. I was intrigued by this obscure piece of photographic history, which illustrated the ongoing desire to capture fleeting impressions. For me, it seems fitting that photographic materials fade, since the subject matters of all photographs inevitably fade over time. In my Anthotype Dress project, silk pattern pieces for the inner lining of the dress were dyed with the fugitive pokeweed juice and put in contact with the pressed flowers and exposed to the sunlight. After seven months of exposure, the fabric retained its magenta color behind the flowers, while the rest faded pink.*"

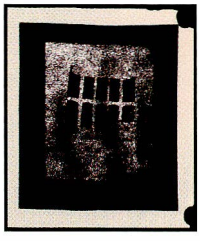
(Courtesy of the Artist)

Figure 2–2
Dan Estabrook, *Anthotype Dressing Gown in Pokeberry*, 1999
This anthotype is another example of Dan's forays into the world of the technically obscure. Dan, a former student of mine at Harvard and a current colleague in the MFA program at the College of Art and Design at Lesley University, made a positive film of the dress, mixed up an anthotype slurry with pokeberries and alcohol, placed the positive in a contact frame with paper coated with the filtered and extracted juices, and exposed it to the sun for several days. Pokeberries make a relatively fast exposure, while other types of flower extracts may take weeks to render a satisfactory image.
(Courtesy of the Artist)

In any event, in the last few years there has been a small revolution of appreciation for this simple and lovely process, and it has been championed by artists like Malin Fabbri, Dan Estabrook, Christine Elfman, Bev Conway, and many others. Read on and you will certainly see why. The anthotype process is probably more true to the definition of photography than any other system used for the same purpose. It is light marking in the truest sense of the phrase.

In this chapter I will provide you with a little history of the anthotype; discuss flowers and fruit, the colors of light, complementary colors, bleaching, absorption, and reflection; and then recommend certain materials you will need and the procedures necessary for you to make your own anthotypes.

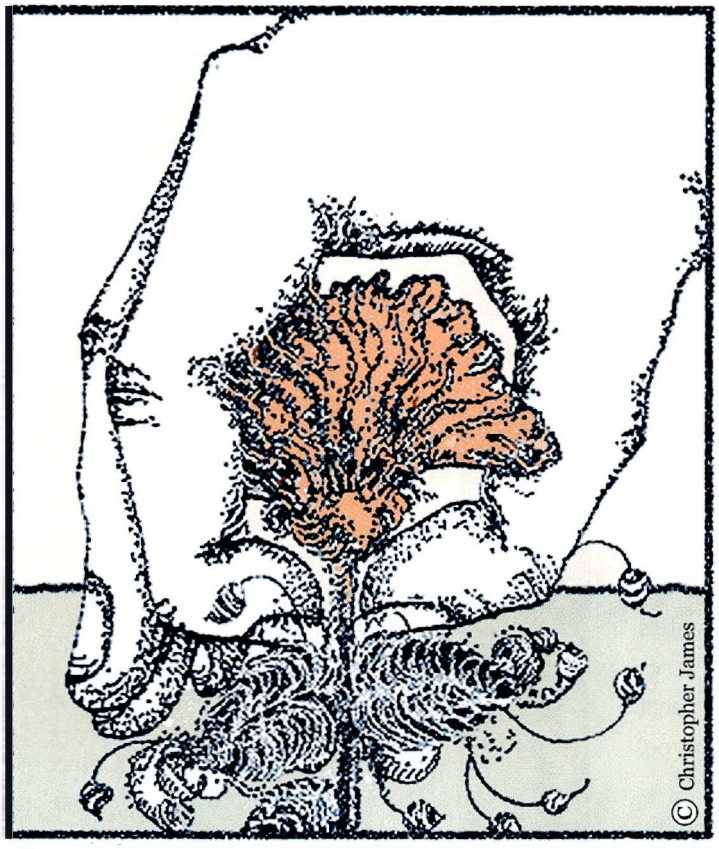
I will also tell you about a beautiful technique used by Vietnamese-born artist, Binh Danh, and how he makes provocative and poetic images on leaves using the process of photosynthesis and large vegetation as his media.



A LITTLE HISTORY

Sir John Herschel's Garden

The anthotype is a whimsical and charming process, credited to, and refined by, Sir John Herschel in the early 1840s. It only requires the natural extracted colors of flowers and fruit, a little alcohol, and sunlight . . . the primary components I would recommend to anyone for a romantic vacation. Like most of the alternative process evolution, many people played a part. In the anthotype, the knowledge that contributed to Herschel's work—specifically the sensitivity of plant matter extracts to UV light—had contributions from others such as Mary Somerville and Henri Vogel. Somerville's work, detailed in a letter to Herschel (following years of Herschel's own



Sir John Herschel's actual fingers selecting an odd flower for his newest anthotype - c. 1840

Figure 2–3
Christopher James, *Sir John Herschel's Fingers Selecting an Odd Flower for an Anthotype,* 1840
(Courtesy of the Artist/Author)

investigations) in 1845, discussed in detail the "action of rays" effect on the bleaching and color transitions of blue and red flowers.

A decade earlier, in 1832, Herschel had conducted several experiments in which he filled glass tubes with a solution called platinate of lime (also known as calcium chloroplatinite). He described his experimentation in a paper entitled "On the Action of Light in Determining the Precipitation of Muriate of Platinum by Lime-Water" in July of that year. Within the text of this paper he discussed the "remarkable action" confined to the violet end of the spectrum and how he had made a solution out of red rose leaves and then acidified it with a small amount of sulphuric acid (in order to better release the colors of the flower petals). He then filled the glass tubes with the liquid. He then described how the tincture of red from the rose-colored solution had prevented the platinum of lime-water from being completely influenced by UV light. Although Herschel did not formally mention what he had in mind in 1832, it suggested two possible avenues for future investigation: the selective filtering of light for purposes of manipulating exposures of light-sensitive materials such as silver and the use of the natural pigments of flowers to make images via the concept of bleaching those colors with sunlight.

Another interesting bit of related information has to do with Herschel's work on a process he referred to as the kelaenotype (also celaenotype) in 1842, the very same year as the anthotype. This process was doomed to failure from the start because of the very volatile nature of the mercury chloride (1/20 of a gram is lethal, just in case you are tempted to resurrect the process) it relied upon to make "the most exquisite imaginable" iron–mercury prints. There isn't a lot of information on this process even though, according to Dr. Mike Ware, the world's leading authority on Sir John, Herschel conducted many more experiments in this technique than in the cyanotype or chrysotype put together.

One clue as to what he may have been working on in both the kelaenotype and the anthotype techniques,

since both were in progress in his laboratory in 1842, is a plant called Salsola kali. This particular plant may have derived its name from the Arabic word *al qaly* (in Arabic, *al qaly/kali* is the source of the English word *alkali*), which described a plant that Herschel might have known as prickly stalwort, Russian thistle, or tumbleweed. The Salsola kali is primarily composed of proteins, fiber, ash, and up to 5% oxalic acid. In biblical times it was burned to make soap due to its significant alkali content. In modern times it has been occasionally used for livestock feed and as a principle ingredient in the production of soda ash/sodium carbonate when the plant is burned to ash.

Here's where it might relate: Herschel may have read that soda ash produced a lemon yellow color when mixed as a solution combining tartaric acid and bicarbonate of soda. He most probably knew about sodium carbonate's yellow bleaching properties on the iron-based processes like cyanotype. And just this simple point may connect his experiments with the kalaenotype, the cyanotype, and the anthotype all within the same time period.

Herschel conducted his first plant-dye photographic experiments by analyzing the light sensitivity of natural vegetable and plant pigments. As an example, he knew that artists had long sought out the minerals found in nature for their paints and dyes because those pigments were not as fugitive as the flavonoids (plant pigmentation) commonly found in plants and vegetation.

Herschel combined this with his knowledge of how specifically colored objects reflected light of the same hue (*hue* . . . meaning a color observed as a result of its dominant wavelength in the spectrum), all the while absorbing the wavelengths from all other hues. One more piece of this anthotype puzzle that Herschel understood was that while a color was reflecting its own color, its pigments could be bleached by the color of its complement.

As an example, Henri Vogel experimented in 1816 on red carnations turning white in a matter of days when placed behind blue glass and exhibiting little change when placed behind red glass. This knowledge was further enhanced when Vogel went on to report that paper coated with the extracts of the red carnation exhibited identical results.

How a color is absorbed determines how the eye observes that color. The color most significantly absorbed is the complement of that color. A material that absorbs the color blue does not look blue, as the colors that are not absorbed are the colors that we can see. Again, the observed color is the complement of the absorbed color. As an example . . . potassium and ammonium dichromate (a common sensitizing chemical used in gum bichromate printing) is a brilliant red-orange to our eyes because these chemicals absorb their color complement, blue. In addition, an orange-yellow

Figure 2–4
Herschel, *Anthotype Portrait #10*, 1840
The word *anthotype* is from the Greek word *anthos* for flower. In Herschel's quest to explore the new science of *photography*, a word that he coined, he distilled his current knowledge of light, color, and botany and set to work on a practical process of making images with natural flower pigmentation as early as 1836. Herschel understood that while a color was reflecting its own color; its pigments could be bleached by the colors of its compliment. This image is from an engraving of Mrs. Leicester Stanhope using the juices of red double stock, something that he used for many of his photographic experiments.
(Photography Collection / Harry Ransom Center / The University of Texas at Austin)

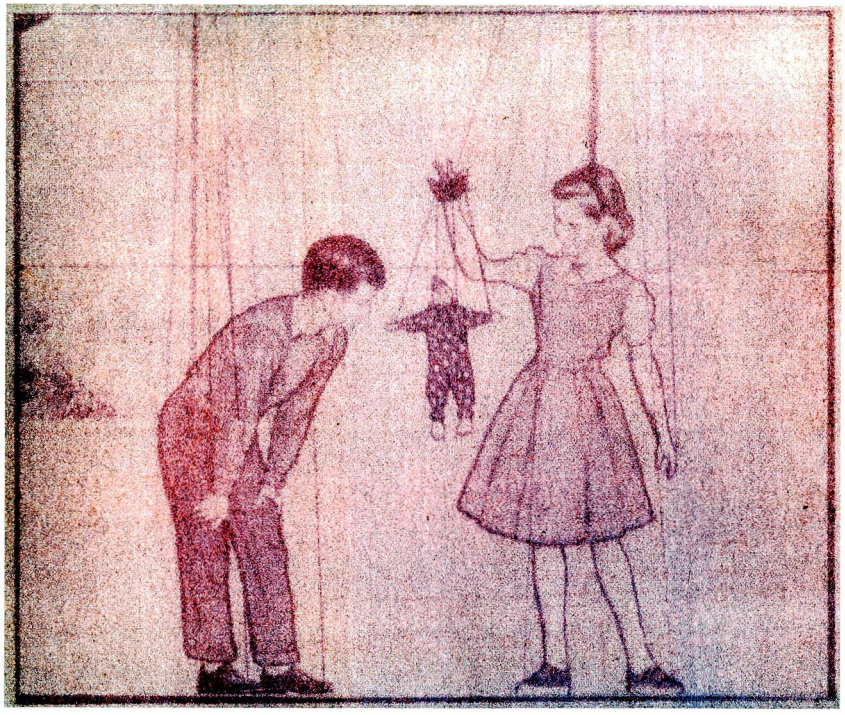


Figure 2–5
Linda Wilson, *Strawberry—Puppeteer*, 2006
Linda's print is an example of the anthotype process utilizing strawberries. The image was created from a found illustration, scanned, printed out, drawn on, re-scanned, and the positive printed out on ink-jet film. To get the color, the berries were slowly boiled to evaporate some of the water, resulting in a deeper color. The berry juice was applied to watercolor paper and then combined with the transparency between sheets of glass sealed together with duct tape. The image was placed outside, weather permitting, for a few weeks of exposure. *(Courtesy of the Artist)*

sensitizer will be bleached more aggressively by blue light rays while transmitting orange-yellow light rays. Blue pigments are bleached by red-orange and yellow rays, while purple and pink pigments are bleached by green and yellow rays.

If you really want to get into color theory you can investigate it from a light or pigment point of view. One of the best books, and one that I have used to great advantage since my undergrad years at Massachusetts College of Art in the late 60s, is Chevreul's masterpiece, *The Principles of Harmony and Contrasts of Colors* (1839 in French and 1854 translation in English). There is also a published contemporary version of this amazing book with an introduction by Faber Birren. Birren was a disciple of Chevreul's and seems to have channeled the great master. I recommend reading Birren's own books that investigate color and human perception. OK , enough of that . . . back to flowers, alcohol, and sunlight.

The word *anthotype* is derived from the Greek word *anthos* for flower. In Herschel's quest to explore the new science of *photography* (a word that he made up by the way), he distilled his current knowledge of light, color, and botany and set to work on a practical process of making images with natural flower pigmentation. Here's how he described it in his paper to the Royal Society in 1842: "*On the Action of the Rays of the Solar Spectrum on Vegetable Colours and on Some New Photographic Processes, . . . In operating on the colours of flowers I have usually proceeded as follows: - the petals of the fresh flowers, or rather such parts of them as possessed a uniform tint, were crushed to a pulp in a marble mortar, either alone, or with addition of alcohol, and the juice expressed by squeezing the pulp in a clean linen or cotton cloth. It was then spread on paper with a flat brush, and dried in the air without artificial heat, or at the most with a gentle warmth which rises in the ascending current of air from the Arnott stove.*"

In that same treatise, Herschel wrote, "*The action is positive, that is to say, light destroys color; either totally, or leaving a residual tint, on which it has no further, or a very much slower action. And thus is effected a sort of chromatic analysis, in which two distinct elements of color are separated, by destroying the one and leaving the other outstanding. The older the paper, or the tincture with which it is stained, the greater is the amount of this residual tint.*"

Herschel used a "positive" engraving that he had waxed or oiled for translucency as his "negative,"

Figure 2–6
Sir John Herschel, *Anthotype #4 ("The Royal Prisoner")*, 1839
A Herschel anthotype made from red double stock solution.
(Photography Collection / Harry Ransom Center / The University of Texas at Austin)

reasoning that the rays of the sun would have a reducing effect on the flower-juice-coated papers in the areas of the engraving that were least blocked with ink . . . , essentially duplicating the engraving via the bleaching action of the sun. And that's the guiding principle of the anthotype process.

In its simplest explanation, an anthotype uses the natural pigments of berries, leaves, and flowers for its coloration. Often the colors of flowers used do not end up as the color on the paper, and this is due to the way certain flowers react to UV rays and to the acidity or alkalinity of the solution coated on the support paper, as well as the paper itself. Once gathered, these plant specimens are ground into a soupy pulp; mixed with a little alcohol to help break it down, give it liquidity, and preserve its true color; and strained through cheesecloth to get chunk-less extract. In the loosest of terms, you could think of it as a "sensitizer."

This liquid extract solution is then coated, several times, on the backside of a damp piece of paper and dried. You may also elect to immerse the paper in the extract for a sincerely deep saturation of the juice. After drying, lay on a film or digital film positive, oiled/waxed paper copy print, or photogram material; put the combination in a contact printing frame or under pressure with a backing board, pad, glass and clamps; and put it in sunlight...often for a very long time.

The average exposure in nice summer weather is totally dependent on the freshness of the flower petals, the individual dye potency of the flower, the intensity of sunlight, the paper used, and whether an acid or an alkali has modified the solution. Generally speaking,

Figure 2–7
Jane Alden Stevens, *Photograph Beneath the Stencil on an Apple*
This is an example, by Jane Alden Stevens, of the time-honored technique of creating stencil patterns on fruits and vegetables. *(Courtesy of the Artist)*

the exposure can be as short as several hours with yellow japonica or beet-root, or several weeks with a plant that is less sensitive. You'll need to open your contact frame and check it every few hours . . . or days.

In researching for this book I found an interesting anthotype-related fact. There was a tradition in France, going back to the early 1700s, in which stencils were arranged on fruit. Once the stencils were secure, the fruit was exposed to sunlight. The sunlight would bleach, or ripen, the areas of the fruit's skin into decorative patterns that were, I would suspect, employed to make a table display more impressive. As mentioned in the Bayard Direct Positive chapter, Hippolyte Bayard, a clerk in the French Ministry of Finance in the 1830s and one of the true inventors of photography, had a father who would create patterns on his peaches at harvest time. This simple decorative exercise had a profound effect on Bayard's life as an artist and inventor.

TABLE SET UP FOR ANTHOTYPE

- Fresh and young flower petals, stalks or leaves, fruits, frozen fruits, vegetables such as beets or onion skins, or even dehydrated versions of this same vegetable and plant matter. The possibilities are endless.
- A blender, hand-blender, or mortar and pestle for crushing and blending the flowers
- Simple alcohol, e.g., Everclear, vodka, rubbing alcohol (preserves color)
- Acetic acid or table-strength vinegar
- Cheesecloth for straining the flower and fruit mash into juices
- Foam brushes for coating

Figure 2–8
Mary Dorsey Wanless, *Ditch Lily*, 2008
This beautiful anthotype was made by my friend Mary Dorsey Wanless and is unusual in that it incorporates not only the extract of the plant but the flower itself, which is employed as a subject of the photogram.
(Courtesy of the Artist)

- A Pyrex glass lasagna dish for immersions
- Water and a clean sponge
- Paper for coating: COT 320, Crane's Platinotype, Buxton, Kozo, etc.
- A contact-printing frame that you can leave outside
- A pencil
- A film or digital film positive, photogram materials, transparent or oiled art work
- Paper towels

Figure 2–9
Christine Elfman, *Pokeweed Anthotype Juice Workflow*, 2011
A wonderfully funny illustration of a Pokeweed extract workflow and anthotypist, Christine Elfman, in her studio.
(Courtesy of the Artist)

THE WORKING PROCESS

Go to the garden or market and collect the flower petals, vegetables, and berries that you want to experiment with for your color. Herschel and his colleague Mary Somerville knew that the freshest flowers yielded the best color, so look for new vegetation and petals. You can dehydrate these petals for later use or go directly to making a solution. The best vegetation (i.e., the most sensitive plants, vegetables, and fruits) is seasonal, so it is possible to work year round if you want to preserve your petals (pretty poetic, I think) by picking them, drying them, and freezing them until you are ready to make a liquid extract.

There is a very interesting section in Henry Snelling's *The History and Practice of the Art of Photography* (G.P. Putnam, NY, 1849) that sits in between sections on Hunt's observations on the Influence of Solar Rays on Compound Bodies and Hints and Suggestions to Daguerreotypists, in which Snelling feels he must leave the subject of the action of light on metallic compounds and investigate the effect of that same light upon the juices of plants, "*some of which produce very good photographic effect*." Here are a few of his observations.

CHORCORUS JAPONICA (yellow japonica)—*"The juice of the flowers of this plant impart a fine yellow color to paper, and, so far as ascertained, is the most sensitive of any vegetable preparation; but owing to its continuing to change color even in the dark, photographic images taken on paper prepared with it soon fade out."*

WALL FLOWER—*"This flower yields a juice, when expressed with alcohol, from which subsides, on standing, a bright yellow finely divided faecula (a term used in the 1700's to define finely pulverized plant matter), leaving a greenish-yellow transparent liquid, only slightly colored supernatant. The faecula spreads well on paper, and is very sensitive to light, but appears at the same time to undergo a sort of chromatic analysis, and to comport itself as if composed of two very distinct coloring principles, very differently affected. The one on which the intensity and sub-orange tint of the color depends, is speedily destroyed, but the paper is not thereby fully whitened. A paler yellow remains as a residual tint, and this on continued exposure to the light, slowly darkens to brown. Exposed to the spectrum, the paper is first reduced nearly to whiteness in the region of the blue and violet rays. More slowly, an insulated solar image is whitened in the less refrangible portion of the red. Continue the exposure, and a brown impression begins to be percieved (sic) in the midst of the white streak, which darkens slowly over the region between the lower blue and extreme violet rays."*

THE RED POPPY—*"yields a very beautiful red color, which is entirely destroyed by light. When perfectly dried on paper the color becomes blue. This blue color is speedily discharged by exposure to the sun's rays, and papers prepared with it afford very interesting photographs. —Future experiments will undoubtedly more fully develope the photogenic properties of flowers, and practically apply them."*

Here is a list of additional plant and vegetable options, along with their observed results, that have proven successful.

Recommendations for Flowers, Fruits, Vegetables, & Ideas

- Frozen or fresh blackberries are fast and rich in tonality.
- Fresh blueberries look like they might be good, but they seldom give you much to be happy about. Frozen blueberries, on the other hand, work better, and the results are often quite purple-like.
- Pokeberries work well and result in a purple/raspberry image.
- Black currants yield a very nice magenta on the order of a raspberry.
- Beets and beet root are red in color, as you might expect.
- Boiled-down brown onion skin is a deep orange brown.

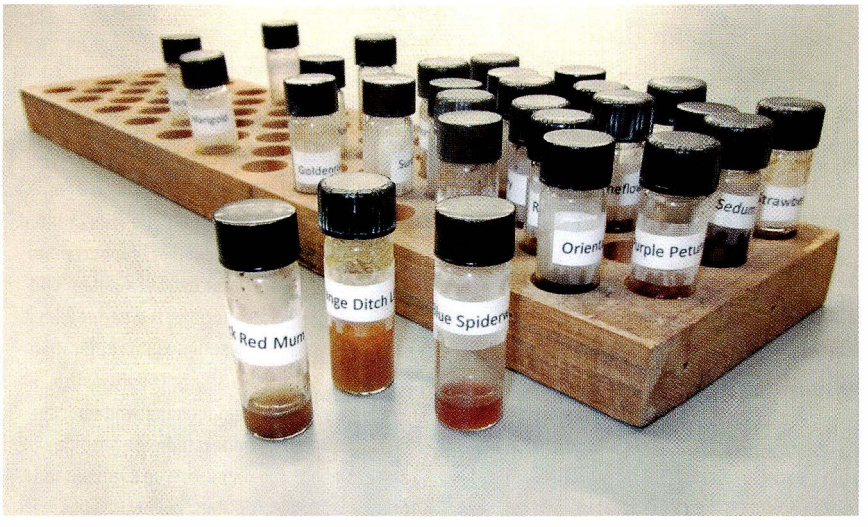


Figure 2–10
Mary Dorsey Wanless, *Flower Extracts*, 2008
An illustration of Mary Dorsey Wanless's anthotype flower and vegetable extract collection.
(Courtesy of the Artist)

- Fresh spinach is quite green. Old spinach is a bit yellow-green.
- Nasturtium flowers come in a variety of colors, are fast, and yield a nice green with good contrast. The leaves are also tangy and peppery and make a nice addition to a salad. There are a few types of nasturtium, and this one is the regular garden variety.
- Bleeding heart petals yield a light blue even though they are pink.
- Purple pansy, of the violet viola variety, is also a nice blue.
- California poppy, yellow and orange varieties, are very fast printing.
- Red poppies provide a nice lavender. With poppies, include the middle anther portion for a richer coloration. This was Herschel's favorite.
- Purple bearded iris is a brilliant blue-lavender, stunning really, and produces a very good image with little effort and only a few petals.
- Black walnut gives a very nice orange brown (http://www.royalwoodltd.com).
- Turmeric is yellow . . . simply yellow.
- Fuchsia: try the different parts for different colors.
- Red wine is a simple and very easy extract with all of the work done for you already.
- Also try such things as yellow japonica (which is very sensitive to light bleaching), marigold, double purple groundsel, red dahlia, and any other form of vegetation that seems like a good idea. Use your imagination and whatever is in the garden, woods, or market.

Making the Extract

A mortar and pestle or an electric blender is required for grinding the vegetable matter into pulp if you use fresh flowers. If you elect to dehydrate and freeze your vegetation first, which often yields a much greater color concentration in the final image, you will need a blender to chop the dehydrated flowers into little pieces before adding alcohol and re-hydrating them. The mortar and pestle is the romantic way to accomplish the task of grinding up your vegetation. Be aware, however, that grinding some fruits and flowers by hand results in a sticky mess. However, if you are feeling practical, and less romantic, you can use an electric blender or blender wand, which is quite efficient and far less messy.

The next step in the process is to add a splash of alcohol to this pulp and re-blend it until it has a nice smooth "soupy" texture. In some recipes you will need

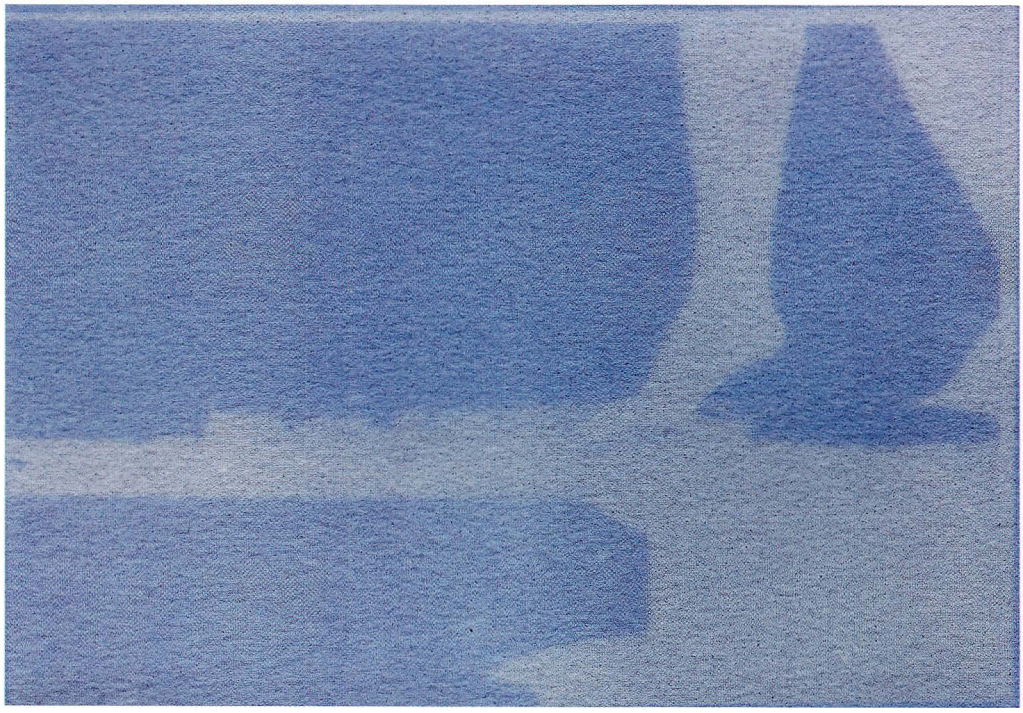


Figure 2–11
Malin Fabbri, *Stockholm at my feet*, 2011 (blueberry)
Malin's, *Stockholm at my feet* anthotype was created by making a blueberry and water extract solution and saturating the paper with it by submersion rather than brushing. The exposure, using a negative film generated with a Holga camera, was exposed to UV light for several weeks. *(Courtesy of the Artist)*

Figure 2–12
Linda Wilson, *Trumpeter Elephant*, 2011 (anthotype)
Indiana artist Linda Wilson made this anthotype using a blend of teas as her extract agent.
(Courtesy of the Artist)

a lot of plant matter to get a decent color. In others, such as a "soup" of purple bearded iris, you won't need a lot at all. If you want to try enhancing the color of the final image you may experiment with acidifying this soupy mix with a little acetic acid or table vinegar. This prevents the matter from oxidizing too rapidly and losing its color. Mary Somerville's anthotype experimentations, which she continued after Herschel left photography to pursue other areas of scientific study, noted that "*the action of rays of mean refrangibility* (meaning the ability to refract light) *on vegetables was much increased by the addition of a little sulphuric acid.*" Essentially, all you need to do is get your solution to a pH 3 and you will have done what is necessary to achieve this effect.

Now, slowly pour the pulp solution into the cheesecloth. Gather in the corners so that the pulp is secure in the bottom of the cloth, twist it shut, and squeeze all of the pulp juice into a new container.

You will need a good piece of paper and I will recommend that it be something along the lines of a nice stationery, Cranes Platinotype or Cot 320. The latter will hold more of the extract if you opt to immerse the entire paper.

Figure 2–13
Francis Schanberger, Anthotype set up for *Somnambulist #4*
Illustrated here are three process images showing how Francis set up his workflow for illustration Figure 2-14.
(Courtesy of the Artist)

Making a Film Positive with Pictorico OHP

If you opt to not immerse, you will also need a clean foam brush or synthetic Richeson brush for coating and a selection of positive (not negative) film or digital films, photogram materials, or anything else that comes to mind. Producing this positive in a pinhole camera is as simple as creating it in Photoshop and printing out the acetate positive on a piece of Pictorico Ultra Premium OHP. The following type is in bold face because it is disheartening to wait 3 weeks to look at a print only to find out that you should have read the text more closely. **A positive film will give a positive image, whereas a negative film will give a negative image.** Again, this is due to the fact that the sun is going to cause reduction and bleaching rather than a darkening exposure. Using a positive film, the shadow areas are dark and will prevent, to a degree, the bleaching effect of sunlight in the print. This means that the berry/flower color is unchanged. The highlights are lighter in the film positive, and this permits the sun to do its bleaching thing on the flower juice coating. I suggest high-contrast positives to begin learning the process.

Next, if you are brush coating, dampen the rear of the paper with a wet sponge. Do this until the paper is wet but not dripping and then flip it over and tack it to a board for coating. It is important to coat the juice on damp paper to avoid brushstrokes in the final image. Saturate the paper. When the coating is bone dry, think about coating it again for good measure. After that, perhaps a third time won't hurt. Dry the coated, or immersed, paper.

Now, place your film positive on the paper and secure it into a hinged contact frame and expose it to sunlight for as long as it takes to make the image. Depending on the flower/fruit it could be several hours to several weeks. I knew a young artist in Maine a while ago who simply put his loaded anthotype contact frames in the rear of his truck and drove around

Figure 2–14
Francis Schanberger, *Somnambulist #4*, 2011
Somnambulist #4 (also known as *Rose Red Pajama Pants*) is a 40" × 40" anthotype made using red rose pigment.
(Courtesy of the Artist)

Figure 2–15
Francis Schanberger, *Mommy Saffron*, 2012 (anthotype)
Mommy Saffron is a 14" × 11" anthotype using saffron extract for its coloration.
(Courtesy of the Artist)

normally for a few weeks to make the exposures. When the exposure is done that's the conclusion of the process. There is no wash out or development. What you see is what you get so this is, in a very real way, a POP (printing-out-paper) process.

Some Additional Anthotype Observations

Generally, natural blue pigments tend to be the fastest in terms of printing time but are difficult to preserve. Extended exposure will cause fading, especially in the reds, but the positive side to this problem is that the highlights will bleach into white. Clove carnations and red damask yield a slate blue. The sparaxis perennial, a yellow/purple spotted deciduous herb from South Africa, yields a dull olive green, while a rose-colored tulip delivers a blue-green. Poppies provide a solid blue, and lavender stalks and flowers give a nice green that will shift to a yellow if the solution is acidified. Beets, when acidified, produce a very nice rose. Bev Conway uses boiled and reduced onion skin and coats it on quality inkjet paper to produce her images. Experiment to your heart's content and you will eventually find what you want.

Other ideas to consider might include mixing different flowers together to create different values and hues. Try mixing the pulp and dehydrating it and then figuring out a system of re-hydration that will give you the best coloration. You might also consider taking a particularly powerful color, such as beets or blueberries, and adding a dichromate to them and using that mix as your color for gum bichromate printing on a sized paper. This obliterates the simplicity of the anthotype process, but it might be a new addition to your gum bichromate printing menu.

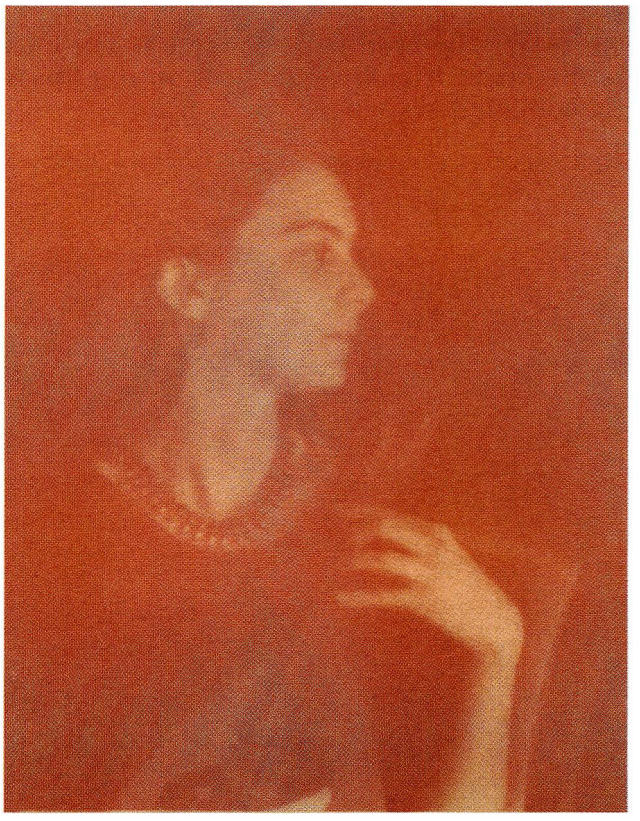


Figure 2–16
Bev Conway, *Onion skin Anthotype of Nahanni*, 2005
The exposure of this onion skin anthotype is a bit tricky to calculate. The image was printed during June/July, and the total exposure was probably about a month. Every day the contact frame was placed in the sun. The exposure continued in Santa Fe as Bev took the contact frame to a workshop she was attending. She continued to check on the exposure until she liked it.
(Courtesy of the Artist)

Bev Conway's Onion Skin Anthotype Recipe

- 6 –10 large yellow onions
- 2 cups water

Step 1 Peel off and use only the brown outer skin of the onion. You will have about 3–4 cups of brown skins.

Step 2 Bring 2 cups of water to a boil and add the onion skins until the liquid is a deep orange-brown color.

Step 3 Remove all of the onion parts and save the liquid.

Note: No alcohol is used in this anthotype process to break the color down, as it has already been broken down via the boiling.

Note: The best paper for this onion juice is the inkjet friendly, 100% cotton rag Epson Smooth Fine Art paper.

Figure 2–17
Bev Conway, *Carrie*, 2011 (anthotype w/black walnut hulls)
This is an anthotype portrait by Bev made with the extract of black walnut hulls. Black walnut is not the easiest product to locate, but a great source for it can be found at http://www.royalwoodltd.com.
(Courtesy of the Artist)

Step 4 Follow the basic anthotype instructions in the earlier part of this chapter and get set up for your exposure. Total exposure duration in the summer is about 1 month. In Bev's anthotype, part of her exposure time was in Santa Fe. The remainder was in New Hampshire.

Here's the rub: unfortunately, there are only a few historical anthotype images left to look at, due to the fact that the process was not really popular . . . probably due to the instant gratification factor and the fact that they must be stored in the dark like a Mark Rothko painting (painted with discount house wall paints when he had no money for supplies), or else they will fade. Dan Estabrook's *Pokeberry Dressing Gown* is almost gone only a few years after he gave it to me and resides in tin foil in the freezer. Herschel's anthotypes can be found in the archives of the Harry Ransom Research Center at the University of Texas, Austin, and the Museum of the History of Science at Oxford. For those of you who absolutely need to know if it works, it does, and there are actually a few contemporary artists who are making images using the technique. The anthotype is an easy, intellectually painless, very inexpensive process to prepare for . . . and is an interesting way to tie up a contact printer for a few weeks. It is not a procedure for anyone who absolutely must have a finished print immediately. It is, however, a charming idea and is eccentric enough to capture the attention of most alternative children. And . . . it is all about the process so you don't have to wreck the experience by laying a conceptual critique on it.

THE CHLOROPHYLL PROCESS: BINH DANH'S PHOTOSYNTHESIS ART

Binh Danh's Photosynthesis Art

In 2002, I was enlightened by an NPR story being broadcast on Ketzel Levine's *Talking Plants* show. The program was about a young Vietnamese-born man by the name of Binh Danh who was, at that time, a graduate student at Stanford University and in control of a beautifully organic process that featured images on plant leaves. I was taken by the fact that this was a technique reflected in his personal history. It also relates to the historical tradition of using fruit stencils on fruit as a way of enhancing the experience of the fruit. The difference, though, was significant

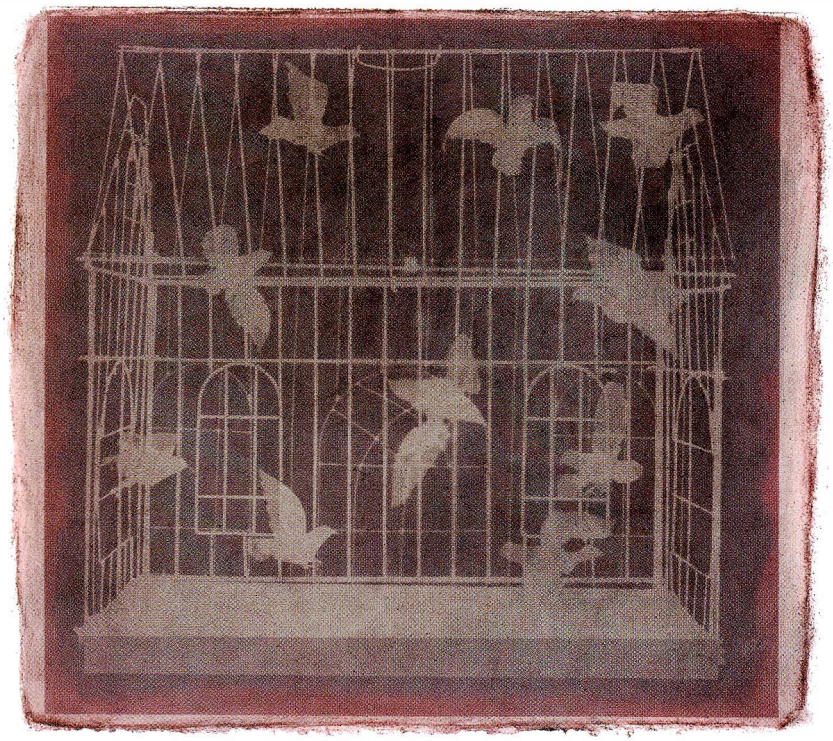


Figure 2–18
Carol Golemboski, *Blackberry Birdcage*, 2008
Colorado professor and artist Carol Golemboski writes, "*I didn't actually use flowers for this. I tried some Orange Gerber daisies and they worked really well but as I was working toward an exhibition and I had tested the blackberries and felt most comfortable knowing what results I'd get. By the way, raspberries definitely have the fastest "ISO."*
(Courtesy of the Artist)

in that the work Binh Danh was creating was filled with powerful, political, and symbolic imagery in ways that greatly exceeded the decorative stencils of the 1700s.

As Ketzel Levine said in the NPR piece, "*When Binh Danh prints pictures on leaves, something inexplicable happens. His small, green canvases expand beyond measure with both the seen and the unseen. The serenity of the Buddha on a circular nasturtium suggests a primordial, benevolent world; armed soldiers in camouflage, crouched in calla lily foliage, appear to be both predator and prey; and a young Vietnamese boy, held in the fingered palm of a philodendron, aches with human vulnerability.*"

Figure 2–19
Binh Danh, *Wandering Souls*, 2003
Binh invented a unique process for printing photographs (digitally rendered into negatives) onto the surface of leaves by exploiting the natural process of photosynthesis. The leaves, still living due to bagging the roots in dampness, are pressed between glass plates with the negative and exposed to sunlight from a week to several months. Coined "chlorophyll prints" by the artist, the fragile works are then encapsulated and made permanent through casting them in solid blocks of resin.
(Courtesy of the Artist and The Haines Gallery)

Figure 2–20
Binh Danh, *Jimmy W. Phipps #18, "One Week's Dead"* 2008
I clearly remember, as a student at Massachusetts College of Art in 1969, sitting on a washing machine in a laundromat in Boston. I was about to be drafted and was reading an issue of *Life Magazine*. In it, set up like a high school yearbook, were portraits of the 242 young boys my age who had been killed in Vietnam in the past week. It was as horrifying then as it is now. This photosynthesis portrait of one of those faces, Jimmy W. Phipps, is Binh's symbolic gesture to the dead, printed on the vegetation of the jungle in which they died.
(Courtesy of the Artist)

Photosynthesis

Binh's chlorophyll prints represent his personal belief in the inter-connectivity between man and the natural world. The process is a mirror of that belief, as the principle force in the making of the imagery is photosynthesis.

The concept of photosynthesis entered the public consciousness as a result of the early scientific investigations of Jean Senebier (1742–1809) as he explored the influence of light on vegetation. Senebier's work, utilizing previous conclusions and speculations from the studies by Malpighi, Hales, Bonnet, Priestly, and Ingenhousz, clearly demonstrated the phenomena of photosynthesis, the process by which the green parts of plants utilize light energy to produce carbohydrates and how "fixed air" (carbon dioxide) was converted into "pure air" (oxygen) in a light-dependent process. Senebier demonstrated that it was the light of sunlight, and not its heat, that was necessary for photosynthesis to occur.

In our contemporary understanding of photosynthesis, we know it as the process by which plants use the energy from sunlight to produce sugars that *cellular respiration* (the transfer of energy from plant molecules) converts into ATP (adenosine triphosphate), the fuel used by all living things on Earth. Photosynthesis takes place in plants as carbon dioxide, water, and light energy are converted into sugars and

Figure 2–21
Binh Danh, *Ancestral Alter* #22, 2008
Born in Vietnam in 1977, Binh Danh immigrated to the United States with his family when he was a young child. Images from the Vietnam War are prevalent in his work, providing a unique connection between process and subject matter. As he explains, *"This process deals with the idea of elemental transmigration: the decomposition and composition of matter into other forms. The images of war are part of the leaves, and live inside and outside of them. The leaves express the continuum of the war. They contain the residue of the Vietnam War: bombs, blood, sweat, tears, and metals."*
(Courtesy of the Artist)

oxygen and is directly connected to the green chlorophyll pigment in plants. In this process, plants use water and release oxygen . . . and basically, along with a healthy bee population, keep us breathing and eating. Keep this in mind if you ever have a doubt about the threat of global warming and the importance of green things.

Binh Danh's Process

Binh's process is pretty basic, and it is this simplicity of his syntax, concept, and intent that is so powerful in his work. He begins by selecting a leaf, often from his mother's garden. To prevent it from dehydrating and losing its color and elasticity, he fills a small bag with water and secures it to the stem of the leaf. He then places the leaf on a felt-covered board and places a negative directly upon the leaf. He lays a large sheet of heavy glass over the negatives and leaf, clips the glass and the support board together, and places the setup in the sun.

Binh will check on the print's progress from time to time, and the process can take anywhere from days to weeks. Most of the time he is dissatisfied with the results, but when it works he will take the leaf and "fix" it by casting the leaf, like a biological sample for scientific study, in a block of clear casting resin such as that made by the Fiber Glast Company. It is not the process that makes his imagery work . . . it is the poetry and power of his message.

The Calotype Process & the Art of Fixing Shadows

OVERVIEW & EXPECTATIONS

This chapter and the Salted Paper chapter that will follow share much of the same history, primarily due to the influence and inspiration of William Henry Fox Talbot. The two chapters are written with the intention that you will connect them, as well as all of the other A Little History segments of each chapter . . . as a single account in the development of photography.

In this chapter I will describe how to make a calotype paper negative that can be utilized for contact printing with a variety of alternative printing-out techniques such as salted paper and albumen. I'll detail the calotype workflows of the primary players in this mid-1800s scientific theater, including those of Fox Talbot, Thomas Sutton, and Arsène Pélegry. I'll also tell you about the contemporary variations of those workflows and discuss waxed calotype techniques based on Gustave Le Gray's influential 1851 process, in which calotypists would wax their paper substrate prior to the chemical stages and then employ the resulting semi-translucent calotypes to make positive prints using a variety of processes.

The calotype was among the first of the silver-iodized techniques that were created to be utilized as a negative in order to reproduce an image multiple times from a single source. Talbot's photogenic drawing negatives also worked in this regard but had significant shortcomings such as very low sensitivity to light, salt stabilization versus a more permanent sodium thiosulphate fixing sequence, and a distinctive lack of clarity due to the transmission of the exposure of light through paper. This made it quite different from the daguerreotype, which was a one-of-a-kind event and brilliant in its secret intimacy and detail. The quality comparisons between the two processes were unarguably in favor of the daguerreotype in terms of fidelity to the image's subject.

It is significant that the calotype negative demonstrated the first example of a latent image on paper, and more importantly, inspired further development of salted paper printing. This, in turn, evolved as a building block in the foundation of the albumen process, which, when used with Archer's wet collodion glass plate negative (1851), offered the clarity of the daguerreotype and the capacity for multiple reproductions of a calotype.

Figure 3–1

Dan Estabrook, *Black Hands*, 2002

I've always loved this piece by my former student, and current colleague, Dan Estabrook, integrating pencil and silver on a waxed calotype negative. Anyone who has spent any working time with calotypes, salted paper, albumen, wet plate, or kallitype knows the silver nitrate stains of honor . . . simply the silver reacting to the proteins in the first epidermal layer of your skin. Dan uses antiquarian processes to metaphorically express contemporary feelings . . . maybe.

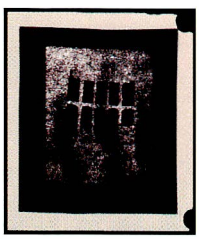
(Courtesy of the Artist)

Fox Talbot's patented calotype process from 1841 was largely ignored in Europe, and this intellectual disrespect resulted in a significant variety of adaptations that I will include in order to offer additional understanding of the process. These variations include the workflow of Thomas Sutton who, in 1855, went into business with another photographic luminary, Louis Désiré Blanquart-Evrard, the inventor of the albumen process. Together they founded the journal *Photographic Notes*, which Sutton edited for nearly a dozen years. For more on Sutton and his significant contributions to the medium, please refer to the Whey Process chapter. I'll include another variation from what may be thought of as the first Internet prototype, *Notes and Queries: A Medium of Inter-Communication for Literary Men, Artists, Antiquaries, Genealogists, etc.,* created in 1853 by Dr. Hugh Welch Diamond. His contribution, on this occasion, was a fascinating view of the calotype process entitled *The Simplicity of the Calotype Process.*

You will find a major section on Arsène Pélegry's developing-out calotype process, from start to finish, and compatible referencing to the contemporary workflows of calotypists Richard Cynan Jones, Alan Greene, Dan Estabrook, and Finn Ó Súilleabháin. You will find that it is Pélegry's workflow that is the most commonly practiced variant among contemporary calotype artists.

The calotype technique, no matter which version you elect to do, is a complicated process to perform well due to the time it takes to execute the little things that can go wrong and an abundant number of technical traps in which you will rapidly find yourself "in the weeds." This is not a process for anyone seeking instant gratification. It is also not recommended for the impatient. The process is overly sensitive to almost everything, including paper, water types and temperatures, ambient heat, cold, relative humidity, and, I would surmise, even karma. However, if you want to go exploring with the earliest of the photographic techniques, you will be amazed to discover how truly unique and lovely a paper negative can be. It is very important to keep in mind that all calotype variants are mercurial, time consuming, and riddled with problems to solve. As Richard Cynan Jones has written to me on multiple occasions, "it is maddening."

I will add that this chapter should be considered a resource and reference on the technique. It is offered in hopes that it will inspire you to investigate on your own and consult the evidence and details in the original manuscripts, treatises, patents, and articles in the words of the Talbot, Sutton, Pélegry, Le Gray, Keith, Diamond, and all of the others who were excited and burning with desire to make pictures. Equally important are the contemporary calotype research of Alan Greene's *Primitive Photography,* Richard Cynan Jones's Calotype Society on the web, Dan Estabrook's interpretation of Richard Morris's Talbot workflow, and Mark Osterman's G.E.H papers in this area. If you get into calotypes, remember that you are doing it for the love of the process and not for an exhibition of your calotype production at MOMA a few months from now.



A LITTLE HISTORY

The predecessor of the calotype, the photogenic drawing (1834), was documented and submitted by William Henry Fox Talbot in two separate letters to the Royal Society. The first and most well-known reading was modestly titled *Some Account of the Art of Photogenic Drawing or the Process by Which Natural Objects May be made to Delineate Themselves Without the Aid of an Artist's Pencil* and was delivered on January 31, 1839. This was Talbot's very serious attempt, having heard about Daguerre's announcement on the seventh of that month, to be recognized as the sole inventor of *photography* . . . a word that had not yet been used for the first time by his colleague, Sir John Herschel. A technical clarification letter was sent and delivered the following month that described how to perform the process. Several days later, the process was published in the *Literary Gazette* and was officially "in play" as a technique for the public to practice and improve upon.

On September 23, 1840, so the legend goes, Talbot made the discovery that changed everything. While re-sensitizing a piece of previously exposed salted

Figure 3–2
***Shark Egg Case*, 1840–1845, Plate #9, (camera-less salted paper print)**
This piece is from a personal album of British watercolorist Henry Bright (1814–1873), and it illustrates a photogram form of a shark's egg case. Unlike other photogram materials, such as leaves, feathers, and lace, the three-dimensional nature of the egg case allows light to pass over and around the parts of the egg case, giving the impression of fluidity and water. *(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)*

paper, one that had failed to come forth as an image, Talbot poured a solution of gallic acid and silver nitrate (gallo-nitrate of silver) over the paper and was privileged to see the very first chemical development of a latent image on paper. Talbot instantly named his new technique *calotype*, from the Greek words *kalos* and *tupos* meaning "beautiful" and "print." In a letter to the *Literary Gazette* in February 1841, Talbot described the moment of his satori. He wrote, "*One day, last September, I had been trying pieces of sensitive paper, prepared in different ways, in the camera obscura, allowing them to remain there only a short time, with the view of finding out which was most sensitive. One of these papers was taken out and examined by candlelight. There was little or nothing to be seen upon it, and I left it lying on the table in a dark room. Returning some time after, I took up the paper, and was very much surprised to see upon it a distinct picture. I was certain there was nothing of the kind when I had looked at it before; and, therefore (magic apart), the only conclusion that could be drawn was, that the picture unexpectedly developed itself by spontaneous action.*"

Talbot repeated the experiment several times with the same results and concluded that the residual chemical content within the paper had been responsible for the spontaneous development. Better still, the addition of gallic acid and extended washing resulted in a more stable image, and if fading occurred, the very same chemistry could repair the problem.

On June 10, 1841, Talbot sent a communication to the Royal Society entitled *The Process of Calotype Photogenic Drawing*, in which he described his calotype technique in full and simultaneously revealed a latent image that could be developed with chemistry . . . the earliest known photographic negative on paper. It should be pointed out that the daguerreotype, as well as Niépce's asphaltum and colophony processes, also involved the development of a latent image.

In Talbot's calotype process, he coated a sheet of Whatman Turkey Mill stationery with a 7.5% silver nitrate solution. The paper was dried under low light and when nearly dry, was dipped into or brushed upon with a 5.6% solution of potassium iodide for 2–3 minutes. This freshly iodized paper was then washed well in water for several hours in order to remove the recently made potassium nitrate in the paper, and when dry, it was a soft primrose yellow and could be subjected to low light without exposure.

The stock iodized paper was then made light sensitive via a second washing of aceto-nitrate of silver solution containing a restrainer . . . glacial acetic acid. This acidic restrainer in the sensitizer was responsible for holding back, or restraining, the spontaneous development of non-image silver. The volume of this restrainer would often be increased when the ambient temperature was high, as in a summertime lab situation.

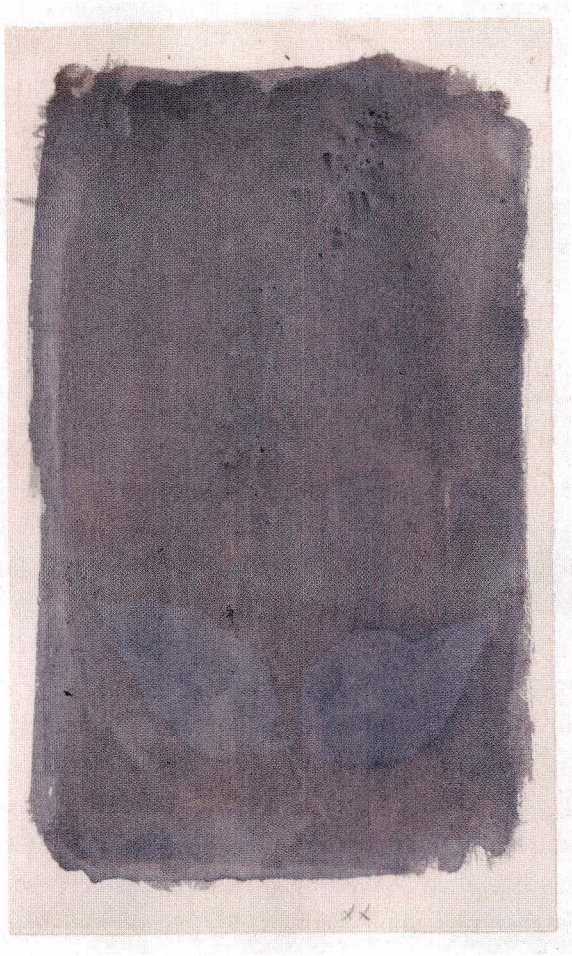


Figure 3–3
William Henry Fox Talbot, *Botanical Specimen*, 1835, Plate #1 (camera-less salted paper print)
This is a very early example of Talbot's experiments with salted paper. The lilac tonalities are a result of Talbot's attempt to stabilize the print with an immersion bath of sodium chloride.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

Figure 3–4
Joseph Foden's Mousetrap Camera Made for Talbot's photogenic drawings, 1830s
Talbot had a collection of small, hand-made "mousetrap" cameras that were made for him by local Wiltshire carpenter Joseph Foden. The cameras were christened "mousetrap" cameras by Talbot's wife, Constance, because of their diminutive size: a bit more than 2 inches square. Talbot's cameras incorporated an acromat lens, from a microscope, for its optics.
(Copyright© Royal Photographic Society / Science & Society Picture Library)

A fresh solution of gallo-nitrate of silver—the silver nitrate, acetic acid, and gallic acid solution—was mixed just prior to use, and the iodized stock paper was painted upon using a soft brush and then rinsed briefly in fresh water. Talbot had originally included gallic acid in the sensitizer (what he called gallo-nitrate of silver) . . . but there is strong speculation that he removed it from his personal workflow because it caused an unpleasant fog, called *browning* in calotype circles. If he did use it, it was only the addition of a few drops for increased sensitivity.

The sensitized paper could then be dried and kept for up to 12 hours or used immediately in a damp state. The paper's sensitivity was far greater than Talbot had expected, and he noted that all of his work had to be performed under candlelight. His in-camera exposure time, using his *mousetrap* cameras (a name his patient wife, Constance, had given to Joseph Foden's camera constructions) was comparatively rapid. Following exposure, there was a faint latent image on the paper.

Once the exposure was completed, the paper was taken into a low-light environment and washed with a solution consisting of equal volumes of aceto-nitrate of silver and saturated gallic acid. In the formula, the gallic acid is the developer and the acetic acid is the restrainer . . . added to hold back the browning of non-image development. The silver in the solution "feeds" the physical development of the image.

The gallo-nitrate of silver solution, in this example, was warmed prior to the wash. In seconds, the exposed portions of the image were revealed by a darkening action created by the development. As in a normal negative, the unexposed portions of the paper remained white. Talbot noted that repeated washings of the initially weak image in fresh gallo-nitrate of silver would result in a more resolved and realized impression within 1–2 minutes.

The fully developed paper negative was then washed in fresh water and subsequently fixed in a solution of bromide of potassium, or sodium thiosulphate, for

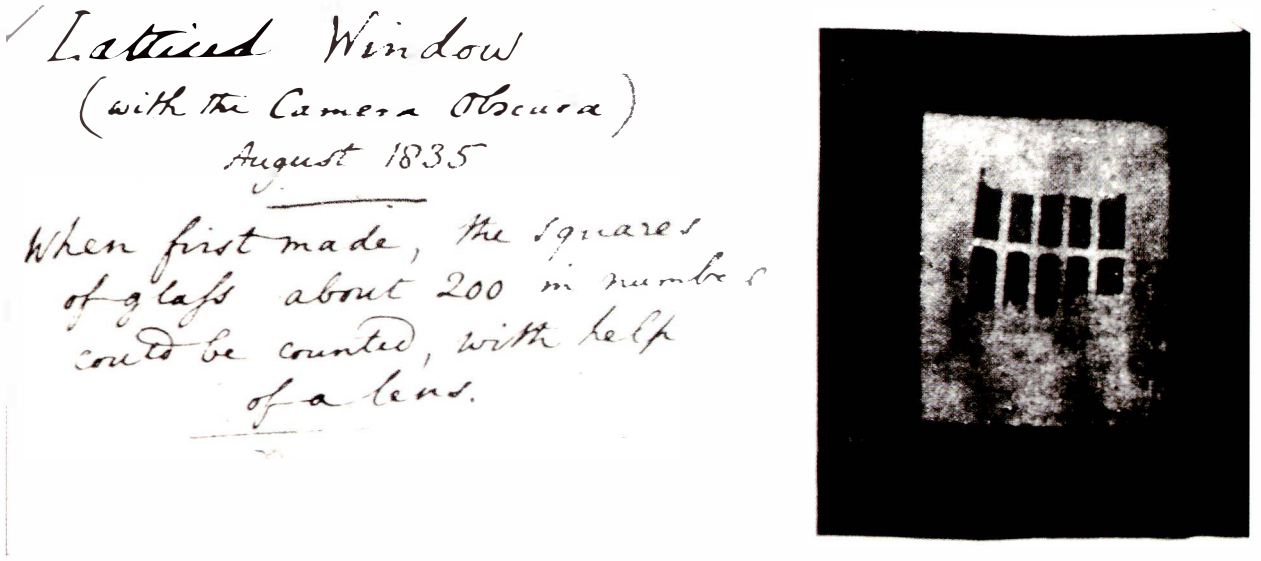


Figure 3–5

William Henry Fox Talbot (1800–1877), *The Latticed Window at Lacock Abbey* (Talbot's home), 1835

The first photographic negative (photogenic drawing) ever made. Talbot wrote of this achievement, "*I obtained* (with his mousetrap camera) *very perfect, but extremely small, pictures* (negatives); *such as without great stretch of the imagination might be supposed to be the work of some Lilliputian artist.*"

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1–2 minutes, washed in water, and then dried. If the calotype was not fixed and washed well, it demonstrated a yellow tint due to the lasting presence of silver iodide in the paper. Talbot would later correct this problem by immersing the paper in a near boiling solution of sodium thiosulphate fixer, a technique he successfully patented in 1843.

After the paper had dried, Talbot occasionally waxed the paper negative, either entirely or in selected areas, to enhance its transparency and then utilized it as a contact negative with a newly sensitized piece of stationery. He also applied ink or graphite to selected areas of the calotype to hold back transmission of light through the paper and created what he called *calotype pictures*.

After a few improvements, some admirers of the process changed its name to the Talbotype, although Fox Talbot modestly persisted using his original calotype label. On February 8, 1841, he placed a restrictive

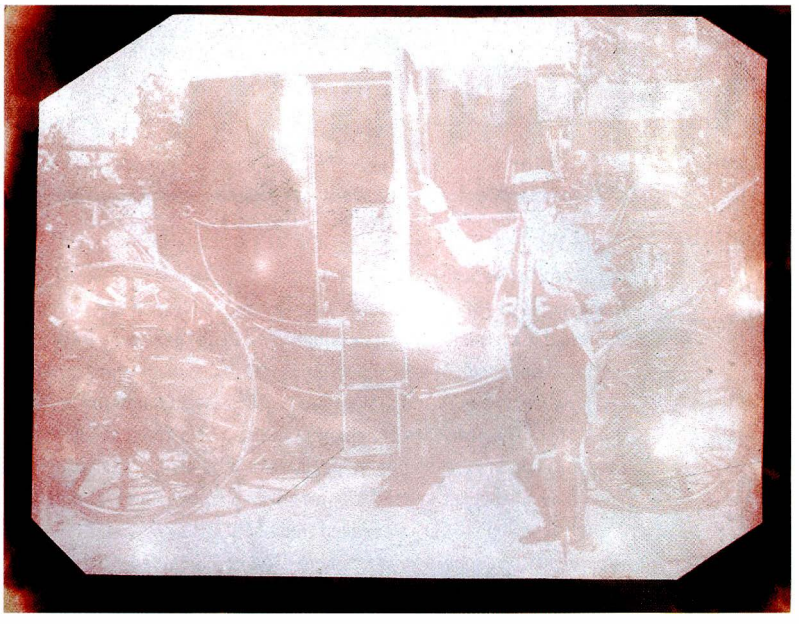

Figure 3–6

William Henry Fox Talbot, *The Footman*, 1840

Talbot's 3-minute calotype exposure of a footman, made on October 14, 1840, is the earliest photographic image of a human figure on paper and is a representative example of a process Talbot had invented 21 days earlier. Talbot sent a sample of the 6 3/8" × 8 ¼" image to his friend Sir John Herschel, and that image is now in the collection of the University of Texas, Austin, as part of the Gernsheim Collection.

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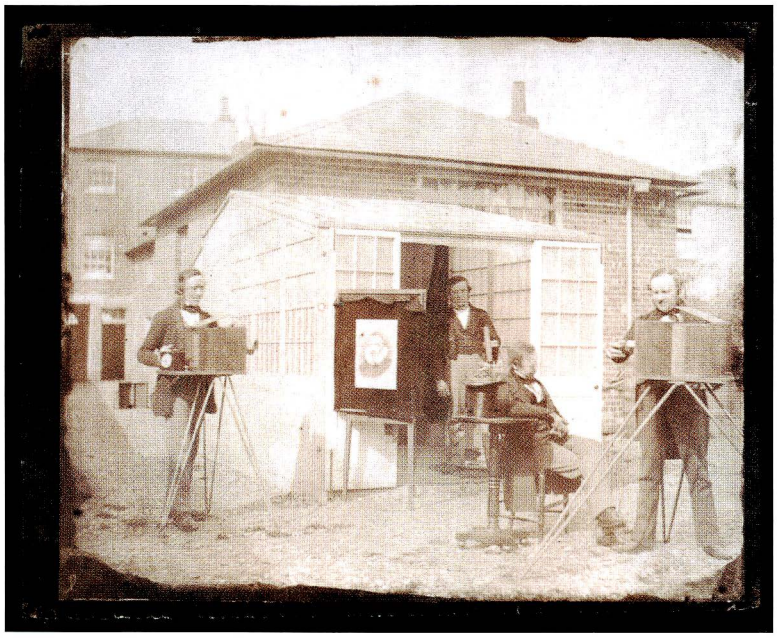

Figure 3–7
***Talbot Establishment*, 1845 (Talbot right; Henneman left)**
In 1844, with aspirations of turning his genius inventions into a viable business, Talbot (on the right) went into a salted paper photographic printing business for the public with his former valet, Nicholas Henneman (on the left) in the town of Reading, England. In this image they are demonstrating two of the services they offered, portraits and the reproduction of art works.
(Copyright© National Media Museum / Science & Society Picture Library)

patent on his "beautiful print" discovery that nearly stopped the new medium in its proverbial tracks. As mentioned, the patent was largely ignored in France and Scotland, leading to significant improvements by those practicing the craft. However, Talbot was tenacious about protecting his patent, perhaps due to a failing family fortune. Unless aspiring amateurs paid him an annual fee of about £2, fledgling image-makers would invariably find themselves threatened with a day in court facing Talbot and an irksome lawsuit over a process that neither the lawyers nor the judges could comprehend.

To illustrate, here's a quote from Henry Snelling's 1849 book, The Art *and Practice of Photography:* "*Calotype, the name given to one of the methods of Photogenic drawing on paper, discovered, and perfected by Mr. Fox Talbot of England, is precisely in the same predicament, not only in that country but in the United States, Mr. Talbot being patentee in both. He is a man of some wealth, I believe, but he demands so high a price for a single right in this country, that none can be found who have the temerity to purchase.*"

In 1844, Talbot established the Reading Establishment with his former valet, Nicholas Henneman, to produce suites of calotype images necessary for forthcoming editions of his *The Pencil of Nature* journal. Although credited as the first photographically illustrated publication, it was actually

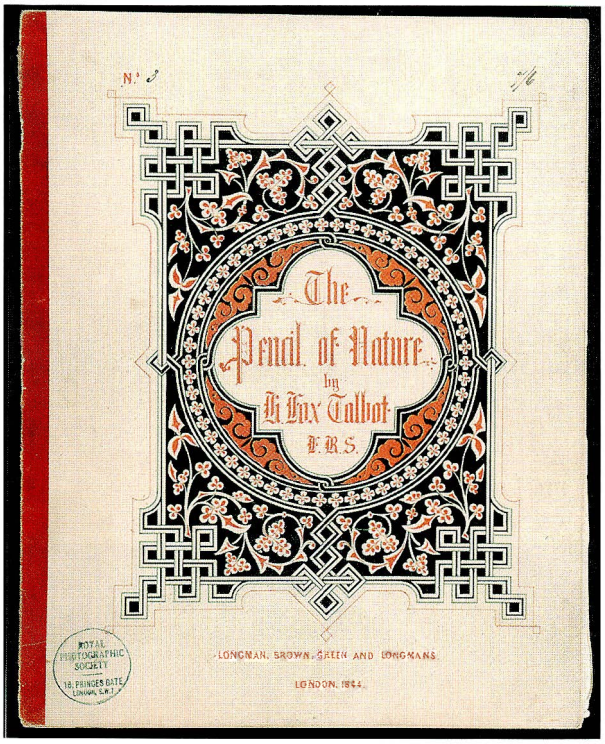

Figure 3–8
***The Pencil of Nature*, Issue #3, 1844**
In the spring of 1844, Longman, Brown, Green and Longmans (London) published the first installment of Talbot's *The Pencil of Nature*. It was printed in an edition of a few hundred copies and available only through subscription, which fell off rapidly due to problems encountered in production. The historians of photography often give credit to Talbot for publishing the first photographically illustrated book. *Pencil of Nature* was, however, second to Anna Atkins's *British Algae: Cyanotype Impressions,* which was released in October of 1843.
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the second, as Anna Atkins's book of cyanotype photograms (*British Algae: Cyanotype Impressions,* October 1843) was the first. In a reflective and modest moment, Talbot summed up his contributions to the medium well when he wrote, "*. . . I do not profess to have perfected an art but to have commenced one, the limits of which it is not possible at present exactly to ascertain. I only claim to have based this art on a secure foundation.*"

In 1843, something very interesting happened to the new medium of making pictures. A portrait painter by the name of David Octavius Hill (1802–1870) entered into a business partnership with scientist Robert Adamson (1821–1848), who, due to the fragility of his health, gravitated from engineering to photography and was subsequently taught the calotype process by his brother John. Hill had accepted a daunting commission to paint a group portrait of the 400 plus people who had recently founded the Free Church of Scotland. Because it wasn't practical to paint hundreds of people from life, Hill adopted Talbot's calotype paper negative to the salt print process as a means of recording each person's portrait. He would use these images as a visual guide for his massive painting of the founders of the Free Church of Scotland.

To accomplish the task, Hill secured the services of Robert Adamson as his technical expert for the project. As both men were from Scotland, they were geographically free of the patent restrictions that Talbot had placed on his calotype process, and between 1843 and 1847 they made nearly 2,000 images. Unfortunately, Adamson died in 1848 at the tender age of 27. Regardless of the impressive volume of work Hill and Adamson produced, what was really unprecedented about their collaborative work was its artistic scope. As a result of Hill's obsession with making photographic

Figure 3–9

David Octavius Hill & Robert Adamson, *The Rev. Thomas Henshaw Jones,* 1843 (salted paper print from calotype negative)

The painter David Octavius Hill had accepted a commission to paint a group portrait of the 400 plus individuals who had recently founded the Free Church of Scotland. Hill turned to the calotype as a means of recording each person's likeness and secured the services of Robert Adamson as his technical support. Between 1843 and 1847 they made nearly 2,000 images. What was seriously unprecedented about their collaborative work was its artistic scope and Hill's obsession with making images that recorded the subjectively true essence of the subjects. They had introduced the concept of artistic "intent" in harmony with the new science of photography.

(Courtesy of George Eastman House, International Museum of Photography and Film)

images that recorded the *true* essence of the subjects, he and Adamson were, in my opinion, the first individuals to introduce the concept of artistic *intention* in harmony with the new science of photography.

In 1844, the French cloth merchant and amateur photographer Louis-Désiré Blanquart-Evrard (1802–1872) began working with Talbot's calotype instructions. In 1847, he wrote a letter to the French Academy of Sciences describing several modifications that he had made to Talbot's calotype process. In doing so, he claimed to have improved the technique by making it more efficient. In some academic circles, the belief was that Blanquart-Evrard appropriated Talbot's method without acknowledgment and with the adaptations, claimed it as his own. While this may not be surprising, considering the rapid domino effect of influences occurring at the time, his work with the calotype led directly to his development, in 1850, of the albumen process that would eventually evolve into the internationally accepted standard for making photographic prints for decades to come. This was especially true when his albumen technique was combined with Frederick Scott Archer's collodion on glass negatives, which was introduced in 1851 at the Crystal Palace "World's Fair."

Rather than coating the surface of the paper, Blanquart-Evrard floated the paper in two separate baths, allowing the sensitizer to penetrate the fibers of the paper more deeply than it could with simple buckle brush application. This resulted in the paper being, many times, more sensitive than Talbot's and

Figure 3–10
Louis-Pierre Théophile Dubois de Nehaut, *Another Impossible Task, #67,* 1854 (salted paper print from a glass negative)
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

able to yield a wider array of intermediate tonalities. Predictably, the news irritated Talbot . . . , especially since Blanquart-Evrard never mentioned his name in his letter to the French Academy.

Talbot formally complained that Blanquart-Evrard was a "pirate," and the French Academy, in a very diplomatic move, said that the two processes appeared to be identical but then proceeded to publish Blanquart-Evrard's work as a means of undermining Talbot's patent in France. Blanquart-Evrard's success likely resulted in the process becoming more popular and inspired him to begin developing a unique version of the technique that utilized gelatin as sizing, albumen, and chlorine, iodine, and bromine in combination with silver nitrate in a sensitizer formula.

A few years later, Blanquart-Evrard's albumen printing technique was coupled with Frederick Scott Archer's wet-collodion glass plate negative process, and this new combination was considered the first true, repeatable, paper-based imaging system that employed an original negative. More importantly, not only did Archer's wet collodion technique describe a photographed scene with the clarity of a daguerreotype, but it could also be reproduced using Blanquart-Evrard's albumen technique, and these attributes immediately made Talbot and Daguerre's processes nearly obsolete.

Talbot wasn't finished trying to protect his patent, however. In 1854, he filed another lawsuit against a photographer by the name of Silvestor Laroche, claiming that Laroche's use of Archer's pyrogallic acid developer was the same as his calotype's use of gallonitrate of silver and that the similarity infringed on his calotype patent. Due to the technical complexity of the subject matter, the judge and jury were once again entirely mystified by the entire argument and eventually ruled that the defendant was not guilty of anything that anyone could comprehend. At this point, Talbot saw the proverbial writing on the wall and moved on.

Students are always enthusiastically willing to experience the unpredictability of making a calotype negative simply because the process is so straightforward. The term *calotype* technically refers to the procedure in which the intended final product is a paper negative. The same steps can be repeated using the calotype negative to create a positive print on calotype paper. In almost every positive print version of Talbot's process, the positive was either a photogenic drawing print or a salted paper print made from a calotype negative. However . . . .

Professor Grove's Direct Positive Calotype

There is an account from Henry Snelling's *History and Practice of the Art of Photography,* which briefly describes Professor Robert Grove's evidence that it was possible to create direct positive calotype images, thus eliminating the texture of the paper contact negative as part of the positive calotype-generated image. Professor Grove, by the way, presented his thesis at a meeting of the British Association for the Advancement of Science (changing its name later to the British Science Association) instead of the more obvious Royal Society because he thought the Royal Society was elitist, socially bloated, and ruled by political cronyism. Interestingly, he was also involved in the unsuccessful patent infringement case between Fox Talbot and Laroche in 1854. I digress . . . .

According to Professor Grove, a positive calotype could be produced directly in camera, eliminating the requirement of a paper negative, which had a downside of incorporating the flaws within the paper itself in the positive print. Grove also expressed his pleasure in not having to repeat the troublesome and tedious sensitizing process in order to get that positive. Professor Grove believed that light influenced most chemical reactions and that paper, darkened by the sun as a result of the precipitation of silver, might possibly be bleached by using a chemical solvent that would leave the exposed silver alone, thus clearing the unexposed highlight areas. Grove's process appears to be quite simple.

Grove described the technique for converting a calotype negative into a positive in this manner: "*Let an ordinary calotype image or portrait be taken in the camera, and developed by gallic acid; then drawn over iodide of potassium and dilute nitric acid and exposed to full sunshine; while bleaching the dark parts, the light is re-darkening the newly precipitated iodide in the lighter portions and thus the negative picture is converted into a positive one.*"

Begin by preparing a sheet of calotype paper and exposing it to sunlight until it turns deep brown-black.

Figure 3–11
William Henry Fox Talbot, *Constance and Daughters*, April 19, 1842 (salted paper print from calotype negative)
This domestic and curious salted paper print from a calotype negative is one of several group portraits Talbot created between 1840 and 1843.
(Copyright© Royal Photographic Society / Science & Society Picture Library)

This creates a silver iodide impregnated paper. The blackened paper is then re-dipped into the simple potassium iodide solution from the first stages of the process and re-dried. This re-dip into the potassium iodide solution results in a silver iodide-laden paper that will inspire a photo-oxidation bleaching effect during exposure in-camera. The hope is that the excess of iodide will render the paper moderately insensitive to light.

When it's time to use the paper for an image, the paper is drawn over a dilute solution of nitric acid (1 part acid to 2.5 parts water). When exposed, those parts exposed to light are rapidly bleached, while the parts that are unexposed, in degrees, remain unchanged. The print is then washed and fixed in either sodium thiosulphate or a solution of potassium bromide and then washed well.

OK . . . , let's begin exploring the calotype variations.

FOX TALBOT & CONTEMPORARY CALOTYPE FORMULAS & WORKFLOW

Fox Talbot & Contemporary Calotype Workflow

William Henry Fox Talbot's calotype process was created in 1840 as an improvement on his original photogenic drawing techniques originating from as early as 1834. The calotype was patented in 1841 and was a developed-out process, as opposed to the more lengthy exposure required in the printed-out salted paper techniques. The first stage in Fox Talbot's calotype negative process is to iodize the stationery paper, in candlelight, first with the silver nitrate solution and then with the potassium iodide. First, mark one side of the paper to indicate which side you intend to make your image upon. Silver nitrate is a clear solution, and there will be no indication of front and back if you don't make the mark.

Weights, Measures, and Chemistry for Calotype

- 1 g = 15.43 grains
- 1 grain (apothecary) = 64.8 mg / 437.5 grains to 1 oz
- 100 grains = 6.47 g
- 1 dram (apothecary dry) = 1.77 g / 27.34 grains
- 1 oz (dry) = 28.35 g / 437.5 grains / 16 drams
- 1 fluid oz USA = 29.57 ml
- 1 fluid oz (GB) = 28.41 ml
- 1 teaspoon = 5 ml
- 1 tablespoon = 15 ml / 4 fluid drams
- 1 drachm or dram (fluid) = 3.69 ml / 60 minum / 1/8 fluid oz
- 1 fluid dram = 3.55 ml (UK)

- 1 dram / drachm dry mass = 3 scruples / 60 grains / 3.88 g (UK)
- 1 fluid dram / drachm = 1/8 ounce (8 drachms to an ounce or 236.5 ml)
- 1 scruple = 20 grains / 1.3 g
- 3 scruples = 1 apothecary drachm / 3.89 g / 1 dram

If you want to get really confused, try immersing yourself in the various definitions of weight and measurement systems from the past to the present and then add in the complexities of volume, liquid, avoirdupois, and apothecary (used for science and medicinal chemistry in the past) conversions between the United Kingdom and the United States. It's maddening. As an example, a quote from the web: "*In the United Kingdom, a reform in 1824 made the troy pound the primary weight unit (a role in which it was superseded half a century later by the Avoirdupois pound), but this had no effect on apothecaries' weights. However, the Medicinals Act of 1858 completely abolished the apothecaries' system in favor of the standard Avoirdupois system. In the United States, however, the apothecaries' system remained official until it was abolished in 1971 in favor of the metric system.*" Got it? If you get lost in the "weeds" you can find solutions to your problems by going to the Internet. Do a Google search for a conversion chart in the weight or volume you are seeking.

Silver Nitrate Solution

Fox Talbot Recipe, 3.6% solution: 100 grains (6.47 g) into 6 oz (177 ml) of distilled water. A contemporary silver nitrate solution for a Talbot calotype is in the neighborhood of 7.5%–8%. To make an 8% solution, mix 8 g of fresh silver nitrate into 100 ml of distilled water. Be sure to wear nitrile gloves, protective eyewear, and an apron when working with silver nitrate.

Potassium Iodide Solution

Fox Talbot Recipe, 6.7% solution: 500 grains (32 g) into 16 oz (473 ml) of distilled water. A contemporary mix of potassium iodide is about 5.5%. To mix, add 5.5 g into each 100 ml of distilled water (I like to make 300 ml of this solution, as I tend to use a lot of it in the process).

Aceto-nitrate of Silver

To make your aceto-nitrate of silver, mix 11.4 g of silver nitrate into 100 ml of distilled water. To this add 19.4 ml of glacial acetic acid. This solution has a good shelf life if you store it in a brown bottle without a lot of air space in it. The best type of container is the one with an eye-dropper cap built in, as you are going to be adding this in drops rather than milliliters. Be sure to wear nitrile gloves, protective eyewear, and an apron when working with silver nitrate.

Gallic Acid

Mix a saturated solution of gallic acid. A saturated solution is one to which you add the chemistry to a specific amount of water and keep adding it until the chemical no longer dissolves into the water. At that point it is called saturated. Gallic acid is saturated near 1% in ambient temperature water. Once saturated, filter it through cotton balls in a funnel or a coffee filter. Gallic acid does not keep well, so only make it up before you are going to use it. If you happen to have a set of Talbot instructions that call for adding gallic acid to your sensitizer, ignore them. Talbot stopped using gallic acid in that part of the process early on due to fogging/browning of the paper. In place of the gallic acid in the sensitizer, use the aceto-nitrate of silver described earlier and in the process. This gallic acid mix will only be employed in development, and then it will be mixed 1:1 with the aceto-nitrate of silver.

William Crooke's Stock Gallic Acid Solution

From *A Handbook To The Waxed Paper Process in Photography* (Chapman and Hall, 1857).

The following is mostly in Crooke's own words and is, according to Richard Cynan Jones, a great way to save time and chemistry. Place 2 oz of crystallized gallic acid into a dry flask and pour over this 4 oz of alcohol, 60 proof or over, and place the flask in hot water until the gallic acid is dissolved. Shake once or twice and filter the solution.

To obtain a saturated aqueous solution, half a drachm of the above solution would be required to be added to 2 oz of water (Crookes states that he uses 5 oz of the liquid used for exciting papers combined with 4 drachms of exhausted exciting bath). The mixture is then filtered into a clean dish. Then combine the newly filtered solution with a half drachm of the above alcohol solution of gallic acid. These quantities are sufficient to develop one sheet 11 × 9 inches.

Paper

Most contemporary papers work rather poorly with the calotype process and are quite different than the stationery paper made in the nineteenth century. English stationery was sized with gelatin and the French counterpart with starch. Both were made without additives such as buffers, which are highly alkaline, and brighteners, which make the paper look nice and white in the art store. You need a paper that is strong and can withstand a lot of time in liquid and put up with a good deal of handling. Good results can be reliably obtained using Canson Marker, Ruscombe Mill's Chateau Vellum, Bienfang 360, and Clearprint 1000H drafting vellum. Several friends recommend using the 70 g Chateau Vellum, an excellent paper for all of the calotype workflows with the exception of Talbot's.

The Process

Step 1 **Silver Nitrate:** Begin by making a percentage solution of silver nitrate . . . either the 3.6% that Talbot favored or the contemporary 8%, 8 g of silver nitrate in each 100 ml of distilled water, and stir it well until the silver nitrate has completely dissolved. Two to three hundred milliliters will be adequate for your needs. Store the mixed solution in an amber glass bottle. Be safety conscious when using silver nitrate. Wear gloves and safety glasses when mixing and never, ever touch your eyes while working with the chemistry.

Note: In Snelling's text, it is mentioned that a Mr. Joseph Cundall, known for being a founding member of the Royal Photographic Society, practiced the calotype process but worked with a far stronger silver nitrate solution of 30 grains (2 g) to each ounce of distilled water. To that solution he added 50 grains (3.2 g) of common table salt (sodium chloride). Cundall recommended adding iodizer to the silver bath to make a solution of chlorinated iodide of silver. "*He found that the chlorinated iodide of silver is infinitely more sensitive than the simple iodide; and by this addition of common salt, a similar, though a less remarkable, modification is obtained of the sensitive compound*" (from the *Philosophical Magazine*, May 1844).

Step 2 **Potassium Iodide Mix:** Next, make your separate potassium iodide solution. You can use either Talbot's 6.7% solution or the contemporary 5.5% solution, 5.5 g potassium iodide in each 100 ml of distilled water, and store it in an amber glass bottle. You will be using a good deal of this solution, so you might consider making a larger volume (for example, 55 g to a liter of distilled water).

Step 3 **Paper:** Select your paper (Talbot preferred Whatman Turkey Mill stock), hopefully one that does not feature a watermark in the image area unless, of course, you want that watermark to be a contextual part of the final image. Larger size sheets of these papers are best to avoid the watermarking. Clearly mark the paper with a penciled notation on one side because this will be the surface you will sensitize. It's a good idea to sensitize stationery size sheets and then, after sensitizing, cut the paper with care so that it will slide into your film holder or metal sleeve made for an older wet or dry plate camera for exposure. Talbot also recommended that you have sheets of *bibulous* paper on hand to serve as a blotter.

Step 4 **Iodizing:** Sensitizing the paper in Talbot's method was a two-stage process. Using a Richeson synthetic, hake, foam, or buckle brush or a hand-held cotton ball (be sure you have nitrile gloves on), coat only the pencil-marked side of the paper with your prepared

Figure 3–12
William Henry Fox Talbot, *Vase with Medusa's Head*, 1840 (salted print from calotype)
On September 23, 1840, while re-sensitizing a piece of previously exposed salted paper, one that had failed to render an image, Talbot poured a solution of gallo-nitrate of silver over the paper and saw that he had created the first chemical development of a latent image on paper. Talbot named his new technique *calotype* (from the Greek words *kalos* and *tupos* meaning "beautiful' and "print"). On June 10, 1841, Talbot presented his discovery to the Royal Society in a paper titled *The Process of Calotype Photogenic Drawing*, in which he revealed how a latent image could be developed with chemistry. For the first time, any number of prints could be made of a single image from a negative.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

silver nitrate solution and set it aside to begin drying until the paper loses its wet gloss and has a satin-like sheen to it. Do this next step under low ambient light such as candlelight.

When ready, prepare a glass Pyrex baking dish with enough potassium iodide to cover the paper when it is submerged. Prepare one sheet of paper at a time. Bend it in the middle, holding opposite corners of the paper, and lower it into the potassium iodide. Agitate the paper gently for 2 to 3 minutes. When complete, move the paper to a separate Pyrex dish and wash the paper for 2 hours. Change your water often, be super-gentle handling the papers, and shuffle them randomly during the 2-hour wash cycle. When you're done, the paper will be a gentle pale yellow. Remove the paper from the wash, one sheet at a time, and line dry with new plastic clothespins. You have now created iodized paper. This washing stage is critical, so don't be in a hurry.

A Note Regarding Dr. Keith's Wax Paper Process

A similar adaptation to Talbot's workflow was also the subject of Dr. Thomas Keith's waxed paper process, referred to as a "No Pre-Silver Variant," published in *Photographic Notes* in 1856. It echoes Dr. Ryan's account, in Snelling's 1849 text, where the potassium iodide is the first step in the process and is followed by the application of silver nitrate. One of the ways in which it is different is that the chemical work is performed following the waxing of the paper!

A contemporary account of this work can be found as a PDF on the Internet: *Kate Jennings and Mark Osterman, Dr. Thomas Keith's Waxed Paper Process Experiment - Part II, Advanced Residency Program in Photograph Conservation (ARP) at George Eastman House, International Museum of Photography and Film, August 2002*. I'll go into this paper negative technique and workflow, along with Gustave Le Gray's waxed paper negative process.

Note: When you get into the calotype process, check out Davanne's calotype iodizer formula that omits fluoride (increases sensitivity) and cyanide. For more on this, please seek out the modestly titled manuscript written by the Rev. W. H. Burbank, *The Photographic Negative Written As a Practical Guide to the Presentation of Sensitive Surfaces by the Calotype, Albumen, Collodion, and Gelatine Processes, On Glass and Paper, With Supplementary Chapters on Development*, etc., (Scovill Manufacturing, New York, 1888).

Step 5 **Sensitizing the Paper for Exposure:** The sensitizing portion of the calotype process should be conducted under very-low-light conditions. Talbot used a candle behind a sheet of yellow glass, but you have the benefit of doing this step under red safelight, with yellow sheets on a window out of direct sun, by candlelight, or with a string of festive red chili pepper lights. Just avoid the blue end of the spectrum.

The sensitizer is made up of four components that, when combined, Talbot called gallo-nitrate of silver. It consisted of a silver nitrate, acetic acid, gallic acid, and distilled water. This chemistry has an extremely short life once in solution. This is especially true for gallic acid. As mentioned earlier, Talbot, and other calotypists, dropped the gallic acid from the sensitizer part of the formula early on, and the rumor that persists is that Talbot kept the gallic acid instruction in his writing as a technical diversion in order to protect his process.

For contemporary calotypes, the preferred sensitizer is aceto-nitrate of silver, and this formula eliminates the problems encountered while using Talbot's gallo-nitrate of silver recipe. Aceto-nitrate of silver lasts indefinitely.

PART A-1: Silver Nitrate

Fox Talbot's calotype formula for Part A was 100 grains (6.47 g) of silver nitrate dissolved in 2 oz (59 ml) of distilled water. A contemporary mix is an 11.4% solution of silver nitrate made by dissolving 11.4 g of silver nitrate into 100 ml of distilled water.

PART A-2: Aceto-nitrate of Silver Solution

Talbot's formula called for a mix in which glacial acetic acid is 1/6 the volume of Part A-1 that is added to Part A-2 to make the complete Part A mix. The glacial acetic acid in the silver sensitizer can be increased to prevent fogging. The silver and acid restrainer should be added to the developer little by little as needed as you develop the image.

The contemporary mix of aceto-nitrate of silver is to add 19.4 ml of glacial acetic acid to your 11.4% A-1 solution. . Store this mixture in a small brown bottle with an eyedropper built into the cap. Less silver can be used for better keeping properties. You have now made aceto-nitrate of silver.

Note: Glacial acetic acid refers to a 97%–100% concentrated acetic acid. Acetic acid, as a title for this acid, can refer to any concentration up to 100%. The addition of "glacial" to the name references the fact that it has the appearance of being frozen at 61°F (6.5°C).

Note: When the ambient temperature is high it will likely be necessary to increase the volume of glacial acetic acid in the restrainer (A-2). This will hold back the chance of spontaneous non-image development, also known as fogging or browning. This is similar to the correction you might make with wet collodion developer in hot weather in an effort to cut down on the possibility of fogging the plate during development.

Contemporary Sensitizing with Aceto-nitrate of Silver

Set up your camera and shot. Set up your working environment under safe light or festive red chili pepper light conditions. Using a plastic dropper, you can now create the aceto-nitrate of silver sensitizer by combining four drops of your aceto-nitrate of silver to every 4 ml of distilled water. This volume will easily cover a 4" × 5" piece of iodized paper. It is important to remake a new solution mix for each sheet of paper if you are using gallo-nitrate of silver from the older formula. If you are using aceto-nitrate of silver and distilled water, your sensitizer will have a longer life.

The sensitizer is applied to the surface of the iodized paper with either a fresh Richeson synthetic, foam, or buckle brush . . . a thin test tube with a wad of cotton ball stuffed into the end. The advantage of the buckle brush is that you can have a "new" brush for every stage of the process by simply replacing the cotton ball. You may also elect to use a simple cotton ball, held in your fingers (nitrile gloves are mandatory here). Once the paper is coated, allow it to sit for 1–2 minutes or until you see a surface reflection that

is luster rather than wet and shiny. You will want to expose the paper while it is damp. An optional extra drop or two of glacial acetic acid added to the 4–5 ml sensitizer helps to prevent fogging.

Wet or Dry Paper Option

Expose the paper in the damp state. Talbot's original workflow called for the paper to be dipped into water following the sensitizer, and then blotted and dried. He wrote that when the paper was dry it was fit to use and could then be called calotype paper. Talbot noted that if the paper had been kept in the dark, it could be used in-camera for up to three months with no appreciable difference in its quality or ability to record an image using the camera obscura. His caveat was that this wasn't always the case and that using it immediately after drying was the better option. Printing when the paper is moist lessens the chances of fogging/browning of the paper.

Optional But Not Recommended: Talbot's Gallo-nitrate of Silver Recipe

Although gallic acid was originally in Talbot's process, it was soon realized that the chemical was unnecessary and actually very problematic, as it oxidized rapidly, usually in 2–3 hours. It was also responsible for a premature browning (fogging) of the image. I've included it here for informational purposes and for you to proverbially walk in Talbot's footsteps if you are one of those insanely confident technical people . . . you know who you are. However, if you simply eliminate it from your workflow, your calotypes will be more successful. If you want to stay pure in your calotype process, you might consider exchanging pyrogallic acid for the gallic acid, as it works a bit better.

To make Talbot's gallo-nitrate of silver sensitizer, dissolve 100 grains (6.5 g) of silver nitrate crystal into 2 oz (59 ml) of distilled water. To this solution, add 2.66 drachms/drams (9.8 ml) of glacial acetic acid. Now make a saturated solution of gallic acid by dissolving 1.1 g of crystallized gallic acid, a pale white-yellow crystal, in 100 ml of cold distilled water.

Under safelight or candlelight conditions, mix Part A and Part B together in equal proportions and work rapidly, as this solution will deteriorate within minutes. Next, wash over the sheet of paper with a brush, being careful to not get the solution on the backside of the paper. Allow the paper to rest for 30 seconds and then immerse it in a small tray of distilled water, submerging it two to three times before allowing it to drain.

According to Mr. Snelling, Talbot modified his process in the following manner. He iodized the paper in the usual way and then proceeded to wash over the iodized paper with a solution of saturated gallic acid and distilled water and allowed the paper to dry. He called this paper IO-gallic paper. When he wanted to use it, he washed it in a solution of silver nitrate consisting of 50 grains (3.2 g) to an ounce (29 ml) of distilled water. At this point, the paper was inserted in a holder and exposed in camera. As I mentioned a moment ago, if you want to follow Talbot's lead, stay with the gallic acid. If you want to stay historically consistent, consider using pyrogallic acid instead of gallic acid. When the acid solutions are saturated, filter them through a coffee filter so there is no sediment.

Note: If you opt to try Talbot's gallo-nitrate of silver recipe, be aware that it oxidizes very rapidly and that this oxidation results in flat imagery. Talbot would occasionally develop his calotypes face down in a puddle of developer applied to a level sheet of glass in an effort to prevent the oxidation.

Calotype Exposure

Talbot exposed his first photogenic drawings in Foden's tiny *mousetrap* cameras. In later work with calotype he used larger cameras and sensitized papers in either a dry or moist state and a "sandwich" of an absolutely clean glass plate (in front) and a warmed piece of slate or metal (in back) to hold the paper flat. There is a direct similarity here to Bayard's direct positive process using warm slate as a backing plate for moistened and sensitized paper in camera. The warmed plate accelerates the exposure. You can use your 4" × 5" film holder. To avoid the problem of having the dark slide harming the moist paper as it is pulled out and reinserted during the exposure stages, you might want to just load the film/paper holder while still in the darkroom and place it in the camera prior to each exposure. Then simply remove the lens cap for the proper

Figure 3–13
Dan Estabrook, *Talbot's Grave #2*, 2012 (calotype negative and positive on paper)
Dan writes, "*When I finally made my pilgrimage to Lacock Abbey, it rained almost the whole time, of course. I shot this Calotype negative of Talbot's grave during a dispiriting drizzle, feeling great empathy for the old man, and thanking my stars I wasn't trying to make Photogenic Drawings. Back home, I enhanced the rain spots with some little penciled devils of my own . . .*"
(Courtesy of the Artist)

exposure time as you do with wet plate collodion exposures. Keep in mind that warming during development seldom results in happiness.

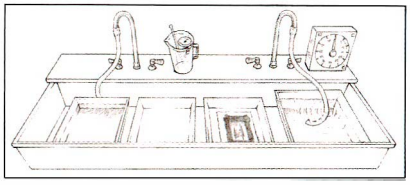
Another option here is to use a film insert that was designed for older wet plate and dry plate cameras. This is a black metallic sheet with a tiny fold on three sides that is open at the top for inserting film or paper. The insert is placed in the wet or dry plate holder as if it were a piece of tin or glass. These can often be found on alt pro forums and Internet auction sites. Moist or dry calotype paper can also be fitted into a clean Mylar or Krystal Seal sleeve before sliding into the film holder.

This is going to be a situation in which you will need to customize your exposures to various influences such as where you live, the amount of heat present at that time of year, excessive heat is not beneficial to calotypes, how strong your sensitizer is, the time of day you are making pictures (as there is stronger UV light in the middle of the day that will require less exposure), and how fast your camera lens is. With a modern (meaning something like a mid-1800s Petzval type) lens, a 2-minute exposure at F.8 should be fine in bright sunlight. Adjust accordingly. For Talbot, the average exposure time was difficult to predict, but it ranged from 30 seconds to 5 minutes. For contemporary lenses, consider *f* 5.6 or wider with a start time of 1 minute. Don't forget, you can calibrate with a dark slide using a film holder by pulling the dark slide up fully for the first minute and then closing it down in calibrated increments. After the first test piece you will know the exposure time.

If you are making pinhole or zone plate (a better option than pinhole due to the shorter exposure time required) calotype negatives then you must have patience and optimism. In open shade, a good place to begin exposures would be 3 minutes with a wide-open aperture. If you are using a lens that is not very fast, your exposure may be as long as 5 minutes. Talbot, in his 1841 reading of *Calotype Photogenic Drawing,* claimed that with his process you could lay a leaf upon a sheet of gallo-nitrate of silver-sensitized paper under the light of a full moon and make a contact photogram exposure in 15 minutes! This seems a bit odd in terms of accuracy, but the image it presents in one's head is quite romantic.

Note: One thing to keep in the back of your mind about exposure times is that if you opt to try Talbot's recipe, a small amount of gallic acid will increase sensitivity, but too much will reduce the sensitivity of the paper. Talbot

re-sensitized his papers until just before the paper exposed spontaneously. You might want to increase the percentage of silver nitrate in the formula, as that may help as well. Over exposure will often result in a visible image when the paper is removed from the camera. Dilute your developer and silver or add more restrainer prior to developing over-exposed negatives.



SINK SETUP FOR TALBOT'S CALOTYPE DEVELOPMENT, FIXING AND WASHING

- Solution A (aceto-nitrate of silver)
- Solution B (saturated solution of gallic acid)
- Stabilize in Talbot's potassium bromide or . . .
- Fixer 10% Sodium Thiosulphate fixing bath
- Distilled water
- Sea salt
- A tray and a sheet of glass larger than the tray
- A glass/plastic beaker for warming the developing solution
- Cotton balls
- Nitrile or latex gloves
- Clear tape
- Buckle brush (glass tube and cotton balls) or just cotton balls handheld

Development of Talbot's Calotype Negative

Note: You will need to work in a room that has either a safelight, a candle, or a string of festive red chili pepper lights, as the paper will be sensitive to blue light. You will also want to be wearing latex or nitrile examination gloves, an apron, and protective eyewear.

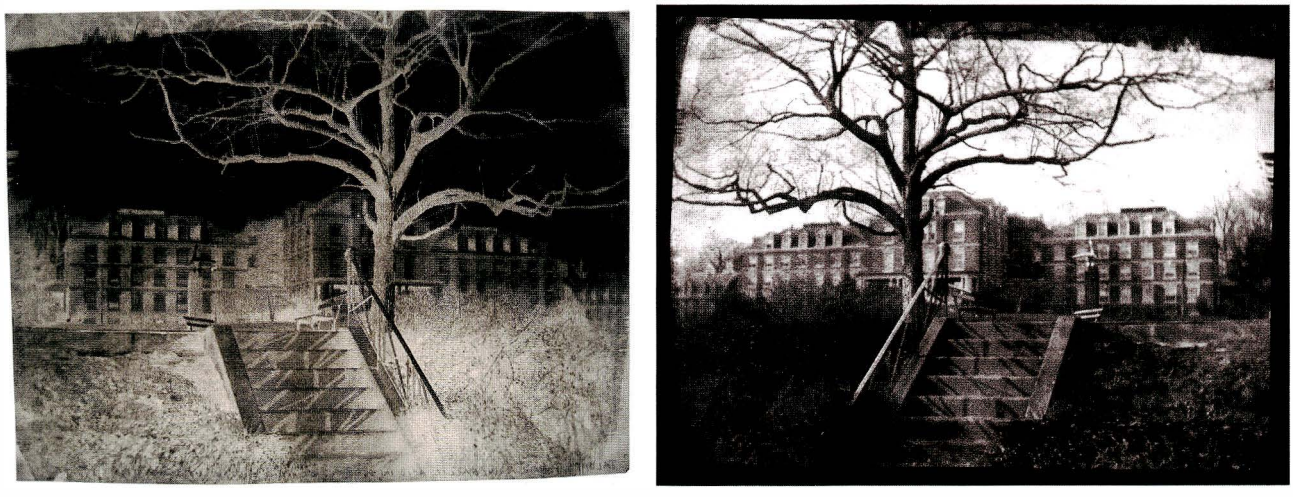


Figure 3–14

Mark Osterman, *George School*, 1996, (waxed calotype negative using Talbot's formula, 6" × 8" and gold-toned albumen print from waxed calotype negative, 2002)

The definition of a calotype is used to describe both negative and positive prints. This has often resulted in confusion of the true definition because a calotype is a latent image made with silver iodide-sensitized paper and made visible through a development process . . . it is *developed-out* with chemistry. Talbot did make some developed-out positive prints from his developed-out paper negatives, and these would also be called calotypes. However, almost all of his final images were salted paper *printed-out* prints using the silver chloride process. During the nineteenth century, a calotype negative was most often used to make a photogenic drawing (stabilized with a salt solution) or a salted paper or albumen print fixed with hypo. *(Courtesy of the Artist)*

Calotype Developer: 1:1 Solution

Mix up a developer that is made up of an ambient solution of equal portions (1:1) of your Part A aceto-nitrate of silver and Part B saturated solution of gallic acid. You will need about 2–3 ml of Parts A and B combined to develop a sheet of writing paper. This is called gallo-nitrate of silver.

Development

Remove the exposed paper from the film holder in the safely illuminated workspace and you will notice that there will be a slight whisper of a latent image, or perhaps nothing at all. Lay the exposed paper on a clean glass surface and gently brush on a light coating of the mixed solution of the gallo-nitrate of silver with a *new* buckle brush or cotton ball held in your gloved fingers. Make sure your application is even, and allow the image to emerge slowly for about 2 minutes. The first image densities will show up quickly. Allow your dark highlight details to become deeply rich and dark on the paper. Watch your lighter negative areas, the shadows, and look for details. What is going on is that the gallic acid is doing most of the development work, and the added aceto-nitrate of silver is increasing the densities by depositing small amounts of additional silver on the image. Feel free to repeat the development with fresh developer if you feel that the image needs additional stimulation.

Note: Talbot would warm his paper at this point to help bring out the image, but using a hairdryer is *not* a great idea because it will dry out the paper too quickly. Instead, fill a tray with hot water and place a larger piece of thick glass over it so the glass rests on the edges of the tray and absorbs heat from the water below. The back of the glass will warm up and you can use the surface to heat the paper. Warming the paper creates darker values in the negative.

An Important Caveat to the Note: It should be noted that heat speeds up a chemical process and promotes fog and browning in calotypes. For this reason, depending on the temperature in your lab, it might be best to forget the warming of the paper or developing surface when first beginning to do calotypes. The development will take longer, perhaps up to an hour, but you will avoid the fog.

First Rinse with Distilled Water

Once the image has reached a point where you are satisfied with it, rinse off the paper with distilled water to remove free silver. Two to three fresh baths will be sufficient.

Re-Immersion with Saturated Gallic Acid Solution

After the distilled water rinse, immerse the paper in a fresh saturated gallic acid solution to intensify the blacks. Do this for 2–3 minutes in order to complete the development. It is difficult to over-develop so don't worry about it. You will notice that the greatest degree of darkening will be evident when the paper is nearly dry.

Post-Development Rinse

After 2–5 minutes, immerse the developed paper in distilled water for 10 minutes. This is done to remove any free silver or developing agent before fixing. I've played around with the idea of immersing the print at this point in a bath of kosher salt and distilled water, as you do in salted paper printing, to help in the removal of the free silver. I don't have a strong recommendation one way or another in this writing, but it won't hurt to try it.

Fixing, Washing, Waxing, and Printing the Calotype

Talbot's original formula called for a first rinse in water followed by an immersion in a solution of 100 grains (6.5 g) of *bromide of potassium* dissolved in 10 oz of water (295 ml). He also used hyposulphite of soda (sodium thiosulphate) to fix his images after having tea with Sir John Herschel. Talbot recommended a good wash in distilled water following the calotype negative's fixing stage that was then followed by drying the paper.

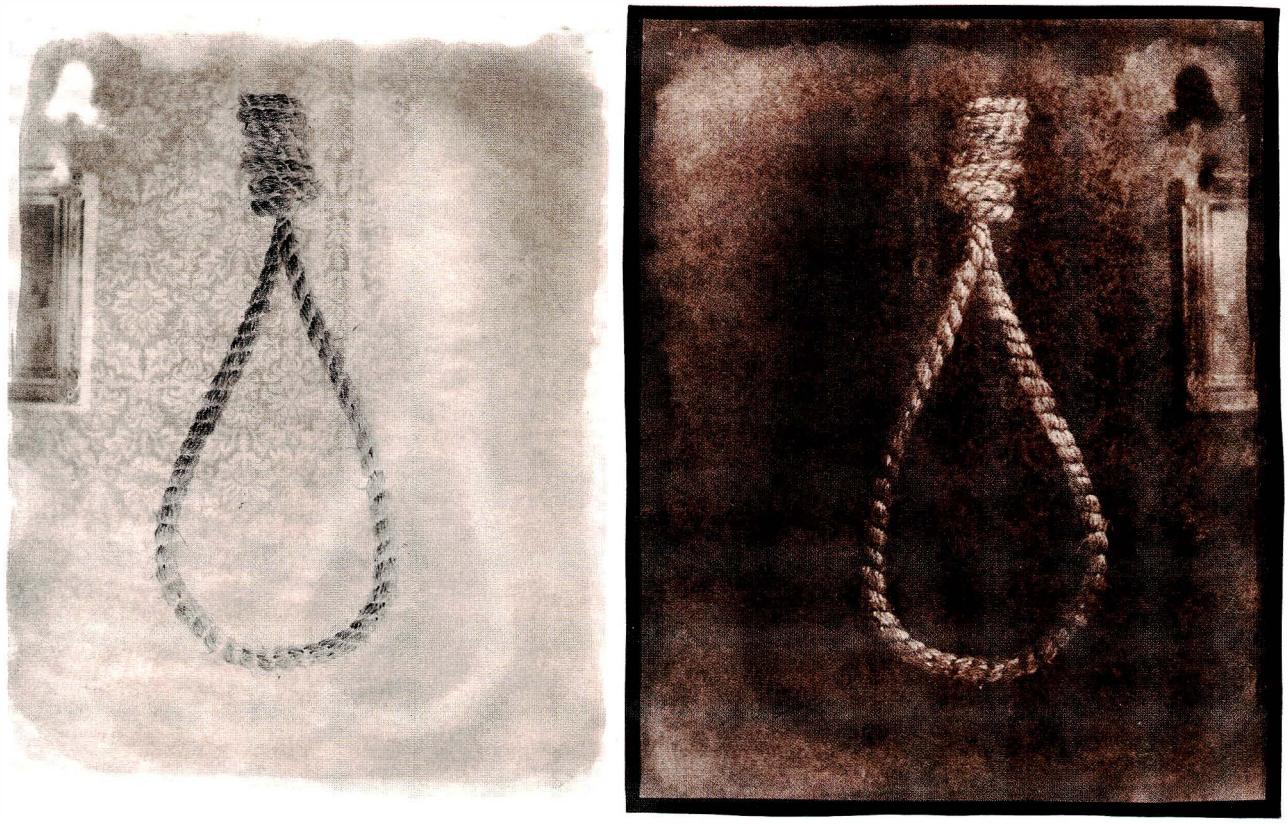


Figure 3–15

Dan Estabrook, *Noose, Drawn*, 2001

Here is another image illustration from Dan Estabrook's extensive portfolio, a calotype negative and the salted paper print created from the paper negative. *(Courtesy of the Artist)*

Contemporary Fixing

Set up two separate fixing bath trays. We will use the 10% sodium thiosulphate (regular alt pro silver fixer) solution made by mixing 100 g of sodium thiosulphate to every 1,000 ml of water. To this sodium thiosulphate solution, add a pinch of sodium carbonate to make the solution slightly alkaline. This will prevent some of the bleaching issues with the process. Immerse the print in the fixer for approximately 5 minutes in each of the two baths. Do not stop this fixing step until all of the yellow tint has been cleared from the paper's lightest shadow areas. If you see any yellow in your paper it indicates that there is still silver iodide in it.

Note: Talbot had a dramatic solution to this yellow staining problem. He would make a solution of hyposulphite of soda dissolved in about ten times its weight of water and heat it to near boiling. He would then immerse the print in the hot fixing solution for 10 minutes, causing the paper to become white and transparent.

Final Wash

Wash the fixed print in softly running water for 20–30 minutes, followed by an immersion in distilled water, and then lay it on a clean screen to dry. Talbot wrote that the lights and shades of the image were now reversed and not "comfortable to nature." At this point in the process, he suggested that it was entirely possible to use the negative to make a positive version of the image once the negative was "rendered transparent by wax or oil." Talbot went on to say that you could not make a great many positives with the negative, as repeated use in the sun would cause it to grow faint.

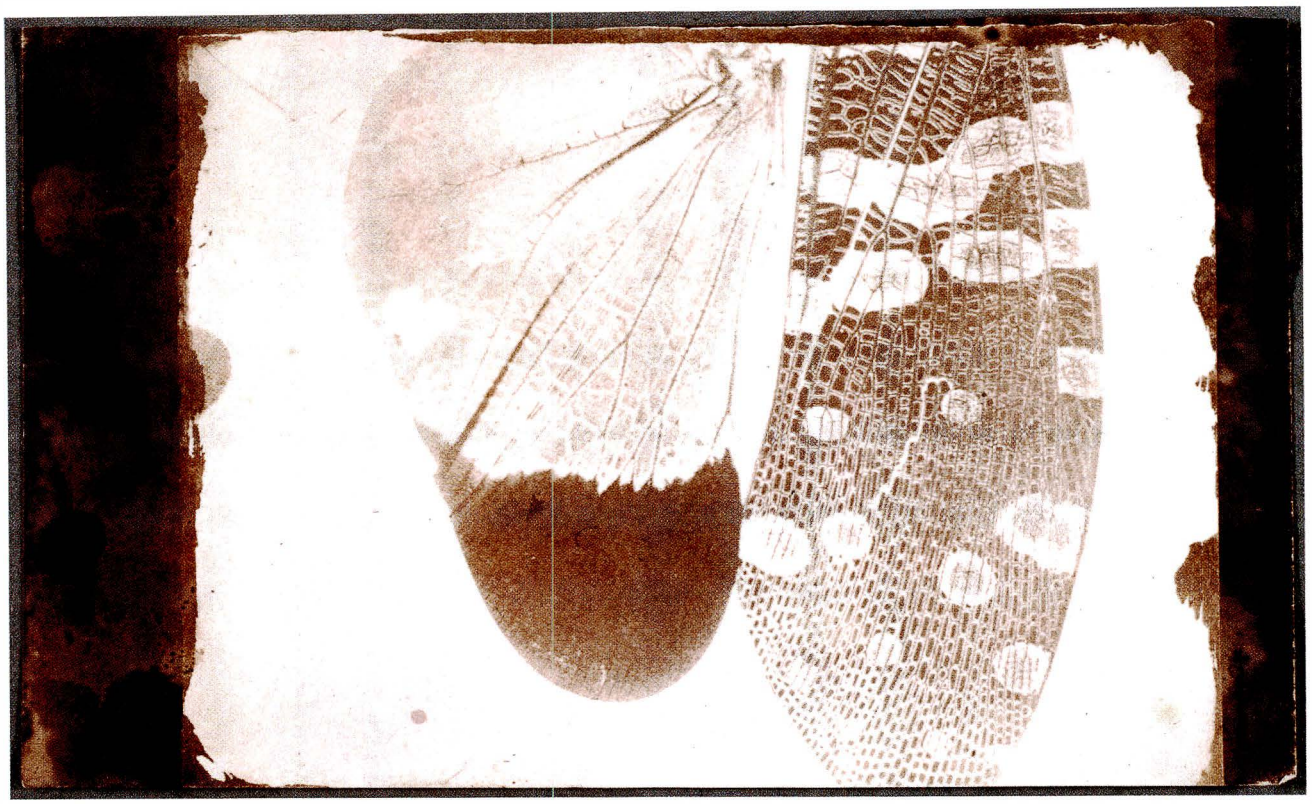


Figure 3–16
William Henry Fox Talbot, *Insect Wings*, 1840 (photogenic drawing and positive)
This is a very cool photomicrograph of insect wings (maybe *Fulgora candelaria* wings) as recorded using a solar microscope and translated by Talbot as a photogenic drawing and positive.
(Copyright © National Media Museum / Science & Society Picture Library)

Post Development and Fixing Table Setup

- Selection of waxes including Renaissance Wax or simple beeswax. Also lavender oil or vegetable oil.
- Hairdryer
- Paper towels
- Blotters or blotting paper
- An electric iron

Waxing the Calotype

If you are using vellum as a paper support for your calotypes you have eliminated the need for waxing for transparency. If not, read on.

Microcrystalline Transparent Wax

Once your calotype is dry you can wax it in order to make a more translucent negative for contact printing. Talbot's waxing method called for beeswax and a hot iron. I like Renaissance Wax, a soft microcrystalline transparent wax that can be applied with your finger and heated with a hairdryer with great success. Renaissance Wax is used throughout the museum world and is archival and simple to use.

Beeswax and Hairdryer

To apply wax, tape down your paper on a surface that you can throw away or that can be cleaned easily. Hold your beeswax in one hand and a hairdryer in the other, and place the beeswax block over the paper area where you will be melting the wax. As the wax melts, buff it into the paper with your fingers and then buff it smooth with a lint free cloth or the palm of your hand. If it's not smooth enough, place the paper between two blotters and iron it.

A variation of this method is to sandwich the calotype negative between two blotters and iron over the blotter–negative stack. As soon as the paper is too hot

to touch comfortably, pull back the topmost blotter, and begin sliding the beeswax block on the back of the hot negative. When the paper cools, replace the topmost blotter and re-iron the stack again. Repeat this as necessary until you get a decent translucency.

Beeswax and Lavender Oil

One pleasant-smelling solution to waxing the negative is to use a 2:1 beeswax to lavender oil mix that can be applied to the calotype and then buffed. The lavender acts as a solvent upon the wax and breaks it down for use. You can place your paper between blotters and apply a hot iron to impregnate the paper and allow the excess to be absorbed.

Hot Sodium Thiosulphate

Still another method of achieving translucency is to heat up some saturated sodium thiosulphate and immerse your paper in it as a fixer stage rather than a long and extended wash cycle. This hot solution breaks down the sizing in the paper and causes the paper to be more translucent.

Once the calotype negative is waxed and semi-transparent, you can use it as a contact negative for a compatible process such as salted paper, cyanotype, or albumen, or you can repeat this entire procedure and contact print the calotype negative with a newly sensitized calotype paper to obtain a positive calotype. You might also want to try an older waxing technique that calls for waxing the back of the calotype negative and mounting it on a piece of white, black, or colored paper for an unusual effect.

Another option with your negative, to improve upon it or add to its visual vigor or content, is to draw directly on the negative, creating details and shadows that were anemic in the original negative exposure. This is especially important in situations where detail, as in a portrait, is too soft due to the difficulty of making an exposure through a textured paper negative.

Once the paper is dry, gently rub a very thin layering of the wax in delicate circular motions with your finger and evenly cover the entire negative image area. Be sure that there is no excess wax and then take a hair dryer and blow hot air over the surface of the print until the wax melts and dries into the paper's fibers.

Wax is not always mandatory. Hill and Adamson hardly ever waxed their work, and if your stationery is thin enough you may not have to either. Both Talbot and Hill and Adamson used a writing paper called Whatman's Turkey Mill. As an aside, the Whatman Paper Mill began in 1719 on the site of an old mill that ground corn imported from India called "turkey wheat." It produced paper up until 1976 and was the favorite stationery of Napoleon, William Blake, Gainsborough, George Washington, and Queen Victoria.

Restoring a Calotype Negative if it Fades with Gallo-nitrate of Silver

As Talbot discovered, if you don't perform the calotype process perfectly, i.e., removing all of the silver iodide yellow from the paper negative in the fixing stage, your calotype will eventually fade. I also believe that exhausted fixer, and ironically, fixer that is too strong and not eliminated from the paper completely, are also responsible for this malady.

To make things right, maybe immerse your calotype in a warm solution of gallo-nitrate of silver (or aceto-nitrate of silver) for several minutes or until you see a noticeable change in the dark areas of the negative. Talbot wrote that very often this technique revealed portions of the image that had not been obvious in the original calotype and had, indeed, been lying in the paper as a latent image.

Restoring a Calotype Negative if it Yellows

This is the same recommendation from above with the goal of helping your calotype get rid of the yellow tonality that's plaguing it. If your calotype is exhibiting a yellow veil, Mr. Talbot has a solution for you. Plunge the calotype negative into a bath of sodium thiosulphate dissolved in water that is ten times its weight and then heated to just below boiling. Keep the image in the hot fix for about 10 minutes and then wash it well and dry it. The paper should be clear of

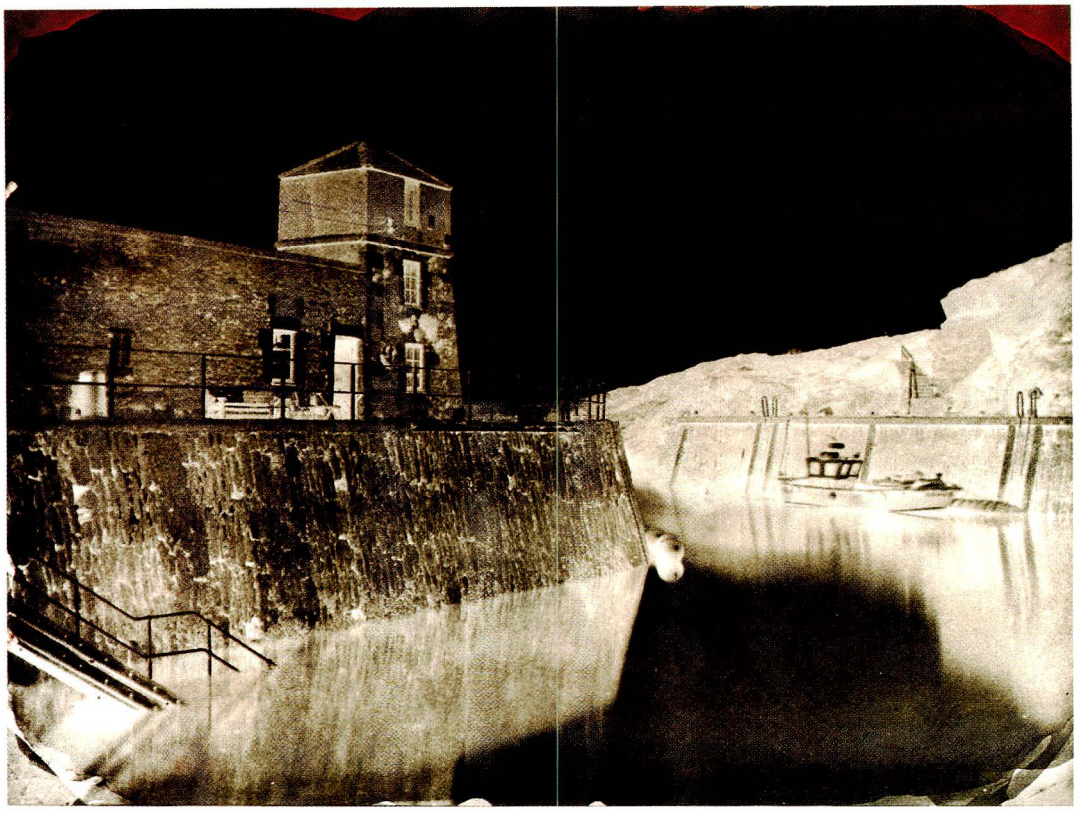


Figure 3–17
Richard Cynan Jones, *Porth Amlwch*, April 13, 2012
In this striking example of a Sutton single wash variant by calotypist extraordinaire Richard Cynan Jones (referred to by Sutton as Class II), the paper is first coated with an alkaline iodide and then subsequently "excited" by a strong bath of silver nitrate. This is followed by an extensive wash in which excess of free silver nitrate is removed. Richard wrote, *"The paper was iodized a year before ago (single wash) and exposed to direct sunlight for one hour before sensitizing."*
(Courtesy of the Artist)

yellow now and a lot more transparent as well. Wax the paper and see if you get a better image from your negative.

THOMAS SUTTON'S CALOTYPE

The Difference Between the Single and Double Wash Variants in Calotypes

According to Sutton's 1858 *Dictionary of Photography*, the basic principle of the calotype process was to prepare and expose, in a camera, a sheet of paper that had been rendered sensitive to light by being impregnated with a mixture of iodide of silver, silver nitrate, and organic matter. And then, having achieved that first stage, develop the picture by means of gallo-nitrate of silver or some similar developing agent.

The primary differences among an assortment of processes that go by the name of the calotype, consist of how the paper is sensitized . . . that is, how the various required and necessary ingredients in the process are introduced in the beginning of the process stages, as the mode of development is nearly identical in all of the variations and only different in the strength of the developer and the way the developer is applied to the exposed paper.

A sheet of sensitized calotype paper contains a large quantity of iodide of silver, a small quantity of silver nitrate, a small quantity of organic matter (the paper itself will provide this requirement), and enough organic acid to keep the highlights bright and clean.

In one method, the paper is immersed in a strong bath of silver nitrate. In another method, the organic matter in the paper has little opportunity to be introduced to the strong bath of silver nitrate, and it becomes necessary to add organic matter to the

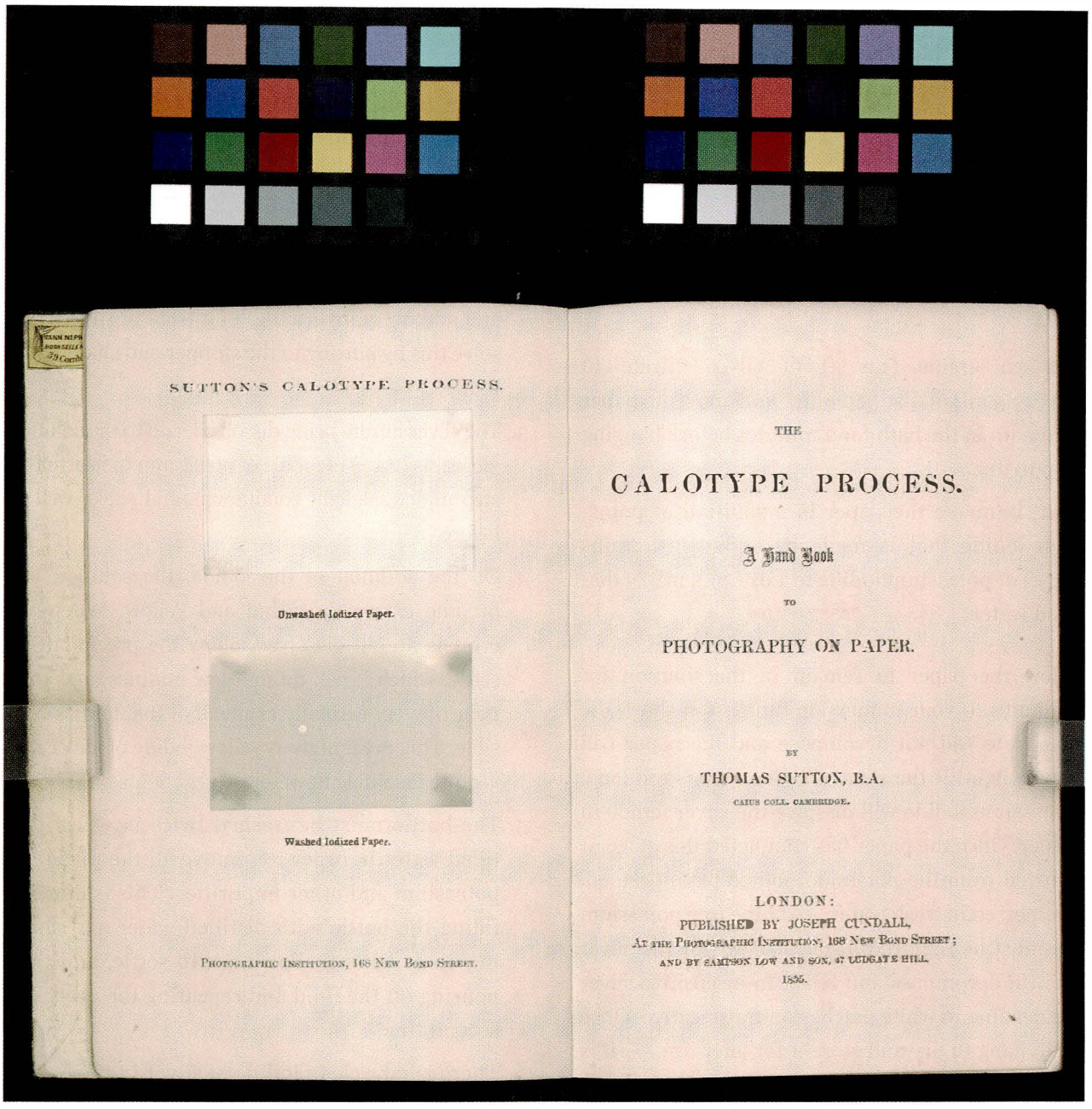


Figure 3–18

Thomas Sutton, A *Hand Book to Photography on* Paper, 1855

The opening pages of Thomas Sutton's *The Calotype Process, A Hand Book to Photography on Paper*, 1855. *(Photography Collection / Harry Ransom Center / The University of Texas at Austin)*

solution. Keep this in mind while you are trying to understand all of these variants.

Explanation of the Single and Double Wash Variants

In the first example (referred to by Sutton as Class I), the paper is first coated with insensitive silver iodide and then "excited" by a weak solution of acidified gallo–nitrate of silver. This Class I calotype is called "argento-iodized paper." *Argento* is an Italian word meaning "silver." Argento-iodized paper is prepared by what is called the "double wash" variant.

In the second example, referred to by Sutton as Class II, the paper is first coated with an alkaline iodide and then subsequently excited by a strong

bath of silver nitrate. This is followed by an extensive wash in which the excess of free silver nitrate is removed. The paper in this class is called "iodized" paper. This is called the "single wash" variant.

Argento-Iodizing by the Double Wash Variant

To argento-iodize the paper by the double wash method, float the paper on a bath containing as follows:

- Add 20 grains (1.2 g) of silver nitrate to 1 oz (29.5 ml) of distilled water and allow the paper to remain in the bath for 2 minutes before hanging it up to dry.
- Next, immerse the paper in a solution of potassium iodide that is made by adding 25 grains (1.6 g) of potassium iodide to 1 oz (29.5 ml) of distilled water.

Allow the paper to remain in the solution for 1–2 minutes. If your immersion time is too short, the silver nitrate will not decompose and the paper will darken in light. If the time of immersion is too long, the potassium iodide will dissolve the silver iodide in the paper. Once the paper has completed this stage, it is removed from the potassium iodide bath, drained, and immersed in fresh water. All of the free potassium iodide must be removed in the soaking, or the silver iodide will decompose and result in insensitive silver iodide, leading to white patches on the negative. Once washed, hang to dry and store it for later use . . . it is not sensitive to light.

Argento-Iodizing by the Single Wash Variant

For argento-iodizing by the single wash variant, lay the paper on a board, covered by a blotting paper, and brush over the paper with a double-iodide solution of silver iodide and potassium iodide. Here's the double iodide technique *from The Calotype Process: A Hand Book to Photography on Paper*, 1855. My thanks to Richard Cynan Jones and Dan Estabrook for their assistance in explaining the double iodide map.

Sutton's Double Iodide Sequence

1. Take a 4-oz (114 ml), wide-mouthed, stoppered bottle (amber-colored), which you should keep exclusively for this purpose, and upon the outside of it, make a scratch with a file corresponding to the level of the 3 oz of fluid (85 ml).
2. Wash the bottle well and rinse it with distilled water. Then fill it up to the mark with distilled water and add 40 grains (2.6 g) of nitrate of silver. Dissolve this by putting in the stopper and shaking the bottle.
3. The silver nitrate being dissolved, add to the solution 32 grains (2.1 g) of iodide of potassium (perform this step under safelight conditions), and shake well as before.
4. On the addition of the iodide, the solution will become extremely turbid and yellow. When the crystals are all dissolved, allow the precipitate to settle, which it will do in a few minutes, and then pour off very carefully as much of the fluid as possible. This precipitate is yellow iodide of silver and is quite insoluble in water.
5. The bottle must be washed twice in warm distilled water in order to remove all the nitrate of potassium and other impurities. This is done by filling the bottle with distilled water and shaking up as before, allowing it to settle, and then pouring off the fluid and repeating the process a second time.
6. There is now clean iodide of silver in the bottle, moistened with a little water, which will be added to a strong solution of potassium iodide. To do this, add 1.5 oz (42.6 ml) of distilled water and 400 grains (25.9 g) of iodide of potassium. Shake it up well and the whole of the yellow iodide will disappear, being dissolved in the iodide of potassium, leaving the solution nearly colorless.
7. Now add distilled water, a few drops at a time. Upon the addition of the water the surface of the solution will become instantly turbid, but it will clear again upon being shaken.

8. Repeat this addition of the water until the solution will no longer clear itself, and then add a crystal or two of potassium iodide in order to restore its perfect transparency. In this state an exact balance will have been struck between the water and the iodide, and it only remains to filter the solution, which will then be ready for use.
9. As a guide to the quantity of water that ought to have been added the second time, the whole quantity of double iodide obtained should be about 3 oz (85.2 ml).
10. To iodize, the paper can be brushed, rod-coated, or floated in this solution. Apply the solution copiously with a camel hair brush (I would recommend a buckle brush or a synthetic Richeson), being sure to cover the paper completely both vertically and horizontally. If you want a more sure and even saturation, try floating the paper in the solution using the "tray" method. Turn up the edges of the paper about half an inch, making a tray, and float it on the surface of the solution.
11. Once dry, the paper must be washed in several changes of water, and then left to float for 4–5 hours. Sutton suggested one entire day.
12. Once washed, hang the paper in a clean space.
13. Sutton recommended that the room be free of acidic or sulphurous vapors that would bleach the reddish tint of the paper. When the paper is nearly dry, immerse it in a tray of fresh water to remove the excess potassium iodide. Wash the paper for several hours and change the water every half hour. Do not be in a hurry to complete this step. When complete, dry the paper and put it in a portfolio for storage. This paper, kept from dampness, will last for quite a long time. Sutton went on to say that he had it on good authority that this paper would be greatly improved by exposing it to strong sunlight for an hour or two. When this was done, he recommended that the paper be stored in the dark for a few days.

Sutton compared the two variants by writing that the first method (single wash variant) is most economical but the least certain in terms of outcome. He went on to write that the second variant (double wash variant) wasted a great deal of potassium iodide and that the process itself, due to the very lengthy washing stage, I presume, was tedious.

Sutton's Directions for Exciting the Iodized Calotype Paper

Make two solutions. **Part A** is a saturated solution of gallic acid made with cold distilled water. A saturated solution is one in which the chemical is added to the prescribed amount of water until no more of the chemical will dissolve and a precipitate settles at the bottom of the mixing container.

Part B is made by dissolving 50 grains (3.2 g) of silver nitrate in 28.4 ml of distilled water and then adding 3.9 ml of glacial acetic acid.

Immediately before use, mix in a clean beaker 28.4 ml of distilled water, 15 drops of Part B, and about as many drops of Part A. This exact mix will be dependent upon the type of paper used and the ambient temperature of the lab and exposure site.

Exposure

Exposures in camera take anywhere from 3 to 8 minutes, depending on the weather and your stop selection.

Development

In low ambient light, lay out the exposed paper on a board. Tack the paper down, and with a clean buckle brush (a clump of cotton balls will do), brush over the surface with a solution made up of three parts of Part A and two parts of Part B. The image will emerge slowly with the shadow areas becoming visible first and turning a reddish tint.

Sutton warns that you need to be aware that in order to avoid feeble reds instead of dense blacks in the darker portions of the negative, you should brush over the surface of the paper with a solution of gallic acid alone. This will cause, according to Sutton, the reds to darken and intensify and make a transition to black. This is the same as Fox Talbot's instruction. Sutton recommends accomplishing this part of the development process by laying the paper face down on a sheet of glass on which you have poured a quantity of gallic acid. The entire development time should take approximately 20 minutes.

Fixing the Image

Sutton recommended washing the paper negative image in water and then immediately immersing it in a solution of 1 part sodium thiosulphate, hypo-sulphite of soda, to 4 parts water—a 25% solution. Keep the paper in the solution until the highlights clear from their yellow straw coloration. Following that, wash the paper for several hours in order to remove all traces of hypo. Then, hang the paper negative to dry.

Waxing the Negative

Refer to the instructions for waxing the calotype negative in this chapter.

Troubleshooting

Sutton relates that if the iodized paper is excited with a weak solution of aceto-nitrate of silver with no addition of gallic acid it will be as sensitive as, if not more than, before, but the calotype negative will be devoid of density, with the dark portions of the negative demonstrating a grey and feeble, metallic-like appearance in the darker areas, like the darker areas of a wet plate collodion positive on glass when viewed by transmitted light. He goes on to stress the importance of the organic matter influence of particular kinds of paper, specifically Whatman's, which he refers to as "spongy." In this case, he indicates that the gallic acid might be eliminated from the process to the print's advantage. He then points out that too much gallic acid in the process will be evident when the paper turns brown, especially in hot weather.

A good test of the paper is to take a strip into bright light. If the strip darkens instantly to a cool grey tint, incapable of further exposure, the negative will likely be grey and feeble as well. If, on the other hand, the paper darkens to a reddish tint and continues to darken during the exposure, this will indicate that there is sufficient

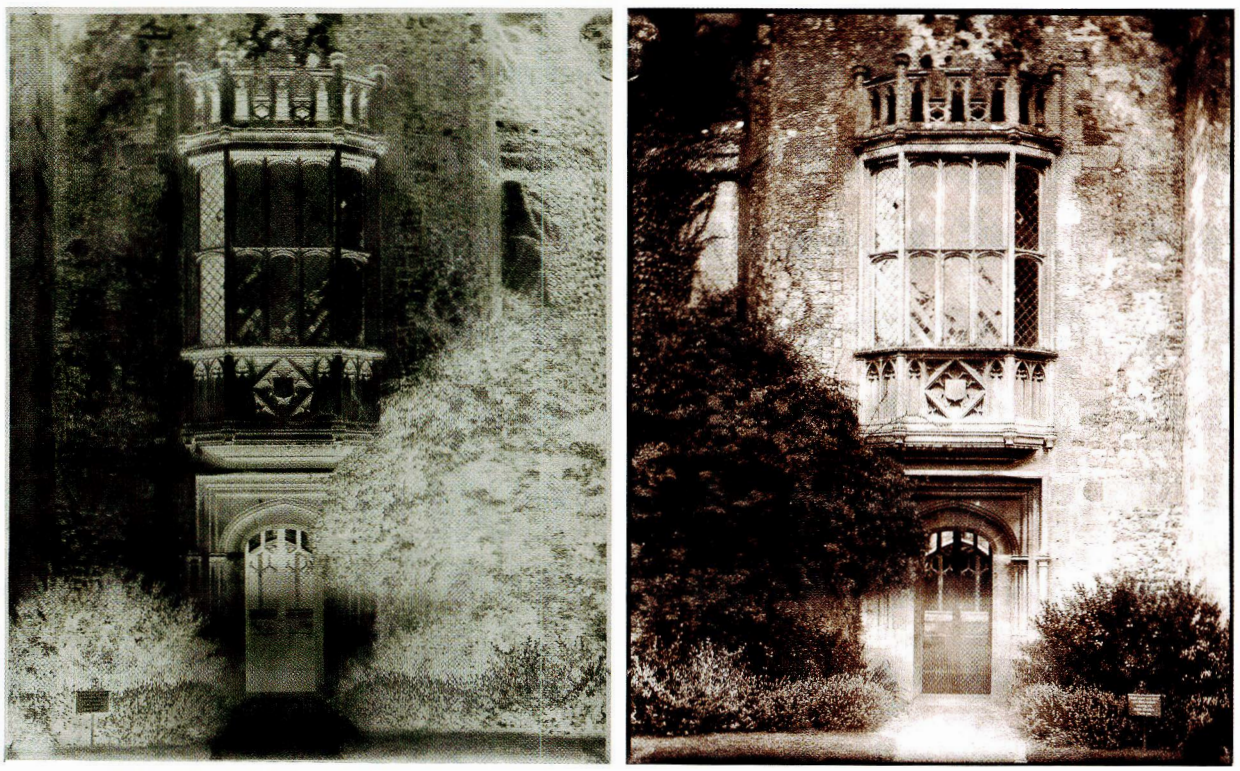


Figure 3–19

Fionnbharr Ó Súilleabháin, *Oriel Window at Lacock Abbey* (Pélegry calotype and salted paper print)

Fionnbharr Ó Súilleabháin, known to his friends as Finn, and a truly superb editor who I am indebted to, uses Arsène Pélegry's technique to make his calotypes. This technique is nearly identical to Gustave Le Gray's waxed calotype from 1851 and Maurice Lespiault's variant. Pélegry's workflow, likely due to the clarity of his detailed instructions and the fact that the process actually works (a big plus in the calotype genre), is the variant that is most favored by contemporary calotypists.

(Courtesy of the Artist)

organic matter to provide the practitioner with a good and intense calotype.

If you see a calotype negative with an abundance of blacks and very little detail in the grey or shadow areas, it may be due to too much organic matter in the process. Omit the gallic acid, change papers, reduce the acidity in the nitrate bath, or increase the exposure time.

ARSÈNE PÉLEGRY'S CALOTYPE PROCESS

Arsène Pélegry's Paper Negative Whey Developing-Out Process

In this section I'm going to provide you with complete and reasonable instructions for producing calotypes in the manner of Arsène Pélegry. Although Pélegry's technique is nearly identical to Gustave Le Gray's waxed calotype in 1851 and Maurice Lespiault's variant. Pélegry's workflow, likely due to the clarity of his instructions and the fact that the process actually works (a big plus in the calotype genre), is the one that is most favored by contemporary calotypists. (For further explanation about why whey works effectively with silver nitrate, please refer to the Whey chapter.) For that reason, it is not too complicated to provide a modest comparative workflow between Pélegry's technique and the personal variations of the same used by my friends Richard Cynan Jones, Alan Greene, Dan Estabrook, Malin Sjoberg, and Fionnbharr Ó Súilleabháin.

Arsène Pélegry

Arsène Pélegry (1813–1881) was a landscape painter and well-regarded calotypist who worked with the process well after it had ceased to be widely practiced

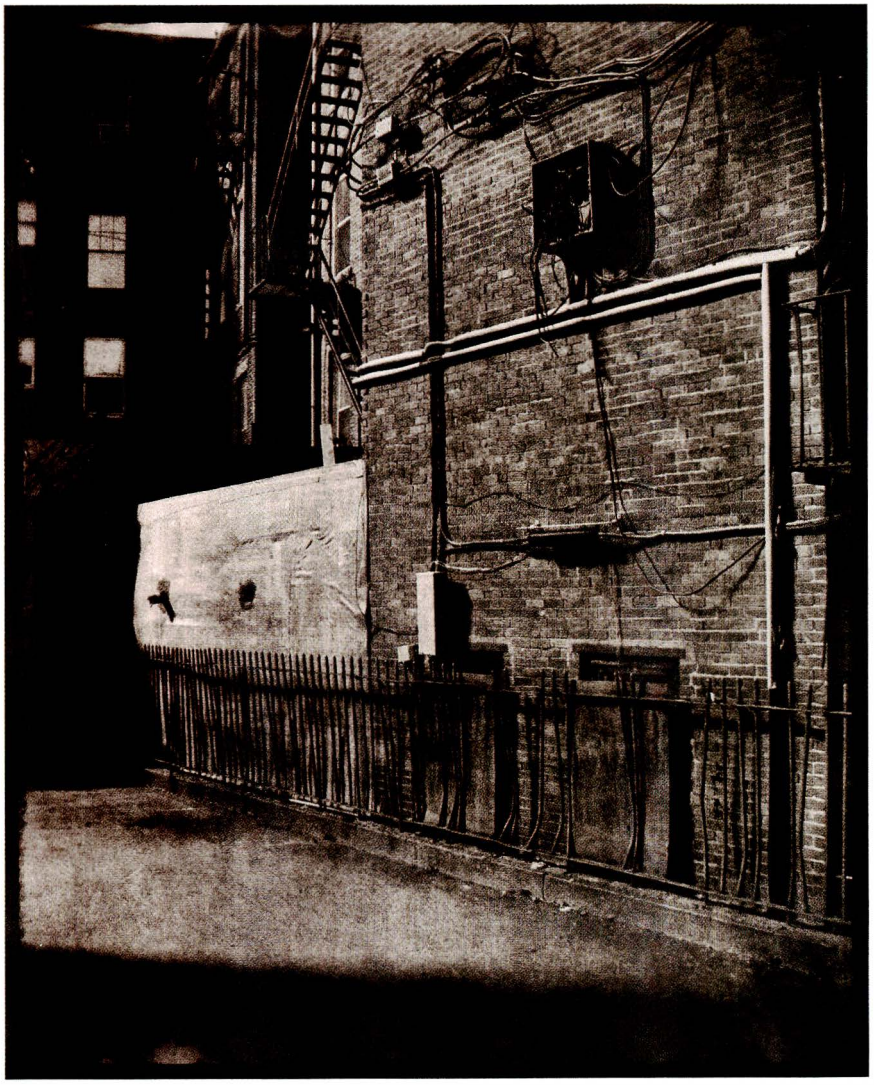


Figure 3–20
Alan Greene, *North End, Boston,* 2002. (developed-out serum-process print made from a dry, Pélegry-process paper negative) Alan Greene, author of *Primitive Photography* (2001), made this beautifully executed developed-out serum process print from a dry Arsène Pélegry process paper negative. Pélegry wrote a book, *La photographie des peintres, des voyageurs et des touristes* (Gauthier Villars), on his use of the process in 1879, in which he defended the need for paper negatives for landscapes, architecture, monuments, and things that didn't move. In it he quoted a text by Charles Chevalier, written in 1859, adding that "*the painter photographer who works with the collodion in his excursions is not free in his movements and his inspiration as he is forced to enlist a helper to carry his equipment while with the paper he can carry only his box of colors and equipment.*" *(Courtesy of the Artist)*

by photographers. He wrote a book, *La photographie des peintres, des voyageurs et des touristes* (Gauthier Villars), on his use of the process in 1879, in which he defended the need for the paper negative for landscapes, architecture, and monuments (things that didn't move) and quoted a text by Charles Chevalier written in 1859, adding that "*the painter photographer who works with the collodion in his excursions is not free in his movements and his inspiration as he is forced to enlist a helper to carry his equipment while with the paper he can carry only his box of colors and equipment*."

Making Whey . . . the Olde Whey

If you want to make your whey in a simple contemporary method using dried whey powder, please go to the Whey chapter for that recipe. In this one, instead of using dried whey powder, you can make whey from scratch. It's really quite simple. Begin by heating whole milk (some folks prefer the 1% fat type) until it reaches an active boil. Add a little vinegar (or rennet) to the boiling milk and turn off the heat. In a flash, the milk will curdle. If you want, you can use citric acid instead of vinegar or rennet as your acidic component. A half-teaspoon in the summer and a full teaspoon in the winter will do the job.

Filter the solid curds from the cloudy liquid whey through cheesecloth and then filter the solution several more times through a piece of scrupulously clean cotton or tufted cotton balls in a funnel. The liquid whey will always be slightly cloudy despite the filtering through the cheesecloth and cotton. Use it as is without dilution.

In Sutton's 1856 modification of the process in *Photographic Notes* (December 1856), he recommended "*that the rennet be washed once or twice to remove the excess of salt; but that a small portion of salt remaining in it is of little importance; it merely renders the paper more sensitive, and the ultimate tint of the picture a shade colder*."

These instructions are for the preparation of forty sheets of 8" × 10". All weights and volumes can be scaled down to smaller formats as required. The paper you select is critical, and in the great majority of calotype performances, if something goes wrong, it is usually the fault of selecting the wrong paper. Good results can be reliably obtained using Canson Marker, Ruscombe Mill's Chateau Vellum, Bienfang 360, and Clearprint 1000H drafting vellum, although that paper has a faintly visible mesh-like texture that can sometimes be seen in positive contact prints from the calotype. There is a strong recommendation from several friends for the use of 70 g Chateau Vellum, a 100% linen paper from Ruscombe Paper Mill (http://www.ruscombepaper.com) in France. Mark one side of each sheet with a pencil reference mark in one corner. I number the sheets to help keep track of them.

Iodizing the Paper

Beaker #1: 500 ml fresh whey (goes bad in 2 days)

Beaker #2: 7.5 g potassium iodide and 2 g potassium bromide dissolved in 25 ml distilled water

Beaker #3: 10 g lactose dissolved in 25 ml distilled water

Beaker #4: Optional addition: 0.2 g of iodine to the iodizer, to turn the paper a deep purple color. This will clear after complete sensitization, acting as an indicator.

The beginning of the process features the iodizing of the paper and can be carried out in daylight. You first need to make some fresh whey following the instructions given earlier or those in the Whey chapter. Pour 500 ml of fresh whey into Beaker #1 or a clean glass bottle. In Beaker #2, dissolve 7.5 g of potassium iodide and 2 g of potassium bromide in 50 ml of distilled water. In Beaker #3, warm another 100 ml of distilled water and stir into it 10 g of lactose powder until fully dissolved. Filter both of these solutions into the beaker containing the whey and shake it well.

Place the mixed solution in a flat-bottomed tray or Pyrex baking dish that is larger than your paper. Put on a pair of nitrile gloves, hold the first sheet of paper by diagonally opposed corners, lower it on to the surface of the liquid, and then immerse it. Using your gloved fingers, push the paper under the surface of the solution and gently remove any air bubbles. Turn the paper over and immerse again and then repeat this process. If you need to lift the paper and find it complicated, use a picnic knife made of plastic to raise one

corner of the paper for leverage. Leave this sheet in the solution and repeat with the second sheet, again turning it twice. Repeat this sequence until you have ten sheets of paper saturated and iodized. Then lift the entire packet and turn it over. The time this series of steps took is sufficient for iodizing using a vellum or very lightweight paper. Remove the top sheet from the stack that you just flipped over and hang it from a line with plastic clothesline clips. Finn Ó Súilleabháin recommends attaching a small 1" × 0.5" piece of the same paper in the lowest drip corner of the paper. This encourages the solution buildup to collect off of your primary piece of paper. Hang all ten sheets and allow them to dry. Repeat the procedure for the second batch of ten sheets and so on until you have iodized all forty sheets. The iodizer will remain good until used up but will only keep for a couple of days in the refrigerator before the whey goes off.

When the papers are absolutely dry, put them together and place them in between clean blotting papers. Place the blotting sheets and iodized paper bundle between two boards or Lucite, place a weight on top, and leave it overnight to perfectly flatten the paper. Your iodized papers will keep for a very long time.

Sensitizing the Paper

Tray #1: Combine 50 g silver nitrate and 0.5 g citric acid in 500 ml distilled water. Richard Cynan Jones and Davanne recommend increasing the citric acid component to 3.5 g.

Tray #2: Distilled water

Tray #3: 500 ml 1% sodium chloride solution

Tray #4: Distilled water

Tray #5: Preservation solution: 600 ml distilled water, 15 g dextrin, and 15 g tannic acid (age this solution 48 hours before using it). An optional addition to this solution is 15 ml of gallic acid in alcohol. It is not mandatory and many leave this out although alcohol helps to clarify the mixture.

Now it's time to make your iodized papers light sensitive. You perform this miracle by immersing the iodized paper in a bath of silver nitrate and citric acid. In doing so, you create light-sensitive silver iodide and silver bromide within the paper through the reaction of the iodide with bromide from the first iodizing stage and the silver nitrate in this stage. When you are ready to begin, you must be in a safelight environment or have taken steps to filter the UV light outside with yellow or red sheets. Of course, you can always sensitize by candlelight at a distance to replicate the 1800s.

Put on a pair of nitrile gloves, an apron, and protective eyewear if you are not wearing glasses. The silver nitrate will turn your fingers black for a few days if your skin comes in contact with the silver solution. This isn't dangerous to you, as all that is happening is that the silver nitrate is reacting to the proteins in the epidermal layer of your skin. That said, never touch your face or eyes during the sensitizing sequence, as silver nitrate and the tender parts of your eye are not compatible.

Your five trays are set up according to the directions just given. Each tray is filled with the solutions described next. During the sensitizing process, the papers go through the gauntlet in successive steps until the process is complete. The paper is then hung to dry.

Tray #1 contains 50 g of silver nitrate and 0.5 g (up to 3.5 g) of citric acid dissolved in 500 ml of pure distilled water. After your five to ten sheets are immersed, the stack of sheets is turned over and they are moved one by one into the distilled water bath of Tray #2. From Richard Cynan Jones: "Pélegry doesn't specify how much water is used" (for 8" × 10" sheets, but Jones uses about 1 liter per bath and washes twice before the salt to reduce the formation of sticky silver chloride precipitate). When all ten sheets are immersed in the distilled water, the papers are turned once more and moved one by one into Tray #3, which contains 500 ml of a 1% sodium chloride solution. When all ten sheets are immersed, the papers are flipped again and transferred to Tray #4, which is filled with clean distilled water.

The ten pieces of paper must be thoroughly washed, and you should take care to change the water in the tray a minimum of three to four times during this stage of the process. The purpose of this is to wash out all the insoluble or free silver nitrate from the paper as thoroughly as possible before the final step. Any silver chloride left

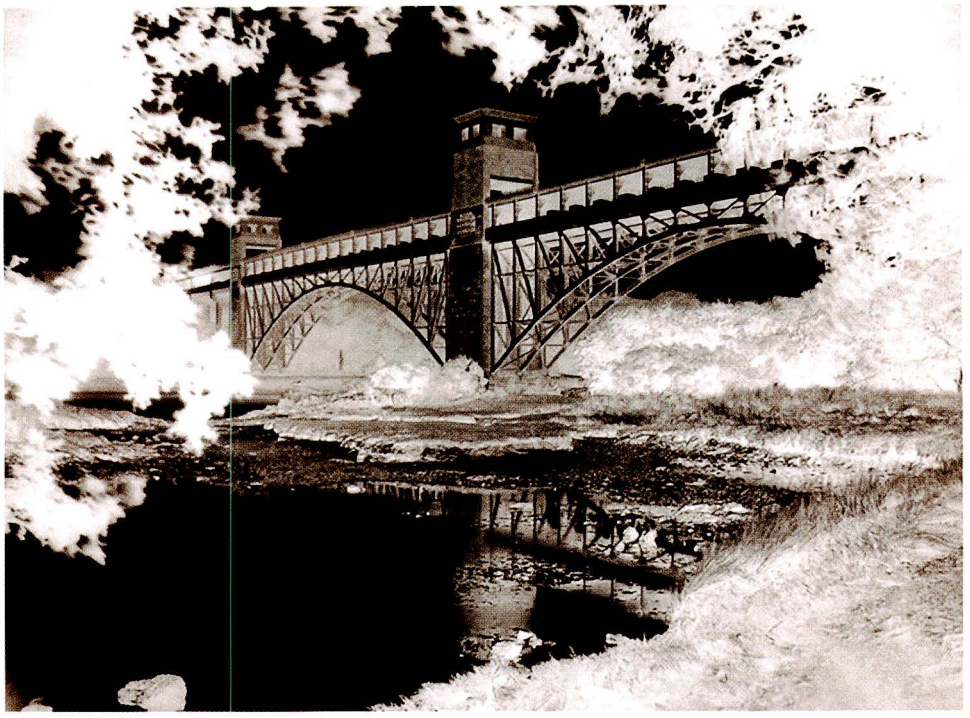


Figure 3–21
Richard Cynan Jones, *Britannia*, 2013 (Pélegry calotype)
This is an extraordinarily nice example of the calotype potential by Richard.
(Courtesy of the Artist)

in the fibers of the paper will result in fogging. The final tray contains a preservative solution of dextrin and tannic acid that has been left to mature for 48 hours. Each sheet is immersed individually for 3 minutes in the dextrin–tannin solution and then hung to dry. When the sheets are thoroughly dry they must be stored in a light-proof portfolio or dark safe box.

Exposure

Figure that your sensitized paper has a UV 1 rating and use a professional light meter to calculate an exposure or get the LightMeter app for iPhone, which I find perfect for wet plate collodion calibration at a similar UV number. As a guide, for a UV level of 1 give it 2.5–3 minutes of exposure at f/8. If you don't have a UV meter or an iPhone LightMeter app, use this rule of thumb: if it is a nice sunny day with blue sky, try 3 minutes at f/8. In shadow or overcast conditions, try 6 minutes at f/8. Any combination of sun, shade, clouds, and shadows can be figured out quickly through trial and error.

Development: 12–45 minutes

Development is subjective and you can expect it to last 12–45 minutes in total.

Developer: 100 ml of 0.8% gallic acid. You may add 1 ml–5 ml of aceto-nitrate of silver to this solution after 10 minutes of development in gallic acid. This solution is made by combining 7% silver nitrate solution with 14% acetic acid solution.

Tray #1: Distilled water

Tray #2: Developer

Tray #3: Distilled water

A brown glass bottle, with pipette, for your aceto-nitrate of silver solution

Immerse the exposed calotype on paper in the first tray of distilled water. This immersion is very brief, and as soon as the paper is fully saturated, remove it from the distilled water and lay it face down in the developer. Be sure that the back of the paper becomes completely immersed, at which point you can turn it over and leave it to develop face up.

For an 8" × 10" negative you will need at least 100 ml of the 0.8% gallic acid solution. Pour the 100 ml of developer into Tray #2, a flat-bottomed 8" × 10" tray dedicated to this task. After 10 minutes in the gallic acid solution, you may choose to speed up the development by adding between 1 ml and 5 ml aceto-nitrate solution. When it is time to perform this step, lift the developing

paper clear of the tray and add the aceto-nitrate to the gallic acid developer, stirring it into the solution well. Then, re-immerse the negative and leave it until it has developed sufficient density. This is a subjective evaluation, of course, but be mindful that you will likely be using the calotype to make a salted paper or albumen print, and both would enjoy a bulletproof and contrasty negative.

First Wash: 3 minutes

When you have decided that the development is complete, move the negative to the Tray #3 bath of distilled water for 3 minutes. This will stop additional development. Change the distilled water two to three times over the 3-minute period.

Fixer: 20–40 minutes total

Fifteen percent solution (150 g in 1,000 ml) sodium thiosulphate in two trays of 500 ml each

Figure 3–22
Hill & Adamson, *Artilleryman and Highlander, Edinburgh* Castle, 1846
This image is a salted paper print from a calotype negative example of Hill and Adamson's prolific portfolio during the short time they collaborated.
(Private Collection / The Stapleton Collection/ The Bridgeman Art Library)

To fix the developed calotype, make up a single liter (1,000 ml) of a 15% solution of sodium thiosulphate. Divide the solution between two 8" × 10" trays. Fix for 10–20 minutes in each tray for a total of 20–40 minutes of fixing time. Then rinse the negative in a water tray and go directly into a tray of hypo-clear (1% solution of sodium sulphite) for 4 minutes.

Hypo Clearing Solution: 4 minutes

1% sodium sulphite solution (4 minutes)

Final Wash: 1 hour

Wash prints for 1 hour in tap water, changing the water a minimum of three times during the hour. Finish with a 5–10 minute soak in distilled water to assist with removing any additives to the tap water that may cause your paper to turn from white into yellow upon drying.

DR. DIAMOND'S CALOTYPE

In *Notes and Queries: A Medium of Inter-Communication for Literary Men, Artists, Antiquaries, Genealogists, etc. – Volume 8th - December 17th, 1853,* Dr. Hugh Welch Diamond wrote in his calotype entry, "The Simplicity of the Calotype Process" that the greatest number of failures in the calotype process are caused by the failure of making a good and realized iodized paper and that the primary reasons for failure were caused by

1. the quality of the paper,
2. the mode of preparing it, and
3. the want of proper *definite* proportions for a particular make of paper.

Dr. Diamond goes on to explain that he had unsatisfactory results while iodizing French (likely sized with starch) and German papers and the thicker English papers (likely sized with gelatin), specifically the Turner's paper from Chafford Mills. He attributed the frequent malady of white spots on the paper to minute shavings of brass from the mill's machinery or from the rims of the brass buttons left in the rags when they were being reduced to pulp for the paper . . . where a single button could be responsible for contaminating a large portion of the paper run.

Dr. Diamond preferred Whatman's stock and suggested that aging a paper for calotype use was a good idea.

He preferred the calotype paper to be iodized by the single wash (English) method due to its ease and efficiency and economy of time. As well, he believed it had a better "rapidity of action" as well as a greater intensity of blacks.

Explanation of the Single and Double Wash Variants

In a single wash variant, a quality paper is initially coated with an alkaline iodide, followed with an immersion bath in silver nitrate and concluded with a long wash to remove free silver.

Single Wash Variant

60 grains (3.9 g) silver nitrate
60 grains (3.9 g) potassium iodide

- Dissolve each separately in an ounce of distilled water.
- Mix and stir briskly; the precipitate of iodide will fall to the bottom of the vessel.
- Pour off the fluid.
- Wash the precipitate once with a little distilled water.
- Pour on it 4 oz of distilled water.
- Add 650 (42 g) grains of potassium iodide that should perfectly re-dissolve the silver and form a clear fluid.

The marked side of the paper should be immediately laid (floated) upon the marked side of the paper. Immediately remove the paper and lay it dry side down on a sheet of blotter paper and stroke over it once or twice with a glass rod (Puddle Pusher), expelling any air bubbles from the floating. Hang or pin up the paper to an almost dry state.

Immerse the sheets in common cold water for 4 hours, changing the water once an hour. This removes all of the soluble salts from the paper.

If the paper is well made it will be a straw or primrose color and free of "unevenness of tint." It will keep now for several years unless the soluble salts have not been completely removed. You will know if this is the case because any dampness will react with the salts in the paper, turning the paper into an uneven brown color. The paper is not sensitive to light.

The Double Wash Variant

In this example the paper is first coated with insensitive silver iodide and then "excited" by a weak solution of acidified gallo- nitrate of silver. This Class I calotype is called "argento-iodized paper" and is prepared by what is called the "double wash" variant.

Having floated your marked surface of the paper on a 30-grain (1.9 g) solution of silver nitrate and dried it, immerse it for 20 minutes in a potassium of iodide solution made up of 20 grains (1.2 g) per ounce (29.5 ml) of distilled water in which the paper will assume the desired straw/primrose coloration. At this point, proceed with the same washing steps as in the single wash variant.

All of this is done under a low ambient light.

Exciting the Paper with Aceto-nitrate of Silver

To "excite" the paper, use 10 drops of aceto nitrate of silver (which is made by combining 30 grains [1.9 g] of silver nitrate, 1 drachm or dram [3.9 ml] of glacial acetic acid, 8 drams [28.4 ml] of distilled water) and 10 drops of a saturated solution of gallic acid mixed with 3 drachms/drams of distilled water. If the weather is warm, 6 drops of gallic acid to 10 drops of aceto-nitrate of silver is fine.

Under very dim light, (Dr. Diamond refers to the intensity as "feeble") apply the silver solution to the paper by a floating or glass rod. Use a synthetic Richeson brush as an optional coating technique. As soon as it is applied, lay the paper on a blotter for a single use. Put the paper in a film or plate holder for exposure. It is not necessary for the paper to be completely dry.

Addition of Potassium Bromide to Increase the Excitement

On occasion, the addition of potassium bromide to the iodized paper will enhance the power of the recording of the color green during exposure. This is

similar to the effect found in the addition of bromide salts to wet plate collodion. It does not accelerate the time of exposure; it simply increases the ability of the sensitized paper to render foliage in a more efficient manner.

- Dissolve 30 grains (1.9 g) of potassium bromide in a half ounce (14.7 ml) of distilled water and label it as Part A.
- Dissolve 42 grains (2.7 g) of silver nitrate in a half ounce (14.7 ml) of distilled water and label Part B.
- Mix the two solutions together.
- Add 1 oz (29.5 ml) distilled water.
- Add 245 grains (15.8 g) potassium iodide to get a clear solution. If it is not clear, add some more potassium iodide.

Dr. Diamond has no specific recommendation for the proportions of this potassium bromide solution to the aceto-nitrate of silver sensitizer above, but Richard Cynan Jones thinks it is 4:1—4 iodide to 1 bromide.

Exposure

Length of exposure is 3–8 minutes with the medium time of 5 minutes. The duller the day, the longer the exposure.

Development

Development should be performed with equal volumes of aceto-nitrate of silver and saturated solution of gallic acid that are mixed together and applied to the exposed surface of the paper. Exposure may be done up to several hours following exposure, so a changing bag might be most helpful in the field for reloading the plate holder, allowing you to return to a lab for processing.

If the image is clearly seen following exposure, before development apply a small quantity of gallic acid solution first and follow that with the aceto-nitrate of silver–gallic acid developer. This action will limit the possibility of staining and result in a stronger negative.

If browning is seen, adding a few drop of acetic acid may check the browning.

If the exposure is slow in resolution from too little exposure or insufficient light, a few drops of a solution of pyrogallic acid made with 3 grains of pyrogallic acid to an ounce of water and a drachm of acetic acid, may be beneficial.

Following Development: Fixing Options

As soon as the image is developed it should be immersed in a water bath for an hour. This water should be changed on the half hour. Then the paper is removed, pinned up, and dried. The other option here is to fix the image with a saturated solution of sodium thiosulphate until the yellowing in the image clears. Personally, I would forget the sodium thiosulphate and stick with the first option of a long water soak. If you use the sodium thiosulphate, it is now necessary to wash for at least an hour to remove the fixer from the paper.

Figure 3–23
Hill & Adamson, *Fence & Trees in Colinton Wood*, 1843–1847 (salted paper print from calotype negative)
(Private Collection / The Stapleton Collection/ The Bridgeman Art Library)

Note: Dr. Diamond suggested boiling the sodium thiosulphate and pouring it on the paper, thus removing the paper's sizing and most of the "coloring matter" in the paper. This makes waxing the paper negative easier to do and in some cases, depending on the paper, more translucent . . . making the job of waxing easier or irrelevant.

Waxing the Negative

Refer to the instructions for waxing the calotype negative in this chapter.

GUSTAVE LE GRAY AND MAURICE LESPIAULT'S WAXED CALOTYPES

Gustave Le Gray's Dry Waxed Paper Negative

Before closing this chapter, this is a good place to mention Gustave Le Gray and his idea leading to dry waxed paper negatives in 1851, an invention that is said to be the single most important force promoting paper negative printing at the time. Recognizing the importance of translucency in contact negatives, Le Gray began analyzing personalities and composition of available

Figure 3–24

Gustave Le Gray, *Oak Tree and Rocks, Forest of Fontainebleau*, 1849–1852 (salted paper print from waxed paper negative)

Gustave Le Gray had a great idea leading to dry waxed paper negatives in 1851 . . . an invention that is likely the single most important influence promoting paper negative printing at the time. Recognizing the importance of translucency in contact negatives, Le Gray began analyzing available papers with regard to chemical absorption, weight, and wet strength. His idea was to pre-coat the paper in melted beeswax prior to sensitization and in this way instigate a more uniform absorption and ultimate coating of chemistry . . . much like the way silver nitrate demonstrates better image clarity on a surface of albumen or gelatin. The wax coating did away with the problem of paper substrate inconsistency. The waxed paper was then treated with a potassium iodide solution and whey/milk serum and a silver nitrate solution.

(Image copyright© The Metropolitan Museum of Art. Image source: Art Resource, NY)

papers with regard to chemical absorption, weight, and wet strength.

His idea was to pre-coat the paper in melted beeswax prior to sensitization and in this way instigate a more uniform absorption and ultimate coating of chemistry, much like the way silver nitrate demonstrates better image clarity on a surface of albumen or gelatin. This pre-sensitized wax coating did away with the problem of paper substrate inconsistency. The waxed paper was then treated with two chemical solutions: a potassium iodide solution with whey/milk serum and a silver nitrate solution. Because the whey was functioning as the organic protein in place of a salt, the treated and sensitized waxed paper could be used dry, eliminating the trouble of sensitizing the paper on the spot before shooting. As a result, this method became widely used in travel photography. Among those who worked and modified Le Gray's technique was Maurice Lespiault, who wrote about the process in an article he submitted to *Notes and Queries, 1854,* describing a dry paper waxed process for calotype preservation, translucency, and strength. It is not very different from Gustave Le Gray's technique.

Maurice Lespiault's Turpentino–Wax Paper Process

Note: For original documentation on this method, refer to the *Photographic News,* Volume II, Number 50, August 19, 1859, "The Turpentine Waxed Paper Process."

Maurice Lespiault, working with a calotype on Canson paper, begins his description by placing 200 g of white wax in a liter bottle that is subsequently filled with spirits of turpentine (referred to as rectified spirits). He goes on to write that he then fills a larger vessel with water, large enough to accommodate the vessel containing the wax and turpentine, and heats it to a temperature between 85°F (30°C) and 100°F (40°C) for about half an hour or until the turpentine has dissolved the wax to the consistency of olive oil. This heating will be repeated throughout the process so as not to allow the solution to get chilled and set. If this happens, it may be necessary to add a bit more turpentine and to re-heat the solution.

If the solution is clear, you may commence with the waxing. If not, you will need to filter the solution before immersing your paper. Once clear, submerge your paper, and if it's thin enough, you will notice that it becomes transparent quite quickly. Lespiault described the look as "glass finely polished." Proceed and know that you may work with many sheets of paper at a time. Remove the paper after 5–15 minutes, and hang it on a line.

As the paper dries, it takes on an opaque white appearance. Once the sheets are well dried, immerse them in an iodide solution for 2 hours so that the wax is fully saturated. The iodide bath is made with the following ingredients.

Iodizing Bath

1 liter	filtered rice water (Rice water is a starchy suspension and what you get by boiling rice until it practically dissolves and by draining it.)
6 g	gelatin
20 g	milk sugar (lactose)
25 g	potassium iodide
2 g	ammonium iodide
4 g	potassium bromide (important for the black tones)
2 g	sodium chloride
0.5 g	(half a gram) fluoride
0.5 g	(half a gram) potassium cyanide

Note: Read the warnings about potassium cyanide in the Wet Plate Collodion chapter, as it is extremely lethal and you need to know everything about it and the correct way to neutralize it quickly with hydrogen peroxide. M. Lespiault indicates in his entry that he is not convinced that the fluoride and potassium cyanide are very efficient and worth the trouble and danger, but that since Gustave Le Gray used these proportions for those two chemicals and got nice results, he would include them. My personal feelings are that you try the process without the potassium

cyanide and fluoride first and that if you don't need them, don't bother. An iodized paper will be blue-black.

The fully iodized papers, after 2 hours in the iodizing bath, are hung on a line by their corners until fully dry. They may rest in that position for a long time.

Sensitizing Bath

Note: This is the original recipe in which you are expected to weigh the liquid measure in grams. Take a container, weigh it on a gram scale, push "tare," and the screen will go to zero. Add the liquid to the container and you will get the correct weight.

15 g	silver nitrate
24 g	acetic acid
300 g	water

Lespiault discusses adding some of the iodizer to the sensitizer solution. This would be the time to adjust the potassium bromide amount if your blacks were pasty. First, try it without the additive iodizer. A sensitized paper will be white.

Sensitize by immersing several sheets at once in the sensitizer solution and wait a bit. It's not clear how long, but I would imagine not more than 3 minutes, or until the paper clears, losing its purple/blue tint. Again, adding 0.2 g iodine per 500 ml of iodizer acts as an indicator. Remove the sheets at once and immerse them in "rainwater" or distilled water. Once dried, the paper is good for several weeks, and this is why the method described was a favorite among travel photographers.

Expose the paper in the camera, and if the exposure is correct, the image will be visible. It is then developed with a saturated solution of gallic acid, whereupon it takes on a reddish hue and ultimately begins to darken to black. Follow the fixing, washing, and waxing instructions found in the various methods in this chapter to complete the process.

LAST WORDS AND HINTS

A Simple Test of Your Formula's Sensitivity

Here's a simple test to determine the sensitivity of your calotype formula. Sensitize a piece of paper and then expose it with a flat opaque object, such as a quarter, lying on the paper's surface. Begin to develop the outer edges of the sheet to maximum density. If you can do this without generating a stain under the area where the coin covered the sheet, then you should be fine.

Paper for Calotypes: Good, Bad, and Ugly

First rule: Order samples for testing before committing to a paper type.

You will need a thin and high-quality stationery stock to be successful. Unfortunately, many nice writing papers have the paper maker's watermark stamped, inevitably, somewhere in your image area. If this doesn't trouble you, then Crane's Kid Finish is a nice paper for you. Personally, I love it. We've tried Buxton and Weston Parchment, but few papers work as well as a difficult-to-find French paper called Crobb d'art, although it has been getting a reputation for spontaneous development unless it is acidified before the process commences. Next time you're in Paris, hunt for it. Many calotypists like Bienfang 360, and calotypist extraordinaire Richard Cynan Jones uses Canson Marker. In the meantime, you'll need to test a lot of paper before finding one that suits you, and be aware that the paper that works well for a negative might not be the paper best suited for a positive. Perhaps consider gelatin sizing the paper you select, as I've found that gelatin sizing helps a lot with image clarity but occasionally hinders the translucency of the paper, necessitating a boiling sodium thiosulphate fixer immersion to break down the sizing. You might also want to experiment with fumed silica before applying solutions when you are really proficient with this process.

Figure 3–25
Richard Cynan Jones, Pélegry Calotype Process (L) and Waxed Calotype (R)
This is a nice comparative example by Richard Cynan Jones of the results of Pélegry's calotype process on the left and a waxed calotype technique on the right.
(Courtesy of the Artist)

Here is a list of papers that will help make your calotype more successful . . . and a list of papers that have been less than helpful. The recommendations come from the http://www.flickr.com calotype newsgroup that is hosted by Richard Cynan Jones.

These Papers Work Well

- Canson Marker, Extra White Layout Paper. Alpha-cellulose (70 gsm): This paper will curl when floated.
- Canson Calque (70 + 90 gsm)/Canson Vidalon Vellum (90 gsm): To avoid curl, tracing paper should be immersed, not floated. Alpha-cellulose.
- Transvel Vellum from Butler-Dearden (30 lb) Alpha-cellulose: To avoid curl, immerse paper. Blistering may occur upon drying.
- Clearprint 100H drafting vellum, 100% cotton (16 + 20 lb): This paper will curl when floated. Noticeable fine-line screen markings can be seen in contact printing.
- Staedtler Mars Vellum, 16 lb, 100% cotton: Noticeable screen markings. It tends to curl upon immersion but then settles down.
- Bienfang 360, 13.5 lb 100% cotton: This is a standard, well-respected paper and a favorite of Pt/Pd practitioners. However, there are occasional noticeable screen markings in calotype negatives when using this substrate. There have also been reports of spotting.
- Herschel Platinotype 110 gsm from Ruscombe Mill: Occasionally out of stock 100% because it's beautiful rag linen paper and much desired in spite of the price.
- Chateau Vellum White 70 and 110 gsm from Ruscombe Mill: Suffers from the occasional black spot or smudge during development with Talbot's technique, but loved by calotypists. 100% rag linen paper. Fix with a hot 15% solution of sodium thiosulphate to increase translucency.
- Southworth 24 lb Resume.

These Papers Do Not Always Work Well

- Canson Crobb d'art (70 gsm): Turns black in the developer (spontaneous development). This paper works best when pre-acidified with 33% glacial acetic acid (5.5 ml–100 ml of water). Another

simple method of acidifying your paper is to make a 2% citric acid or oxalic acid solution and to soak or brush coat it on your paper. If soaking, allow 1–3 minutes and then rinse for 10 minutes and allow the paper to dry overnight.

- Cranes Crest (90 gsm) Pearl White: Varies from batch to batch, and will blacken during development 90% of the time. Works when acidified.
- Cranes Crest (105 gsm) Fluorescent White.
- Arches Text Wove (120 gsm): Too much surface texture. Will blacken during development. Works when acidified.
- Conqueror Connoisseur (110 gsm): Blackens during the sensitizing stage (single wash + gallic in sensitizer).
- Piero Natural White Connoisseur Piero Cotton Paper 110 gsm.

Contamination

Contamination is your biggest enemy. Keep everything as clean as you possibly can, and do not overlook anything. I strongly suggest using a buckle brush or a cotton ball for chemical application and then retiring the cotton.

Heat Issues

Hot weather is a problem. If you are working in high ambient air temperature then think about increasing the volume of your restrainer (acetic acid) in the developing solution. In fact, if you see fogging

Figure 3–26

Richard Cynan Jones, *Michael Mosley at Laycock*, 2012

The seated gentleman in this Richard Cynan Jones calotype and positive is physician, commentator, and television presenter Michael Mosley. The calotype negative was made following Arsène Pélegry's instructions (an 1879 late variant), and the positive is arrowroot-sized salted paper.
(Courtesy of the Artist)

(browning), one of the first steps you might want to consider is adding extra drops of acetic acid to your sensitizer and developer.

Patience

Calotype printing may be a difficult alternative process to do well, as the variables are many and any misstep can spell disaster. However, it is a great deal of fun standing in the proverbial footprints of Mr. Talbot and Mr. Sutton and discovering how utterly human, and photographically feeble, making calotypes will make you feel. It will also make you feel amazing. Please be patient and do not expect miracles when you first begin to work in this process. All of my expert alt pro friends who are familiar with this technique insist that there is no other technique that is as mercurial, so it is essential to enjoy the process and have fun doing it. Patience my friends . . . patience.

Bayard's Direct Positive Process

OVERVIEW & EXPECTATIONS

Considering the abundance of documentation regarding the contributions of the first inventors and explorers of the photographic medium—artist-scientists such as Elizabeth Fulhame, Daguerre and Niépce, Fox Talbot, Herschel, and Atkins—there is not nearly as much evidence and acclaim given to Hippolyte Bayard, who was denied the validation he deserved because of politics, social class, and bad timing.

In this relatively brief chapter, it is my intention to tell you about Bayard as the first person to create a direct positive image in-camera, the first person to have an exhibition of his photography, and the first person to conceptualize the subject of a photograph as a political protest and statement, rather than simply adopting photography as a science vehicle to record reflected light and make it visible with chemistry and a camera.

In addition, I will describe the relatively simple process in a step-by-step sequence and will try to avoid giving you a hard and fast menu of answers as to what your own Bayard Direct Positives should look like. I will also speculate on some ways to alter the process and let you be the judge as to whether it grabs your imagination sufficiently to give the technique a shot.

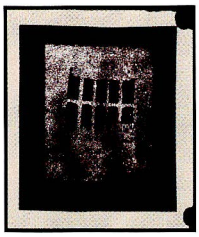
Keep in mind: this process was born in the imagination of a curious and brilliant man who happened to have a day job as a clerk in the Ministry of Finance in Paris. The only reason you may have never heard of him before was because he was denied the honor of being first. Of course, William Henry Fox Talbot felt exactly the same way . . . but that's another story.

Figure 4–1

Hippolyte Bayard, *Windmills, Montmartre,* 1839

While Talbot and Daguerre were on the verge of claiming to have invented what would soon become known as *photography,* Hippolyte Bayard was successfully making images in his free time away from his job in the French Finance Ministry. Working alone, Bayard had conceived and executed a miracle in only a few months . . . that of reproducing a two-dimensional likeness of reality with chemistry and light. Like Daguerre's process, Bayard's was a direct-positive technique. Like Talbot's process, it generated images on paper. This image of the windmills of Montmartre, made in the spring of 1839, is one of his earliest and likely among the images he exhibited in Paris in July . . . the first recorded public exhibition of photographs.

(Image copyright© The Metropolitan Museum of Art. Image source: Art Resource, NY)



A LITTLE HISTORY

Timing is Everything

Hippolyte Bayard was born in Breteuil-sur-Noye, a 2-hour drive north of Paris today on A-16, in 1801 shortly following the conclusion of the last French revolution in 1801. According to legend, Bayard's father introduced young Hippolyte to the effects of UV light by taking his own freshly harvested peaches and cutting an opaque stencil, with the letter "B" for Bayard or the carefully cut out shape of a horse, which he would place over the skin of the peaches.

The peaches would then be arranged in direct sunlight for several days where the UV light would accelerate the ripening of the fruit to a deep orange red . . . all except for the areas protected by the opaque stencil, which would remain a pale pink-orange as if just picked from the tree. Working on the same principle as Herschel's anthotype process, where an opaque or translucent positive is placed on the colored extracts of flower petals, fruit juices, and alcohol applied to paper and left to expose for weeks on end; these artfully decorated peaches were then wrapped and presented to relatives and friends as gifts and examples of peach-growing excellence.

Nearing thirty, Bayard moved to Paris (1827) and went to work as a clerk in the Ministry of Finance. To put this date in context, Niépce has already had a royal rejection of his photographic discovery by the Royal Society because his process had too many "secrets." As well, Niépce and Daguerre were two years away from beginning their collaboration in 1829. In Paris, Bayard fully embraced the intellectual energy of the city and took his new life by the proverbial horns, immersing himself in the art and scientific communities. On the seventh of January 1839, Bayard became aware of Daguerre's invention of photography when Daguerre's principal sponsor, the politically astute astronomer and physicist Francois Arago, presented Daguerre's discovery to the Academie des Sciences.

Figure 4–2
Jane Alden Stevens, Rubylith Apples
This is a fine example of Jane Alden Steven's stencil on growing fruit. According to legend, Bayard's father introduced young Hippolyte to the effects of UV light by taking his own freshly harvested peaches and cutting an opaque stencil, with the letter "B" for Bayard, which he would place over the skin of the peaches. The peaches would then be arranged in direct sunlight for several days where the UV light would accelerate the ripening of the fruit to a deep orange red . . . all except for the areas protected by the opaque stencil, which would remain a pale pink-orange as if just picked from the tree.
(Courtesy of the Artist)

Bayard had been working on a system of light-based image making of his own, and upon hearing of Arago's involvement in the celebration of Daguerre's achievements, he took his own exposed in-camera, *direct positive* paper images to members of the Academie des Sciences in an attempt to stake his own claim of discovery. It is important to note that Bayard had made his images shortly after the first news of Talbot's work in England but before the "official" announcement of Daguerre's invention by Arago to the Academie.

Bayard was creating direct positive imagery with an assortment of papers and chemicals that were quite different than Daguerre's although, like Daguerre's plates, also direct positives. Bayard's, however, were on paper and not metal, and though they could not compare with the brilliance of the daguerreotype, they were far easier to produce and had enormous upside potential photographically. Shortly after Arago presented for Daguerre, on January 30, William Henry Fox Talbot showed his photogenic, salted image drawings to the Royal Society in London. Like Bayard, Talbot's images were on paper. A week after that, in early March 1839, Bayard visited Cesar Desprets, a distinguished member of the French Academie and showed his own photographic efforts.

At this point, Talbot and Bayard were asking for meetings and showing their results to any and all who were curious and interested on both sides of the English Channel but with a political focus on the members of the Academie where the original announcement had been made. In March 1839, Bayard demonstrated his direct positive process to two members of the French Academie, Gravedon and Saint, and made an hour-long exposure. A few weeks later he was able to reduce the exposure time to 30 minutes.

Talbot, not to be outdone in the race for appropriate recognition, showed Monsieur Boit, another member of the Academie des Sciences, his own examples while making his own case for recognition. Bayard followed up in May with a meeting of his own with M. Boit. At this point, assuming that the members of the Academie were getting weary of these politics, Arago inserted himself in the proceedings and asked Bayard to retreat from his self-promotions and claims of authorship.

By June of 1839, Bayard's exposures were reduced to 15 minutes for statues and 20 minutes for landscapes, and he was making progress rapidly. In spite of being removed from the stage, Bayard was about to make history . . . he had just arranged, on the twenty-fourth of June, the world's very first solo exhibition of photography in a prestigious benefit exhibition that included the so-called "high arts." Here's the story . . . .

Figure 4–3
Hill & Adamson, *Lady Elizabeth Eastlake,* 1845 (salted paper print from a calotype negative)
As it happened, there was an earthquake on the island of Martinique in 1839 in which 400 people had perished. In response, the good people of Paris organized a benefit exhibition on behalf of those who were victims of that disaster, in which the works of such art-stars as Rembrandt and Titian were to be shown. With the assistance of Lady Elizabeth Eastlake, Hippolyte Bayard's calotypes hung adjacent to the masterworks in July 1839, several weeks before the official unveiling of Daguerre's work at the French Academy of Sciences, thanks to Lady Eastlake, who was an astute observer on the fledgling photographic arts. Bayard's work was highly praised for its artistic merit and described by the major French newspaper *Le Constitionnel* as having an "exquisite fineness and softness of light . . ." like painting.
(Courtesy of George Eastman House, International Museum of Photography and Film)

Being much like printmaking (reproductions from a single source) and drawing (the flaws of syntax and hand work) in its approach to image making, the calotype had the look of one-of-a-kind art, and as a result it was championed by one of the earliest writers on photography, Lady Elizabeth Eastlake. (Do an Internet search for her famous article, *Photography,* from 1857.) Lady Eastlake, also known as Elizabeth Rigby, had a "nerve-ending desire" to have photography imitate painting.

As it happened, there was an earthquake on the island of Martinique in 1839 in which 400 people lost their lives. In response, the good people of Paris organized a benefit exhibition on behalf of the people who were victims of that disaster, in which the works of such art-stars as Rembrandt and Titian were shown. With the assistance of Lady Eastlake, Bayard's calotypes hung adjacent to the masterworks in July 1839, several weeks before the unveiling of Daguerre's work at the French Academy of Sciences. Bayard's work was highly praised for its artistic merit and described by the major French newspaper *Le Constitionnel* as having an "exquisite fineness and softness of light . . ." like painting.

As mentioned, Arago told Bayard to cease discussing his invention further with members of the Academie and that his personal reputation and investment in Daguerre were significant, and furthermore, that it was Daguerre, not Bayard or Talbot, who he would be championing for the discovery. As compensation, Bayard was granted a pension of 600 francs to purchase equipment and supplies to continue his work on the condition that he simply stopped talking to people about his discovery.

In a pique at the disrespect he had experienced, Bayard created his masterpiece, *Autoportrait Noyé, 1840.* In June of that year, Bayard enshrined his anger and unhappiness forever in the history of art by creating

Figure 4–4
Hippolyte Bayard (1801–1887), *Self Portrait as a Drowned Man,* 1840
This tableau set self-portrait playing on the well-known Jacques-Louis David painting *The Death of Marat* (1793) features Bayard as a man, made so miserable by the political suppression of his achievement, that he committed suicide by drowning. His image of protest and imagination, along with being the first photographer to have an exhibition of his images, made him a luminary in the Paris art community.
(Societe fransd)

Self Portrait as a Drowned Man. This tableau set self-portrait playing on the well-known Jacques-Louis David painting *The Death of Marat* (1793) features Bayard as a man, made so miserable by the political suppression of his achievement by the scientific and art establishments that he committed suicide by drowning. His image of protest and imagination made him a luminary in the Paris art community, and many art historians consider this work to be the first conceptually conceived, political protest photograph. Here is what Bayard wrote in conjunction with his self-portrait:

"The corpse which you see here is that of M. Bayard, inventor of the process that has just been shown to you. As far as I know this indefatigable experimenter has been occupied for about three years with his discovery. The Government, which has been only too generous to Monsieur Daguerre, has said it can do nothing for Monsieur Bayard, and the poor wretch has drowned himself. Oh the vagaries of human life . . . .! . . . He has been at the morgue for several days, and no-one has recognized or claimed him. Ladies and gentlemen, you'd better pass along for fear of offending your sense of smell, for as you can observe, the face and hands of the gentleman are beginning to decay."

HIPPOLYTE BAYARD'S DIRECT POSITIVE PROCESS

The Direct Positive Process

Bayard's direct positive process, a system of image making that relied upon bleaching through photo-oxidation, was initially introduced by him in May of 1839 though the rudimentary details of the process were not publicly known until the following year. Tania Passafiume, a former Mellon Fellow in the Advanced Residency Program at the George Eastman House, in 2001 wrote that Bayard did not formally document a personal working account for his direct positive paper images made exclusively in-camera. Documentation of his process exists almost solely from the observations of others, and this is likely the reason that there are several different workflows attached to Bayard's technique.

The following account was recorded after an observation by a group of gentlemen from the Academie des Beaux Arts in November of 1839. I've taken the specifics and contemporized them for explanation and ease should you decide to try the process. I'll also be incorporating some of the notes and examples that Lindsay Rogers, one of my MFA candidates at AIB/Lesley University, wrote up in 2012.

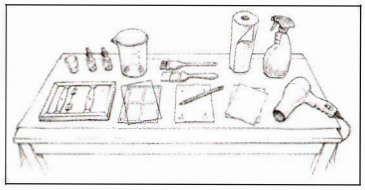


TABLE SETUP FOR STEPS 1–3

- High-quality paper or stationery (e.g., Canson Crob' Art, Cranes 8111S, Rising Stonehenge, Rising Bond, Arches Platine, Crob'Art, and Magnani Pescia). If you can locate any old Whatman paper, I would buy it. For more on paper, read further in this chapter to the Additional Considerations for Bayard's Direct Positive section.
- Cotton balls and a glass tube or test tube for a traditional buckle brush sensitizer application
- Foam brushes for applying chemistry instead of using the buckle brush. This is a better suggestion for sensitizer application.
- Nitrile gloves
- An apron
- Eye protection
- Window glass or white Lucite with the edges smoothed down
- Masking tape
- Contact Printing Frame or UV Exposure Unit for consistent results

Prepared Solutions

- Ammonium chloride (2% solution: 2 g per 100 ml distilled water)
- Silver nitrate (15% or 20% solution: 15 g per 100 ml of distilled water or 20 g per 100 ml of distilled water)

Table Setup For Step 4

- Contact printing frame and the sun or a UV exposure unit
- Sheets of clear glass for photograms or contact negatives if you don't have a contact-printing frame
- Potassium iodide (4% solution: 4 g per 100 ml of distilled water)
- Blotter paper
- Foam brushes
- Safety eyewear, gloves, and apron

Sink Setup for Step 5

- Ammonia
- Sodium thiosulphate (10%–12% dilution: 10 g to 100 ml of water)
- Potassium bromide (10% solution for Bayard "fix" formula: 10 g to 100 ml water)
- Distilled water
- Several Pyrex glass or plastic trays

For Advanced Experiments

- Pyrogallic acid (for intensification, but the effect is marginal)
- Nitric acid (1:2.5 nitric to water mix)
- Slate and sand
- Antique metal film sleeve designed and made to fit into wet-and dry-plate cameras

The Process: How It Works

A piece of fine stationery is soaked in a 2% solution of ammonium chloride. You may also saturate the paper using a foam brush. If you are using a stationery paper that is lighter than 32 lb, I would recommend using a plastic screen hammock for raising and lowering your paper in and out of solution. The hammock is easily made by stapling plastic screening to two dowels, one on either side of the screening that is narrower in width than the tray you use. The paper is placed on the screening, lowered into solution, and removed while resting in the hammock where it can dry.

When dry, the paper is brushed with a 10% to 20% solution of silver nitrate using a foam brush or buckle brush, creating two compounds, silver chloride and ammonium nitrate. Decent results can be realized within the range of 10%–20% silver nitrate concentration, and a double coating is recommended as a way to reduce visible brush strokes.

After the paper has dried, it is freely exposed to bright sunlight, and this results in printing out *photolytic* silver (*photolytic* means the decomposition of molecules by the action of light), reducing the compounds into a brown-colored metallic silver state.

This brown metallic silvered paper is washed in a delicate bath of sodium chloride (kosher salt) or water that precipitates the excess silver nitrate in the paper

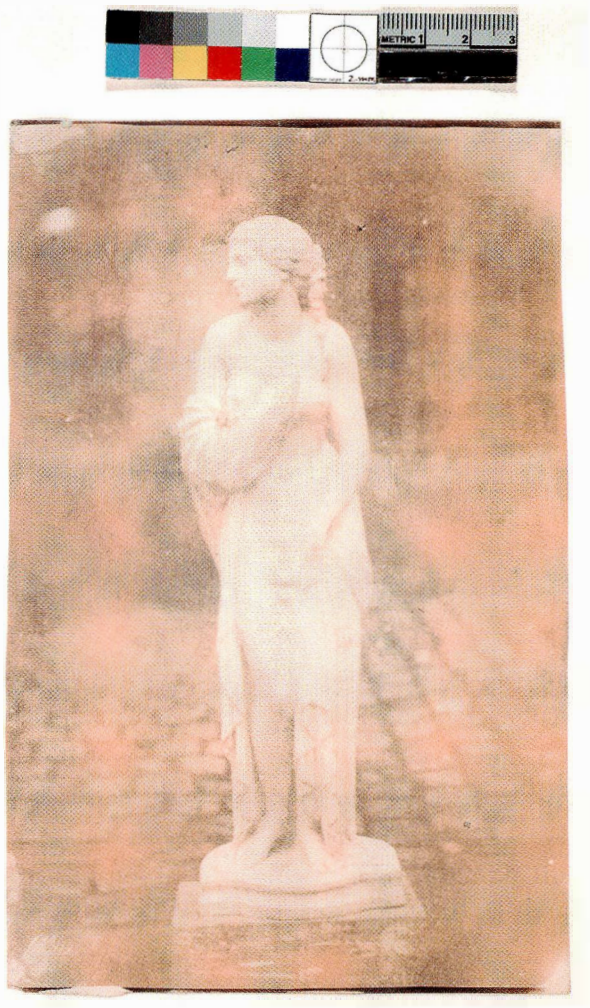


Figure 4–5
Hippolyte Bayard, *Etude de l'image photographique*
(Courtesy of George Eastman House, International Museum of Photography and Film)

as milky white cloudy sediment in the bath. The bath also removes the ammonium nitrate compound. The paper and a piece of *bibulous* (as Talbot liked to call it) blotter paper of the same size is then soaked in a light solution of 4% potassium iodide with the browned paper on top and the blotter paper beneath it, and a subsequent exposure, say with a piece of plant matter as the subject of a photogram, is made with UV light. All portions of the paper that receive exposure demonstrate a pale tea-stain-like yellow coloration. At this point, the exposure is concluded and the formerly browned paper is washed in distilled water and then fixed with sodium thiosulphate, which clears the yellow highlights to white. The developed print is then washed and dried.

Bayard's Direct Positive Process Workflow

Step 1 The paper is soaked in a 2% solution of ammonium chloride for 5 minutes, or brush-coated with a foam or Richeson brush and allowed to dry.

Step 2 The paper is then floated on a 10%–20% solution of silver nitrate (your choice) for 5 minutes and allowed to dry, sheltered from light. You may consider using a buckle brush (a glass tube with a cotton ball stuffed into the end of it to act as a swab) instead of floating. Or, easier still, go to the hardware store and purchase a collection of assorted and inexpensive foam brushes. Use a paper safe to store your nitrated paper or force dry with a hairdryer. When dry, I recommend a second coat of silver nitrate as a precaution against brush strokes showing up in your finished print. Also be careful, if brush coating, of getting any of the silver on the rear of the paper . . . it may cause black spots. When ammonium chloride and silver nitrate are combined they become silver chloride, a light-sensitive salt that will be affected by exposure to ultraviolet light.

Step 3 Expose the silver nitrate-laden side of the paper deeply to UV light until it becomes light to dark brown/black, being careful not to push the exposure to the point where bronzing occurs. Bronzing is the deep metallic effect that occurs when silver nitrate is over-exposed.

Then wash the paper in many changes of a light solution of kosher salt and/or distilled water, removing all of the excess free silver (and ammonium nitrate), and dry it, storing it in a clean folio or paper safe until you are ready to make your direct positive image in camera, a photogram. Don't be alarmed by the milky white

Figure 4–6
Lindsay Rogers, *Print 005*, 2012
This Bayard direct positive was done by one of my former MFA graduates, Lindsay Rogers. It is on an Arches 90 stock with a 15- and 18-minute exposure time in a UV exposure box.
(Courtesy of the Artist)

cloud of sediment that floats about the surface of the paper during this washing stage. It is only excess, free silver washing out of the paper.

It is a good idea to only wash your papers at this stage in the process one or two sheets at a time, as the free silver (the milky cloud) is quite present. If your sheets stick together during this part of the wash cycle, the free silver residue will not wash out. Go through several water changes per sheet until you are relatively sure the water is rinsing clear. Then you can put several washed sheets in the same tray and run a final gentle wash cycle with flowing water.

Step 4 **Photo-Oxidation:** Soak the paper for 2 minutes in a 4% potassium iodide solution, creating a silver iodide-laden paper that will instigate a photo-oxidation bleaching effect during exposure in the camera.

In a nutshell, this is what happens. When an iodized paper is exposed to UV light, water, and oxygen, it produces hydrogen peroxide that converts the browned metallic paper into a light yellow wherever the light impacts the paper. Think of changing dark hair into blond using hydrogen peroxide in a salon . . . it's the same thing, more or less. The important thing to remember when making these paper images is that when one of the elements—light, water, or oxygen—is removed, the process of photo-oxidation comes to an end. What this means is that if you wash and fix your print properly, it should last a long time.

The blackened brown paper when exposed in-camera will begin to bleach out further in the highlights to a yellow-white, while leaving the shadows dark. This yellow-white is excess iodine, and the paper will continue to turn yellow until the exposed paper is washed in water, washed in ammonia–water bath, and fixed in sodium thiosulphate.

Once the paper has been soaked in the potassium iodide, it is placed on a potassium iodide-dampened blotter paper between sheets of potassium iodide and dampened glass or on a piece of slate that has been coated with sand and soaked with the potassium iodide. A quick note regarding the moistened base reservoir for the final exposure . . . Two sheets of glass, creating a potassium iodide-soaked "sandwich" for the iodized paper to be exposed, seems to work quite well . . . especially for contact prints with photogram material or film/waxed paper positives. If you use blotter paper, it holds a great deal of potassium iodide and does a fine job of maintaining moisture in the paper to be exposed. Some papers, especially thicker varieties like Arches Platine, hold enough of the moisture to eliminate the need for a blotter or slate base. This is especially valuable in the case of in-camera exposures. Keep in mind that the process is not a perfect science, and lots of experimental fun is in your future.

Figure 4–7
France Scully Osterman, Bayard direct positive test before fixing
France Scully Osterman was a guest artist for one of my alt pro classes at the College of Art and Design at Lesley University and was demonstrating Bayard's direct positive technique. When she reached the pre-fixing stage, everyone got very enthusiastic about this unexpected and seductive color palette. Alas, the fixing stage (potassium bromide in Bayard's technique and sodium thiosulphate in more contemporary times) stabilized the image and brought the image color back to a less chromatically inspiring reality.
(Courtesy of the Artist)

Using a Pictorico Film Contact Positive

Using a Pictorico Ultra Premium OHP film to make a positive contact film is really the easiest way, other than using an object for a photogram, to learn this process. Your positive should be typical for a salted paper process, contrasty and deeply endowed with dark blacks and bright highlights. The process is able to render quite delicate mid-tones as well, so don't shy away from them. Like the anthotype, what is clear in the positive (your highlights) will bleach out to give you highlights at the end of the process. What is dark in the positive are your shadows, and they will remain dark to the degree of their transparency and the length of the exposure.

Make the best positive so that you can print it out on a good Epson printer using a Photo Rag or glossy exhibition paper setting. Allow it to dry for a little while before using it.

The Pictorico positive, when used as a contact film, must be in direct contact with the iodized paper, and you will need to exercise care in laying the film into contact with the paper, rolling the film and gently pressing out the air bubbles as you go. If you are careful, you can re-use the positive after the exposure by slowly peeling the film from the paper and placing it face down on a paper towel and delicately removing the sensitizer on the back. Be very careful not to allow any of the sensitizer to touch the inked side of the positive.

Exposure

Performing a contact print, or photogram, is the easiest way to figure out the process. In-camera exposures take a bit more effort and require the right-plate camera, an adapted film holder for an old wet or dry-plate camera, and a much longer exposure in most cases due to the lens and the weight of the paper. Average exposures, depending upon light, will run 5–30 minutes. You will need to test and make conclusions based upon your personal technique. It is very simple to make a strip test in-camera using your dark slide at different intervals during a long exposure.

Using the blotter sheet, cutting to the identical size of the paper is the best way to assure success. Immerse both the blotter sheet and iodized paper in the potassium iodide solution. Then lay down the soaked blotter paper and your prepared paper face up on a sheet of glass. Roll your Pictorico positive face up on the soaked paper that will hold your image. You will notice that the positive will adhere well to the paper as long as it is damp.

If you are exposing in-camera, the best setup is an old wet or dry plate camera with a single sheet film holder, open on one end where the film and paper are inserted and with rolled metal on the other three sides . . . these are found on Internet auction sites regularly.

It is important to expose as quickly as possible so that the paper stays moist. Gradual exposure to light will cause a gradual lightening of the highlights, thus revealing the final image . . . which will likely look quite pale and wispy. Examining the exposure as you go will take some invention, as you don't want to mess with the registration or focus during the exposure. If you are performing an in-camera exposure, I have heard of a way to modify your camera by drilling a peephole in the front plate so that you can peek through and examine how the exposure is going. This seems a little hard-core to me, but if you have a hacker-camera and don't mind modifying it a little, it probably works just fine. It might be easier to simply do a test strip with your first piece of prepared paper.

If you simply want to play with the process, I recommend making direct positive photograms of objects that run from opaque to transparent or using Pictorico Ultra Premium OHP film positives with good contrast and density.

Step 5 **Washing and Fixing:** Following exposure, wash the exposed paper in warm water for about 15 minutes. This step is followed by a bath containing one part ammonia to one part distilled water. Immerse the print for a minute or two and then wash once more in warm water for 15 minutes and allow the print to dry. This is basically the way it was performed.

The image may be intensified by immersing it in a very dilute solution of pyrogallic acid followed by a simple 5%–10% sodium thiosulphate fix for at least 5 minutes and a 20-minute final wash. Bayard used a potassium bromide as his image stabilizer but settled upon the now traditional hyposulphite of soda, or

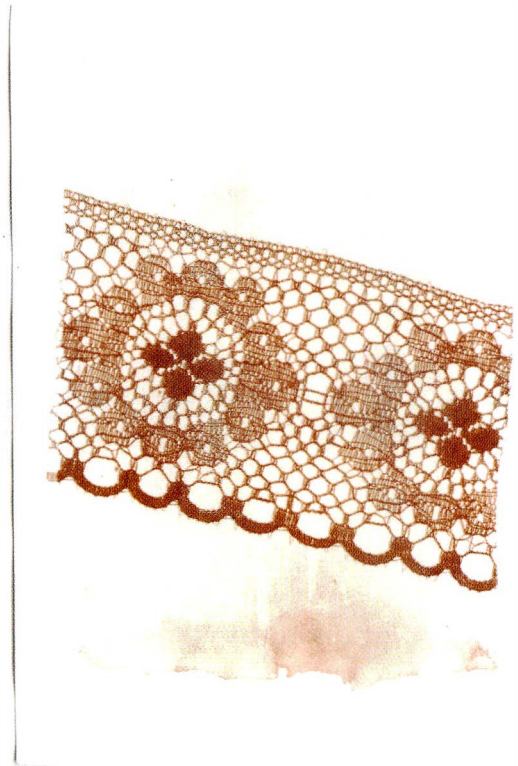


Figure 4–8
Malin Sjoberg, *Lace Study at Lacock Abbey*, 2012, (Bayard direct positive)
One of my favorite and fearless alternative-process-minded students, Malin Sjoberg, went to Laycock Abbey and produced this simple lace study using Bayard's direct positive process.
(Courtesy of the Artist)

sodium thiosulphate, that is commonly used for fixing alternative process images. He abandoned the potassium bromide because it didn't work very well. However, I have given you the recipe in case you want to be true to the process.

Lindsay reported that because of the ammonia aroma and her reaction to it, she cut it out of the process and simplified the sequence with a wash, sodium thiosulphate fix, and wash and found no significant difference in clearing the highlights to a less yellow coloration. Try it in the variations above and see what you achieve. Remember, this is a bleaching-out direct positive process, and the longer you expose the image, the lighter the highlights will be. However, this means very little if your positive is lacking any robust densities.

ADDITIONAL CONSIDERATIONS FOR BAYARD'S DIRECT POSITIVE

Papers and Sizing

Different papers will yield different degrees of contrast and color in the final direct positive print. When Bayard was selecting papers for his work, he had a choice between the gelatin-sized English papers and the starch-sized French. A gelatin-sized paper will have a cooler value and renders colors between a grey

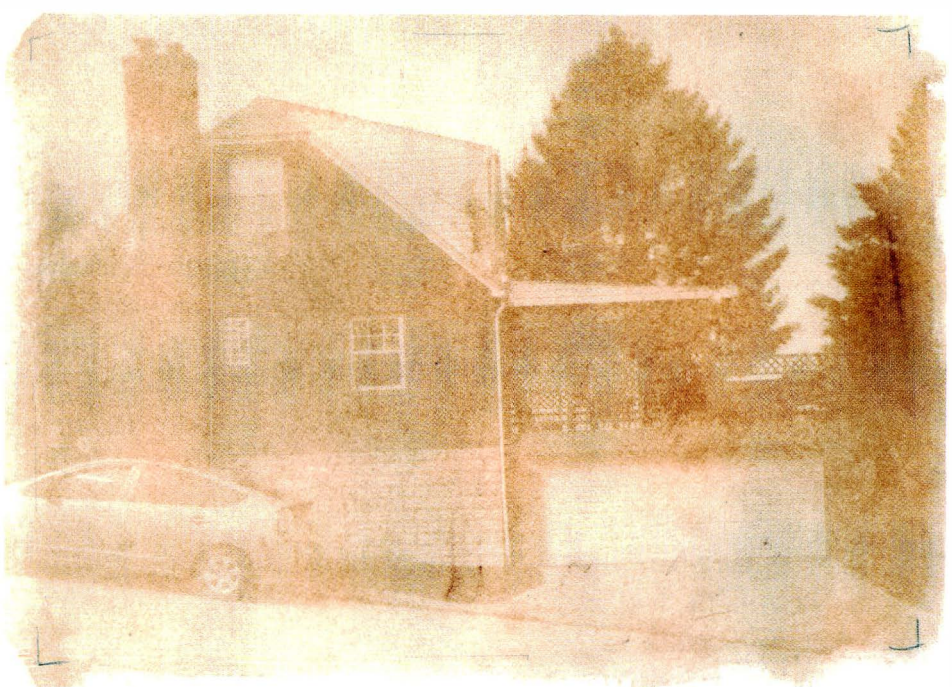


Figure 4–9
Tom Persinger, *Prius*, 2009 (Bayard direct positive)
Tom, the leader of F295, an organization that is dedicated to all things alternative, (http://www.f295.org) produced this Bayard direct positive of a Prius in 2009.
(Courtesy of the Artist)

and violet in its dark-rendered values. The color black isn't really an option. A starch-sized paper tends to be warmer and provides color from brown to sepia and red. You may discover that a paper such as Rising-made Stonehenge or Arches will display a better contrast range than a paper such as Copperplate.

Regarding the weight of the paper, lighter papers tend to decrease exposure times. Lindsay Rogers found in her tests that a switch from a 140 lb Fabriano, to a 90 lb Arches resulted in a 25% decrease in exposure. Lighter weight, high quality, stationery or lightweight hot press watercolor paper will allow more of the sizing to remain on the immediate surface of the paper.

If you are experienced in the alternative process workflows, you might consider doing your own sizing with starches (arrowroot, for instance) and gelatin on pre-existing papers. This is a relatively simple task, and there is no good reason not to try it out to see what you can do with the color palette of the process.

Try this salted gelatin sizing formula for something different as a way of preparing paper for the Bayard direct positive process. There are no guarantees, but it is a reasonable idea. This gelatin-sizing process is detailed here and in the Salted Paper chapter. The only differences will be that you have elevated the amount of gelatin or starch sizing in the paper, changed the sizing formula to make it more in line with Bayard's direct positive process, and embedded a 2% ammonium chloride solution into the gelatin before starting Step 1 of the process.

Gelatin Salting #1

(Yields a reddish- purple salt print without toning)

8g gelatin
20g ammonium chloride (this will make a 2% solution)
1 liter (1000 ml) distilled water
Electric kettle for heating water (non-metal heating element)
Several clean plastic beakers
Clean trays for salt-soaking the paper
(One large tray for hot water and one small tray that will float in the larger hot water tray for the gelatin salting formula and the paper that you will immerse in it.)
Clothesline for hanging salted paper
Ziplock bag for paper storage
Paper for salt sizing (Different papers will yield different values.)

Step 1 Begin by soaking the gelatin, in a clean plastic beaker, in half of the water at room temperature for 15–20 minutes. This period of time is referred to as the "bloom" time. The bloom number of your gelatin will inform you as to its hardness. Knox gelatin has a low bloom number and is considered "soft." Photo-grade gelatin has a higher bloom number and is harder. This fact will not matter to you if you get the results you want.

After the bloom, add the remaining 500 ml of distilled water and heat the solution to 100°F. I find that the easiest method of doing this is to create a double-boiler-like system in which you have a very clean plastic beaker to hold your sizing solution and this is set into a larger container holding water warm enough to maintain a 100°F constant temperature.

Step 2 When the gelatin and water mix is at temperature, slowly add the ammonium chloride and stir slowly into solution.

Step 3 Prepare a "double-boiler" tray setup in which a smaller tray (large enough for your paper) is filled with the warm gelatin and salts. This smaller tray is set into a larger tray filled with hot water. The smaller tray floats on the hot water in the larger tray, like a boat, keeping the gelatin warm during the sizing. If the gelatin cools, it hardens . . . just like a gelatin dessert.

The purpose of the gelatin sizing is to suspend the salt and silver in a nicely behaved layer on the paper and to prevent the silver nitrate from sinking too deeply into the paper, resulting in a less-than-vibrant shadow density. Also, it helps eliminate a muddy-looking image after dry down. The use of ammonium chloride will result in a little better contrast and a reddish-purple tonality. Contrast can be increased with a smaller concentration of sodium citrate. If, on the other hand, you wish to lessen the contrast, or want

a print that is blue–purple, then you should consider the Gelatin Salting Emulsion #2 in the Salted Paper chapter with a sodium chloride formula.

Step 4 Gently feed your paper, a sheet at a time, into the tray of warmed gelatin-salted solution. I like to put about ten sheets of paper into the gelatin at a time and slowly sort through the stack, being sure to immerse each sheet completely.

Step 5 After 3–5 minutes, remove the paper from the warm gelatin solution and hang each sheet on a line with clothespins to dry. After the first minute or so, flip the papers upside-down on the line to prevent the gelatin from hardening on the lower half of the hanging paper. This will help ensure an even coverage. When the paper is dry, flatten it in a dry mount press at a low temperature, raising and lowering the platen so as not to burn the gelatin. If you don't have a dry mount press, don't worry about it. You can use a clothes iron on a low setting without pressure or simply use a heavier weight paper that is less likely to curl. Hanging with pins on the top and bottom corners will also help reduce curling when drying.

Double Coating Silver

Double coating the silver nitrate doesn't appear to do much to help the final contrast of the image. However, the strengths of the solution and the degree of exposure in the darkening stage will have a significant impact upon the quality of the final image. Double coating, as mentioned earlier, will also reduce the brush stroke evidence for a smoother image.

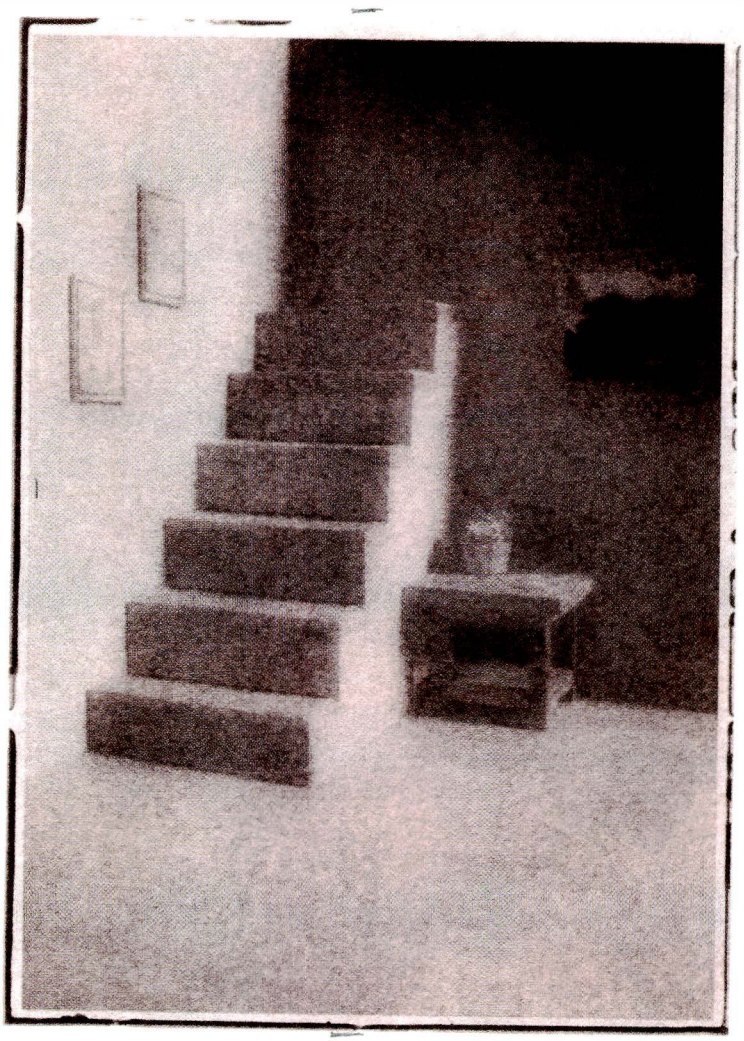


Figure 4–10
Lindsay Rogers, *Stairs*, 2013 (Bayard direct positive)
This is a miniature set construction, interpreted with Bayard's direct positive technique that Lindsay created in conjunction with her MFA thesis.
(Courtesy of the Artist)

Contrast

Better contrast will result if you can keep the exposure short and the paper, coated with potassium iodide before the final exposure, moist. Be inventive and try to think of ways to keep the humidity high during exposure. One trick that I use in wet collodion in arid conditions, and that works well in-camera, is to lay a piece of plastic on the inside bellows and put a damp towel on it. When you close up the camera for the exposure, the outside warmth in the air creates a humid environment inside the camera, slowing down the drying process of the paper. It works well with wet plate collodion and may well work well with Bayard's direct positive. In most instances, simply having a saturated blotter paper adjacent to the prepared paper will result in improved contrast.

Bright Light

The brighter the light employed for exposure, the better. This fact makes using a UV box desirable.

Foam Brush Application of Chemistry

Consider using foam brushes for coating silver, potassium iodide, and possibly the nitric acid dilution if you go that route with your chemistry. They are inexpensive and ensure cleanliness throughout the process.

Nitric Acid to Expand the Color Range

Acid added to the formula sequence makes the print image cooler, and it can demonstrate a color range from a greenish hue to purple lavender. The way to accomplish this color shift is to follow all of the steps through potassium iodide. Dry your paper at this point rather than expose it, which would be your normal next step. Now, put on examination gloves, an apron, and protective eyewear.

After drying the exposed and blackened paper, make up a dilution of 1 part nitric acid to 2.5 parts distilled water (always add acid to water and never water to acid) and using a foam brush, or buckle brush, saturate a piece of blotter paper. Then, using the same foam brush, coat your blackened and iodized paper with this same dilution of nitric acid and water. Apply your film positive and expose the paper in a UV exposure unit until the highlights brighten and the darks take on a cooler value. Wash the print in warm water for 20–25 minutes and hang to dry.

As an additional experiment, following the final exposure, immerse the paper in a 10% solution of potassium bromide for 15–20 minutes to "fix" the image as Bayard did. Then wash in ambient to warm water for another 15–20 minutes and hang to dry.

Last Words

This is simple. . . . Think of Bayard's direct positive process as the beginning of photography, and you should have as much fun with it as possible. Embrace its unpredictability, imagine what Bayard was thinking when he saw those windmills on his paper for the first time, build on the past to see what is possible, and enjoy the knowledge.

The Salted Paper Process

OVERVIEW & EXPECTATIONS

The salted paper process, and the calotype process from the previous chapter, share a homologous history, largely because the inspiration behind both was William Henry Fox Talbot (1800–1877). He was also the person who took 200 years of assorted scientific and observational clues regarding light, metal, salt, and the camera obscura and solved a significant portion of the photographic puzzle. For that reason, the chapters covering the two processes share a combined narrative and are written with the intention of connecting them as a single account in the development of salted paper photography.

This chapter will introduce "a little history" regarding the investigations of chemists and scientists who preceded Talbot, including Schulze, Hellot, Scheele, Wedgwood, and Davy. Talbot, however, plays the leading role in this account of the development of the salted paper process, as he did in devising the *art of fixing shadows* through photogenic drawings and the calotype process . . . the first chemically developed latent image and the first light-sensitive, silver-based, negative-to-positive paper imaging system. This set the stage for the future of photography in which the negative could be used as a matrix to reproduce an image multiple times. You will also learn how Talbot's discovery and work fit into the context of photography's beginning and its future impact upon international culture.

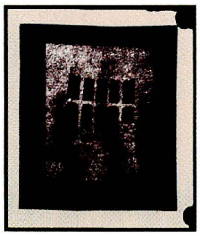
This chapter will reveal the chemistry and formulas for salted paper and will illustrate variations of sizing and salting formulas. Also described are variations of silver nitrate sensitizing formulas, gelatin-salt formulas, pre-sensitizing paper preparation with fumed silica, application techniques, and guidelines for how the prepared paper is exposed and processed. You will also learn a number of toning options along with fixing and final washing considerations. My advice to you, should you want to get a good idea of the path Fox Talbot explored, is to consult the calotype chapter and begin by learning how to make a calotype.

Figure 5–1

Christopher James, *Mosque, Cairo, Egypt*, 1992

I made this image of the two boys outside a mosque in Cairo, Egypt, with my toy Diana camera that I had adapted to work with a mechanical shutter. The negative was translated digitally on Pictorico Ultra Premium OHP inkjet film and contact printed in a variety of processes . . . including this one in salt.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

Being in a State of Salax

In 1912, Ernest Jones, the Welsh psychologist and disciple of Jung, published an essay about what he perceived to be an irrational, at times lustful, fixation among humans for salt. He could have made his point in a myriad of ways but chose to cite the Abyssinian (Ethiopian) custom of always presenting a piece of salted rock to a guest, who would then lick it to show his appreciation of the gift. Did you know that when an ancient Roman man was stricken by love he was described as being in a state of *salax*, or in a salted state? Salax, it turns out, is the origin of the word describing obsessive lust . . . *salacious*. Did you also know that if you fall below the average level of seven tablespoons of salt in your body you will be courting the end of life, but you will never experience a craving for it before you die? Composed of an unstable metal called sodium, it reacts with the poisonous gas chlorine, which becomes table salt, (i.e., sodium chloride), a key ingredient of life. Salt is the reason some wild animals ended up domesticated, the only rock obsessively eaten by everyone, and the primary component in the early discovery of photography. And that should make the salted paper process really personal to you. If you want to know even more about the history of salt, I recommend reading Mark Kurlansky's *History of Salt* (Penguin Books, 2003).

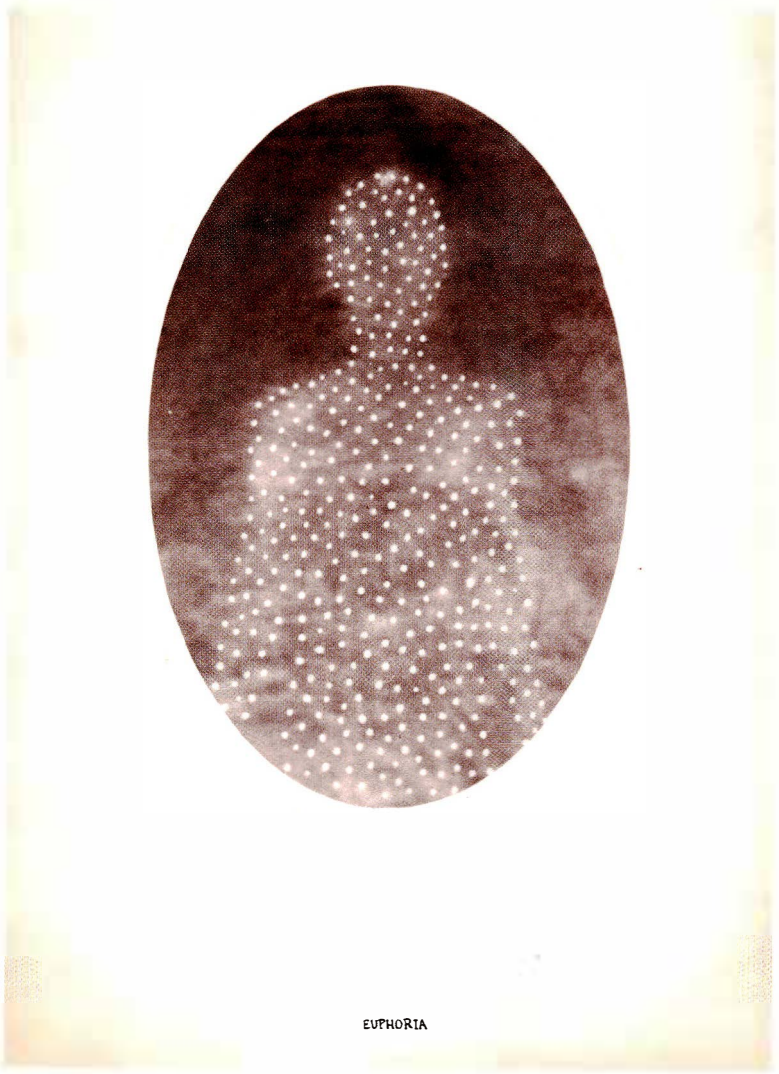


Figure 5–2
Dan Estabrook, *#9, Euphoria*, 2004 (salt and ink)
Dan, a former student of mine from Harvard and a colleague in the MFA in Photography program at Lesley University, is still, decades later, one of my favorite artists. This salted paper print is from his series *Nine Symptoms*. *(Courtesy of the Artist)*

Fox Talbot Gets Married

The salted paper process owes its existence to several hundred years of very clever gentlemen and gentlewomen studying the surprising relationships between light and chemistry. The actual concept made its unique debut in the imagination of William Henry Fox Talbot while he was on his honeymoon in 1833. Talbot; his new bride, Constance; and his new toy, a *camera lucida,* traveled to Lake Como, Italy, to celebrate the beginning of their life together.

While attempting to make a decent drawing of the lake (which is truly beautiful and well worth the effort of attempting a drawing) with his camera lucida, Talbot confronted, head-on, his utter lack of talent for rendering with this new instrument. Faced with this shortcoming, he considered the charming possibility of being able to accurately record images of his life with which he might impress friends and neighbors. When the honeymoon concluded, Talbot, his new bride, and the useless camera lucida returned to England and he

Figure 5–3

William Henry Fox Talbot, *Camera Lucida Drawing, Italy,* 1833

Talbot, like most English gentlemen of his class, was expected to be a great dinner guest and as accomplished at drawing as he was at science, botany, poetry, and music. Sadly, Talbot's skill with a camera lucida or freehand drawing left much to be desired in his efforts to make vacation pics. It was precisely Talbot's difficulty mastering the device that drove him to seek an alternative way to make representational images to show his friends.

(Copyright © Royal Photographic Society / Science & Society Picture Library)

set to work on a solution for his inspiration . . . a burning desire for vacation pics. In 1834, five years before photography was "officially" announced, he came up with the beginnings of a significant discovery.

William Hyde Wollaston's Camera Lucida

In 1806, William Hyde Wollaston (1766–1828) invented the *camera lucida,* a drawing and tracing instrument welcomed by many English gentlemen and women who were not only expected to be scholars, poets, adventurers, and interesting at dinner, but also to possess the skill to render an object with a pencil in a lifelike manner . . . something Talbot did not do very well even with the aid of the camera lucida. As an aside, Sir John Herschel was quite good with Wollaston's device . . . . very good actually.

A camera lucida is composed of a series of interrelated parts including an eye-level glass prism held by a rod and connected to a drawing surface. All the operator had to do was look through the prism, and the image before the "artist" was visible at both eye and drawing board levels simultaneously. The operator's task at that point was to "trace" the projected image on the drawing board to achieve a realistic graphic interpretation of the subject. Unfortunately (or perhaps fortunately), the skill required to use the contraption escaped Talbot's control, and it was this difficulty that drove him to seek a way to make his holiday images in another manner.

But Wait . . . There's More: Schulze, Scheele, Wedgwood, & Davy

But first . . . in 1802, 31 years before Constance and William went on their honeymoon, Thomas Wedgwood and his friend, Sir Humphry Davy, made what may have been the first silver-sensitized *photogram.*

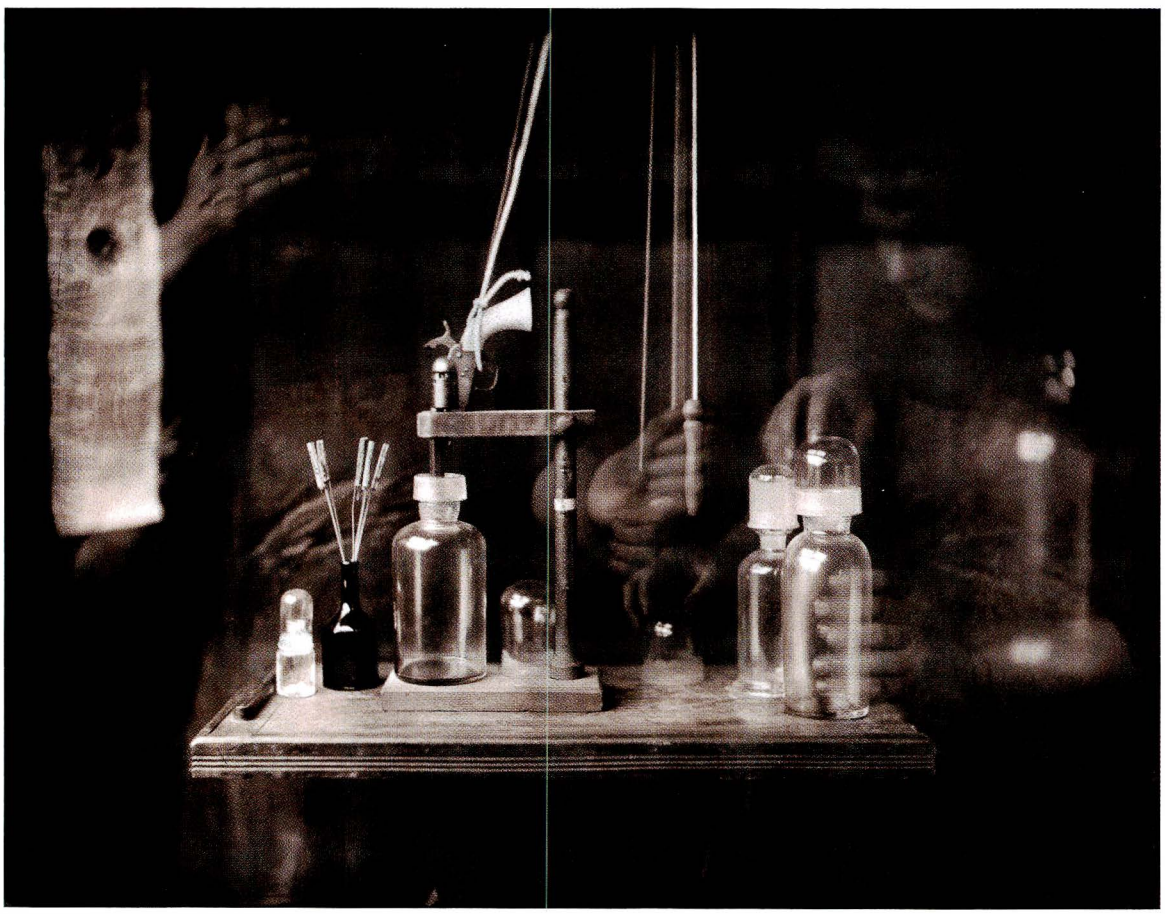


Figure 5–4

Mark Osterman, *Catching Blanks,* (waxed salt print from 8 × 10 collodion negative)

There are several of Mark Osterman's images in this book because he is simply one of the best practitioners of the genre. This is a waxed salted paper print made from one of his wet collodion glass plate negatives in his *Confidence* series.

(Courtesy of the Artist & The Howard Greenberg Gallery)

Wedgwood, as mentioned in an earlier chapter, was familiar with the scientific investigations of Johann Heinrich Schulze (1687–1744) who, in 1725, accidentally discovered the darkening effects of light on silver when he mixed silver-contaminated nitric acid with chalk (*calcium carbonate*), creating silver carbonate. He was originally attempting to make a phosphorescent compound associated with the study of alchemy called "aluminous stone" or "Baldewein's Phosphor Hermeticus" (first prepared in 1675 and reputed to be an impure calcium nitrate) that was supposedly able to provide a glow even on cloudy days. In any event, curious about why his results turned a deep violet when exposed to sunlight, Schulze eventually figured out that contamination of the nitric acid solution by the silver had caused it. In addition, Schulze was aware that the silver nitrate in his lab had turned dark in its glass bottle . . . except for where the bottle's label on the jar covered the silver nitrate. This prompted him to conduct experiments on the light-sensitive properties, and potential, of silver salts.

He performed these experiments by first filling up jars with a mixture of silver nitrate and calcium carbonate (chalk). He then got to work cutting out and adhering paper alphabet letters with beeswax to the outside of the silver nitrate jars. Regarding his investigations he wrote, "*. . . I often wrote names and whole sentences on paper and carefully cut away the inked parts with a sharp knife. Thus I struk (sic) the paper thus perforated on the glass with wax. It was not long before the sun's rays, where they hit the glass through the cut-out parts of the paper, wrote each word or sentence on the chalk precipitate so exactly and distinctly that many who were curious about the experiment but ignorant of its nature took occasion to attribute the thing to some sort of trick.*"

A very interesting side note regarding Schulze's experiments and silver nitrate's sensitivity using letter stencils is that in 1737 French chemist Jean Hellot (1685–1766) recommended the use of a dilute silver nitrate solution as an invisible ink that could be utilized by spies in the course of their espionage. According to Hellot, the message to be delivered by the spy would be written using silver nitrate. Later, having reached the intended eyes, the message could be made legible by exposing it to sunlight, whereupon the color of the secret message would turn purple, then brown, and finally black.

A short time later, Swedish chemist/pharmacist Carl Wilhelm Scheele (1742–1786) published a book entitled *Chemical Observations and Experiments on Air and Fire* (1777). In it, Scheele worked with his newfound knowledge of how the blue-violet end of the spectrum had a noticeable impact on a compound of silver and chlorine (*silver chloride*) through the chemical act of salt-to-metal reduction. This is clearly illustrated in a spectral analysis of wet plate collodion in which the silver-sensitized/-salted collodion is most sensitive to the blue-violet–ultra violet end of the spectrum. Scheele's findings were later confirmed by Jean Senebier (1742–1809), who re-confirmed the sensitivity of silver chloride to blue-violet rays, noting that darkening took a scant 15 seconds versus the 20 minutes it would take to achieve the same effect if the rays were solely from the red end of the spectrum. This partially explains why safelights are effective in the darkroom.

In case you have an insatiable thirst for obscure knowledge, in a publication titled *Mémoires 4hysic-chimiques sur l'influence de la lumière solaire* (Genève 1782, vol. III), Senebier's experiments are described; they reveal muriate of silver's (silver chloride) sensitivity to the various bands of the light spectrum. Times required to darken muriate of silver by the UV rays of the sun are as follows:

- Red = 20 minutes
- Orange = 12 minutes
- Yellow = 5 minutes and 30 seconds
- Green = 37 seconds
- Blue = 29 seconds
- Violet = 15 seconds

This knowledge had a significant impact on Sir Humphry Davy when he and Thomas Wedgwood began experimenting with silver nitrate sensitizers on white leather 20 years later.

Scheele eventually gave up his occupation as a pharmacist for the privileged and rarified life of a university professor in order to dedicate himself to revelation and discovery. Among his observational gems was that silver chloride could be dissolved by ammonia but that

darkened (exposed) metallic silver was impervious to it. This knowledge allowed him to preserve his experiments with exposed silver chloride on sheets of paper by bathing them in an ammonia-rich bath . . . a method of fixing/clearing the print that was ignored for years! Armed with the knowledge of Senebier's and Scheele's work (with the unfortunate exception of overlooking Scheele's ammonia fixing bath), Wedgwood and Davy commenced coating paper, glass, and bleached white leather with silver nitrate solutions and laying stencils and other objects on these surfaces in sunlight.

You may recall from an earlier segment of *A Little History* how, in 1793, Davy had been told by Joseph Priestly (who incidentally discovered oxygen and soda water) about some experiments being conducted by Elizabeth Fulhame and how those efforts eventually became the foundation of her 1794 self-published book, *An Essay on Combustion, with a View to a new Art of Dying And Painting, wherein the Phlogistic and Antiphlogistic Hypotheses are Proved Erroneous.*

In her early research, Fulhame had been seeking a way to impregnate and stain fabrics with precious metals such as gold. She hypothesized that this might be possible with the influence of water and light, and her research brought her to the conclusion that water played the major role in catalytic reactions as both the *reducing* and *oxidizing* agent. She also noted that following those particular actions the water was always restored to its original state. Fulhame suggested that taking advantage of the phenomena of silver and light interaction might be employed by cartographers as a technique to create maps. My assumption is that Davy, being a very intelligent and curious scientist, put all of these influences together as he went into collaboration with Wedgwood.

During the photogram exposures made by Davy and Wedgwood, the silver salt sensitizer turned a gray, purple-brown (the same colors that Talbot achieved in his photogenic drawings preserved with salted water), and eventually black in the areas open to exposure. Their "Sunprints" required only a simple water wash to remain visible and were successful enough that Wedgwood and Davy formalized their discovery . . . which of course exposed the paradox that the light required to make an image would also destroy that image if it could not be stabilized. Undeterred, Wedgwood and Davy showed their stenciled photograms by candlelight, thus validating their work and allowing it to be acknowledged. Although there is some written evidence that a few of these prints were still visible into the late 1800s, I am unaware of any still in existence. Wedgwood and Davy published their findings, including documentation of making images on paper and white leather by means of silver nitrate and a camera obscura, in a manuscript delivered to the *Journal of the Royal Society* in 1802 titled *An Account of a method of Copying paintings Upon Glass and Making Profiles by the Agency of Light Upon Nitrate of Silver.*

Figure 5–5
Andréa Brächer, *Photogenic Drawing*, 2011
Andréa, a university professor in Brazil, started working with alternative photographic processes without a teacher and with only the first edition of this book as her guide. She wrote, "It was also the first time I heard about Anthotypes (or Phytotypes), which I am currently researching and practicing. I'm re-doing the experiments of Herschel and Somerville." *(Courtesy of the Artist)*

By the early 1840s, amateur artists and chemists were employing photogram techniques with simultaneous creative and practical scientific intentions. Notable projects underway during this period were Sir John Herschel's Anthotypes created with the juices of flowers and sunlight, Anna Atkins's cyanotype studies of algae (a process she presumably learned from its inventor, Sir John Herschel, who lived down the lane), Mongo Ponton's work with potassium dichromate as a light-sensitizing solution for his "shadowgraphs" (which would eventually lead to the gum bichromate process), and William Henry Fox Talbot's efforts with his photogenic drawings and calotype paper negatives. And after that short history excursion, we are now back to Talbot's significant discovery following his honeymoon in 1834.

In January of that year, Talbot began to experiment with the ideas and inspirations generated on his honeymoon trip to Lake Como. Using his knowledge of past silver salt experiments, he proceeded to create precise photogram "tracings" of flowers, leaves, feathers, and lace on salted and silver nitrate-sensitized stationery. He called his discovery "the art of photogenic drawing."

In Talbot's earliest photogenic drawing exercises, he coated a fine piece of gelatin-sized stationery in a weak solution of common table salt (sodium chloride). The paper Talbot used was typical of the majority of high-quality stationery manufactured in the 1800s and was intentionally sized and infused with gelatin or other natural organic binders such as albumen and whey (a high-protein by-product of cheese making) in order to enhance the sheet strength of the paper. English-made stationery papers for the well-to-do were traditionally sized with gelatin, while French papermakers employed starch for the same purpose.

After the salted stationery had dried, Talbot applied a second coating of a 6%–8% or stronger silver nitrate solution. This idea wasn't completely serendipitous. As we have seen there is evidence of a fairly well-worn path leading to Talbot's moment of inspiration.

When the silver nitrate coating had dried, a light-sensitive compound of silver chloride had precipitated within the fibers of the paper. What Talbot was to surmise later was that the silver chloride will provide only a wispy rendition without the organic impurities within the paper to absorb the chlorine formed during the compounding of silver and sodium chloride. This was to be a great and important revelation and it, combined with the conclusion that it is the excess of silver nitrate that facilitates the light-sensitive reaction, really got things moving at breakneck speed.

Figure 5–6
William Henry Fox Talbot, *Photogenic Drawing of a Leaf*, 1839
Talbot coated a piece of gelatin-sized writing paper with a solution of sodium chloride. The salted paper was then dried and re-coated with a second solution of silver nitrate, creating a silver-salt compound, silver chloride, paper that was noticeably faster in its light sensitivity than silver nitrate by itself. Talbot then contact printed and exposed the paper and selected objects, such as leaves and lace, to sunlight until an image appeared. The print was "fixed" initially in a strong salt solution of sodium chloride or potassium iodide and later, after a tea-time demonstration by his friend, Sir John Herschel, in sodium hyposulphate of soda. Talbot called his representational creations photogenic drawings.
(Copyright © Royal Photographic Society / Science & Society Picture Library)

Figure 5–7
Carol Panaro-Smith & James Hajicek, *Earth Vegetation - 2*, 2005
Carol Panaro-Smith & James Hajicek have been making photogenic drawings in collaboration for many years. Using their unique variations on Talbot's formulas, they select organic matter from the earth and sea and contact print on their prepared papers. During exposure, the organic materials wither under the intense heat and UV light of the Arizona sun as they complete the final act of participation in the creation of their own image.
(Courtesy of the Artists)

These *Sciagraphs,* or *Photogenic Drawings,* that Talbot made during his experiments were semi-preserved with a bath of saturated salted water, although, as Talbot noted, "*we shall find that its* [regarding his exposed paper] *sensibility is greatly diminished, and, in some cases, seems quite extinct.*" Talbot went on to write that if that same piece of paper was then to be washed with an additional coating of silver nitrate it would become sensitive once again—indeed, even more sensitive than the first time. Excited by the idea of creating an even faster exposure, Talbot noted that the proportions of salt and silver were critical and that in some cases the silver chloride was "*disposed to darken of itself*" without any exposure to light at all. Eventually, he got to the point that he could alternate between percentages, and numbers, of washes of salt and silver nitrate to the critical point where the paper would be ideal for rapid exposure in the camera obscura.

His method of selecting which piece of sensitized paper to use was an interesting one. He would prepare several large sheets in the manner described, cut off small samples, and number both. He would then lay the test samples out in a line in very diffused light for 15 minutes. The sample paper that showed the greatest tendency to change under the influence of that low light was the winner of the test and Talbot would proceed to use its larger companion sheet (the one with the corresponding number) for his camera obscura exposure.

It is interesting to point out several things at this crossroad in the process. First, in Talbot's initial attempts to "fix" his *photogenic drawings* he used Scheele's ammonia fixing bath from 1777 but with, as he wrote, "*imperfect success.*" Talbot then recalled a remark by Sir Humphry Davy in which Davy indicated that his experiments with the iodide of silver (actually a sub-iodide) showed that chemical to be more sensitive than silver chloride in producing a light-sensitive reaction.

During a subsequent residence in Geneva, also in 1834, Talbot tried working with Davy's information and

discovered in his own experiments that the opposite was true and that Davy's silver iodide formula was not sensitive to light in the least. Talbot immediately began to use this knowledge as a way to *fix* and stabilize his silver chloride photogenic drawing images by dipping them in a very dilute bath of iodide of potassium. In this way, an iodide of silver was formed, making a fixing bath that would render the print "*absolutely unalterable by sunshine.*"

During the "*brilliant summer of 1835*" Talbot returned to his original goal of making pictures in camera and created the first camera-made paper negative that could be used to generate multiple positive photographic prints *(see Fig 3-5)*. Following his discovery, Talbot wrote a charming description of this experience in his 1839 paper to the Royal Society, *Some Account of the Art of Photogenic Drawing*. He wrote, "*In the summer of 1835 I made in this way a great number of representations of my house in the country . . . and this building I believe to be the first that was ever yet known to have drawn its own picture.*"

The year 1839 was a big one for photography, and the first months were really chaotic. On the seventh of January, Daguerre's sponsor, Dominique François Arago, delivered his "invention" of photography to the Academie des Sciences in Paris. Talbot immediately wrote a letter to Arago, not realizing that the two techniques were quite different, informing him that it was he, and not Daguerre, who had invented this image-making process.

Ironically, a clerk for the French Ministry of Finance, Hippolyte Bayard, had shown his own invention of photographic production, consisting of direct positive salted images on sensitized paper, to the same Monsieur Arago just three months earlier. But Arago had already invested too much of

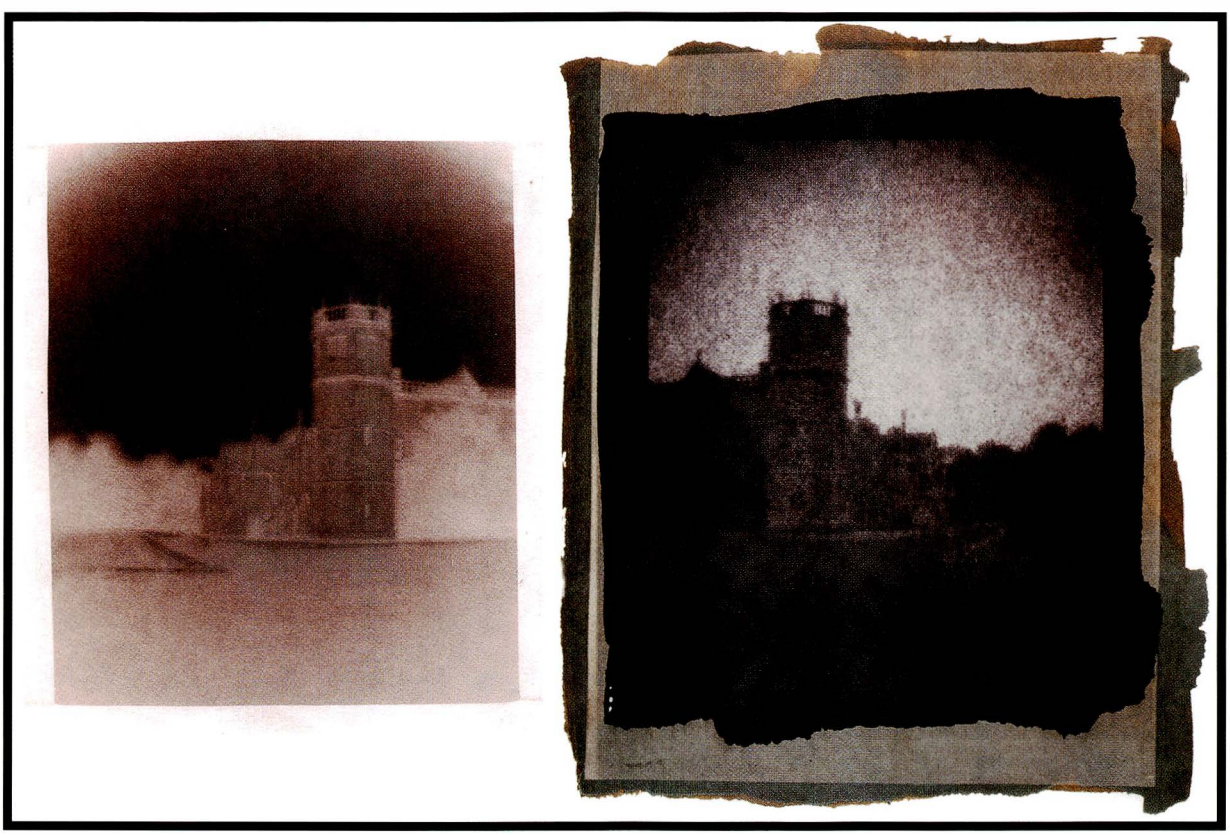


Figure 5–8

Malin Sjoberg - Botanical Series, photogenic drawing neg & pos—Lacock Abbey 2012

Malin, a friend and former student of mine, writes, "These scraps of paper are studies of plants from Fox Talbot's botanical garden, which he collected on his travels in the Mediterranean. The colors are rendered by stabilizing them in chloride, bromide, and iodide, instead of fixing them in hypo. I don't care that the images are fugitive and will eventually disappear, because the colors one gets are so beautiful."

(Courtesy of the Artist)

his reputation in Daguerre, and Bayard was told to retreat, promised a 600 franc pension for more chemistry and supplies, and subsequently ignored. On January 25, Michael Faraday (1791–1867), the discoverer of *electro-magnetism,* showed a random collection of samples of Talbot's work, including leaves and lace, to the members of the Royal Institution. Interestingly enough, on that same day, Sir John Herschel wrote to Talbot from London informing him that he was preparing to deliver a paper the following week before the Royal Society, respecting the *"possible fixing upon paper the image formed by a Camera Obscura; or rather, I should say, causing it to fix itself, I should be most happy to show you specimens of this curious process."* Herschel then went on to write, *"If you cannot make a convenient call here, Slough has now become so accessible by railway that I would take a drive there any day if you would appoint an hour."* On the thirty-first, Talbot unveiled his salted paper "photogenic drawings" to the Royal Society in London and read from his paper *Some Account of the Art of Photogenic Drawing or the Process by Which Natural Objects may be Made to Delineate Themselves Without the Aid of an Artist's Pencil.*

Note: Considering the documentation above, it is interesting to me that on the eighth of January, 1819, in the *Edinburgh Philosophical Journal*, Sir John Herschel (1792–1871) wrote, *"Muriate of silver (silver chloride), newly precipitated, dissolves in this salt (referring to hyposulphite of soda— discovered by Chaussier in 1799) almost as readily as sugar in water."*

Mr. Talbot's Ferns Are Fixed by Mr. Herschel

Talbot's friend, Sir John Herschel, became very interested in all of this commotion and wrote a letter to Talbot using the word *photography* for the very first time. Then, on the first of February, Talbot dropped in on Herschel for tea and learned of Herschel's knowledge of the fixing abilities of sodium hyposulphite of soda (sodium thiosulphate), a factual chemical reaction that Herschel had actually realized some 20 years earlier.

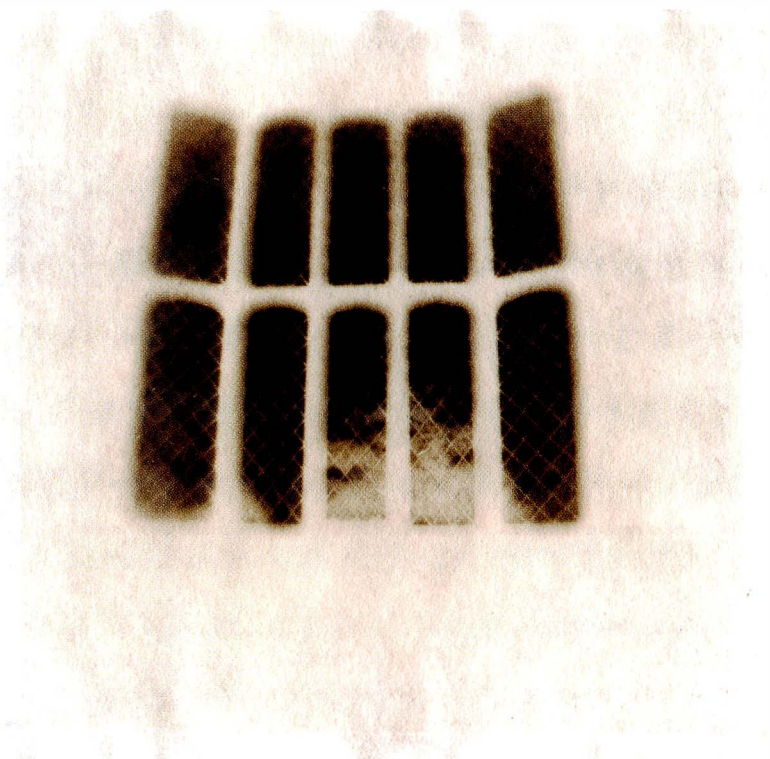


Figure 5–9
Andréa Brächer, *Lacock Abbey*, 2011 (photogenic drawing)
A photogenic drawing made of a familiar window at Lacock Abbey in 2011.
(Courtesy of the Artist)

In a letter written by Maggie Herschel to her son, Alexander, in February 1872, she wrote, "*I remember very well the visit . . . to Slough of Mr. Fox Talbot, who came to shew [sic] to Herschel his beautiful little picture of ferns and Laces taken by his new process – when something was said about the difficulty of fixing the pictures*." Maggie Herschel continued her account by recalling Herschel saying to Mr. Talbot, "*let me have this one for a few minutes,*" and after a short time he returned to give the picture to Mr. Talbot saying, "*I think that you will find that fixed*." This was the beginning of hyposulphate of soda fixing.

With Herschel's consent, Talbot described this last piece of the photographic puzzle. When Daguerre heard the news, he immediately adopted the chemical for use in his own work, thus solving one of his biggest problems. On February 8, 1841, Talbot placed a restrictive patent on his calotype discovery, almost completely putting the brakes on the new "photographic" medium. As Lady Eastlake put it, "*Mr. F. Talbot's directions, though sufficient for his own pre-instructed hand, were too vague for the tyro; and an enlistment into the ranks of the "Pilgrims of the Sun" seldom led to any result but that of disappointment*." Because you're probably thinking that the line "Pilgrims of the Sun" is a brilliant bunch of connected words about photographers, you should know that it refers to the title of James Hogg's poem, an allegorical lament about the heartache of platonic love, written in 1815.

The effects of Talbot's patent were relatively short lived, however, due to the enthusiasm of other scientists for making pictures and to the advent of Blanquart-Evrard's albumen technique and its integration with Frederick Scott Archer's wet-collodion glass plate negative process in 1851. It is interesting to note that Talbot eventually realized that he had not perfected an art form but had, instead, certainly commenced one. It is Talbot's salted paper process that led directly to our modern silver halide-based photography.

Up until the mid-1850s almost all salted paper prints were produced by printing out an image on a sheet of gelatin- or starch-sized stationery that had been immersed in a simple bath of gelatin, sodium or ammonium chloride, and sodium citrate. After drying the salted paper, it was sensitized with silver nitrate and exposed to sunlight, in which it would print out to more or less what it would look like following a rinse in acidic salted water (to precipitate the free excess silver), a simple sodium thiosulphate fix, and final wash. There was, however, another salted paper process being practiced at the same time that was developed and practiced by Thomas Sutton, then the editor of the British photographic journal *Photographic Notes,* who championed an alternative salt technique of developing out the image with a weak solution of gallic acid. Although many practiced this technique, including such notable gentlemen as Louis Désiré Blanquart-Evrard, with whom Sutton had a business relationship, the colder and more neutral coloration of the developing-out method did not achieve the popularity of the warm reddish-browns of the more commonly practiced printing-out method. For more on the developing-out technique, please see the calotype chapter.

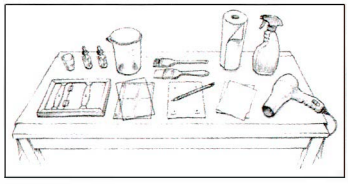


TABLE & SINK SETUP FOR GELATIN SALTING PAPER

Gelatin Salting Chemistry & Formulas

In 1835 Fox Talbot had no need to size his papers with gelatin because the fine stationery of that time was manufactured with gelatin and other organic binders in the rag fibers. In my workshops and classes I have found that a simple gelatin sizing is a painless way to enhance detail, contrast, and tonal scale in a salted paper image. This may be less than a pure approach to the process, but it beats being frustrated by the inevitable dry-down that occurs in salted paper. Don't size automatically. Try many different kinds of papers and do an abundance of comparative testing to find what papers work most successfully for you and your imagery. It is quite likely that you will find that the differences in a gelatin salted paper versus a simple salted paper will be so obvious to you that gelatin salted sizing will become a matter of accepted practice in your workflow. If you

Figure 5–10
France Scully Osterman, *Laszlo and Carole*, 2002
France Scully Osterman is a charter member of the antiquarian avant-garde. This beautiful waxed salted paper print, from an 8 × 10 collodion negative on glass, is representative of her art and skill. France is among the elite when it comes to the history and craft of alternative photographic processes.
(Courtesy of the Artist & The Howard Greenberg Gallery)

run into problems, there's more than a good chance they can be fixed with a greater attention to detail. In the salted paper process, the paper is initially immersed in a gelatin, or starch, and multiple-salt solution. This allows the subsequent coating of silver nitrate to react with the salt to create a silver chloride. There are several formulas, and we'll begin with my favorite.

Gelatin Salting #1

(*Yields a reddish-purple salt print without toning*)

8 g gelatin (*Knox gelatin from the grocery store works just fine.*)
18 g sodium citrate

Note: You may play with the proportion of sodium citrate here. It is primarily in the formula for contrast control. If you remove it entirely, you will see an increase in contrast. If you use less than the recommended 18 g in this recipe, it will result in a slightly higher-contrast image in proportion to the amount not added.

20 g ammonium chloride
1 liter (1,000 ml) of distilled water
Electric kettle for heating water (nonmetal heating element)
Several clean plastic beakers
Clean trays for salt-soaking the paper
(*One large tray for hot water and one small tray, which will float in the larger hot water tray, for the gelatin salting formula and the paper that you will immerse in it.*)
Clothesline for hanging salted paper
Ziplock bag for paper storage
Paper for salt sizing (*Different papers will yield different values.*)

I use this sizing formula almost exclusively and find it especially successful when working with classes or workshops with a large number of people. Remember this important rule of gelatin sizing: keep your gelatin warm at all times or it will firm up like a dessert.

Gelatin Salting #2

(*Yields a blue-purple salt print without toning.*)

8 g gelatin

Note: Knox gelatin from the grocery is perfectly fine and I personally prefer it to Ossein, sometimes referred to as photo-grade gelatin or Maco-LPE410.

18 g sodium citrate

Note: The same recommendation applies as in Gelatin Salting Formula #1: a slight decrease in the gram weight will yield a slightly higher-contrast print.

20 g sodium chloride
1 liter (1,000 ml) distilled water
Electric kettle for heating water
Several clean plastic beakers
Clean trays for salt-soaking the paper
(*One large tray for hot water and one small tray, which will float in the larger hot water tray, for the gelatin salting formula and the paper that you will immerse in it.*)
Clothesline for hanging salted paper
Ziplock bag for storage
Paper for salt sizing (*Different papers will yield different values.*)

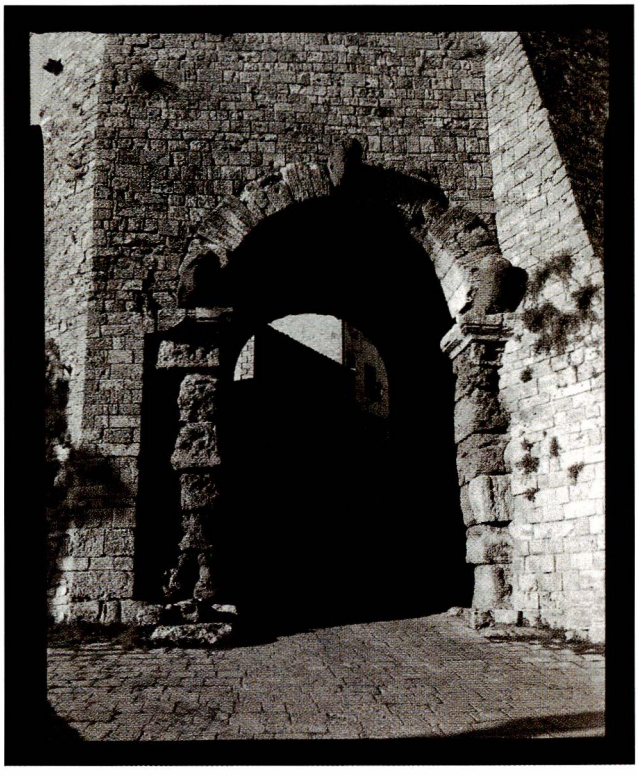


Figure 5–11
Bob Kiss, *Volterra Etruscan Gate, Tuscany*
Bob Kiss, who gets to live on a Caribbean island full time, writes, "*Volterra Etruscan Gate* salt print is an image from my Luce Nova on-going book project. Shot 4 × 5 T-Max 400 and developed in PMK. I printed on COT 320 paper exactly as per the instructions for salt prints in your book. The exposure was 70% skylight and 30% direct sunlight. I never cease to be awed by the timeless beauty of Tuscany."
(Courtesy of the Artist)

Contrast Control in Sizing for Gelatin Salting #1 and #2

Employing a slightly weaker salting solution can increase contrast. Increasing the amount of sodium citrate in your gelatin/starch sizing solution will reduce contrast, whereas decreasing the amount of sodium citrate, or eliminating it altogether, will increase the contrast. Make adjustment in very small increments and begin with slightly reducing the sodium citrate, for example, 14 grams instead of 18 grams.

A Bit about Gelatin

The role of the gelatin is to provide an emulsion-like surface that will contain the salts so that they can easily be affected by the application of the silver nitrate sensitizer. The thickness of the gelatin is proportional to the amount of silver salts that it can contain, the ease of coating the silver nitrate sensitizer, and the clarity of the final image. As a rule of thumb, a less-concentrated gelatin formula will result in an image with greater clarity. Also, it results in a smoother coating, a faster drying time (important when dealing with silver nitrate and its relationship with organic matter such as gelatin, salt, and paper fibers), and a better rendition of traditional salted paper ambers and reds. The downside of a lighter concentration of gelatin is a slight loss of printing speed.

Gelatin Salting Step Sequence

Step 1 Begin by soaking the gelatin in a clean plastic beaker in half of the water at room temperature for 15–20 minutes. This period of time is referred to as the "bloom" time. The bloom number of your gelatin will inform you as to its hardness. Knox gelatin has a low bloom number and is considered "soft." Photo-grade gelatin has a higher bloom number and is harder.

After the bloom, add the remaining 500 ml of distilled water and heat the solution to 100°F. I find that the easiest method of doing this is to create a double-boiler-like system in which you have a very clean plastic beaker to hold your sizing solution and this is set into a larger container holding water warm enough to maintain a 100° constant temperature.

Step 2 When the gelatin and water mix is at the proper temperature, add the sodium citrate and ammonium chloride by slowly stirring it into the solution.

Step 3 Prepare a "double-boiler" tray setup in which a smaller tray (large enough for your paper) is filled with the warm gelatin and salts. See each formula for specifics. This smaller tray is set into a larger tray filled with hot water. The smaller tray floats on the hot water in the larger tray like a boat, keeping the gelatin warm during the sizing. If the gelatin cools, it hardens just like a gelatin dessert.

The purpose of the gelatin sizing is to prevent the silver nitrate from sinking too deeply into the paper and resulting in a less-than-vibrant shadow density. As well, it helps eliminate a muddy-looking image after dry-down. The primary difference between gelatin formulas #1 and #2 is an ammonium chloride/sodium chloride swap. The use of ammonium chloride will result in a little better contrast and a reddish-purple tonality. Contrast can also be increased with a smaller concentration of sodium citrate. If, on the other hand, you wish to lessen the contrast or want a print that is blue–purple, then you should consider the Gelatin Salting Emulsion #2 with sodium chloride formula.

Step 4 Gently feed your paper, a sheet at a time, into the tray of warmed gelatin salted solution. I like to put about ten sheets of paper into the gelatin at a time and slowly sort through the stack, being sure to immerse each sheet completely.

Step 5 After 3–5 minutes, remove the paper from the warm gelatin solution and hang each sheet on a line to dry, using clothespins. After the first minute or so, flip the papers upside down on the line to prevent the gelatin from hardening on the lower half of the hanging paper. This will help ensure an even coverage. When the paper is dry, flatten it in a dry mount press at a low temperature, raising and lowering the platen so as not to burn the gelatin. If you don't have a dry mount press, don't worry about it. You can use a clothes iron on a low setting without pressure or simply use a heavier weight paper that is less likely to curl. Hanging with pins on the top and bottom corners will also help reduce curling when drying.

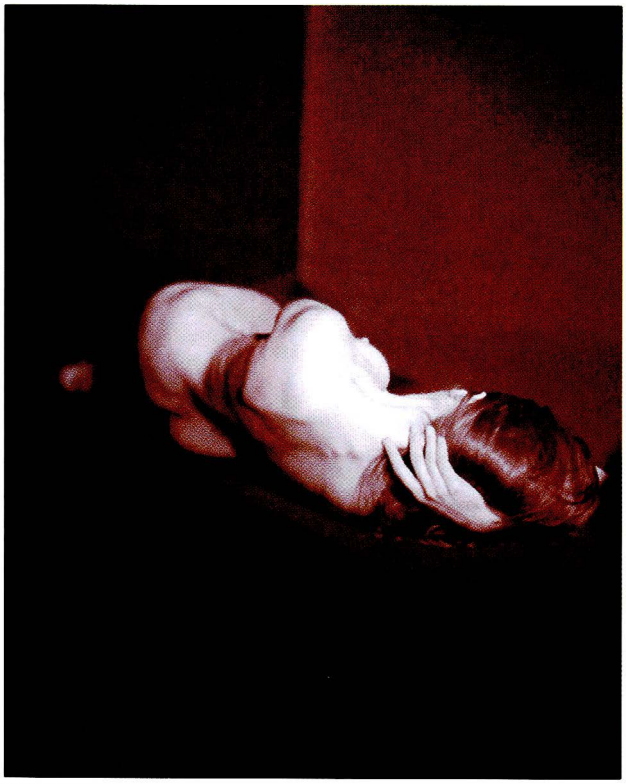


Figure 5–12
Allyson Fauver, *Salt #10*, 2005
Allyson used to attend my workshops simply to make better salted paper prints than I did in my demonstrations. This is one of her excellent images, unfixed, stabilized with kosher salt, forced to a solarized state via re-exposure. *(Courtesy of the Artist)*

Allyson's Gelatin Salting Formula

20 g	citric acid
20 g	Kosher salt (*sodium chloride—Morton's kosher*)
4 g	Knox gelatin (or photo-grade gelatin)
1,000 ml	distilled water

Allyson Fauver demonstrated this formula to me in a workshop many years ago as she was heading off to law school. Allyson's images were known for their brilliantly deep reds and by her "old-school" use of salt as a stabilizing bath. Notice that there is no sodium citrate in her formula, indicating that she was seeking a higher-contrast image from the start. Begin by making sure

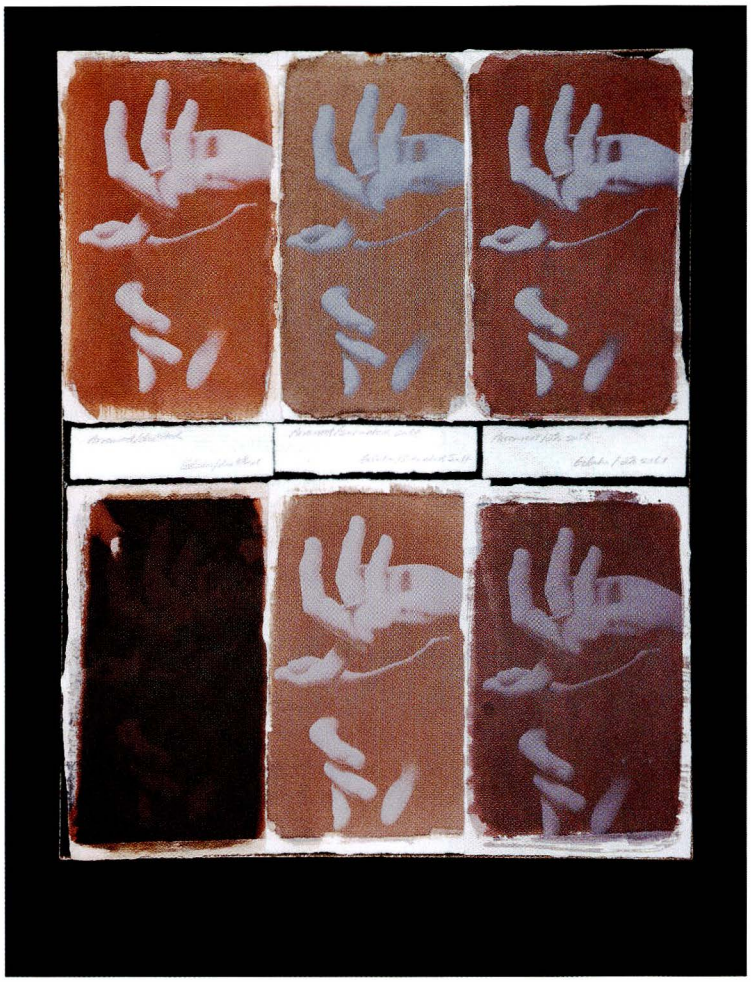


Figure 5–13
Allyson Fauver, *Experiments*, 2005
Illustrated here is a series of test images that Allyson made to determine coloration. Top left—arrowroot with distilled water; bottom left—gelatin with distilled water; top center—arrowroot with saturated salt; bottom center—gelatin with saturated salt; top right—arrowroot and 2% salt; bottom right—gelatin and 2% salt.
(Courtesy of the Artist)

everything you will be using—beakers, stirrers, trays, etc.—is meticulously clean.

Step 1 In a 1,000 ml-beaker, sprinkle the gelatin into 200 ml of cold distilled water and let it stand for 15 minutes.

Step 2 Dissolve the sodium chloride (kosher salt) and citric acid in 700 ml of distilled water that you have heated to a 100°F constant temperature.

Step 3 Pour the sodium chloride/citric acid solution into the gelatin solution and add hot (distilled) water to make a total volume of 1,000 ml. Place the beaker, double boiler style, in a larger beaker of hot water and stir well until the gelatin is fully dissolved.

Step 4 Continue the gelatin salting sequence as detailed above.

Allyson's Deep Red: Post Exposure

Allyson's deep red coloration is due to her post-exposure work on the print. She washes her images in a 2%–3% salted bath. This stabilizing bath changes the color of the print to a dark red/brownish-orange. Here is the sequence.

Step 1 **Stabilizing** After exposure (at which point the print should be a beautiful, deep, rich, eggplant-to-black color), put it directly into a 3% salt bath (30 g Morton's kosher salt, and tap water to 1,000 ml) for 5–6 minutes, agitating. This alters the color to dark red/brown/orange.

Step 2 **Re-Exposure** Next, the wet print is then re-exposed to UV light. As the print is unstabilized at this point, the new salt bath essentially washes the print in a new and different silver chloride/salt solution. This

Figure 5–14
Niles Lund, *Portrait of Christopher James*, 2004
Niles attended a workshop of mine in Maine 10 years ago and brought along his view camera with a motorized focal plane shutter. In the years that have followed, Niles continues to impress me with his inventions and ideas and is a regular guest wizard in my workshops, where he brings along new products from his company, http://www.lundphotographics.com. This piece is an example of one of Nile's negatives of me that I used in a salted paper demonstration. *(Courtesy of the Artist)*

second exposure brings out lavender in the highlights and results, after drying, in a deep rust red/lavender duo-toned print after the dry-down. I'm not sure why this is the case, but old salts are good salts, and the older the sodium chloride salt-stabilizing bath, the more dramatic the color shift to lavender.

Step 3 **Washing** Wash the print in a running-tap-water bath for 15–20 minutes and then hang it up to dry in a very low-light place.

Step 4 **Heat Press** If you iron or flatten your dried print in a dry mount press, it will result in a deeper and darker coloration.

Allyson doesn't mention these variations to her technique, but I'll toss them in here as I think it may help make the print more stable. While you are experimenting, try adding 10 g of citric acid to the sensitizer solution. This will beneficially lower the pH, helping with stability.

Also, after washing, try toning your print for 30 minutes in a gold/borax toner. Finally, in answer to the obvious question of why she hasn't included a fixing step in her process . . . it's quite simple. Fox Talbot's earliest salted paper prints were unfixed, and the technique Allyson is using is a form of tribute to the mystique and alchemy of a final result that could only be appreciated by candlelight. Her prints, as were Talbot's, are stabilized but unfixed with sodium thiosulphate. They are, by their nature and intent, changeable and ephemeral, both physically and emotionally . . . a reflection of our own beauty, fragility, and mystery.

SIZING WITH STARCH OPTION

You may recall the information that fine French stationery paper was sized with starch, while English stationery was sized with gelatin. After working with both types of sizing, in my experience gelatin is the

superior option. That said, there is a possibility that the look and coloration of a starch-sized paper, combined with salt and silver, will suit the intentions and look you are working for better than the gelatin sized. It is certainly better than no binder at all.

There is a choice of starches for you. Arrowroot is traditional, while tapioca starch (not the pudding beads, but the starch that you will use for thickening in Asian cuisine) is used in the matte albumen formula. Rice starch and wheat starch are also options, but my experience with them is limited, so I wouldn't be able to give you a thumbs up or down as opposed to the use of arrowroot or tapioca. Here's a pretty standard "old-school" starch-sizing formula from the late 1800s for salted paper using any of the starches listed.

Formula for Starch Solution

20 parts	starch
6 parts	ammonium chloride
3 parts	citric acid
600 parts	distilled water

12% Silver Nitrate Sensitizer

12 g of silver nitrate to 100 ml of water

Size and sensitize, as you would using a gelatin-sized paper. You will likely discover that the contrast with starch-sized papers is a bit less pronounced. You can try double coating, and that should help. I've read that the exposure times with starch-sized papers are a bit longer than with gelatin-sized papers, but I personally have not experienced this difference. My guess is that it has more to do with the negative than it does with the sizing.

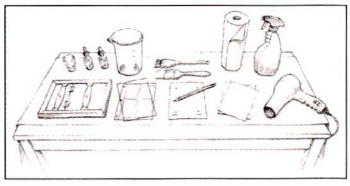


TABLE SETUP FOR SENSITIZING SALTED PAPER

Clean dark brown glass bottle, suitable for chemicals, for the silver nitrate solution
(*See below for several sensitizer formulas that will be suitable for your printing needs.*)
Plastic dropper for silver nitrate drop count
Heavy-duty shot glass
Clean paper or clean piece of Lucite for a coating area on the table surface
Salted and labeled paper for coating (*See instructions in text for salting.*)
New or silver-nitrate-only hake brush or Richeson synthetic fiber brush

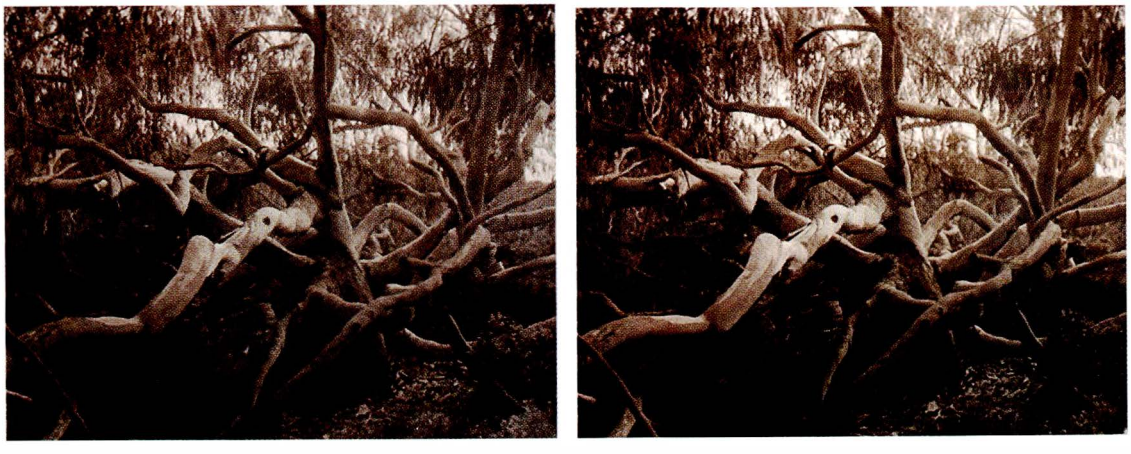


Figure 5–15
Dick Sullivan, *Fumed Silica and Albumen Test #2*
A comparative example for you to consider . . . of a silver nitrate sensitizer on an albumen paper that had been pre-treated with an application of fumed silica. Although a salted paper will not have the same dramatic difference in densities due to the surface preparation option between salted gelatin and albumen, this is a variable that you might consider experimenting with. See the fumed silica chapter for more information and the technique.
(Courtesy of the Artist)

Clean distilled water in a beaker for brush rinsing
Pencil for writing data on paper
Hair dryer
Contact printing frame
Negative for contact printing
Tape
Fumed silica if you are pre-coating before silver nitrate
2" foam brush for coating silica

Fumed Silica Paper Preparation Option

If you are open to an extra step in this process and are hoping for a way to intensify the full tonal range of salted paper with a greatly enhanced tonal range, you might wish to consider applying a micro application of fumed silica to the paper prior to sensitizing it with silver nitrate. The technique is relatively simple, and when done well, the results are quite satisfying. I'll go into more detail for both wet and dry fumed silica application in Chapter 11, but for now, here is the quick overview.

You'll need a 5" paint roller with high-density foam replacement rollers and a small quantity of fumed silica. The silica is almost lighter than air, and since you'll only be using it sparingly, ordering a modest container of it will be inexpensive and will have very reasonable shipping charges.

For an 8 × 10 print, take about an eighth of a teaspoon (just a pinch) and place it on the gelatin-sized paper in the middle of the area that you will be sensitizing with silver nitrate after this step. You can also place the fumed silica in a paint roller tray the size of your 5" rollers and simply charge the roller by running it back and forth in the tray and then moving to the paper to apply the silica.

With firm pressure, begin to rapidly roll out the silica in all directions and continue this, covering your entire surface area, for several minutes. When you touch the paper's surface, you will find it doesn't feel like paper any longer. Actually, it may feel more like the soft nap on sand-washed silk. Now you may go on to sensitize the paper with your silver nitrate solution.

Silver Nitrate Sensitizing Salted Paper

When your salted paper has dried sufficiently it is time to sensitize it with a solution of silver nitrate. Up to this point, getting to the completion of the salting stage, your paper has not been light sensitive. The coating of silver nitrate will change this situation, and it is necessary to conduct the sensitizing stage of your salted paper preparation under a very low light level. This does not mean under safelight conditions. You simply don't want overhead neon or direct sunlight flooding the room while you are coating the silver on the salted paper.

Begin by preparing the preferred percentage of the silver nitrate solution, and be very careful while doing so. Please put on a pair of examination gloves and wear eye protection simply for the safety factor (see below). I'm going to give you three different silver nitrate formulas. The first is a simple and basic one that you use directly. The other uses citric acid as a preservative and extends the time that you can use the paper should you decide to print later. In any case, both standard formulas will do the job. The third formula is one that I use at high altitude. *Before you begin, be sure to note the following.*

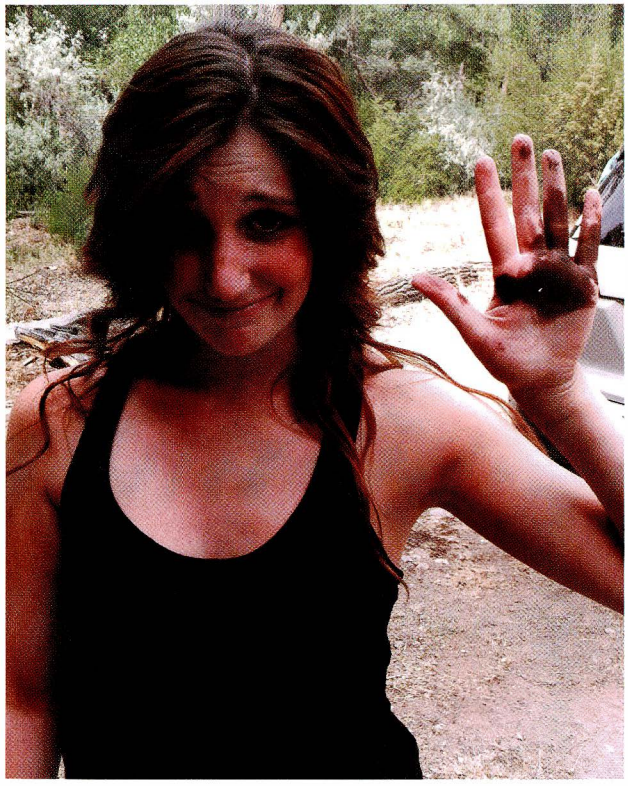


Figure 5–16
Alicia with Silver Nitrate Hand, New Mexico, 2012
Alicia, and her silver nitrate hand, standing next to the Rio Grande, during my wet plate collodion road show workshop at the Santa Fe Photography Workshops in 2012.
(Courtesy of the Artist/Author)

Silver Nitrate: Read This Please

In the thirteenth century, Albertus Magnus, a Catholic bishop remembered for his still contentious advocacy of the peaceful coexistence of theology and science, documented the ability of nitric acid to separate the metals of gold and silver by dissolving the silver. As part of this experimentation, Magnus noted that the resulting solution of silver nitrate would blacken skin. Silver nitrate will indeed discolor your skin as it binds with the proteins in the epidermal skin layer and will resemble a temporary henna tattoo. The stain will go away in about a week, but if you're impatient you can gently rub away your silver nitrate stain with a pumice stone, similar to the tool some use on their feet to smooth out rough areas of skin.

Silver nitrate appears as a colorless and odorless crystal and darkens on exposure to light. Silver nitrate is also highly corrosive and can cause severe skin and eye problems. Silver nitrate is particularly destructive to mucous membranes and the upper respiratory tract. It is the primary silver salt found in photographic emulsions, alternative processes (e.g., kallitype, wet plate collodion, van dyke, albumen and salted paper), and some intensifiers.

If silver nitrate splashes into your eyes it may cause blindness. It is caustic, and if it gets into your eyes you will be in a bit of trouble, so do not touch your face when working with it. If you get silver nitrate on your skin you may experience redness, pain, and burning.

Upon exposure to silver nitrate, rinse the area repeatedly and thoroughly with water. Rubbing the area of exposure with sodium chloride (common table salt or kosher salt) will help to a degree and will also help with skin stain removal. If you get silver nitrate in your eyes, immediately flush with copious amounts of water and continue flushing while medical attention is summoned. Do not panic . . . .

Silver salts have antiseptic properties, and until the development and adoption of antibiotics, very dilute solutions of silver nitrate were commonly dropped into newborn infants' eyes to prevent contraction of sexually transmitted disease (STD) that the mother may have been afflicted with. First utilized in 1881, this treatment resulted in a significant reduction in eye infections and blindness in newborns. However, an incorrect dosage could result in blindness.

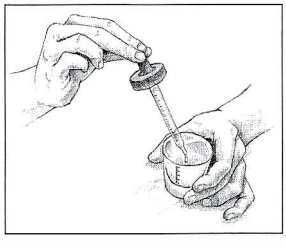
Black silver nitrate stains on counters can be eliminated by washing the stained area with a solution of two teaspoons of sodium bisulphite in a quart of water. Be cautious of the sulphur dioxide gas that will be created by this act of cleaning.

Silver nitrate is additionally a very strong oxidizer. It will combust and form an explosive precipitate if allowed to come into contact with any ammonia compounds, for example, ammonium hydroxide (the strong concentration of ammonia used in mordançage).

Never mix silver nitrate with metals such as aluminum or zinc. Again, use all safety precautions, especially by wearing gloves and goggles or safety glasses when working with this chemical.

All things considered, I have been discoloring my skin for several decades now without pain, burning, or any other negative effects. No matter how careful, or how often they decide to wear nitrile gloves, students inevitably get a brown spot or two from silver nitrate solution on their fingers during coating. To date I've not seen any short-term damage. Long-term exposure is unknown, so please be aware that silver nitrate can be dangerous if you don't respect it.

Here's another bit of silver nitrate information you might want to keep in mind . . . silver nitrate isn't very light sensitive all by itself, but as soon as it gets together with an organic binder such as dust, gelatin, starch, or the like it will become quite sensitive to light.



Standard 10% Silver Nitrate & Citric Acid Sensitizer Formula

I prefer this 10% silver nitrate solution, with citric acid added, to the traditional standard formula discussed next, especially if I am experiencing highlight problems or do not intend to print immediately. The citric acid lowers the pH of the silver nitrate sensitizer and acts

Figure 5–17
Christopher James, *Whispering-Prague*, 1983
Taken in the courtyard of an asylum in Prague, this image is from my portfolio is made with plastic children's toy cameras. To make the print, I scanned the film negative and from that generated a digital contact-sized negative using Pictorico Ultra Premium OHP inkjet film with an applied salted paper curve. The end result is an ammonium thiocyanate and gold-toned salted paper print.
(Courtesy of the Artist/Author)

as a preservative. To make it, mix 10 g of silver nitrate with 50 ml of warm distilled water and carefully pour the solution into a clean dark glass container with a plastic cap. Then mix 5 g of citric acid with the remaining 50 ml of warm distilled water and add it to the silver nitrate solution. Store this solution in a dark glass bottle and label it with the date, its contents, and a warning.

For me, this is a double-coating formula, meaning I will coat a perfectly dry piece of salted paper, dry it completely, and then re-coat and dry again before exposure.

100 ml distilled water
10 g silver nitrate
5 g citric acid (*This lowers the pH and makes it more acidic.*)

Standard 10% Silver Nitrate Sensitizer Formula

This traditional formula makes a 10% sensitizer solution. Add 10 g of silver nitrate to 100 ml of warmed distilled water and stir gently with a non-metallic stirrer until it is dissolved into solution. You can make any concentration that you like, and many salted paper printers prefer a less aggressive concentration of 6% with which they double coat their paper. Silver nitrate has a very long shelf life, and if you happen to have a kallitype kit in the lab, it is a pre-mixed 10% solution that can be used straight from the bottle.

10 g silver nitrate
100 ml distilled water

High Altitude/No Humidity 20% Salted Paper Sensitizer Formula

This formula is an option if you happen to be working in Aspen, Santa Fe, or Kathmandu. Interestingly enough, I've started to use this mix as a single-coating application at all altitudes and it works well, as long as your exposure time to sensitizer coating is very short. Notice that the citric acid is also in this sensitizer mix, lowering the pH and extending the time I can have before exposure.

100 ml distilled water
20 g silver nitrate
5 g citric acid

Mix 10 g of silver nitrate with 50 ml of warm distilled water and carefully pour the solution into a clean dark glass container.

Finally, mix 5 g of citric acid with the remaining 50 ml of warm distilled water and add it to the silver nitrate solution in the dark glass container.

15% Silver Sensitizing on Delicate Paper

Often, when making a salted paper print on a delicate paper or complicated surface such as Clearprint Chateau Vellum, Bienfang 360, or Rives Lightweight, you will want to coat once rather than subjecting the coating to a second sensitizing step. In a situation like this, I recommend mounting the sized paper on a thin and rigid surface that can be put into your contact frame without a conflict of thickness. One of the best methods for this is to use a thin brown packing tape that has glue on one side that is activated by moisture. In art school, you are taught to prepare watercolor paper by soaking the paper in warm water and then putting it on a backing board and double taping the edges to the board. As the paper dries, it shrinks and becomes taut with the resistance of the tape. If you gelatin-salt size your delicate paper and apply it to a rigid and thin surface, you will be able to easily give it a fumed silica top preparation followed by a single 15% silver nitrate coating. You can cut the tape away for the contact frame exposure or simply put the backing board and prepared salted and sensitized paper in the frame for the exposure . . . providing it won't break the glass in the frame.

Nikki Seggara's salted paper print was prepared in this manner using 8 g of gelatin, 12 g of sodium citrate, and 20 g of ammonium chloride. She then mounted the paper on Lucite until dry. Nikki then applied a fumed silica top dressing with the dry-coating method and then coated the paper with a 15% silver nitrate sensitizer. Following exposure, the print was immersed in a liter of water with 30 g of kosher salt and 10 g of citric acid for 2 minutes. This was followed with a 1-minute sodium thiosulphate fixer bath and a 30-minute wash followed by a several-minute soak in distilled water.

Figure 5–18
Nikki Segarra, *Between L and Sea*, 2012
One of my former MFA students at the College of Art and Design at Lesley University, Nikki Seggara, made this salted paper image on the delicate, but elegant, Bienfang 360, which she taped down on thick Lucite before starting to work. Here are Nikki's specs: salt sizing #1, but with 12 g sodium citrate instead of 18 g. Fumed Silica application to the substrate, about 1/3 tsp. applied with a hot dog roller. A double coating of 15% silver nitrate, fan dried, and a 95-second exposure in a UV exposure box. Then, 2 minutes in salted first bath, 15-minute wash, a 1-minute fix, sodium sulphite for 3 minutes, and final wash for 20 minutes followed by a distilled water soak before hanging to dry.
(Courtesy of the Artist)

Sensitizing Considerations

As a rule, try to use the freshly sensitized paper as soon as you can. Salted paper dislikes humidity, and in humid conditions the paper will begin to discolor in a few hours. Think of table salt in a salt-shaker on a hot and humid summer day to reinforce this recommendation. If this is the environment you are printing in, try using the silver nitrate formula with the addition of citric acid. In dry, dark, and cool conditions the addition of the citric acid will help extend the life of sensitized paper for a day or two.

Be careful not to apply too much heat (when blow-drying) to the newly sensitized damp paper because that temperature change will cause a loss of sensitivity. If you do use a hairdryer be sure that it is set on a cool setting and blow on the backside of the coated paper for the majority of the drying time, making sure that your paper is totally dry before exposing. Blow-drying on the backside of the coated paper also helps draw the sensitizer into the paper's fibers. Moisture in the paper will cause staining and the conditions for generally poor results, so you might want to consider having a dry mount press, set at a low temperature, nearby for removing any residual moisture immediately prior to printing. Often, you won't see the staining until after the dry-down. If using a press, make sure that the time the hot press platen and the paper are together is very brief. Open and close the press rapidly and you'll see the moisture escape out of the back of the press. Do this rapidly until you don't see the steam any more.

If you see a speckled print with black or brown freckled spots, reminding you of an ancient albumen print found in an antique store, you could be experiencing a variety of maladies. The most common of these are paper contamination of some type, paper that is ill suited for the process, a silver nitrate application brush that has been compromised and not thoroughly washed between coatings, silver nitrate (if you are dipping the brush) that has gone bad due to this contamination, paper that was moist when you exposed it, not using distilled water, kosher salt not being added to the first wash bath, and so forth. This list can get quite lengthy, and the best remedy is to do everything perfectly from the start.

Figure 5–19

Margaret Adams, *Dress*, 2000 (salt print diptych and salt print w/ potassium dichromate added)

Margaret, a former workshop student of mine, is now teaching alternative processes at the Corcoran. She did a good deal of salt testing for me in the first edition, and this is one of her images that illustrates the difference between a straight salted paper print and one made with potassium dichromate added to the sensitizer for an increase in contrast.

(Courtesy of the Artist)

Very often the problem is simply related to the brush not being cleaned well. What has happened is that the brush has picked up salts, gelatin, paper fibers, and dust from repeated applications of silver nitrate sensitizer when brushing across the paper's surface. Then, when a second coating is performed, and the brush is dipped again into the silver nitrate, the solution becomes contaminated. My advice, especially to those in workshops, is to use a shot glass with a drop count (approximately 22 drops for a 4 × 5 inch negative) of fresh silver nitrate for each individual print. You could also use a glass-coating rod (refer to the platinum/palladium chapter for the technique) or new foam brush for each application; however, the latter wastes sensitizer.

If you are having problems, only change one thing at a time. My first move would be to re-mix the silver nitrate solution, adding the citric acid, and try again. My second change would be to go to the drop count in the shot glass versus the dipping of the brush into a beaker of silver nitrate. Third, change papers. Fourth, make absolutely sure that your paper was bone dry before exposing. If you're in a hot and humid climate, perform the entire exposure in open shade to cut down on building up heat (resulting in moisture) in the contact frame.

Contrast Enhancements: Potassium Dichromate

One of the easiest methods of affecting the contrast of your salted paper print is to alter the initial wash-development bath. In order to increase the contrast, as well as change the color of the image to a reddish-brown, simply add 3–5 drops of a 10% potassium dichromate solution (100 g potassium dichromate to a liter of distilled water). This is almost a saturated solution of potassium dichromate, which saturates at 13%, so if you are lacking a scale or are short on time, just make a saturated solution and add a little extra water to it. To use it, heat

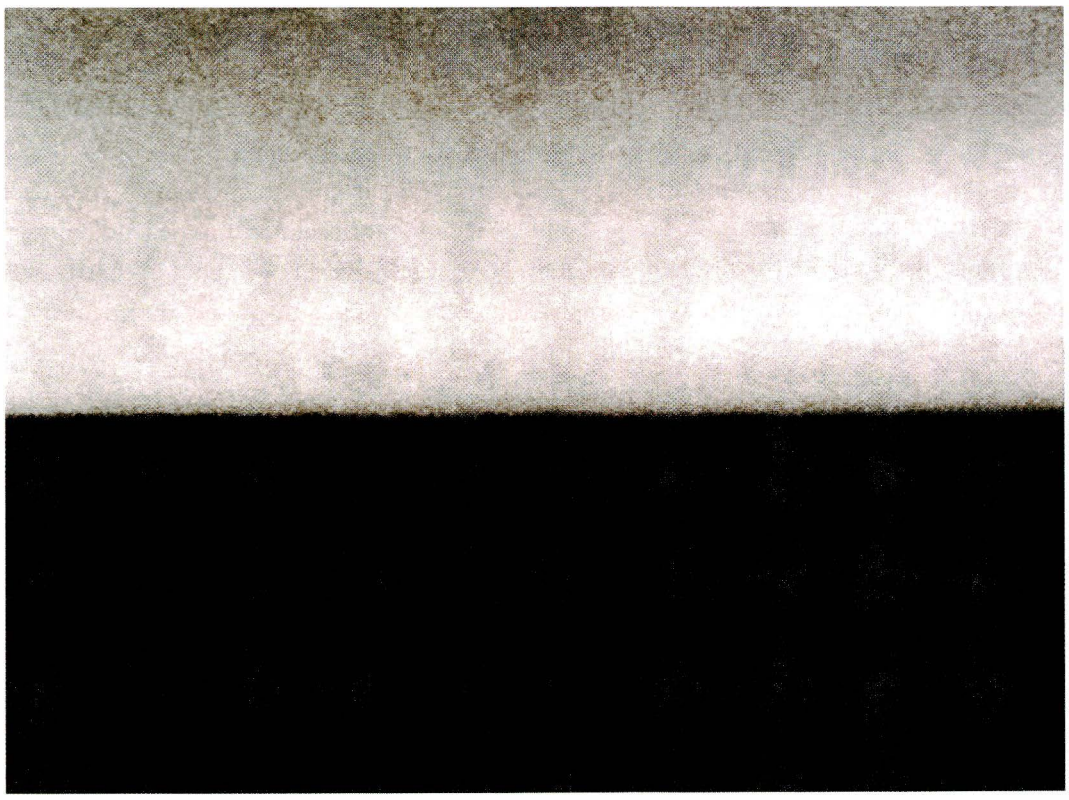


Figure 5–20
Rebecca Welsh, *Sunrise, Grand Canyon #2*, 1995
New Hampshire fiber artist, painter, photographer, athlete, conservationist, and tactical arts range officer Rebecca Welsh made this image at the edge of the Grand Canyon at sunrise. Besides being talented in a boatload of disciplines, she is also a legendary beauty . . . and my wife of 20 years.
(Courtesy of the Artist)

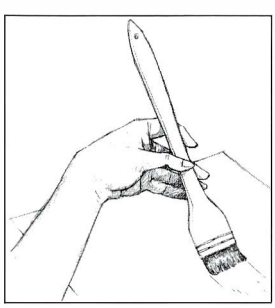
this solution in a microwave oven in a plastic beaker or use a double-boiler-like tray setup. The warmer the solution, the stronger the change to contrast and color and the less likely you will be to experience paper speckling.

Contrast Enhancement with Color Change

You can also increase the contrast of your print by adding a drop or two of a 1%–5% solution of potassium dichromate to every 28 ml of the sensitizer. (A 5% solution is made by dissolving 5 g of potassium dichromate in 100 ml of distilled water.) This will also result in a color change to reddish-brown that is similar to that caused by the gold/borax toner described later. If you elect to add some potassium dichromate to the solution, warm it up first so that it will dissolve within the silver nitrate more efficiently. This will also help reduce the "speckling" that occasionally shows up on the print when a dichromate is added.

Contrast Enhancement Using Shade and Sun Exposure

This contrast technique is more aggressive than adding potassium dichromate to your wash development, and I would recommend other approaches to contrast adjustments before this one. Simply perform your entire exposure in the shade, and then have your first wash for 5 minutes in distilled water with no salt added. Lastly, I would consider making a new digital negative with adequate contrast for the process.



Coating Salted Paper with a Synthetic Richeson Brush

I used to teach this process using a common beaker of silver nitrate and having the students lightly dip a clean brush into it and proceed to coat their paper. Most of the time this method worked perfectly fine with minimal contamination issues. As mentioned earlier, the easiest fix for this situation is to make an individual drop count in a shot glass for each print that you do. Consult the Platinum/Palladium and Ziatype chapters for drop count charts and technique. Keep in mind that if you are working in a very arid environment, say the high desert in the Southwest, you will want to give yourself more drops to work with because the sensitizer will be drying quite rapidly and overbrushing silver nitrate often results in fogged images.

I am going to recommend that you put aside your traditional hake brush for this process and move to a Richeson #9010 Series Synthetic Flat Wash Brush. I have used this brush in all of my workshops and classes for several years now and it's unfailingly perfect. I use less sensitizer, the coating is consistent and doesn't rough up the wet paper fibers, and I am able to move between processes with it easily without contamination, as long as the brushes are meticulously clean and rinsed thoroughly with distilled water between every coating application.

I understand that it's alt pro heresy to use a brush with a metal ferrule, but if you employ the shot glass when creating your sensitizer drop count, you will not be dipping your brush into a container of sensitizer and will be avoiding the metal. If I anticipate dipping, say, for a large piece where I need a lot of sensitizer, I simply run a bead of super glue along the edge where the brush hairs meet the metal and then, after it's dry, seal the metal with a clear nail polish or varnish.

Coating with the Traditional Floating Method

Another method of coating is the traditional "floating" of the salted paper on a volume of silver nitrate in a shallow glass dish. If you opt for this technique, I recommend using a Pyrex lasagna baking dish, as it's easy to clean, contains a lot of fluid, and has high sides. The traditional method is to float the paper on the silver nitrate solution for 15 to 30 seconds, being sure not to get any emulsion on the "back" of the paper. The easiest way to *float* successfully is to bend up the four side edges on your paper (just like in albumen coating) so that you create a little origami-like "serving tray." The folded edges of the "serving tray" can be trimmed off after the process

Figure 5–21
Alan Vlach, *Break Time*, 2007
Alan made the salted paper print *Break Time* in the French Quarter of New Orleans using a Canon 5D digital camera. The print is 14" × 9" and generated from a self-calibrated digital negative. Printed for 18 minutes in an Edwards Engineering UV box and then toned in gold–thiourea. *(Courtesy of the Artist)*

is complete, and this almost eliminates the problem of getting silver nitrate on the back of the paper.

Coating is performed in subdued light, that is, no direct sunlight or bright artificial CFL or neon. Sensitize the sized paper using any of the coating methods, applying one to two coats of your silver nitrate solution. If you are double coating, dry thoroughly between coats. The more silver nitrate in the formula, as Talbot discovered, the more sensitive the solution. This means that you can increase the silver nitrate amount in the previous silver nitrate formulas to make a more light-sensitive solution. However, this doesn't mean loading up on a big concentration in one coating. Multiple low concentration coatings work better.

If floating is too difficult for you I suggest using a Richeson Synthetic Wash Brush or the glass rod method. Always mark the front of your coated paper with an "S" (for silver or sensitized) because the formula tends to be impossible to see in low light conditions. In both brush and rod coating, allow your newly sensitized paper to sit still in the dark for a few minutes before drying or hanging it up. For extra karma, talk nicely to your paper.

Be sure to use distilled water because normal tap water will almost always cause one problem or another due to the mineral concentration, chlorine, or the pipes that the water flows through. I'll repeat this later, but always do a final wash with distilled water after the last tap water wash with this particular process. This will rid the paper of these various contaminates and chemicals. Also, always clean your brush after every coating application.

PRINTING SALTED PAPER

For the salted paper process, I recommend using a quality 100% rag paper with a smooth surface such as Bergger's Cot 320, Stonehenge, Crane's Platinotype, Arches' Platine, Crane's Kid Finish, Arches Aquarelle, Arches Grain Satine, or Bienfang 360. Another paper that has been used by a number of alt pro folk lately

Figure 5–22

Dan Estabrook, *#1. Shortness of Breath* (*Nine Symptoms* series)

This is another salted paper print from Dan's Nine Symptoms portfolio.

(Courtesy of the Artist)

is the Weston *Diploma Parchment,* and it is available through the Butler & Dearden Paper Service in Boylston, Massachusetts. You will, of course, determine which is best for you according to the intentions of your image.

Legion Revere Platinum is a paper that I've had uneven results with, and it will occasionally exhibit a splotchy/mottled appearance after sizing and sensitizer application. My best guess is that when this paper, at 90 lb, is immersed in a salted gelatin sizing solution, the paper becomes over-saturated, removing the original sizing. If it's humid, the paper will be so loaded with salt that it will continue to absorb moisture—think salt shaker on a picnic table in the summer. When the silver nitrate sensitizer is applied to this surface, it displays an uneven texture that doesn't dry down evenly. Consider brushing on the gelatin salt sizing in the first stage of the process rather than immersing the paper in the gelatin sizing as a solution to the problem.

When using a lighter weight paper, the resulting image often will exhibit a greater degree of clarity and tonal resonance. Since the process is going to be taking place on a gelatin sized paper, the best results come from a delicate technique and application with restrained printing. Laying down a fumed silica application on a lighter-weight paper will also enhance the quality of your images.

As a place to start, your negative should be relatively high in contrast with a D-max in the 1.5 to 2.0 neighborhood. This is a moderately dense and contrasty negative that would generally be suitable for a conventional silver paper of grade 0. When making negatives for the salted paper process, try to make the best negative possible and then overdevelop it by 50%. If you are going to be making a digital negative, seek a curve profile that increases the contrast and density. You will want to refer to your tonal scale as being "bulletproof," and then it's important to keep in mind that the sun is many times more intense than your wet lab enlarger. See more on this in the Digital chapter.

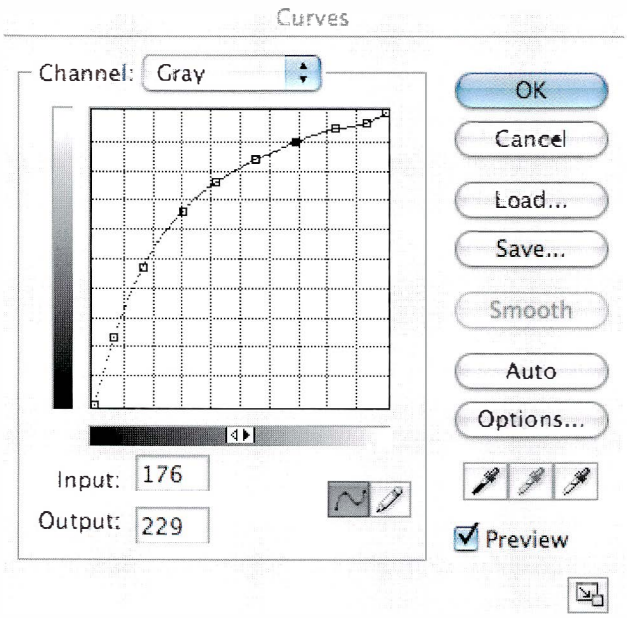
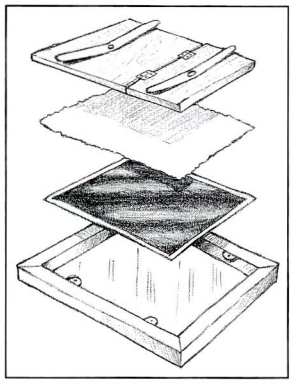


Figure 5–23

Salted Paper Curve Profile Example before Invert

A simple example of a salted paper curve prior to inverting and printing-out for contact negative.

(Source: Adobe® Photoshop®)

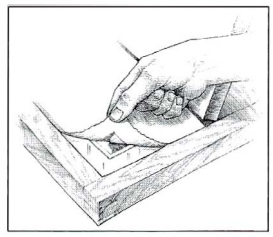


Exposure Times

Once you are ready to expose your sensitized paper, place your negative and bone-dry sensitized paper in a hinged, contact-printing frame so that the light will penetrate the glass, right-reading negative, and sensitized paper in that order. Go outside and place your printing frame in light, preferably open shade, so that it's not directly facing the sunlight. You will notice that the paper begins to darken immediately and subsequently eases off. In my experience, sunlight will expose an average negative well in 6–12 minutes but will likely block shadow details in the darkest values. A UV exposure unit will provide a good exposure in 7–12 minutes. Again, the darkest shadows will tend to block up and deny detail unless you filter the exposure with a translucent sheet such as Pictorico Ultra Premium OHP.

My recommendation for the best exposure strategy is to use a combination of sun and shade for 6–12 minutes. Do the majority of your exposure in the open shade and then hit it with some direct sunlight, or place it in a UV exposure unit, at the end of the open shade exposure to intensify the darks in the image. This technique will yield the best contrast potential with the best density and detail in the shadows.

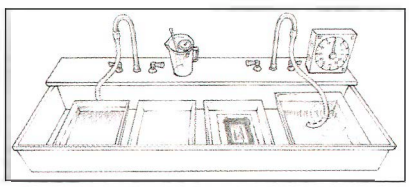
As mentioned, it is generally best to face your contact printing frame away from the direct sun or keep it in the open shade so that you can better control your exposure and contrast. Negatives low in density or contrast should be printed in this manner for greater contrast. Contrast can also be slightly increased by placing a sheet of tissue or vellum over the glass during exposure to slow the pace of the exposure.



Examine the progress of the exposure at different, but regulated, times during the printing in the same manner you would with other printing-out processes when using a contact-printing frame. Look at your paper in a very-low-light area so as not to fog the image. The printed-out image should be allowed to

Figure 5–24
Tom Persinger, *I Cried in My Dream #17*, 2011
Tom writes, "In 2011 I was commissioned by the Pittsburgh Song Collaborative to create a series of 21 images to accompany a performance of Schumann's piece 'Dichterliebe' or 'A Poet's Love.' Schumann composed the piece in 1842. The images were shot digitally and edited in Photoshop, after which digital negatives were created so that the final prints could be created using the salted paper process. After printing the images were carefully cut out of the paper (arch chat at top) and affixed to hard board. This method of presentation was contemporary with what would have been common in the 19th century. Each image is meant to augment, not interpret, the piece of music it accompanies." *(Courtesy of the Artist)*

go quite deep: highlights should appear much denser than you will often want in the final, and shadows will become almost a metallic bronze color. You may lose a minimum of two to four steps on a calibrated gray-scale step tablet after all of the processing has been completed, but there are some things that you can do at this stage to reduce that depreciation.



SINK SETUP FOR SALTED PAPER

Tray 1 **3% Salting Bath:** Mix 30 g of kosher salt with 1 liter of distilled water. Add 1% citric acid (10 g) to the salted bath per liter. Agitate for 4–5 minutes.

Tray 1 **Higher Contrast Option:** Mix 30 g of kosher salt with 1 liter of distilled water. Add 1% citric acid (10 g) to the salted bath per liter. Then, add 3–4 drops of a 10% potassium dichromate and warm the entire solution. Immerse the exposed print and agitate for about 5 minutes.

Tray 2 **Optional Toning Baths:** Toning must be done BEFORE fixing the print. Toning baths will alter the image color and often aid in the archival properties of the print. Please refer to the text for specific salted paper toner formulas and times.

Tray 3 **10% Sodium Thiosulphate Fixing Bath:** Mix 100 g sodium thiosulphate with 1 liter distilled water and 2 ml household-strength ammonia. You may try adding 2 g of sodium carbonate to the fix to enhance the cooler values of the print. Fixing time in fresh sodium thiosulphate will be about 1 minute.

Tray 3 **Optional Sel d'or Toner/Fixer Monobath Formula:** Mix 500 ml water with 75 g sodium thiosulphate, 1 teaspoon bicarbonate of soda, and 3 grains of gold chloride. Fixing time will be 6–8 minutes. (Use a 30 ml stock solution. Stock Gold Solution for Sel d'or Toner/Fixer: Mix 154 ml distilled water with 1 g gold chloride [1 g = 15.43 grains].)

Tray 4 **Sodium Sulphite Hypo Clearing Bath:** Mix 1% solution of sodium sulphite (10 g to 1000 ml water).

Tray 5 Final wash for 20–30 minutes.

PROCESSING SALTED PAPER

Kosher Salt Wash Bath

This first bath in the processing sequence consists of a slightly acidic salt bath whose purpose is to precipitate (in chemistry this term means to separate in solid form

Figure 5–25
Jesseca Ferguson, *Finis*, 2003
A compelling and inventive salted paper image contextually integrated into the pieces of an ancient book by Boston artist Jesseca Ferguson. *(Courtesy of the Artist)*

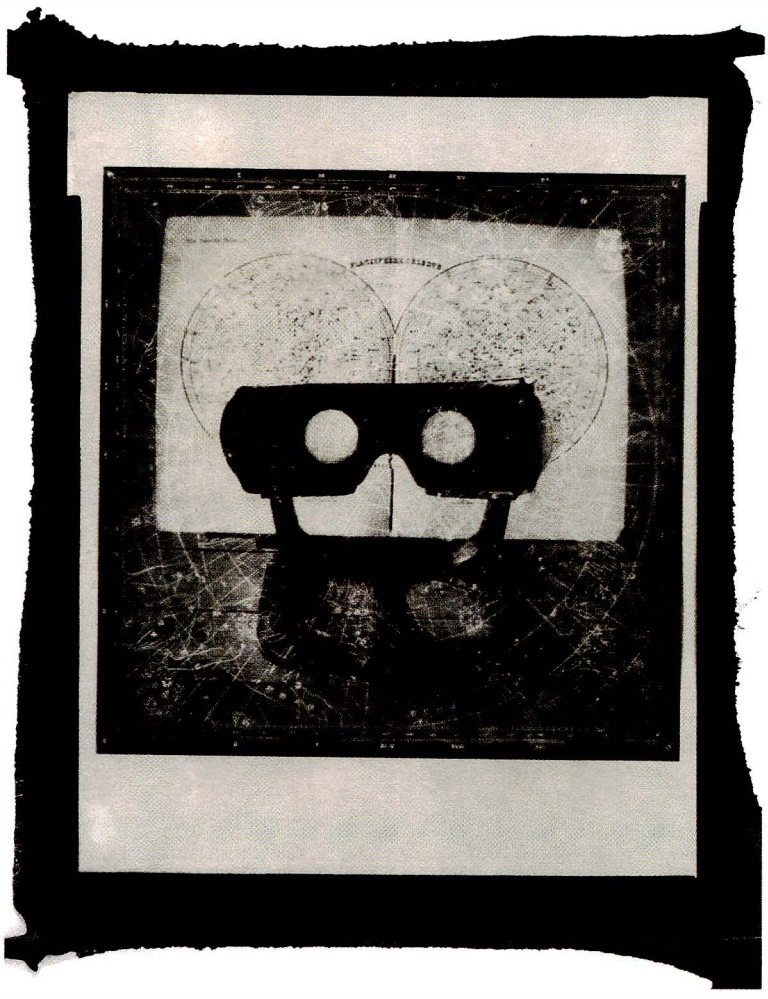


Figure 5–26
Carol Golemboski, *Planisphere Celeste*, 2004
A salted paper print by Colorado artist and professor Carol Golemboski. Carol writes, "The first version of this image was a silver gelatin print. I made the salt print by shooting a B&W 4 × 5 copy negative of the original 20 × 24 print. Then I contact printed the 4 × 5 copy negative to make this salted paper print."
(Courtesy of the Artist)

from a solution) the free, or excess, silver by producing silver chloride. If you have no salt in this bath you will not be removing the free silver and this will create problems with toning, as the gold will not adhere to the silver unless the free silver nitrate has been eliminated. Following your exposure, immerse your print for 5 minutes in this bath of salted water that has been made slightly acidic, lowering its pH, with the addition of citric acid.

10 g citric acid
30 g kosher salt
1000 ml distilled water

Immerse your print under moderate light and agitate slowly for the entire 5-minute recommendation.

Following this step, move your print to a tray filled with fresh water and gently agitate. Repeat the fresh water exchange with a separate tray of fresh water two to three times and then move on to the normal washing stage that follows. As a side note, if you forget to remove your print from the salted bath you will notice that it will begin to fade a bit. The stronger the salt solution, the more fade you'll see. This could be a way to clear your highlights in a desperate situation.

If you wish to increase the brightness in the highlights that are slightly blocked and less brilliant than you had anticipated, try the first bath option noted previously. Then, add 3–4 drops of a 10% potassium dichromate and warm the entire solution. Immerse the exposed print and agitate for about 5 minutes.

Washing the Print

After the pre-wash salt bath, immerse your print for 15–20 minutes in clean running water, making exchanges on a regular basis. This bath clears out the remaining free, unexposed silver. If you do not wash the print adequately, subsequent toning and fixing will not work well and your final image will likely be flat

Figure 5–27
Christopher James, *Ferris Wheel & Corpse, Delhi, India*, 1995
This image describes the way I think about India when I consider all of the images I've made within her borders. This is one of those rare and perfect "gift" moments when reality and metaphor merge. The children's toy plastic camera was the ideal tool for me to use as it captured the image-moment in the way I remembered it . . . rather than the way a grown-up camera would.
(Courtesy of the Artist/Author)

and muddy in appearance. You will also notice a host of salted paper irritations, the most common being little dark spots.

Continue to rinse the print until all of the silver chloride milkiness that you saw after the first immersion in the water has disappeared. If you have a black plastic tray this will help. The paper is still slightly sensitive to UV light so be careful. Also, do not be shocked by the color of the image when it is placed in the water wash. It will shift toward red, and the print will lighten considerably. Hot water will also accelerate the highlight clearing and may result in a more reddish-brown shift if your water is alkaline.

SALTED PAPER TONING FORMULAS: PRIOR TO FIX

If you go directly to the fixer after the wash stage your print will be reddish brown or a variation on that palette depending upon your paper and salted gelatin choices. A toning step is not necessary if this is a color decision you've made for your image.

Toning the print following the wash cycles, and prior to the fixing bath, allows you to select from a palette of colors that range from red to purple to blue-brown and smoky black. Toning will also increase the longevity of your image. The following toning formulas are for you to experiment with and will provide an assortment of tonalities, hues, and contrasts.

The first toner example is made with gold chloride and borax, and it yields a warm reddish color. The ammonium thiocyanate toner will yield a more blue shift in the highlights and mid-tones but, depending upon time, will often leave your reds alone. The Gold 231 will often result in a smoky black with highlight shifts to cool rather than the original warmth. Each toner will react differently depending upon freshness and intensity of the toner, paper you are toning, temperature of the toner, success of your washing cycles, and a host of other alt pro gremlins that may

Figure 5–28
Christopher James, *Sarah, Maine,* 2000 (gold borax toned salt)
This gold-borax toned, salted paper print of Sarah was generated from a Polaroid Type 55 P/N film and a pinhole camera. Following the completed salt process, I enhanced the darks with a very brief gum bichromate exposure using a mix of gum arabic, saturated potassium dichromate, and dark red watercolor pigment in registration with the salted paper print. This technique was a common one often employed by the Photo Secessionists.
(Courtesy of the Artist/Author)

decide to visit your print. Experiment and do not invest even a portion of your self-worth in the success of the toner. Have fun with it and see what happens.

Gold-Borax Toner

(*warm/reddish color*)

800 ml	distilled water at 100°
6 g	borax
12 ml	1% gold chloride solution

Dissolve the borax in the distilled water and add the prepared 1% gold chloride to the solution. Gold chloride in a pre-mixed state can be purchased from most chemical suppliers. Toning will take 15–30 minutes of gentle agitation depending on the tone you are seeking. Generally, the color of the image becomes cooler the longer you have the print immersed in the solution. Keep in mind that a dry print looks cooler than a wet print. Prepare this toning solution at least an hour before use and work with it at room temperature. If you find the toning less than active, add or replenish the toner with additional gold chloride solution. One way to be economical about gold chloride is to trim off any parts of your paper that you will eventually overmat. This will cause less of the gold to be absorbed by the paper. For a black tonality, check out the gold–borax combination with platinum toner in this section. Note that this formula is very similar to the gold–borax albumen toner except that it is half as concentrated.

If you are seeking a deep burgundy color, try the gold borax toner for 30 minutes followed, after a rinse, by the 30-minute gold–ammonium thiocyanate toner.

Gold–Ammonium Thiocyanate Toner: Standard Salt

(*blue/gray tonality*)

800 ml	distilled water
25 g	ammonium thiocyanate
2 g	tartaric acid
5 g	sodium chloride
20 ml	1% gold chloride

Distilled water to make 1 liter (1000 ml)

Figure 5–29
Carol Panaro-Smith & James Hajicek, *Earth Vegetation 2*, 2005 (photogenic drawing)
Another extraordinary photogenic drawing from the collaboration of Carol Panaro-Smith & James Hajicek.
(Courtesy of the Artists)

Tone in the same manner as you do with the gold–borax formula. This toner will give you much colder values and an immersion of 6–15 minutes in a fresh ammonium thiocyanate toning bath will yield blue-gray tonalities. This toner does not keep well so only mix the amount that you intend to use during a single working session . . . about eight prints. If you use a thiocyanate toner be aware that the sodium thiosulphate fixing bath may precipitate sulphur. If this is a problem, and you will know it by the aroma, you can easily fix the problem by adding 5 g of sodium sulphite to the sodium thiosulphate fixer formula and replace the fixer every 4 to 5 prints.

Gold-thiocyanate toner is particularly compatible with platinum toner and a range of colors, from warm red to slate gray to sepia, and can be achieved by adjusting the times of the salt print in each toner and in the sequence they are used.

Gold–Ammonium Thiocyanate Toner II: POP Formula (Bostick & Sullivan Pre-Mixed Solution A & B)

(blue/gray tonality)

Stock Solution A

10 g	ammonium thiocyanate
500 ml	distilled water at 120°F

Combine the ingredients into a uniform solution, store in a clean plastic or glass bottle, and allow the solution to sit for 8–12 hours before use.

Stock Solution B

1 g	gold chloride
500 ml	distilled water at 70°F

To use: Mix 50 ml of Stock A with 50 ml of Stock B and 900 ml of distilled water. The toner is good for about 6 to 8 prints before it begins to wear out. When you need to replenish the solution simply keep what is in your toning tray and add 50 ml of Stock A and 50 ml of Stock B to it. The toning time is subjective and usually between 10 and 30 minutes. The longer you tone, the cooler the mid tones and highlights.

Gold–Sodium Acetate Toner

(sepia to deep burgundy)

800 ml	distilled water at 95°F to 100°F
20 g	sodium acetate
20 ml	1% gold chloride solution (*order it prepared; see resources*)

Distilled water to make 1 liter (1000 ml)

This toner, like the others, is used prior to the fixing bath. Begin by immersing the print in the distilled water pre-wash and salt pre-wash baths. Prepare your toner and see that its temperature is in the 65°F to 75°F range. Place your print in the toner and inspect it closely for the changes. Do not over-tone the print with the gold-acetate toner or you will get an overall yellow cast. It is a decent idea to do a test print for a few minutes and see if you like it. Gold acetate toning can be employed in a double toning sequence with the gold borax toner to get a black tonality. Be sure to wash the print well between the two toners if you are performing

the split. After toning, rinse and continue the process with the fixer and final wash.

Palladium Toner

(*reddish-brown to slate gray*)

450 ml	distilled water
2.5 ml	sodium chloropalladite (15% solution)
2.5 g	sodium chloride (sea salt)
2.5 g	citric acid

Distilled water to make a solution of 500 ml

This palladium toner will alter a salted silver nitrate sensitizer (with a little potassium dichromate for a contrast boost) from a traditional reddish-brown salt print to a slate gray. It's quite nice but different from its companion toner (platinum). The sodium chloropalladite can be ordered in a prepared state and can also be used for your palladium printing.

Begin your toning process by pre-washing your print in the recommended salt pre-washes and then rinse the print in running water for 15 minutes. After the wash, immerse the print in the palladium toner until you are pleased with the results. After toning, continue the process with the fixer and final wash stages.

Platinum Toners

(*warm sepia/reddish-brown/yellow/gray)*

I'll give you two options for salted paper platinum toning. The first is a traditional salted paper platinum formula. The second is a similarly constructed formula but one that is designed to work with printing-out process papers; you'll find it repeated in the POP chapter. Platinum toner is a little more expensive due to the cost of the potassium chloroplatinite (20% solution), but like the palladium, it can also be used for platinum printing or as an additive for palladium printing. Some very nice tonalities can be realized by two-stage toning combinations such as platinum toner and gold-thiocyanate toner. I'll provide you with the POP platinum–gold-thiocyanate formula as well. Gold-thiocyanate toner is particularly compatible with platinum toner, and a range of colors, from warm red to slate gray to sepia, can be achieved by adjusting the times of the print in each toner and in the sequence that they are used. As with all toning, in every process experimentation will often yield some lovely results . . . and then drive you crazy when you try to repeat the color on a different day.

Platinum Toner #1

450 ml	distilled water
1.5 ml	potassium chloroplatinite (20% solution pre-mix)
2.5 g	citric acid
2.5 g	sodium chloride (sea salt)

Distilled water to make 500 ml

Begin your toning process by pre-washing your print in the distilled water and salt pre-wash baths and then rinse the print for 15 minutes in fresh running water. After the wash, immerse the print in the platinum toner until you are pleased with the results. After toning continue with the fixer and final wash stages.

POP Platinum Toner #2

(*neutral black-sepia*)

Bostick & Sullivan makes a prepared POP platinum toner using potassium chloroplatinite #3. The kit includes the following:

10 g	citric acid
10 ml	potassium chloroplatinite #3 (20%)
1 empty 1000 ml	plastic container for storage of the solution

You can make this toner up in a second if you have some Pt/Pd chemistry lying around the house. If not, follow this recipe. To make the platinum toning solution, measure out 10 g of the citric acid on a gram scale and dissolve it in 1000 ml of room temperature distilled water. This will result in a 1% solution of citric acid.

For the citric acid solution, add 7–15 drops of the potassium chloroplatinite #3. This is the Part C metal from your platinum chemistry. The more drops added to the citric acid solution, the faster the toning and the faster you will run out of this very precious mix. You may wish to add fewer drops to allow time to subjectively inspect your toning progress. *Platinum toner does not have to be discarded*

after use; it simply wears out. If you feel that its effectiveness and speed are not what they used to be, then simply add 5–10 more drops of the potassium chloroplatinite #3.

It's best to over-expose your salt print by 15%. Go through the pre-wash and salted pre-wash bath sequence and rinse your print in fresh water for 15 minutes. Next, place the print in a clean tray and immediately pour the platinum toner over its entire surface. Agitate the tray continuously during the toning process. The toner will make itself evident first in the deeper shadow areas of the print and then work its way through the sequential tonal stages from dark to light.

A short toning time will result in a warmer print, and a longer toning period will yield blacks with a cooler image. When you are content with the coloration, rinse the print for 5 minutes and proceed to the fixing stage.

POP Platinum–Gold-Thiocyanate Split Toner

After your pre-wash sequence you can achieve a wonderful gold–platinum split-toned POP print by partially gold toning the print (a short toning time in the POP gold-thiocyanate toner), rinsing the print for 5 minutes, and then immersing the print in the platinum toner until you like what you see. The darker values will become purple-sepia in the shadows following the gold toner, while the highlights and lighter mid-tones will tone a cool blue-black in the platinum. Always be sure to first tone with the gold because the citric acid in the platinum toner will be unkind to the gold toner.

Black-Gray Toning

Add 3 drops of a warm 5% potassium dichromate solution to every 28 ml of the silver nitrate sensitizer; coat

Figure 5–30
Danielle Ezzo, *Two Women*, 2011
Two women, is a 13" × 19" salted paper print made by Danielle Ezzo, a current MFA candidate in my program at Lesley University and a former student of my own former student, Dan Estabrook. In this print, from a series made in 2011, Danielle used a digital negative in the first stage of the process. In this example, she drew directly on the negative to create the linear references.
(Courtesy of the Artist)

and expose the print in a normal manner. Following exposure, proceed through the distilled and salted water pre-wash sequence. This salted pre-wash is quite necessary here, so don't overlook it. Then, tone the print in the gold-borax toner for 5 minutes and wash it in clear running water for 15 minutes. Following the wash, tone the print in the platinum toner for 5 to 15 minutes followed by a wash of 30 minutes. Rinse the print in fresh water for 10 minutes, and then move on to the fix and final wash.

FIXING THE SALTED PAPER PRINT

Standard 10 % Sodium Thiosulphate Fixing Bath for Salted Paper

Prepare two separate fixing trays and into each one add a liter of 10% sodium thiosulphate fix solution detailed next. Fix prints un-toned or toned for 30 to 60 seconds in each bath. Do not over-fix.

1 liter	distilled water (1000 ml) *
100 g	sodium thiosulphate
2 g	sodium bicarbonate OR 2 ml ammonia **

You may go directly to the fixer after the toning, and your image will become lighter the longer it stays in the solution. *Do not over-fix the print, and certainly leave it for no longer than a minute in each bath.*

SEL D'OR TONER/FIXER MONOBATH FOR SALT

Sel d'or Toner/Fixer Monobath

Several years after the Daguerreotype process was announced, a French physicist, by the name of Hippolyte Fizeau, introduced an important process change, called *sel d'or* (salt of gold) that gave Daguerreotypists a way to intensify and gild their work. Sometime between 1847 and 1855 the technique was applied to paper prints, for example, calotype, salted paper, albumen, etc.

In the mid-nineteenth century, sel d'or gold toning was commonly incorporated into the albumen and salted paper processes. Although it was quite difficult to predict whether the technique would ultimately improve or fade the print, the single bath toner/fixer was widely practiced. When an albumen or salted paper print was immersed in the sel d'or toner/fixer monobath the image color would lighten (orange-brown) and then reconstitute itself to a cool sienna, purple, or blue-black as gold replaced the silver. The final image color is based upon the depth of the printing, the toning formula, and the length of time the print is in the toning solution. I recommended that you print deeply if you intend to use this technique.

The sel d'or toner is a toning-fixing monobath and is constituted by mixing a solution of gold chloride into a solution of sodium thiosulphate and a little bicarbonate of soda to make the solution a bit too alkaline. Using it allows the photographer to tone and fix a print in a single bath. Again, it is often unpredictable, and the following formula is more "kitchen sink" than serious lab. Toning/fixing time is approximately 6 to 8 minutes following the wash stage.

Sel d'or Toner/Fixer Formula

500 ml	water
75 g	sodium thiosulphate
1 teaspoon	bicarbonate of soda
3 grains	of gold chloride (use a 30 ml stock solution*)

* Stock Gold Solution for Sel d'or Toner/Fixer

154 ml	distilled water
1 g	gold chloride (1 gram of gold chloride = 15.43 grains. Therefore, every 10 ml of this stock solution will equal 1 grain of gold.)

A Brief Word about Ampoules

Some chemicals, such as the gold chloride in this formula, are shipped in sealed glass ampoules. When received, they need to be tended to carefully and opened

* Be sure to use only distilled water for your fixing bath to avoid bleaching down the road.

** The addition of either the sodium bicarbonate or ammonia makes the solution slightly alkaline. This will reduce the *bleaching* effect of the fixer but will not affect the color or contrast of the image.

to release the chemical within. Be sure to unpack the gold chloride ampoules in a safe location away from the edge of a table where they might roll off and break on the floor. I recommend a rubberized shelf liner, similar to the material that you would use to cut glass on.

There are a couple of ways to open the ampule. First put on a pair of exam gloves. A simple way to handle the task, if you have the option, is to freeze the liquid inside, which will not harm the chemical or cause other problems. Another technique is to make a small scratch with a glass cutter on the neck of the ampule and then touch the scratch with a hot wire or rod. The heat-caused expansion of the glass will cause the neck to separate from the ampoule's body. One other way to do the job is to immerse the ampule in the water you will be adding it to and then break the glass ampule with a glass rod while it is submerged. You may then filter the solution if necessary or simply leave the ampoule's shards at the bottom of the solution.

Fisher Scientific has a "Safe-snap Ampoule Collar" made from nonbreakable polyethylene that allows the fracture of glass ampoules with complete safety. The collars are disposable and are meant to be used only once so that cross contamination does not occur.

In the last technique, take your 1-g ampule of gold chloride and drop it into a bottle containing 154 ml distilled water. (Leave the glass ampule there and break it open it with a glass rod releasing the gold chloride.) Since 1 g equals 15.4 grains, and you mixed this amount with 154 ml distilled water, every time you need 1 grain of gold chloride for a formula all you need do is add 10 ml of the gold stock solution.

1% Sodium Sulphite Clearing Bath Option

Use a 1% solution of sodium sulphite following the fixer to shorten your final washing time. To make it, add 10 g of sodium sulphite to each 1000 ml of distilled water.

Figure 5–31
Christopher James, *Bayside, Maine*, 2006
This is a gold-borax-toned salted paper print from a handheld 4 × 5 pinhole camera, outfitted with a zone-plate adapter ring. The image was made in conjunction with a Teacher's Workshop that Craig Stevens and I were teaching, where the concept was to involve strangers in the activity of alternative process image making, such as pinhole photography with Type 55 and cyanotype murals that were processed in the ocean.
(Courtesy of the Artist/Author)

FINAL WASH & COMMENT

If you can, it is a good idea to do your final wash, or at least the final minutes of your final wash, with distilled water. Wash your images for 20 to 30 minutes after the fixing stage. You can reduce this time if you elect to use the sodium sulphite mix above. Be very, very careful not to rub the print surface during the wash because the delicacy of the process depends on the surface of the print as well as the rendering of the negative. Following the "dry-down" you will notice that your image has darkened and that some of your contrast has been lost. I often force dry a print to see an approximation of what I will have at the end of the process.

Salted paper, like Van Dyke, has always been labeled as an unreliable process that will eventually fade and break your heart. This is true if you have casual lab skills or if you've been subjected to misinformation when learning the techniques. Most of the time, however, it's simply a matter of working clean and paying attention to the process. Salt prints will fade if there is residual thiosulphate left in the paper. Another reason that early salt prints faded was that they were rinsed and fixed in nondistilled water. As far back as the beginning of this process it was known that even small amounts of muriatic acid (hydrochloric acid) in well water reacts with simple nitrates and will cause your print to bleach out.

In some locations where there's a good deal of chlorine in the water supply, the print will look totally fantastic until it dries. Then, your heart breaks because the highlights have turned grey. As a solution, use the sodium sulphite wash and soak the washed print in distilled water for about 10 minutes before hanging it up to dry.

One other element to help insure the longevity of your salted paper print is to tone it with one of the gold toners. This works well as long as you have maintained decent work habits during the process. Salted paper printing is a lot of fun to do, but it's loaded with little traps that will drive you nuts if you're not paying attention. Whatever you do, please approach this process, and all of the others that are in the book, with a sense of adventure. Don't take the success of your work too seriously while you're learning. Remember, every living creature learns through the process of play . . . so please have fun with the process.

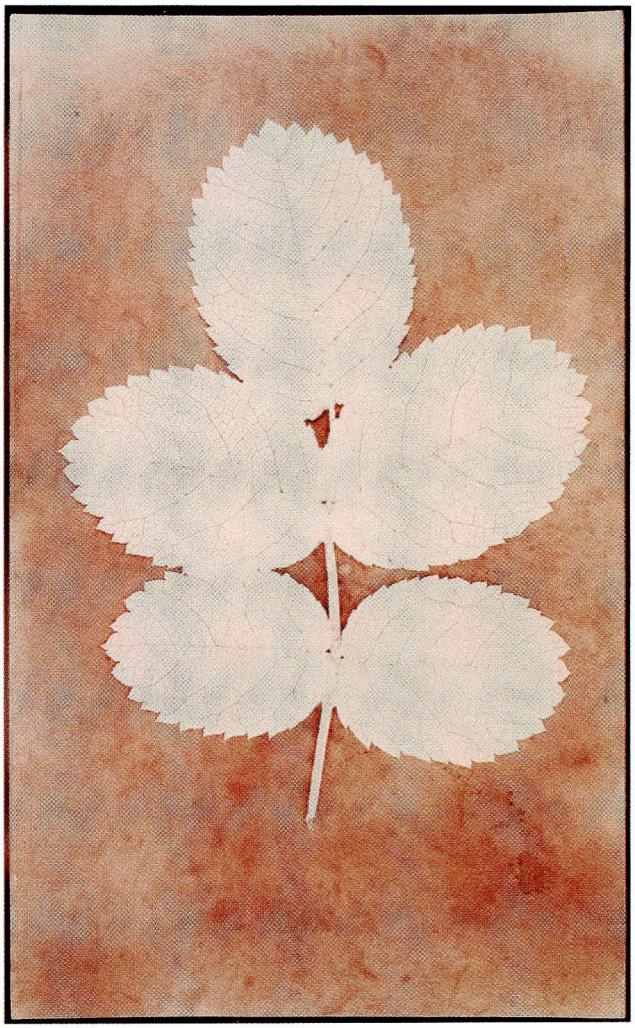


Figure 5–32
William Henry Fox Talbot, *Five Leaves*, c. 1830s
A very early example of a photogenic drawing of five leaves by its inventor, William Henry Fox Talbot.
(Copyright © Royal Photographic Society / Science & Society Picture Library)

The Whey Process

OVERVIEW & EXPECTATIONS

This very modest chapter is included here as one of the bridges crossed between 1840 and 1860, in that very busy time in photographic history when gentleman artist/scientists were seeking a solution to a number of the new medium's vexing issues. Among those that led the parade was obtaining a quality positive and permanent image from a paper calotype negative that would be a successful alternative to a printing-out workflow. This called for a developing-out process, possibly employing a waxed paper negative, that would result in greater printing speed and a modest increase in print quality.

In the mid-1850s, Thomas Sutton created a notable solution, and it featured a technique using whey as an organic protein in place of a salt such as potassium iodide and potassium bromide. First, I'll provide a little history component and then discuss what makes this whey process distinctive. I'll describe the traditional and new "whey" of making your milk serum. Then I'll provide a simple sequence of steps showing how to achieve a developed-out image using a digital, film, or calotype paper negative. For instructions on producing calotype paper negatives, please see the Calotype chapter that includes Sutton's calotype negative process as well as single and double wash variants from several different sources.

It is important for me to acknowledge the written and oral dialog I've had with several friends who have done a significant amount of work and research relating to the whey and calotype processes of Fox Talbot, Thomas Sutton, Gustave Le Gray, Arsène Pélegry, and Blanquart-Evrard. My gratitude to Alan Greene, Richard Cynan Jones, Mark Osterman, France Scully Osterman, and Dan Estabrook for their correspondence and always great advice.

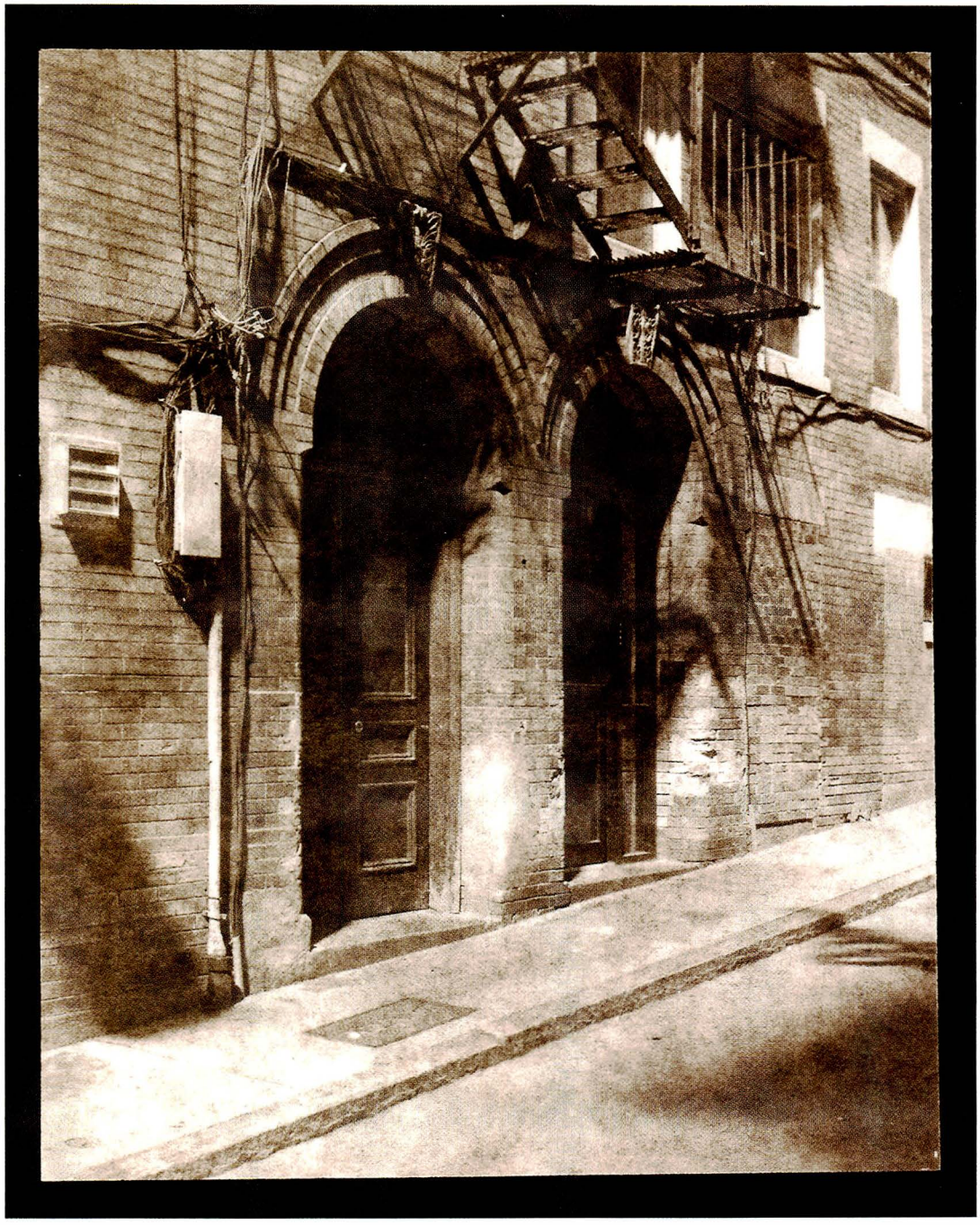
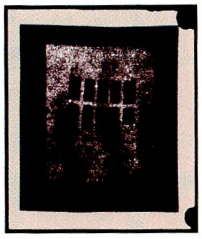


Figure 6–1

Alan Greene, *North End, Boston,* 2002

This image is an example of a developed-out serum-process print made from a dry, Pélegry process, paper negative.
(Courtesy of the Artist)



A LITTLE HISTORY

The calotype paper negative process, while lacking the precision and clarity of a daguerreotype, had one distinct advantage that made the search for a developing-out, versus printing-out, solution worthwhile . . . from a single calotype negative, an abundant number of nearly identical paper prints could be produced. The hoped-for advantage was that rather than archiving and displaying each singular image in a decorative case, like a daguerreotype, paper prints from a calotype negative could be used to produce hundreds of virtually identical photographic impressions. Additional advantages included the paper support that made calotype more easily integrated into the matted, framed, and exhibited world of the graphic arts, such as printmaking and publishing. They were sturdier than Frederick Scott Archer's collodion glass negatives, and aesthetically, the lack of clarity in a paper negative resulted in a printed-out image that delivered a more artistic and painterly impression than did the perfection of the daguerreotype.

Most all of this section is a biographical tip of the hat to Thomas Sutton, who was, in my opinion, a force in the development of the photographic medium equal to Daguerre, Talbot, Herschel, and other light-marking titans. In 1853, seven years out of Caius College in Cambridge, where he studied architecture, Sutton returned from an extended trip to Italy and Switzerland, where Frederic Flacheron had tutored him in the calotype process, using a wet paper technique. He also made the acquaintance of Robert MacPherson, who instructed him in the albumen on glass process, which Sutton ultimately rejected in favor of the paper negative process.

In 1851 at the first World's Fair, called the Great Exhibition of the Works of Industry of All Nations, held in the Crystal Palace in London's Hyde Park, Louis Désiré Blanquart-Evrard exhibited a selection of chemically developed-out photographs from calotype negatives that differed from the printed-out salted paper prints common at the time.

It is important to note that in January of 1847, Blanquart-Evrard took advantage of Fox Talbot's discomfort in managing the patents of his calotype process in the French language and his failure to notice that his former business partner in the Société Calotype, Eugéne de Bassano, had given up his ownership of the Talbot patents two years earlier. Seizing the opportunity, the entrepreneurial Blanquart-Evrard presented to the Academy of Science a photography on paper process nearly identical to Talbot's, claiming it as his own. The refinements he presented provided a faster and less costly way to produce a more permanent positive image . . . making the concept of publishing photographic editions plausible. In September 1851, Blanquart-Evrard opened the first photographic printing enterprise in Lille, France. As a side note to this exposition, Frederick Scott Archer exhibited photographs produced from a distinctly refined non-paper negative made by shooting silver-sensitized collodion on glass in-camera. Exposure times were drastically reduced, and the image quality from the glass plate negatives was a perfect marriage of the clarity of the daguerreotype with the reproducibility of the calotype.

At the conclusion of his time away, Sutton received an important commission from the London publisher Joseph Cundall to make an edition of 100 folios, of a dozen prints each, from 100 of his best negatives from Italy. Accepting the commission, but dismayed by the task due to his lack of affection for the quality of printed-out salted paper, Sutton attempted to arrive at a developing-out printing process similar to the one introduced by Blanquart-Evrard at the Crystal Palace and employed in his photographic printing enterprise, *Imprimerie Photographique*. Blanquart-Evrard, by the way, was the first person in France (1847) to publish instructions and impressions of the calotype process in which papers were sensitized in solutions of potassium iodide and silver nitrate.

Sutton came away from his personal experimentations unsatisfied with the results, and in response to the situation sent Blanquart-Evrard some of his negatives, requesting that prints be made in the Lille facility. Apparently Sutton was quite satisfied with the results of the *Souvenirs de Jersey* edition and made an offer to Blanquart-Evrard of 100 pounds if Blanquart-Evrard

would kindly provide him with the technical details of his developing-out printing process. The offer was politely refused, and in 1854 Sutton returned to his research, again seeking his own solution to the problems of quality, speed, and permanence.

In 1855, Sutton published a technical treatise titled *The Calotype Process: A Hand Book to Photography on Paper,* which made every effort to address all of the issues related to the technique. He followed up with the publication of a short but comprehensive handbook titled *A New Method of Printing Positive Photographs, By Which Permanent and Artistic Results May be Uniformily Obtained,* in which he detailed his developing-out printing technique using whey, or milk serum, as the organic matter that would be compounded with silver nitrate and developed-out with an acidic developer and additional silver.

With a business in mind, and aware that he lacked experience with full-scale industrial printing, Sutton once again contacted Blanquart-Evrard, this time asking for his assistance in establishing the printing facility. Blanquart-Evrard, in somewhat dire financial straights, realized that Sutton was a rather tenacious fellow with many resources and saw the logic of entering into business with him rather than rejecting his overtures for a partnership. In 1855, a very good year for Thomas Sutton, he went into a venture with Blanquart-Evrard, forming the Jersey-based business *The Establishment for Permanent Positive Printing.*

Their relationship lasted for a few years, during which time they published several irregularly scheduled albums. Then, in January 1856, they launched a photographic journal titled *Photographic Notes,* which Sutton wrote and published essentially by himself from 1856 to 1867. For Sutton, it was a platform for his science and often acerbic opinions on the sate of the fledgling medium. It was in this journal that Sutton published an expanded version of his 1855 research on the developed-out printing technique that required far shorter exposure times with less UV light.

As the 1860s approached, the future of the daguerreotype and the calotype negative appeared to be coming to a respectable conclusion. While the romance and artistry of the paper negative era is still widely admired and celebrated, and was used throughout the next decade by travel photographers (as paper was unbreakable), the glass plate negative found ever increasing favor and became the accepted standard.

In 1858, Sutton published *A Dictionary of Photography,* which featured encyclopedic articles on every aspect of photographic processes. The publication was primarily authored by himself, and shortly thereafter his interests moved away from the chemical considerations of photography to those that dealt with

Figure 6–2
Richard Cynan Jones, *Porth Amlwch,* (Thomas Sutton calotype method & inverted scan, 2012)
This comparative diptych of Porth Amlwch by Richard Cynan Jones illustrates a calotype negative (and an inverted scan) made following Thomas Sutton's instructions for the single wash/washed precipitate technique. For print specifics, visit his photo-stream (https://www.flickr.com/photos/richardcynan/with/9393442832/).
(Courtesy of the Artist)

optics and lenses. His lens designs were pretty unique, and one example featured a round, double-glass element lens with water between the two pieces of glass, functioning as an optical component and capable of an extreme wide-angle view. This innovative lens was never widely adopted, as the practitioner, in order to benefit from the unique design, was required to have a curved ground glass, curved negative plates, and a curved contact-printing frame.

> *"A print on plain paper may be dead, foggy, inky, sunk in the paper, &c., &c., but in its most unhappy state it does not look vulgar; there is always a certain sentiment about it, even in its worst phase of failure."*
>
> —Thomas Sutton, 1856

A Short Explanation of the Whey Process

Here's the simple beginning explanation . . . the common calotype describes several varieties of William Henry Fox Talbot's *paper negative processes,* whereas the whey, or milk serum, process pertains to a *developing-out positive printing* technique conceived by Thomas Sutton. They are two different entities. In the whey process, the iodide (salt) is omitted from the procedure. In Sutton's short 1855 treatise on the process, he writes, "*One of the reasons for omitting the salt in the first [whey] preparation, is, that it renders the paper too sensitive and liable to solarize. Without it, the exposure is an operation more under command.*"

The whey technique is unique as a variant, as it is halide free, unlike a salted paper print. Without an organic material to react with, such as a halogen (e.g., chlorine, bromine, or iodine) or a halide (one of the compounds formed between metal and a halogen), silver nitrate is insensitive to UV light. Only when silver nitrate is combined with organic material, like a halogen or halide, does it become useful in a photographic process. An example is a plain silver nitrate solution on paper, an organic substrate, which, when exposed to UV light, results in a pale, grey whisper of an image. I see examples of this during every intro to alt pro workshop when someone uses a non-gelatin salted paper to make a salted paper print. Whey is also organic matter, and when silver nitrate is applied to whey-saturated and dried paper, it is more effective than just the organic paper by itself. The difference in this case is that the exposed paper will require chemical development to realize its potential.

Many practitioners of this technique, most notably Alan Greene in his excellent book, *Primitive Photography,* have considered whey as being a vehicle whose task it is to carry, like starches and gelatin, the silver halides in a sensitizer. Whey also contains a protein that bonds with the silver and changes it in much the same manner as it does with albumen and gelatin. Sutton likely learned to use whey from his admired colleague and business associate Blanquart-Evrard. The sensitized paper employed in Sutton's 1855 technique would have been less sensitive than a silver chloride printing-out technique like salted paper and much less sensitive than if it contained silver iodide. The whey in Sutton's process probably contained influential amounts of calcium, sodium, magnesium chloride, and potassium iodide, as it was unclarified and contained the remnants of milk fluids of healthy free-range cows after their milk had been curdled and strained. The organic protein of the whey, combined with the organic material in the paper, when combined with the silver nitrate was sufficient to drive the photographic reaction without the need for an iodizer.

A generic web description of whey goes like this . . . whey, or milk serum, is the thin liquid remaining after milk has been curdled with an acid, vinegar, or rennet (curdled milk from the stomach of an un-weaned calf) and strained to remove the solid curds. Whey is also a by-product of the manufacturing of cheese or casein. Sweet whey is manufactured during the making of rennet types of hard cheese like cheddar or Swiss cheese, while acid or sour whey is a by-product of dairy products such as yogurt.

In a recent correspondence, Alan Greene wrote, "*What Sutton published as being Blanquart-Evrard's developed-out procedure, which would have involved a silver iodide surface similar to that contained in making a paper negative, would have been much more light-sensitive and harder to control. Generally speaking, my experience has been that a developed-out process renders a higher contrast positive as compared with one made by printing-out. On the other hand, that*

takes it closer to 20th century black and white photographic printmaking sensibilities, which I think was what Sutton was more or less anticipating in his constant comparisons to the inferior quality of the printed-out salt prints of his day as compared to printmaking. For more on the subject, I refer you to an article I wrote a few years back, which goes into further details: 'Les épreuves salées par dévelopment (1843-1866),' Etudes photographiques, *no. 14 (January 2004), pp. 130-43.*"

Sutton concluded that like the calotype paper negative, a developing-out technique would result in a more significant silver particle profile. This profile would be less prone to deterioration due to the effects of sulphurous industrial air, . . . a significant factor in image fading. Compared to a printing-out process (such as salted paper), developed-out prints did not require lengthy printing times or strong UV light. An additional advantage was that the silver sensitizing solution remained viable until it was gone.

Sutton's 1850s process evolved as a methodic strategy to correct the chronic fading tendencies of a printed-out image. The process commenced with the making of the whey by boiling whole milk and then adding rennet, vinegar, or acetic acid to coagulate the solid curds. As mentioned, the cloudy fluid remaining after the curdled milk was filtered and strained was called whey. The paper intended for image making was then immersed in or brush coated with the whey and dried. The dried whey paper was then saturated in a silver nitrate solution and dried for a second time.

This silver and whey sensitized paper was subsequently contacted printed with a negative for a short exposure until a whisper of an image was visible . . . much like the whisper in a Pt/Pd process following exposure. The development of the latent image was accomplished with an acidic solution of gallic or pyrogallic acid, followed by a water wash, a fixing step with a sodium thiosulphate solution, and a final wash. The result was slightly richer than a printed-out salt print due to the development stages and was cool in color. As well, it featured an image on the back of the paper that was a mirror of the image on the front. Whey prints could be warm or neutral toned with gold chloride, and yet despite these advantages, the developed-out whey process never gained a significant public following. A lot of that was due to the timing of the process, which coincided with Archer's wet collodion on glass negative technique.

My friend Mark Osterman offered this very interesting bit of information: "*Sutton had a very nifty way of shooting his negatives dry . . . and I use his technique. A sheet of glass is cleaned and the wet sensitive paper is laid on the glass, sensitive side up. The paper is longer than the glass allowing the ends to wrap around the*

Figure 6–3
France Scully Osterman, *Invitation*, 2005 (whey developed-out positive)
This is a fine example of a whey developed-out 8" × 10" salt print on tissue. There is another version of this image that is segmented and is an impressive 8' × 10' pigment print on Japanese rice paper, hung like scrolls in five sections of 5' × 2' each. *(Courtesy of the Artist)*

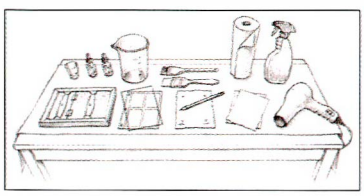
back and stuck down with mucilage . . . remember that great stuff in the bottle with the rubber tip?

"When the paper dried . . . the ends held fast . . . allowing the paper to dry dead flat against the glass. The 'plates' were kept in a light tight grooved box for transport. They are slower than when used wet . . . but 99.9% of the work was landscape. I have one of these boxes in the studio somewhere."

THE WHEY PROCESS

The Whey Process: Milk to Nuts

A few years ago, France Sculley Osterman visited as a guest artist in my advanced alternative process class at the College of Art and Design at Lesley University (it was called the Art Institute of Boston at that time) and presented her version of Sutton's whey process. Her research notes were clear and concise, as you would expect, and the following dialog represents a nice beginning overview, with some additions of my own, of how to introduce yourself to the technique.



MATERIALS AND CHEMISTRY

Papers for the Whey Process

The following types of paper are recommendations that have a decent chance of surviving repeated washing, drying, and chemical stages. Sutton recommended using French papers, as they were sized with starch, and avoiding the gelatin-sized English paper.

- Southworth Resume, 24 lb, white or ivory: Has decent wet strength and doesn't curl. It can also be resized if needed. This is a top choice for the process.
- Crane, 24 lb: This paper comes in white, ivory, and natural and does not require additional sizing. It features moderate wet strength and has slight curling issues that can be dealt with.
- Chateau Vellum, 70 g: A 100% linen paper from the Ruscombe Paper Mill in France.
- Crane Kid Finish, 32 lb: Crane's Kid Finish is one of my favorites and comes in white and off-white. It has good sizing, good wet strength, and slight curling tendencies. Due to its thickness it will require more silver than a thinner stock.
- Bienfang 360: A favorite of platinum and palladium printers but tends to be fragile when wet. It has spectacular translucency if you are seeking fine detail.
- Borden & Riley: This is a 100% cotton rag stock that is difficult to find but is the paper that France favors for this process.

Whey Chemistry

- Whey powder for the new whey or whole milk for the olde whey. If you are going to make your whey from scratch, then you will need some vinegar or rennet, cheesecloth, a stove, and a refrigerator. None of these items will be hard to locate.
- Distilled water
- Silver nitrate crystals
- Glacial acetic acid
- Pyrogallic acid
- Latex, vinyl (or similar type) gloves
- Developing and fixing trays. As a note, Pyrex baking dishes are perfect for the solutions. Be sure to clean them with the same technique you would use to clean an ambrotype plate for wet plate collodion (see the instructions in that chapter) and rinse them with alcohol or distilled water.
- Glass rod, Puddle Pusher, or super-clean plastic rod
- Cotton (rolled or cotton balls)
- Funnel
- pH strips

MAKING WHEY

The Olde Whey

Instead of using dried whey powder, you can make whey from scratch. It's really quite simple. Begin by heating whole milk until it reaches an active boil. Add a little vinegar (or rennet) to the boiling milk and turn off the heat. In a flash, the milk will curdle.

Figure 6–4
Mark Osterman, *Three Graces*, 2003
This is a developed-out salt print made with whey, from a collodion negative, created by Mark Osterman, the taller half of the Osterman alternative process tag-team. Of interest to the reader is that the paper was folded up along the edges to form its own processing tray for development. You can see the folds in the outer edges. This is a nice technique when innovation is called for and uses a minimum amount of chemistry. *(Courtesy of the Artist)*

Filter the solid curds from the cloudy liquid whey through cheesecloth and then filter the solution several more times through tufted cotton balls. The liquid whey will always be slightly cloudy despite the filtering through the cheesecloth and cotton. Use it as is without dilution.

In *Photographic Notes* (December 1856), Sutton recommended a modification of the process: "*that the rennet be washed once or twice to remove the excess of salt; but that a small portion of salt remaining in it is of little importance; it merely renders the paper more sensitive, and the ultimate tint of the picture a shade colder.*"

Note: As a side note, to make fresh cheese from the solid curds, identical to the type you will find in a multitude of Indian dishes such as Saag Paneer, add a little salt to the curds, wrap them tightly in the cheesecloth, and place them on a plate. Place a second plate with some weight on top of the wrapped curds and put it in the refrigerator. To prepare traditional paneer, an acid (usually lemon juice or citric acid) is added to hot milk to create the curds. The curds are strained through muslin and then put under some weight to squeeze out the excess whey. The paneer that remains is a semi-solid cheese that is immersed in ice water for 2–3 hours to give it that familiar shape and texture. That's all there is to it.

Making Whey: The New Whey

This is very simple. Mix together ½ teaspoon of dried whey powder and 8 ounces (a cup) of very warm distilled water. Filter this solution two to three times through cotton or cheesecloth and when done, use it at room temperature.

Saturate your selected and trimmed papers with the filtered whey/milk serum and hang them to dry.

MAKING THE PRINT

Silver & Paper

Sutton's acidic silver formula consisted of the following:

1 oz (29 ml)	distilled water
30 grains (1.95 g)	silver nitrate
1 scruple (1.18 ml)	glacial acetic acid

Here is an alternative formula. Put on a pair of nitrile gloves and proceed to add 17 g of fresh silver nitrate into ambient-temperature distilled water until thoroughly dissolved. Next, add approximately 15 ml of glacial acetic acid until the pH of the silver and glacial acetic acid is 3.5. Filter the solution twice through clean cotton.

Note: All operations from here on, from silvering to fixing, need to be done under a red safe light.

The whey-saturated and dried paper should be coated with your acidic silver solution *immediately before using,* as it is much more sensitive than printing-out paper. Sutton recommended drying the paper thoroughly (before the fire) before introducing the whey to it, rather than immersing it in the whey solution. Try both drying first and immersion and see what works best for you.

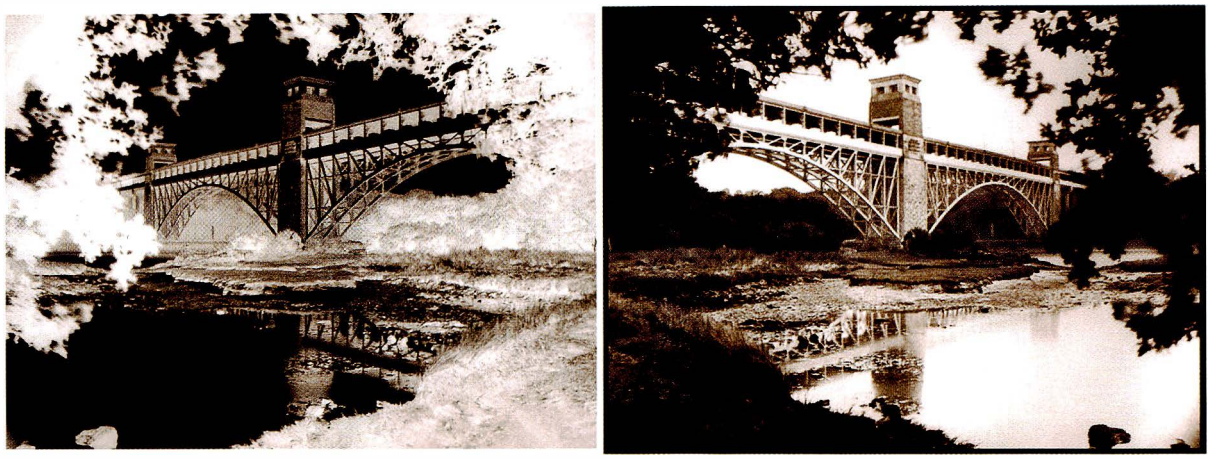
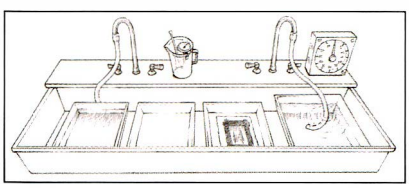


Figure 6–5
Richard Cynan Jones, *Britannia*, 2013
This is another comparative diptych example of the experimentation and craft of Richard Cynan Jones, one of the acknowledged leaders in the resurgence of historic photographic processes. This work follows the instructions of Arsène Pélegry and features a Trutat whey and iodine iodizer and Pélegry's sensitizer. The exposure was 43 minutes using a Petzval Dallymeyer No. 4D lens stopped down to *f*/44. The paper was Canson Marker and was developed in gallic acid 0.8% + 1 ml 14% acetonitrate solution for 35 minutes.
(Courtesy of the Artist)

Soak your paper in the acidic silver solution for 2 minutes, using a glass rod or a very, very clean plastic lab stirrer to try to keep the paper below the surface of the solution. After the 2-minute soak, drain the paper and hang it in total darkness until it is thoroughly dry. This will likely be overnight unless you are in the southwest at high altitude. You may re-use the silver solution, providing it has been stored in a dark environment. You will want to filter it, using a few cotton balls in the bottom of a funnel, if is being re-used. Don't forget that silver and organic matter, like paper, are light sensitive.

Exposing the Whey Paper

Expose the sensitized paper in contact with a negative in a contact printing frame in sunlight or with a UV light source until a very faint, barely perceptible latent image appears on the paper. Progress can be checked under a safelight, or you can do a graduated test strip.



Developer and Development

Be sure to wear nitrile gloves and protective eyewear for mixing and developing. This is especially true when using silver nitrate solutions. Do not touch your face or go near your eyes with your fingers . . . gloved or not. Like the Pt/Pd, kallitype, and collodion processes, the whey print holds a latent image following exposure that is physically developed in an acidic developer that includes small amounts of free silver.

Pyrogallic Acid Developer

This represents a working solution for one 8" × 10" print.

2 g	pyrogallic acid
750 ml	tap water
2 oz	glacial acetic acid (as needed to keep silver nitrate solution at the same acidic percentage)

Development Steps

Step 1 Pour approximately ¼ of the working solution (about 180 ml) into a clean glass Pyrex tray. Immerse the exposed paper and agitate gently. The image should appear very slowly. Develop the paper for 3–5 minutes until there is additional image information and change ceases to be evident.

Step 2 Toward the end of initial development, pour ¼ of your fresh developer solution into a beaker

and add four drops of the silver nitrate solution (approximately 1:12) to it and stir. Pour out your used developer, allowing the print to stick to the glass tray and keeping it from touching the solution that is being changed. Once the used developer is poured out, and while the tray is still tilted, add the new solution with the silver added to the bottom of tray.

Step 3 Rock the tray so that the new silvered solution coats the print evenly. Continue this development as long as possible, watching for subtle changes. This step should take approximately 5 minutes.

Step 4 Repeat steps #2 and #3, gradually increasing the number of silver drops a little each time, until the desired density is obtained. In other words, go from 4 drops, to 6 drops, to 8 drops, etc. Stop developing the print if you begin to see any fogging of your darker values.

A fully developed print will be dark brown to purplish in hue. If the print comes out orange, it means that it was developed too quickly, the negative was too thin, or the print was overexposed . . . this is not difficult to judge. A slower development will give you a more neutral-black-colored print. The density of the negative notwithstanding, contrast is gained by exposing less and pushing the development longer, just as you might expect. Over-exposing more and under-developing will result in lower contrast and more delicate tonalities.

First Wash

After development, the print is placed in a tray of clean tap water. The water should be changed two to three times during this stage. As with salted paper and albumen printing, whey prints can be toned to a variety of hues with gold chloride *prior to fixing*.

Gold Toning Bath

2 grains gold chloride (15.5 grains to a gram)
700 ml distilled water
Baking soda (bicarbonate of soda)
pH strips

Add the 2 grains of gold chloride to the 700 ml of distilled water. Then add baking soda to a gold chloride solution in small quantities until the pH equals 8. Tone the print until it reaches the color you want.

Fixing: 15% Sodium Thiosulphate Solution

2,000 ml warm water
300 g sodium thiosulphate
4 g sodium bicarbonate

Following the gold toner, or the first wash if you decide not to tone the print, the print is placed in a 15% sodium thiosulphate fixer for 5 minutes. Agitate the tray continuously during the fixing stage.

Final Wash

For the final wash, place the print in running water for 30 minutes. Gently agitate and change the water four to five times. In labs where the water is highly alkaline, you might want to consider a last final rinse in distilled water for 5 minutes.

Hang the print to dry. If you decide to tone your print, or not, it will dry to a cooler tonality than it had in its wet state. This is, if you are a regular in the alt process, not an uncommon experience.

Last Thoughts

As always, experiment and enjoy the unknown. Try using oiled or waxed calotypes, digital paper negatives, copy machine negatives, Pictorico films alone or in combination, or simple cliché verre or photograms. Try an assortment of toners such as gold ammonium thiocyanate or heavily diluted selenium, and be open to an assortment of possible outcomes. Also, because the calotype, whey, and salted paper process share many of the same attributes, and many of the same maladies, consult with the related chapters to work out solutions to your problems. An example of this would be Talbot's patent in 1843 of how to eliminate yellowing in the *brights* of his calotypes by immersing the prints in a near-boiling solution of sodium hyposulphate of soda (sodium thiosulphate).

The Cyanotype Process

OVERVIEW & EXPECTATIONS

The cyanotype, or *ferro-prussiate process,* is often the first technique that any of us learn in alternative process photography. Cyanotype is the proverbial "first kiss" that sinks the hook and makes us fall in love with all of the possibilities to come with alternative process image making . . . in much the same way that the wet lab darkroom experience did to all of the image makers who had the pleasure of that experience.

The primary reason for this affection is the absolute simplicity of the process and chemistry and the nearly fail-safe workflow. This is the process that is ideal for both student and teacher alike, as the opportunity of making a great print and experiencing success the first time it is taught or attempted is very high. As an example, I always begin a class or workshop with a 9' × 18' cyanotype mural on pre-sensitized fabric. This bonds a class and facilitates the students' experience in making a beautiful giant-size mural with nothing more than a piece of prepared cotton fabric, sunlight, themselves as the subjects, a hose, an ocean, a stream or plastic trash can filled with water, and a dash of hydrogen peroxide for a cheap thrill finish. In the Cyanotype Variations chapter I will give you a step-by-step guide for making this project work for a class or for a family gathering at the beach.

In this chapter the cyanotype process begins, as always, with a little history to show you where it all came from. I will introduce you to the first woman photographer, Anna Atkins. You'll learn about cyanotype chemistry, how to prepare and use it as a hand-applied ultraviolet (UV) light-sensitive solution to paper and fiber substrates, and how to adjust the cyanotype formula for specific effects and corrections.

Also included is a discussion about alternative substrates, sizing, coating, light sources, exposure, and development in water or acids for additional contrast control. You will also learn about accelerated oxidation, highlight clearing, trouble-shooting, and an abundant number of toning options for the cyanotype . . . just in case the color blue doesn't seem like the right one for the subject in your print.

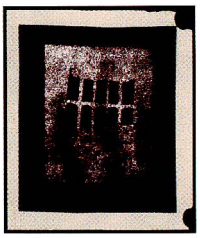
This will prepare you for the following chapter, Cyanotype Variations, where you will learn about inter-media applications, cyanotype on fabrics and optional mural materials, cyanotype on glass, Mike Ware's New Cyanotype process, and combination processes with cyanotype. Let's begin!

Figure 7–1

Christopher James, *Foot of the Pyramid*, 1994 (toned cyanotype)

A demonstration tableau constructed on the lawn of a workshop I was teaching using a plant, a small foot, and a piece of a cardboard box painted black.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

The cyanotype, a technique in the *siderotype* family of iron-based photographic processes, was the first simple, fully realized and practical, non-silver photographic process. Discovered by Sir John Herschel (1792–1871) in 1842, just three short years after the "official" announcement of the discovery of photography, the cyanotype provided permanent images in a vast array of elegant blue values. Herschel, by the way, was a British gentleman who coined the now familiar photocentric words *positive* and *negative, snapshot,* and *photography.*

As an aside, there is strong evidence that the Brazilian inventor and artist Hércules Florence first applied the word *photographia* to describe his images on silver nitrate-coated paper using a camera obscura in 1832–1833. Florence's work was done years after Nicéphore Niepce's unpreserved *retinas* in 1816 and *heliographs* in 1826, but several years before Hippolyte Bayard, William Henry Fox Talbot, and Louis Daguerre were accepting different levels of credit for the medium's discovery. There is no evidence that Herschel was remotely aware of Florence's work or coinage of the word *photography.*

Like many educated and erudite gentlemen of his era, Herschel was involved in a great many activities in a universe of disciplines as diverse as science, the arts, literature, travel, and virtually any activity that would raise his stock as a *Renaissance man* and interesting dinner guest. He was rightfully considered one of the greatest scientific minds in Europe and was renowned for his skills as a mathematician and astronomer, as was his father.

Herschel's imagination was ignited with the new science of making images with light and chemical reaction, and he immersed himself in that field of study. Among his photographic discoveries, Herschel developed the argentotype, in which ferric citrate iron salts were used to precipitate silver under the influence of UV light. These salts were subsequently developed in a solution that included silver nitrate. He also developed a lovely and

Figure 7–2
Anna Atkins, *Cyanotype Specimen*, 1842
Anna Atkins could correctly be called the first woman photographer. The Atkins and Herschel families resided only 30 miles apart in Kent, England, and Atkins's botanist father, John George Children, and Sir John Herschel were peers and contemporaries. Mr. Children was a member of the Royal Society, and when his friend Sir John announced his discovery of the cyanotype (1842), he passed the news on to his daughter Anna. Although there is no conclusive evidence that Herschel was Atkins's mentor, it is more than likely that she learned the cyanotype process in the Herschel household. If not fact, then at least it's a first-rate legend.
(Photography Collection; Harry Ransom Center; The University of Texas at Austin)

odd technique described in the Anthotype chapter of this book that involves crushed flower petals, a little alcohol, and a 2–3-week exposure in sunlight . . . coincidently, the three key ingredients for an outstanding vacation.

Herschel was a gentleman scientist, and like others within the social circle he traveled in, his investigations were instigated by the concept of experimentation for the love of satisfying puzzling curiosities and for the honor of presenting an important paper or idea to distinguished and scholarly societies. Often, the investigations

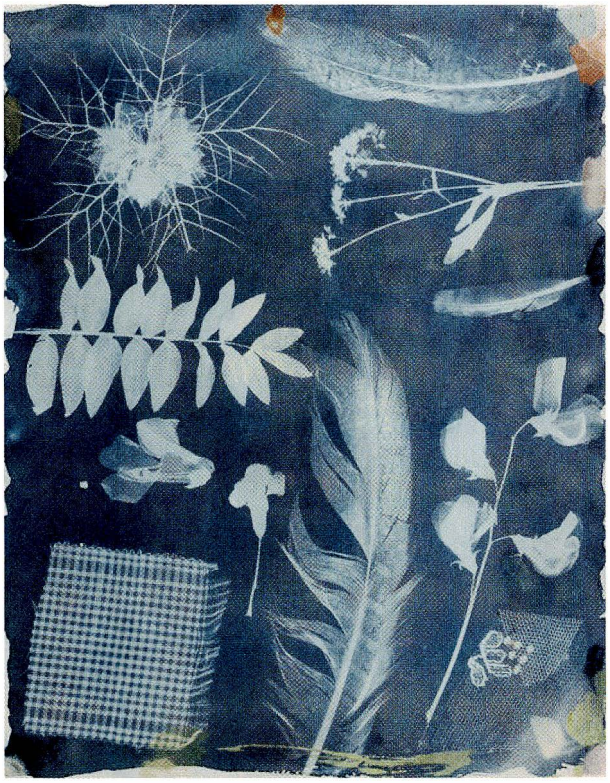


Figure 7–3
Hippolyte Bayard, *Arrangement of Specimens*, c. 1842
There were quite a few brilliant gentlemen working on the same idea in the early 1800s. They included Brazilian, Hércules Florence (who first applied the word *photographia* to describe his images on silver nitrate-coated paper using a camera obscura in 1832), Nicéphore Niépce with his unpreserved *retinas* in 1816 and *heliographs* in 1826, and Talbot, Herschel, and Bayard. This is one of Bayard's cyanotype photograms from around 1842.
(The J. Paul Getty Museum, Los Angeles)

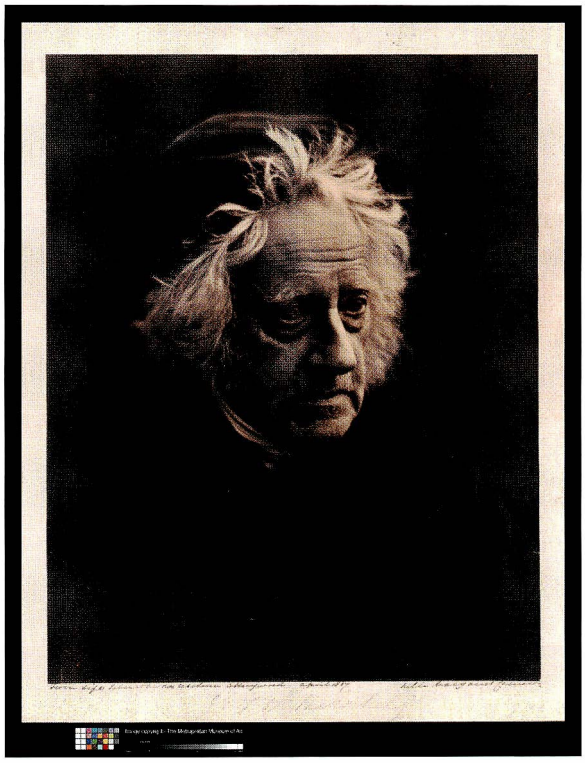


Figure 7–4
Julia Margaret Cameron, *Sir John Herschel*, 1867 (albumen from glass plate negative)
Julia Margaret Cameron began her career as a photographer in 1849, shortly after returning to England from India. Her work balanced upon the ideals, and allegories, investigated by the Pre-Raphaelites, a group of artists who despised industrialization and yearned for the return of the mythic heroes and romanticism of Camelot. Her style, represented by this portrait of Sir John Herschel, is an example of the principal innovation she brought to the medium, the close and uncompromising psychology of the subject before her camera.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

and ideas had practical applications, and I suspect that when Herschel was playing with iron salts and extracts from the flowers in his garden, he had no conceptual reference to imagine that making pictures of life in photograms, or with a box of air when employing a camera obscura, would one day be credited as a significant part of one of the most important, and universally loved, forms of expression on Earth.

Between 1839 and 1842, Herschel conducted hundreds of separate experiments on the light sensitivity of silver salts, metals, and vegetation. A fair percentage of these experiments were dedicated to the idea of making colored photographic images as a way of distinguishing his work from that of his peer, and friend, William Henry Fox Talbot, who was successfully making photogenic drawings and calotypes in brown. In that quest, he embarked on an investigative mission to discover highly colored dye extracts of flowers from his garden that might show evidence of being light sensitive. This work led to the invention of his charming anthotype process.

Another tangent of Herschel's experimentation dealt with an investigation of potassium ferricyanide. This aspect of his work was greatly augmented by Dr. Alfred Smee's work in electrochemistry, which led Smee to a refined variation of potassium ferricyanide produced through electrolytic oxidation that he was generous enough to share with Herschel in 1842.

Dr. Smee, in his early 20s at the time, responded to a request from the 50-year-old Herschel for

"deeply-colored salts" that might be "bleached" or reduced by light. In reply, Dr. Smee sent a parcel of bright red potassium ferricyanide as well as a new chemical substance he was working with at the time, ammonio-citrate of iron, that had only recently become available to chemists and physicians as a prescription remedy for patients who were in need of an iron tonic to stimulate physical energy and to correct certain gastrointestinal maladies.

Working with Dr. Smee's chemical gift, Herschel observed that the ammonio-citrate of iron, a.k.a. ferric ammonium citrate, was quite sensitive to sunlight and that exposure to UV rays would reduce the salt of the iron from a ferric iron Fe(3 +) state to a ferrous Fe(2 +) state. At this point in the process, the newly reduced ferrous irons were free to react with the potassium ferricyanide in the sensitizer.

When a cyanotype sensitizer solution of ferric ammonium citrate and potassium ferricyanide, the two primary chemicals in the cyanotype process, are combined, coated on a paper, and exposed to UV light, they are reduced to ferrous ammonium citrate and potassium ferricyanide, which then forms ferric ferrocyanide, the well-known and insoluble Prussian blue. This vibrant and deep-blue-colored pigment was synthesized by Johann Jacob Diesbach in Berlin in 1706 and first used by the Dutch painter Pieter van der Werff in 1709 in his painting *The Entombment of Christ*. The name Prussian blue is derived from the use of prussic acid and ferrocyanide. *Ferricyanide* is translated

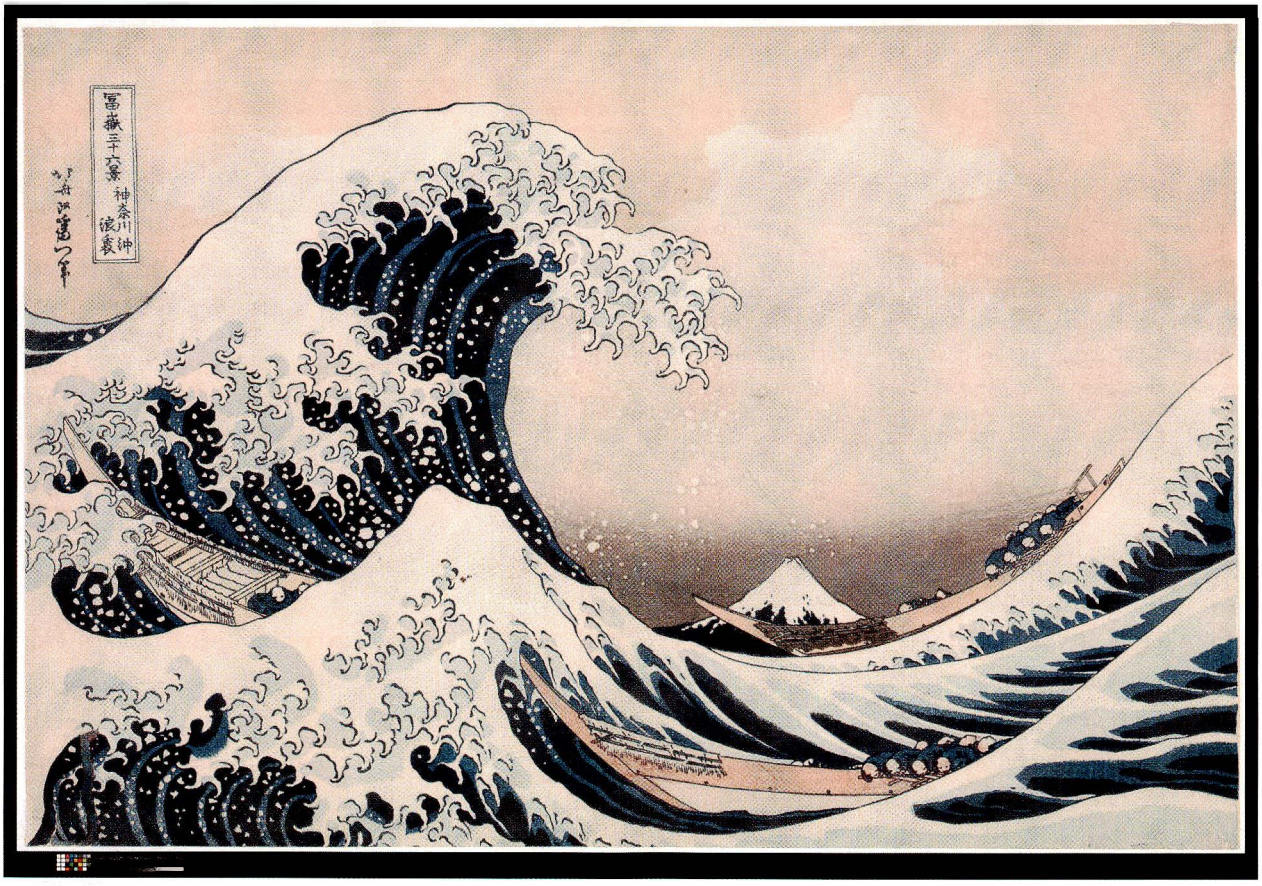


Figure 7–5

Katsushika Hokusai, *The Great Wave Off of Kanagawa*, 1826

Hokusai's *The Great Wave off Kanagawa* is an ukiyo-e woodblock print created around 1826 and is perhaps the most recognized work of Japanese art. It is part of a larger series by Hokusai called *Thirty-six Views of Mount Fuji*. Ukiyo-e, *(pictures of the floating world)*, is a genre that was created for the upper merchant class and depicted a romanticized and ideal cultural perspective. This style flourished in Japan during the flourishing Edo period (1603–1867). What is striking about this piece of work is the profound dark Prussian blue used by Hokusai . . . a new pigment material for artists that was imported from England through China.

(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

as "blue substance from iron" from the Latin *ferrum,* meaning iron, and the Greek word *kyanos,* meaning cyan or dark blue.

Herschel's Original Cyanotype Formula

Solution A

20 parts	ammonio-citrate of iron (ferric ammonium citrate)
100 parts	water

Solution B

16 parts	potassium ferricyanide
100 parts	water

Mix equal volumes of A and B for sensitizer.

The cyanotype was popular for a short time and experimented with by many, thanks to a commercially produced Ferro Prussiate Cyanotype paper. The first commercial use of the cyanotype was initiated in 1876 at the Philadelphia Centennial Exposition, and this industrial application heralded the adoption of the process for schematic blueprint drawings used by engineers and builders for the next century.

An odd historical nugget concerning the cyanotype involved Lt. Col. Baden-Powell, founder of Scouting For Boys (a.k.a. the Boy Scouts). Apparently, Baden-Powell mandated that the cyanotype process be used to make stamps and money during the Siege of Mafeking in the Boer War between Great Britain and the Transvaal (1899–1902). In a modest demonstration of self-importance, he ordered that his own likeness grace the oval-framed portrait in the center of the new currency, which was normally reserved for the portrait of Her Majesty Queen Victoria.

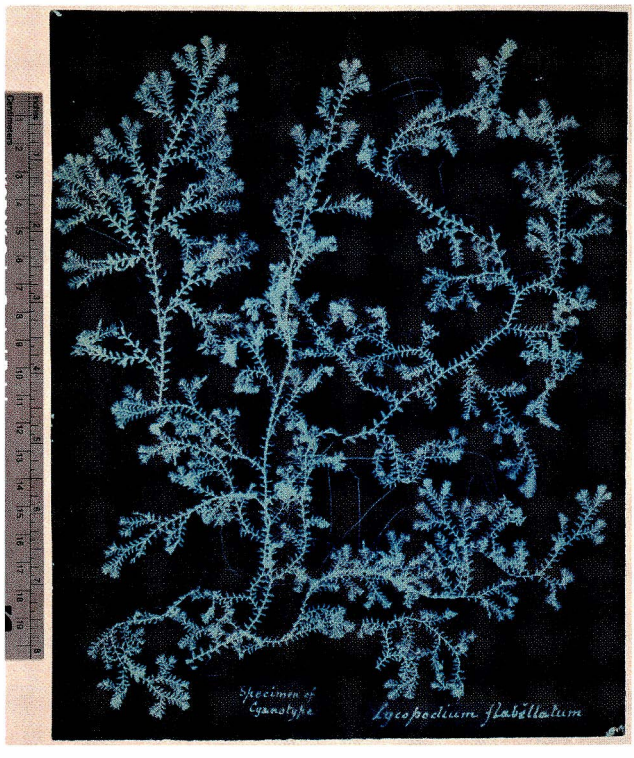


Figure 7–6
Anna Atkins, *Lycopodium Flagellatum*, 1843
This image is from the very first published volumes illustrated with photographic images, *British Algae: Cyanotype Impressions* (1843--1853). Anna Atkins created this three-volume anthology over a period of 10 years. There are few known examples, but one of the surviving manuscripts, published in October 1843, had 231 photograms and was dedicated to her father, John George Children. It is in the Spencer Collection (1843 93-440) and can be seen online atthe New York Public Library web site. *(Photography Collection; Harry Ransom Center; The University of Texas at Austin)*

Anna Atkins: The First Woman Photographer

Anna Atkins (1799–1871) has, until recently, been referred to sparingly by traditional photo and art historians in spite of having produced a significant body of photographic work at the very beginning of the medium . . . to a degree where she could justly be called the first woman photographer. She constructed wonderful cyanotype photogram images of algae, ferns, feathers, and waterweeds using Herschel's cyanotype invention. The Atkins and Herschel families resided only 30 miles apart in Kent, England, and her botanist father, John George Children, and Herschel were peers and contemporaries. Children was a member of the Royal Society, and when his friend Herschel announced his discovery of the cyanotype (1842) he quickly passed the news on to his daughter Anna. Although there is no conclusive evidence that Herschel was Atkins's mentor, it is more than probable that she learned the cyanotype process in the Herschel household. If not fact, then at least it's a romantic legend.

Anna Atkins made thirteen known versions of her work titled *British Algae: Cyanotype Impressions* (1843–1853). In October 1843 she began publishing folios of her photogenic (photogram) drawings. In 1850, she began to publish more comprehensive collections of

her work, completing a three-volume anthology in 1853. These books, containing hundreds of handmade images, were the very first published works to utilize a photographic system for scientific investigation and illustration. Although Atkins published in 1843, Talbot, with his *Pencil of Nature* (1844–1846) publications, is usually credited by historians as the first to have achieved this important milestone.

Note: Sir John Herschel was the former owner of a copy of Atkins's manuscript that now resides in the archives of the New York Public Library. Photographs of *British Algae: Cyanotype Impressions—Part I* was published in October 1843, has 231 photographs, and was dedicated to Atkins's father, John George Children. The manuscript resides in the Spencer Collection, Cat #: 1843 93-440, and can be seen online at the New York Public Library web site. Other examples of Atkins's work can be found at the Harry Ransom Humanities Research Center at the University of Texas, the Getty Museum, and public, institutional, and private collections in the United Kingdom and the United States. The work also exists in printed form: Aperture published Larry Schaaf's book, *Sun Gardens: Victorian Photograms by Anna Atkins*, in 1985. Schaaf's beautiful book is out of print, but an Internet search will likely lead to a copy.

Figure 7–7
Anna Atkins, Book Cover, 1843
The cover of Anna Atkins's book, *British Algae: Cyanotype Impressions*. The first volume of this major work was published in October 1843. Her books, containing hundreds of handmade images, were the very first published works to utilize a photographic system for scientific investigation and illustration. Although Atkins began publishing in 1843, Talbot's *Pencil of Nature* (1844/1846) publications are often given credit for being the first by ill-informed photo historians.
(Copyright © National Museum of Photography, Film & Television / Science & Society Picture Library)

HOW CYANOTYPE WORKS

The Process

Cyanotype is a UV-sensitive contact printing process that requires, as do most alternative photographic processes, a negative the same size as the final print. Of course, you can use transparent, translucent, or opaque objects to make cyanotype photograms, as Anna Atkins did with her photograms of ferns.

The blue color of the cyanotype print is the result of the reaction of ferrous ions from the photo reduction of ferric ammonium citrate in combination with potassium ferricyanide. The cyanotype image is highly stable but can be degraded by something alkaline, such as sodium carbonate. It will also fade, like most things left in UV light, if exposed to direct sunlight over a period of time. Should you experience this fading, your image can be restored to its original blue intensity by putting it in a dark environment for a day or two.

Contrary to some teaching, the cyanotype print can be controlled well enough to yield technically exquisite images. Cyanotype prints can also be toned with a vast assortment of toners to provide alternatives to the color blue, and many of these toning options are described later in the toning cyanotypes section of this chapter. Cyanotypes are also employed very successfully as first impressions in the gum bichromate or Blue-Van-Dyke processes and can also be used, with excellent results, to delicately intensify shadow details in other processes such as platinum/palladium.

Figure 7–8

Edward Steichen, *Moonrise—Mamaroneck*, New York, 1904

On February 15, 2006, an astonishing price of $2,928,000.00 was paid for this print, by an unidentified collector at a Sotheby's auction. This was the highest price ever paid for a photographic print that been made with a single negative. In this version of the image, the print is realized through a combination of platinum and cyanotype processes.

(Image © The Museum of Modern Art/Licensed by SCALA / Art Resource, NY;© PERMISSION OF THE ESTATE OF EDWARD STEICHEN)

THE CHEMISTRY

Cyanotype Sensitizing Formula

There are two primary chemicals that constitute a traditional cyanotype formula, and these are mixed together in equal parts from A & B stock solutions. Combining Part A (ferric ammonium citrate) and Part B (potassium ferricyanide) will constitute a working sensitizing solution that may be applied to paper or fabric substrates using a variety of techniques such as painting with a hake, foam, or Richeson synthetic brush, or by spraying or immersion. Neither of these primary chemicals poses a health risk unless you are one of the very rare individuals who have an allergic reaction to the chemistry. Ferric ammonium citrate is often found in iron and vitamin supplements and is mostly just annoying if it becomes humidified and sticky. Potassium ferricyanide is a stable compound that only becomes a risk to your health if it's heated beyond 300°F or combined with an acid . . . neither of which you will be doing. I will add that in the decades I have been teaching this process, to people of all ages, I have never seen an allergic skin reaction. Stains on hot humid days, yes . . . but that will wash and fade away in a day.

Part A—Ferric Ammonium Citrate (Green Type)

In the green powdered state, ferric ammonium citrate (ammonio-citrate of iron) is a light-sensitive compound that changes from a *ferric* (iron III) to *ferrous* (iron II) state when subjected to UV light.

I refer to this chemical in my classes as the "light-trigger," as it is responsible for the light sensitivity of the sensitizer.

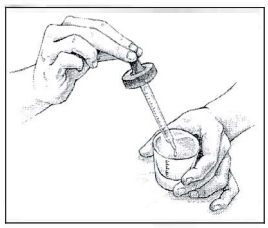
Once mixed into the solution it is, depending upon how it is stored, subject to mold growth after a relatively short period of time. This moldy surface skin state is not detrimental to your cyanotype ambitions and can be avoided by adding a drop or two of formalin (formaldehyde) or a crystal of thymol to the solution. If mold does appear, it is easily strained off by decanting the solution through a coffee filter. In some cases in which the mold has a tangible thickness, it can simply be skimmed off the top of the solution with a pair of chopsticks. In any event, this mold growth is not something that should cause you to lose any sleep. In hot and humid weather, try not to let the chemical sit out in the open too long before mixing it into the solution. Regardless of the mold warning, this chemical, mixed into a stock Part A solution, has a reasonable shelf life.

Part B—Potassium Ferricyanide

Potassium ferricyanide is the other half of the sensitizer formula and is responsible for the blue color when combined with the recently converted, under the influence of UV light, *ferrous* ammonium citrate. If the chemical is in good condition it should be a nice orange-red color, sometimes referred to as "ruby red." If it is in bad condition you'll see yellow lumps and you should avoid using it.

Potassium ferricyanide is not particularly toxic, because the cyanide group in it is bound to the iron atom and is not free to behave as a poison. However, the cyanide part of this chemical has the potential to be released as a hydrogen cyanide gas if it is subjected to a strong acid . . . which is, again, something you will not be doing.

Be diligent about avoiding acid contact. You will most likely use everything you mix, but in the event that you need to dispose of this chemical you should adhere to the following: small portions of potassium ferricyanide should be diluted with excessive amounts of water and flushed. The chemical should never be thrown in the trash in its dry, ruby red, out-of-container state, as it has the ability to become self-combustible.



Making the Sensitizing Solution

You will need a plastic or glass mixing beaker and two dark glass, or dark plastic, 500–1,000 ml containers for the mixed solutions. Try to leave as little air space as possible in the Stock A & B bottles. The easiest way to introduce yourself to the process is to purchase a pre-measured dry or wet pack Cyanotype Kit from a supplier such as Photographer's Formulary or Bostick and & Sullivan. Honestly though, the formula for this process is so elementary and hazard free that it is a perfect process to make from scratch using raw chemistry while simultaneously teaching yourself to use a gram scale. The best place to get a digital gram scale is to go to an auction site, such as eBay, and search for a compact digital jeweler's scale . . . my students jokingly refer to them as dealer's scales. They are very inexpensive, are portable, light up in the dark, and are totally simple to use.

If you are frugal and intend to do large pieces or a sizeable print run, keep in mind that kits from any source literally cost as much as a virtual lifetime supply of cyanotype solution made from dry chemicals. Bostick & Sullivan, Artcraft, or Photographer's Formulary will sell the raw chemistry to you. After buying the chemistry in bulk, all you will need is that gram scale and some basic lab equipment. The following is the classic cyanotype sensitizer recipe. With the exception of Dr. Ware's New Cyanotype, which will be discussed in the following chapter, it is considered the standard cyanotype formula.

Standard Cyanotype Sensitizing Formula

Stock Solution A

400 ml water (68°F)
100 g ferric ammonium citrate (green type)

Add water to make a total solution of 500 ml.

Stock Solution B

400 ml water (68°F)
40 g potassium ferricyanide
Add water to make a total solution of 500 ml.

Parts A and B can be separately mixed in normal ambient light and will work best after a ripening period of 24 hours.

The Part A and B cyanotype solutions, if stored separately in dark glass or opaque plastic containers with a good seal, will keep for quite a while. When mixed together, their shelf life is far shorter. In ideal cool and dry conditions, they may last several weeks. My advice is to mix the two stock solutions together when you intend to use them. The sensitizer is so simple to prepare that there really isn't a good argument for having a combined A & B solution always at the ready.

Sullivan's Cyanotype Sensitizing Formula with Oxalic Acid

Stock Solution A

400 ml water (68°F)
100 g ferric ammonium citrate (green type)
2 g oxalic acid
Add water to make a total solution of 500 ml.

Stock Solution B

400 ml water (68°F)
40 g potassium ferricyanide
2 g oxalic acid
0.8 g ammonium dichromate
Add water to make a total solution of 500 ml.

The oxalic acid in this formula assists in keeping highlights clean and bright. The ammonium dichromate

Figure 7–9
Christopher James, *Self Portrait with Pinhole,* Maine, 1994
(Courtesy of the Artist/Author)

has a similar role in the formula, but be careful, as ammonium dichromate, no matter how little is added to the mix, will have a big impact on the contrast of your tonalities within the print. If I was really concerned about getting higher contrast into my cyanotypes—and the process is going to give you that without too much effort anyway—I would recommend making a higher-contrast contact negative using Pictorico Ultra Premium OHP inkjet film or add a few drops of a saturated ammonium dichromate to the first development wash.

Standard Working Solution

Mix equal parts of 500 ml of ferric ammonium citrate Stock A and 500 ml of potassium ferricyanide Stock B to make 1,000 ml (1 liter) of working cyanotype sensitizer solution. A healthy sensitizer will be a clear yellow-green color. This is also the color that your dried paper or fabric should be just prior to printing. If you notice that the surface of your substrate, paper, or fabric is showing uneven blue or grayish-green stained areas, it is likely that your substrate has been fogged or subjected to high humidity or dampness prior to use.

A Brief Word About Non-standard Mixes

It is a totally acceptable idea to alter the chemical composition of the cyanotype formula in order to achieve variations in density. I've found that increasing the percentage proportions of both the potassium ferricyanide and ferric ammonium citrate to water will result in an increase in the density of the blue. This solution may solve the chronic fading problem that has plagued cyanotype on cotton fabrics in the last few years due to the quality of cotton being compromised by additives in manufacturing. If, however, only ferric ammonium citrate is increased, you will often experience a "bleeding" of the shadow portions of the print.

Figure 7–10
Lisa Elmeleh, *Self*, Santa Fe, 2006
Lisa Elmaleh, now one of the leaders in the alternative process world, produced this piece in one of my alt pro workshops in Santa Fe in 2006. Everyone who knows Lisa will agree that this image is an accurate interpretation of her delicate and introverted personality.
(Courtesy of the Artist)

An increase in only the potassium ferricyanide will result in a print with reduced densities in those same values. This last observation is dependent, of course, on the type of paper you are using and how that paper was made.

Low-Contrast/High-Contrast Solutions and Controls

Contrast control in cyanotype is, as in almost every alternative process, a case of controlling the tonal values of your contact negative, whether it is a conventional silver gelatin film or a digitally produced ink jet film. That said, it is common to experience a fairly moderate loss of tonal gradation during the washing, toning, and drying stages of the cyanotype process. The following suggestions are options you might wish to entertain if your image was made from a negative that was less than perfect for the process and that may be exhibiting problems of too high, or low, contrast for your taste.

A simple solution for reducing contrast is to dilute the standard working sensitizer solution with a small percentage of distilled water. As you dilute the sensitizer, the gradations in the cyanotype print become softer . . . like adding water to soup. You may also create a lower-contrast image by developing out the image in an acidic solution such as the white vinegar concentration described later in this chapter. Another method of controlling contrast is coating your paper, before the cyanotype sensitizer, with one of a variety of weak acid solutions, such as 1% oxalic acid or 1% glacial acetic acid. In most cases, depending on the paper you are using, an acid bath will intensify darks and extend the visible tonal range.

This tonal separation is most noticeable in the lower end of the highlights. Be aware that regardless of the increase in density, this pre-sensitizer acid-wash technique will often flatten the mid-range values and take the thrill out of the highlights by extending the range and lowering the contrast. You can also achieve lower contrast appearance in your image by using direct sun as your UV source. Cyanotype exposed by sunlight tends to provide a longer tonal range than does a mechanical UV light and thus creates a lower-contrast image by a light-to-dark association. This observation changes when exposures are made with color layered digital negatives, different intensity light boxes, and open shade outdoor exposures.

This open shade technique, one that I use in many alternative processes, is a really simple solution to increasing contrast. Depending on time of day, with mid-day summer sun being best, perform the bulk of your exposure in open shade until the color of the open areas of the negative begin to turn a silvery gray. Then, to intensify your shadows, continue the exposure in direct sunlight.

Figure 7–11
Christine Baczek, *Colorado Columbine (Aquilegia coerulea)*, 2012 (cyan on clear glass)
Christine writes, "Discovery and perception are at the heart of this body of work titled Sensitive. Using the canyons and mountains of Northern Utah, these cyanotype photograms on glass reference the first photographic book, Photographs of British Algae: Cyanotype Impressions, by Anna Atkins (1843). The work begins in darkness. Backlit by a motion sensor activated light array, the viewer awakens the piece. Meant to open a dialogue about the sensitive environment we live in, Sensitive reinvents landscape photography."
(Cyanotype on glass from the series Sensitive. *Courtesy of the Artist, Christine Baczek)*

Adding a 1% Dichromate to the Sensitizer for Contrast

A higher-contrast solution can be mixed by adding 4 to 6 drops of a 1% solution of potassium or ammonium dichromate to every 2–4 ml of the standard A & B sensitizer mix. This modest addition to the sensitizer will often let you print a poorly defined negative, but it may also degrade a portion of the middle tonal values and highlights, resulting in a far shorter value scale. To make a 1% solution, mix 1 g of potassium dichromate with 100 ml of distilled water. In my experience, potassium dichromate is less aggressive than ammonium dichromate and allows more control of this technique.

0.2% Potassium Ferricyanide First Bath for Contrast

A solution for achieving greater contrast following exposure is to immerse your exposed cyanotype print in a water bath containing 0.2% potassium ferricyanide . . . in place of a plain water development bath. This bath is made by mixing 2 g of potassium ferricyanide in 1,000 ml of water.

A similar contrast boost effect can be realized by adding a few drops of an ammonium, or potassium, dichromate solution to the initial water development bath. These percentages can range from 1% to 10%, and the exact amount that may be effective will depend on the strength of the percentage that you elect to use and the state of flatness in your print . . . you decide.

Note: Dichromates are carcinogenic, and you must take precautions when working with them. Please consult the chemical section for working recommendations.

Begin testing by making a batch of identical exposures through a Stouffer T2115, or equivalent, step-graded transparent scale. Process the first print in plain water as a control. Then make a specific dilute ammonium, or potassium, dichromate solution and add 10 to 15 drops to a liter of water and process a second test print. Write down the information and record your results. Then, add either more dichromate, or water, and make a third test. Proceed with the testing until you have established a set of working parameters that you can use effectively.

Figure 7–12
Francis Schanberger, *Ginko Photogram Coat*, 2005
Francis Schanberger's working method is a synthesis of past and present, memory and imagination. He carries an old wooden tripod, a view camera, and a lab coat, and his cyanotypes pay homage to nineteenth-century naturalists Herschel, and Atkins. Francis once worked in a cell biology lab where it was considered bad form to wear one's lab coat out of doors. Francis imagines himself an anachronistic scientist alter ego. His doppelganger always wears a lab coat outdoors, his laboratory is nature, and his body's senses are just the instruments to divine its wonders.
(Courtesy of the Artist)

Double Coating to Increase Density

Contrast can also be managed in other ways. If you let a first coating of sensitizer dry thoroughly and then recoat it with a second application of sensitizer you will notice a remarkable increase in the density of the darker values. This makes sense depending on the paper you are using. With fibers, immersion works with similar effectiveness. Image density in the darker values is intensified well enough to merit this option simply as a matter of standard practice even when not experiencing exposure problems. Double coating will often mean that your standard exposure time will be a little longer than when you used a single coating. The best option is to make a

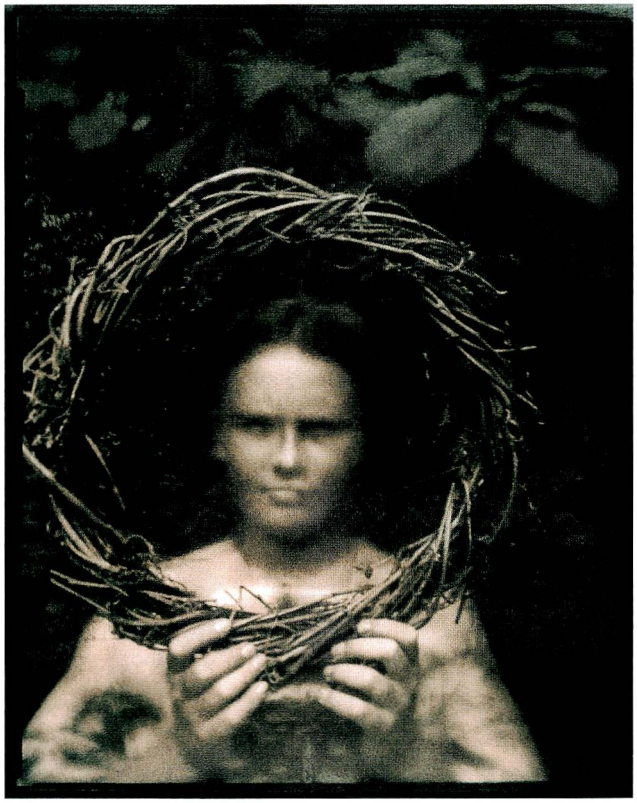


Figure 7–13
Sarah van Keuren, *Seth Holding Wreath,* 1996 (gum over cyanotype)
University of the Arts professor Sarah is one of the leading alternative process artist/teachers working today. This is an example of her combination cyanotype with a gum bichromate second printing. *(Courtesy of the Artist)*

great negative that is well-matched to the process, double coat a standard sensitizer, and make an exposure in good UV light at the optimum time of day . . . or use an exposure unit.

Coating on Gum Sized Paper to Increase Density

Another option that you might find interesting is to make your cyanotype on a piece of paper that has been sized and prepared for gum bichromate printing (e.g., gelatin hardened with glyoxal). Of course, this advice is dependent upon what kind of paper you are working with but is a very good idea if you are intending to follow your cyanotype print with a gum bichromate process and application of colors. In this case, the cyanotype takes the place of your blue gum bichromate pass and gives you a nicely detailed image to register subsequent gum passes on.

THE NEGATIVE

The cyanotype is a contact printing process . . . like a photogram. I have had success with a wide assortment of negative types and can usually get a good-looking print by adjusting the way I work to fit the negative's potential. This is one of the primary reasons that the process is such a great one to begin learning alternative techniques with . . . success comes quickly, even for the rookie. I really do not have a specific suggestion for a cyanotype negative. I've heard a lot of theories that recommend using a negative that would print well on a paper grade of 0 to 1 (indicating a contrasty negative with an average density range between 1.1 and 1.4) and that this particular type will do well with a standard A & B sensitizing formula. This is true. However, the same success can come from negatives that do not meet this recommendation. My best advice is to make a nice negative with a good degree of tonal personality and learn the process with it. Just a quick reference to the digital and negative chapters . . . the "less than fussy" personality of cyanotype makes this a great process for learning, in tandem, the production of digital contact negatives. Just be sure to make your negative deep and rich, versus pale and pointless, and you'll be in good shape. Be sure to check the negative sections in several other chapters including the Gum Bichromate, Platinum/Palladium, and Digital chapters.

PAPER & FABRIC SUBSTRATES

Almost any type of paper or fabric can be used with the cyanotype process. This is entirely dependent upon what your intentions are before and after the print has completed its cyanotype journey. Cyanotypes can be enormously successful when combined with gum bichromate, collage, montage, artist's books, monotypes, printmaking, painting, paper sculpture, clothing, and installation. One of the primary reasons for this is that it is a very simple process to adapt and that after the sensitizer, all you will really need is water. Those options will determine which surface will be appropriate.

Generally speaking, the best paper to use for a single image will be a quality hot or cold press paper like Arches Platine, Legion Revere, Fabriano Artistico,

Lana Aquarelle, Cot 320, Saunders Waterford, Somerset Book, Crane's Platinotype, or any decent watercolor paper. Watercolor papers of all types work well, as do alternative papers such as newsprint, stationary, inkjet prints, and butcher's paper. These alternatives to a standard art paper work with varying degrees of success, so be prepared to experiment. Try any paper that won't break apart in water. Try colored papers for alternative toned highlights or try a watercolor paper with vegetable dyes, teas, or coffee before making your cyanotype.

The art papers mentioned are neutral pH (in the middle of being acidic or alkaline and therefore considered a good bet for an archival rating) and already have a good sizing built into them during manufacturing. This indicates that they are specifically made to withstand the rigors of extended immersion times in liquids.

Other paper options, some of them esoteric, that withstand the rigors of wet processing are those such as the 22" × 30" Gampi Torinoko and Hahnemühle etching paper that you can purchase by the roll. There are a wide variety of rice papers available at well-stocked art supply stores, though I would recommend buying small pieces to test before committing to large amounts. One paper that is fun to work with is a roll paper, 18" × 50 feet, that is simply labeled Oriental Rice Paper for Sumi. The paper is tenaciously strong in water almost to the point of being like fabric.

Generally, sizing beyond the manufacturer's own process is unnecessary for cyanotype and will only be relevant if you intend to extend your ideas with other processes, such as gum bichromate or platinum/palladium. With cyanotype, whether you size or not is really dependent upon the original attributes of the paper you buy and what your intentions are. If you feel sizing is called for, you can simplify your life by adding a ml or two of liquid gum arabic to each 40–60 ml of the cyanotype A & B sensitizer mix. This will help suspend the coating on the paper's surface. Here is a modest list of a few papers that work well with this process. In reality, almost anything will work, and some of the best work I've seen has been printed on the pages of the *New York Times* and road maps.

Figure 7–14
Michele Robins, *Tokyo Harbor*, 2006 (cyan on map)
Michele, a Ph.D. Clinical Associate at the University of Pennsylvania Medical School, made this outstanding cyanotype using a map of Tokyo as her substrate. *(Courtesy of the Artist)*

- Arches Platine—moderate smoothness, can be delicate, nice finish
- Arches hot press watercolor (take your pick for weight)
- Arches Aquarelle—best for gum/cyanotype combination printing
- Bergger COT-320—a beautiful hot press finish paper for most processes; a bit precious cost-wise and lately hard to get
- Buxton from Ruscombe Mills—one of the very best papers for cyanotype and made by Chris Bingham in collaboration with Mike Ware
- Cranes AS 8111—lightweight, kid finish, stationary
- Cranes Platinotype—one of the very best! Smooth gradations, holds up well in water, hot press, works well with many processes
- Fabriano Artistico hot press, works well, rather thick with great surface
- Hahnemühle Photo rag inkjet paper and printmaking paper
- Kozo rice paper—made from mulberries. A delicate and translucent paper with a great wet strength; dry thoroughly to "rest" the paper before toning
- Stonehenge HP 245 gsm
- Strathmore Bristol—very smooth surface, *but* tends to separate and break down in long immersions due to the paper strata employed in the making of Bristol

Making a Paper Hammock

If you are going to use a delicate paper, you should make a lifting device out of plastic screening for raising and lowering your print in, and out of, the trays. Think of this as a paper "hammock." To make it, cut a length of plastic window screening and staple it to two wooden dowels at either end of the screening. You'll be raising and lowering the screening by holding onto the dowels, which will extend over the edges of the tray when the paper is at rest in the liquid.

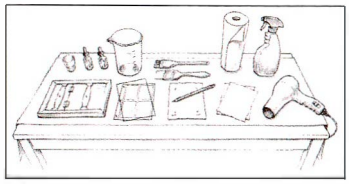


TABLE SETUP FOR CYANOTYPE

- Cyanotype sensitizer Stock A & Stock B: (ferric ammonium citrate and potassium ferricyanide)
- Plastic beaker for brush application of sensitizer
- Pipette for drop count volume
- Good quality shot glass for sensitizer drop count
- Clean paper for the table surface coating area
- Rag content paper for coating
- Richeson synthetic brush or old-school hake brush
- Beaker with water for rinsing the brush after coating
- Distilled water
- Pencil
- Hairdryer
- Contact printing frame
- Negative or photogram materials for contact printing

BRUSHES

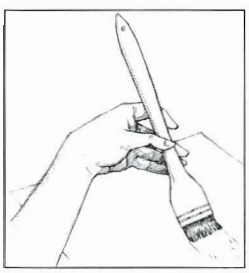
There are several ways to coat your substrates with cyanotype sensitizer, whether it is paper, wood, fabric, or glass. A total immersion technique is the best method for fabrics, certainly easier than spraying the sensitizer but requiring a great quantity of chemistry. Still, it's uncomplicated, and if you're mixing from bulk chemistry this will be of little concern to you, as it is so economical. Spraying with a garden-type misting bottle or a used Windex bottle is a suitable application technique for 16" × 20" and larger paper sheets. I think the best method for paper under 16" × 20" is to coat with a 1.5"–4" wide Richeson synthetic brush, hake brush, or inexpensive foam applicator.

The foam brush is inexpensive and available everywhere. The hake brush is a traditional Japanese instrument and has been used forever as the brush style of choice for alternative process applications. Both brushes

are made without metal *ferrules* (the metallic section that holds the brush hairs to the handle), which may cause problems in a few of the more sensitive alternative processes should metal come into contact with your sensitizer chemistry. Honestly, I've never seen this problem and actually have heard of a teacher who coated with a steel wool pad to see if it were true. Apparently everything worked out fine. Within the last few years, I have been using, and teaching with, a beautifully made synthetic brush made by Richeson that is available through better art suppliers and online at http://www.jerrysartarama.com, which I frequent because of its deep discounts on quality brushes, paints, and art supplies.

Hake Brush & Super Glue

If you decide to go the traditional route with a hake brush you will want to take advantage of this advice. Japanese hake or Chinese Jaiban brushes are made of wood and stitched hairs. Some styles are better than others. Be sure to always buy the most expensive you can find. They are desirable for alternative process coating due to their lack of metal ferrule, their long life expectancy, and their esthetically organic look and feel. The only problem with these lovely brushes is their tendency to shed hairs as they get older, and these show up regularly during the coating. A solution to this shedding problem is simple. When you buy the brush, prepare it for a lifetime of service by running a single bead of superglue along the hairs where they come into contact with the wood handle. Repeat this step along the opposite side and be careful not to use too much glue. Do not smooth the glue with your finger or you will have "hake finger."



Making a Drop Count & Coating

I like to coat in regular ambient-level room light, or if I'm trying to make a lab a bit less uptight, under a few strands of non-blinking red chili pepper lights. As an aside, I use the red chili lights for illumination when doing wet plate collodion on the road in the ice fishing tents that serve as my darkroom (see the Wet Plate Collodion chapter).

The most economical and efficient method of coating a 16" × 20" piece of paper is to create a drop count with your A & B sensitizer in a heavy duty shot glass using a plastic eyedropper or pipette. If the humidity is in the 50%–60% range, you can coat an 8" × 10" paper with approximately 30–35 drops of sensitizer solution. In an arid climate, you will need to increase the drop count due to the speed of the drying and the absorption rate of the paper. With cyanotype you can use as much sensitizer as you wish, as it is so inexpensive. Using your eyedropper, squeeze out 30 drops in the shot glass and be prepared to dump the sensitizer into the center of your paper and begin coating.

Dampen your brush and blot it dry with a paper towel so that it feels cool to the touch. Empty your shot glass onto the paper, and with rapid and very light strokes spread the sensitizer on the paper. Brush vertically until you have coated top to bottom across the width of the paper. Then, change your brush direction to horizontal and repeat the gentle and fast brushing. Be sure to end each brush stroke out of the image area (this is what makes all of those romantic coating edges) and to avoid stopping the stroke short of your goal. Again, apply your sensitizer quickly and evenly using a *gentle* vertical, and then horizontal, stroking technique. Brushing with too much energy and pressure will only serve to make your images fuzzy due to the paper fibers on the surface being aggressively disturbed. Also, be wary of leaving puddles of sensitizer on the paper's surface; they will bronze easily during long exposures and clear unevenly in development.

Single coats work quite well if you get the right degree of saturation, but I recommend drying the first coat and repeating the application of the sensitizer. The quality and thickness of your paper will determine the degree and amount of sensitizer your paper can accept. As a rule, most quality artist's papers will only require a single coating, but a double coating will yield much denser blues. Single coatings are excellent choices if you are intending to do a gum bichromate print on top of your cyanotype or integrate another process with it.

Drying the Paper

Once the paper has been coated well, dry it quickly in the same moderate ambient light that you coated under. You can let the paper dry naturally in an empty drawer or use a hairdryer if you don't want to wait around for nature to do the work. Use a hairdryer on a cool setting to speed up the process, and try to avoid excessive heat and focus on the back of the paper rather than the coated front. Drying from the rear of the paper draws the sensitizer into the paper rather than drying it quickly on the surface.

If you are coating a large piece of fabric, versus the easier solution of purchasing your fabric pre-coated from Linda Stemer at http://www.blueprintsonfabric.com, you will need to hang it on a line or pin it to a wall in semi-darkness for the night following the application of sensitizer. Be careful of staining walls and floors, as you will not make people happy if you drip cyanotype sensitizer on anything. Avoid using a clothes dryer for drying a coated fabric . . . a lesson one of my students learned the hard way at a laundromat in Harvard Square. The heat in tandem with the moisture in the fabric will simply result in a large fogged piece of fabric and the possibility of staining future loads of laundry.

I'll discuss this in the next chapter, but a small warning for now: if you introduce water and light to the substrate, such as laying a sensitized fabric on a dew-laden lawn in the summer, the process of development will commence to your likely displeasure. You'll see the result of this warning when your live models sweat on the fabric and create really interesting and permanent puddles and stains in the image.

Be sure that the paper is "bone" dry because any moisture in the paper will instigate development during your exposure (remember, this is a water development technique) and your image's quality and clarity will be compromised with flat shadows and dull gray highlights. This is especially true when contact printing in sunlight, as the heat from the sun drives up the humidity in the contact frame quickly. A bone dry and ready-to-print cyanotype sensitized paper or fabric will be a light green-yellow chartreuse color. If your sensitized paper or fabric is blue-gray rather than chartreuse prior to printing, you have a moisture problem and the likelihood of a good image, with clean and bright highlights, is slim.

Figure 7–15
Betty Hahn, *Iris Variation #6*, 1985
This piece of Betty Hahn's has always been a favorite example to show students how powerful the cyanotype process can be when mixed with other media . . . in this case watercolor.
(Courtesy of the Artist)

Occasionally you will see a mottling (an uneven coating) on the surface of the support, especially with fabrics. Don't stress about this, as the effect usually disappears after the exposure, development-wash, hydrogen peroxide immersion, and dry down. One last thing: try not to touch the print surface before exposure because the oils and moisture in your fingertips may leave bleach-like fingerprint marks where you touch the surface of the paper.

LIGHT & EXPOSURE

A Few Words About the Sun

Unless you are totally compulsive about controlling every aspect of alternative process exposures—a futile ideal perhaps—I will recommend the sun as the best light source you can use for contact printing. Unless

you are working in a cold and dark climate most of the year, in which case you might think about becoming a poet or a philosopher, the sun provides the most efficient and least expensive means of exposing your contact negatives in printing frames. However, very serious alternative process printers swear by UV exposure units because they provide a consistent and controllable light source year round.

Why is sun best? It's free, really bright, and nothing can come close to the good feeling you get printing outdoors in the sun with friends. Secondly, in the summer your exposure times are short and pleasant and it is easy for you to monitor your progress. Outside, the light is bright enough to read the exposure of your edges and their density. Simple observations of the changes will give you a lot of information, as alternative process sunlight exposures are often best determined by this evaluation method rather than by a set time. When you think that you are close to being done, it's a simple matter of picking up the frame and moving into a shaded area to check on the details of shadows and highlights. This is especially true with any printing-out processes such as Ziatype, albumen, salt, and argyrotype.

Of course there are variables with the sun that you will not find with a UV exposure unit. The time of year, time of day, humidity level outside, and overall atmospheric conditions will all have something to do with your exposure. A misty and foggy day that makes you squint your eyes will often be an ideal one to print in. Printing on a winter's day in Dublin, New Hampshire, where I have my studio, will often be frustrating due to the low position of the sun and the dryness of the air, but the other nine months of the year are outstanding. Use the winter to enrich your life with other interests or make (see appendices) or buy a UV exposure unit. I think the best home unit to buy is made by Jon Edwards at Edwards Engineered Products (http://www.eepjon.com). You can also buy plans if you are handy with tools. Don't waste your time with filtered "black-light" tubes like the ones that I lit my room with in college . . . the type that made Jimi Hendrix posters become animated, because they are very inefficient exposure sources. You may, however, successfully use an unfiltered UV tube as several

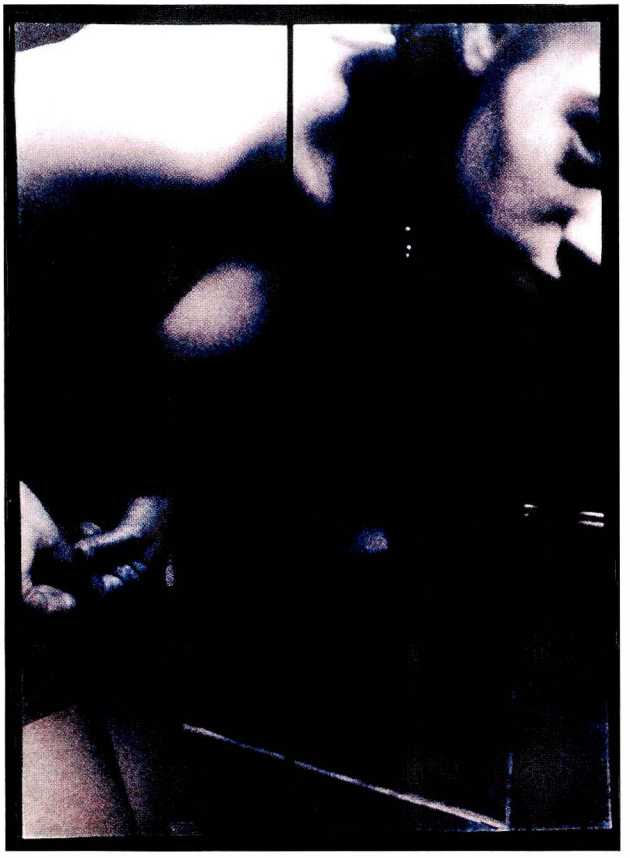


Figure 7–16
Emily Barton, *Self Portrait*, Cambridge, 1987 (toned cyanotype)
Emily made this four-piece heavily toned cyanotype montage when she was a student of mine at Harvard. Emily is the author of two best-selling novels, *The Testament of Yves Gundron* and *Brookland* and teaches creative writing at Yale and Smith College.
(Courtesy of the Artist)

of my students have done when making portraits at night with wet plate collodion. Another option could be a 1,000-Watt BLB Metal Halide Light.

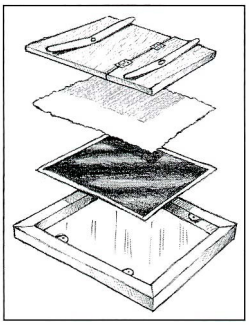
Another Kind of Sun: The 1,000-Watt BLB Metal Halide Light

If you really want to simplify the whole process, you can purchase a 1,000-watt metal halide light source, called BLB, or black light blue. These light sources are strong, full range, effective, reasonably priced, dependable, long-lived, and quick (average exposure for cyanotype is 8 minutes), and they make excellent prints.

One example of this type of light source would is the 1,000-Watt Metal Halide Maximizer Grow Light System from http://www.hydroponics.net. The setup includes a bulb, ballast, reflector, and socket assembly.

The Maximizer reflector is constructed of brushed aluminum with a bright white finish on the inside. The reflector measures 21" long × 17" wide × 7 1/2" tall. The Maximizer reflector has a unique adjustable light pattern to customize the spread of light, and the average exposure time is 8–12 minutes.

Metal halides emulate midday summer sunlight and contain all the wavelengths of the visible spectrum. To plants this means quality simulated sunlight and photosynthesis at a level much higher than that which fluorescent lamps can achieve. The unit runs about $250, and is more than adequate for your UV needs. The one possible drawback will be the law enforcement surveillance helicopters hovering over your studio, primed to seek out high-efficiency grow lights and people who experiment with indoor agriculture.



Exposing a Cyanotype

When your coated and sensitized substrate is completely dry, place your negative or photogram material directly in contact with the coated side of the paper and double check to see that it will read correctly (right-reading) when it is completed. The negative that you use will work very well if it has an average negative density range of 1.1–1.5.

Be aware that you will be losing a considerable amount of density in the wash development stage, so it is somewhat important that your highlights are able to print well before the shadows totally block up from exposure. Making a simple test strip with the negative that you've selected is probably an excellent strategy and one that will save you a lot of time and frustration.

Next, holding the top of your negative and coated paper with thumbs and index fingers, smoothly flip the pairing into the contact printing frame face down so that the negative is next to the glass of the contact printer and the coated paper is behind the negative. Be sure that the hinge part of the frame back straddles the negative/coated area so that you can undo one side of the contact printing frame during the exposure if you wish to check on your progress without losing registration. Once the negative and sensitized paper are positioned correctly in the contact frame, close up the frame and flip it around to see if you've lined everything up nicely. If so, it is time to go out into the sun, or into a UV light unit, for the exposure.

The most common problem in cyanotype printing is under-exposure, in which the highlights and middle values wash out in the water development. It is never a question of whether they will wash out but *to what degree*. I know this seems pretty obvious, but depending on the density of your negative, you will have a short or a long exposure, with denser negatives taking more time than thinner ones, as the UV light needs to penetrate the negative in order to have an effect upon your sensitized coating. Printing with a thin negative is almost hopeless, as the overall density of the final print will usually kill the contrast. Printing with a bulletproof dense negative is equally complicated, but the odds are better. As I said earlier, it's hard to fail with this process, but the negative quality will determine a lot. In summer sunlight, at midday, an exposure might last anywhere from 10 to 20 minutes. If it is early or late in the day, be prepared for a lengthy exposure that might take as long as 45 minutes. This last sentence is a good argument for having a UV exposure unit but, it is an option that lacks romance. Just saying . . . .

Testing Your Exposure Visually

There are several ways to test your exposure while you're making a print. When I am teaching an alt pro workshop about how much fun it is to make cyanotype murals in the sun, I always use the students as photogram objects on a 9' × 18' piece of cyanotype sensitized fabric. During the exposure I periodically lift a shoe or an arm to check on the comparative densities of the exposure in progress. Checking under fingers doesn't do much for you in humid and hot weather, as the sweat from the fingers pre-develops the cyanotype material. By looking at the unexposed areas under an opaque object I am able to see what the base sensitizer

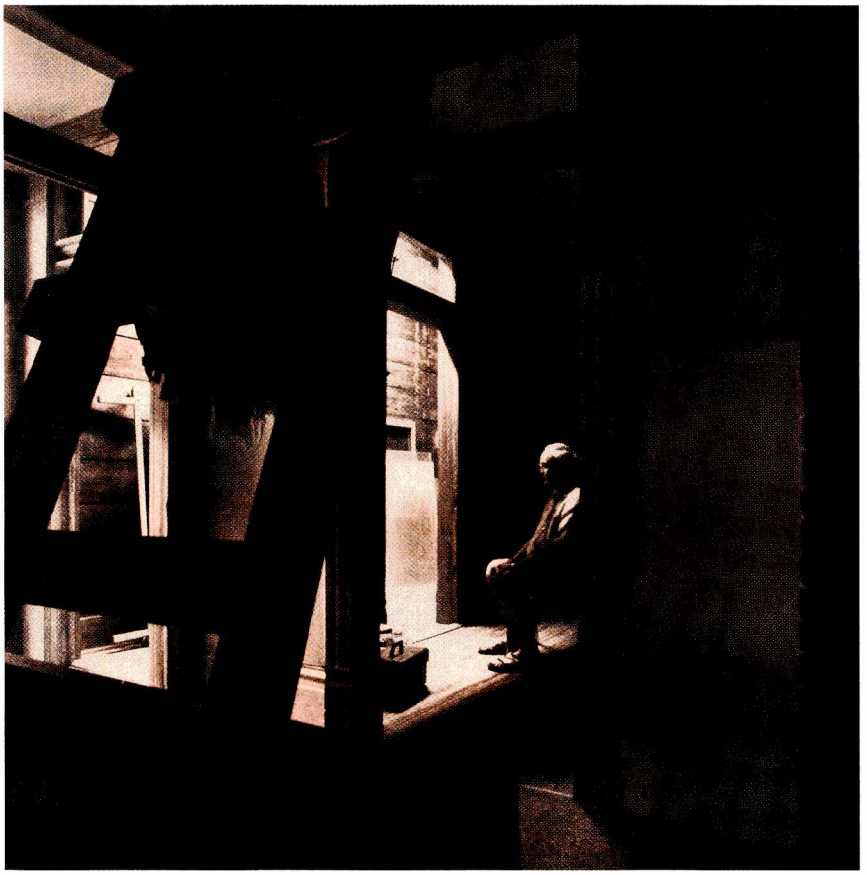
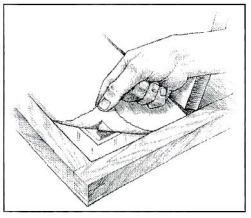


Figure 7–17
Cynthia Morgan Batmanis, *Melancholy*, 2009 (toned cyan)
Friend and workshop student Cynthia Batmanis is an accomplished artist, both of singular images and installations. Her subject matter focuses on the domestic and often unpredictable realities of family life.
(Cynthia Morgan Batmanis, Melancholy, 2009. Courtesy of the Artist)

(that green chartreuse color) is doing in comparison to the open exposure areas with nothing blocking the sunlight. I am looking for the uncovered areas of the fabric to turn a silvery greenish-gray.



In a contact-printing frame, I will often place a small opaque object on the glass so that it covers a separate swatch of sensitized paper that I have added to the bottom of the paper during coating. By quickly lifting the opaque object I can determine how far along the exposure is and how long I have before the processing stages begin. As you will discover, overexposing a cyanotype is a difficult thing to do.

A quick test strip can be easily homemade by coating a piece of paper with the sensitizer, drying it completely, and placing a negative in contact with the coating. Put the sensitized paper and negative in your contact frame and lay a series of opaque strips over the coated test piece. These strips can be removed from the frame, one at a time, at predetermined intervals and then processed for the information. The exposure is long enough that you can do the process tests, or prepare your next paper, while you're making the exposure!

You can also use a transparent step wedge, like an inexpensive Stouffer Strip, for this task, but I feel the negative's information from the test is often more important than how many gradations you might achieve with it. When the test exposure is done, process it in tap water until the whites have cleared and there is no evidence of yellow in the wash water. Then, quickly blow-dry the strip and you'll get a rough idea of approximately what the best exposure time will be. Be aware that cyanotype print values will darken over a period of 24 hours as the print oxidizes. You can accelerate this oxidization by immersing the washed print in a weak solution of hydrogen peroxide.

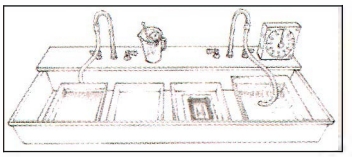
Figure 7–18
Brenton Hamilton, *Gardener*, 2004–05
Maine artist Brenton Hamilton has an unusual exposure unit . . . the back of his pick-up truck. Brenton creates negatives that are quite dense and that are made with paper masks, sticky notes, and frisket film. In pleasant weather, he takes his loaded contactframe for a ride and makes exposures lasting 8–12 hours. The cyanotypes are nearly black when fully processed. The final steps consist of 5 to 8 conventional gum bichromate passes, quite a bit of freehand drawing, and occasional gold leafing. *(Courtesy of the Artist)*

Cyanotype is a printing-out process, so you can examine your exposure as you go, providing you are using a hinged contact printing frame. In a pre-development examination of the exposure, I like to see highlight detail that is a great deal denser than I would be happy with in a finished print. Occasionally I want my deepest shadow areas to have a nearly solarized look in which the density has begun to reverse itself and is transforming to a lighter, almost metallic, negative gray.

In particular, I watch the coated borders surrounding the image area that are wide open to the exposure. More often than not, the best cyanotypes will be realized when the outside borders have converted from the original yellow-green of the sensitizer to a silvery greenish-gray. Another general piece of information is that thicker papers and double coatings often take a little longer to expose than do thinner papers and single coatings. Always write down your exposure time on the paper so that you can evaluate your progress over the course of a printing session.

Split Exposure to Increase Shadow Details

One additional technique that you may wish to apply to your knowledge of exposure is a split exposure technique. When you are halfway through your pre-determined UV exposure time, suspend the exposure. Then, take the printing frame and its contents into a low-level-light environment and wait for 15–30 minutes before going back for the rest of the exposure time. This interrupted printing results in noticeably better shadow details and separation without losing highlight or D-max integrity. If you are looking for more sophisticated levels of value in your cyanotype images, this is a good technique to try. My friend, Mike Ware, suggested that this technique may allow for a greater degree of print-out, which may be slow to build, and therefore more self-masking.



SINK SETUP FOR CYANOTYPE

Tray 1 Initial wash development/running water. You may substitute the sink with the ocean or a flowing river.

Tray 2 Hydrogen peroxide 3% (a splash) in a liter of water for instant oxidation, dry-down, and wow factor.

Tray 3 Final wash in running water

Post-Final Wash Suggestions

If you are in an area where the water has a lot of chlorine in it or is very hard, it is a good idea to soak your finished prints in a bath of distilled water for 10 minutes or so. This will help prevent grayish highlight fog after dry down.

Figure 7–19
Alexander Hartray, *Kiss*, 1986 (toned cyanotype)
Alex made this image of himself and Catherine Harris while a graduate student of mine at Harvard by creating a large inter-negative on a piece of graphic arts film and contact printing it on a cyanotype sensitized sheet of printmaking paper. The print color is due to a post-print toning sequence of sodium carbonate and tannic acid. *(Courtesy of the Artist)*

If your highlights are fogged, try taking a small pinch of sodium carbonate (laundry detergent at times) and mix that up with a liter of distilled water. This will help clear the highlights. Watch carefully: the highlights clear visually first, but the mid-tones clear shortly thereafter. You need to remove the print from the sodium carbonate solution before it reaches the stage you desire. Sodium carbonate is an alkali, and it's going to continue its bleaching action in the rinse water, taking some time to clear it out of the paper.

If you are considering applying a toning process to your cyanotypes, it is a good idea to complete your wash and re-wet the prints 24, or more, hours later to begin your toning experiments.

DEVELOPMENT: WATER OR ACID

Traditionally, the cyanotype is developed out in a running water bath. This is the least complicated step possible. Simply set up a deep tray, fill it with water under a tap or with a hose, and immerse your exposed paper when you're ready to see what it looks like. The one shortcoming of water development, say, if your negative isn't perfect, may be a limited tonal range primarily in the highlight end of the scale. Remember, this is not a particularly sophisticated technique when compared to most other alternative process options, and a full range of values, from light to deepest detailed shadow, are often difficult to achieve. Of course, your tonal scale is dependent on more than your water development, but there are remedies to this normally restricted range of tonalities that go beyond your negative.

An alternative development process, one that often produces a longer tonal scale, involves using varying concentrations of acidic solutions made up of water and distilled white vinegar. I haven't played with other types of vinegar, so these recommendations are going to be restricted to white. Other acids that work well

range from a simple squeezed lemon and water bath to options including acetic acid, citric acid, or nitric acid, which works best of all but is a most unpleasant ingredient to work with . . . I would stay with the simple acids. The nice part of this optional method of development is that the tonal range will be extended without having to lengthen the exposure. The downside is that by trading for a longer tonal scale you will often lose on the highlight-to-shadow contrast in the print. You might think of an acidic vinegar development bath as one that turns the cyanotype into a soft graded paper.

The simplest solution to begin experimenting with is household white vinegar, the equivalent of a 5% concentration of acetic acid. White vinegar can be used straight from the bottle or diluted with water for more flexibility. In its pure state, it is worth about two to four levels on a step table. Here are a few signs to look for if you decide to use vinegar as a development option.

White Vinegar and Citric Acid Recipes

- **White vinegar out of the bottle:** A significant increase in the range of values (two to four steps) but a decrease in the contrast. This might be a good formula for negatives that are hopelessly too high key. A hydrogen peroxide "oxidation-hit" following development will have little effect on this straight vinegar-developed print.
- **Vinegar and water 1:1:** Some of the image's highlight crispness begins to return without a loss in the step table. Accelerated oxidation with hydrogen peroxide has a negligible effect in deepening the blue in the print.
- **Vinegar and water 1:3:** A two- to three-step increase in mid-tone values and better highlight detail, and the hydrogen peroxide oxidation adds a little intensification to the blue.
- **Vinegar and water 1:5:** A pretty decent range in the additional step values, and the highlights are better. Decent *maximum density* equal to the other prints in the test sequence, and the hydrogen peroxide has a modest effect.
- **Citric Acid:** A 1% solution of citric acid, 10 g per liter of water, will behave like a 1:2 water-to-vinegar concentration. Be careful: if you don't remove every trace of the acid from your print it will fade. Be sure to wash your print thoroughly.

Figure 7–20
Vincent Carney, *Graffiti, 2005* (cliché verre cyanotype)
Vincent scans his negatives into Photoshop to enlarge the image size and adjust the image contrast for the cyanotype process. He then prints out a new negative onto Pictorico OHP. The prints were made with Ware's new cyanotype formula, developed in a 1% citric acid solution, and printed on handmade paper.
(Courtesy of the Artist)

If you are using Mike Ware's New Cyanotype process, explained shortly, the effects of vinegar development are less distinct. However, this fact is somewhat irrelevant if you are using Mike's formula that has a longer and similar tonal scale and a softer look to the overall image. Mike's process does, in fact, employ an acid development that softens contrast.

Acid Post-Development Bath for Additional Tonal Range

Still another option for additional tonal range when developing cyanotypes is the technique of rinsing your cyanotype print in a very mild acidic bath following the regular water development. Adding this acid bath step will often result in an intensification of the darker

Figure 7–21
Brooke Williams, *Self with Family*, Jamaica, 1987
New York City artist and musician Brooke Williams made this mural piece while a student of mine at Harvard (she's in the upper-left panel.) The work documents a personal and family experience while visiting Jamaica. The text around the outside of the six panels is printed on acetate, used as a negative, and contains quotations from Brooke's journals and the writing of Marcus Garvey.
(Courtesy of the Artist)

values while reducing the lighter ones. Traditional manuals, such as the *Kodak Encyclopedia of Practical Photography,* suggest a post-development bath of 4 to 5 drops of hydrochloric acid per 1,000 ml of water for a few minutes. I have also heard of cyanotype artists who use weak solutions of citric acid, both chemical and natural, in this step. For fun, try squeezing a few lemons into a water bath and note the effect. You will likely see a bit of clearing and a marginal intensification of darker values.

THE BIG THRILL

Immediate Oxidation and Gratification

If you are a creature who requires instant gratification, and we all do from time to time, try this! After the first development wash, remove the print from the water and add a splash of drugstore grade 3% hydrogen peroxide to the water bath. This is the same solution that you put on cuts to prevent infections. It is not the solution that beauty salons use to turn hair different colors. That is a 33% solution and not something to which you would want to subject your new cyanotype print.

After you add a splash of hydrogen peroxide to your tray of water—about a liter will do—re-immerse the print and watch the blues turn an immediate, and intense, deep blue. This action causes the highlights to appear super white because of their new-found relationship to the suddenly very enhanced and dark blues. This intensification "trick" is everyone's favorite moment in the process.

What is happening before your eyes is really quite simple. You are accelerating the oxidization of the iron

Figure 7–22
Catherine Jansen, *The Blue Room*, 1991
Catherine Jansen has been inspiring students and artists for decades, and her *Blue Room* is a work that I have been showing in lectures for many years. I have seen this image instantly transform a student's approach to alternative process image making.
(Courtesy of the Artist)

in the print, a process that would have happened naturally without your assistance in 24–48 hours. The eventual final densities, with or without the thrill, will be the same. Hydrogen peroxide can be used immediately after the yellow has been washed out of the print. You can mix it casually and without fear; after all, this solution is used to clean wounds and as a mouthwash. Don't forget the washing stage after your moment of being thrilled.

CLEARING HIGHLIGHTS

A 1%–5% Oxalic Acid Bath for Clearing Highlights and Stains

Immersing a completed cyanotype print in a 1%–5% solution of oxalic acid can aid in clearing the highlights in your print if that is a problem that needs to be corrected. To make a 5% solution, mix 5 g of oxalic acid with 100 ml of water. This bath is particularly successful for spotting blue stains out of highlight areas.

Take all necessary precautions when using oxalic acid because it is toxic. Oxalic acid's primary role in your life is likely to be as a cleaning and bleaching agent, especially for the removal of rust-laden iron deposits. In alternative processes, oxalic acid is also used as a reducing agent in the platinum/palladium process. The principle toxicity risk when using oxalic acid is kidney failure, which may cause precipitation of solid calcium oxalate, the main ingredient of kidney stones. That said, be careful and wear nitrile or safety examination gloves and eyewear when using this chemical.

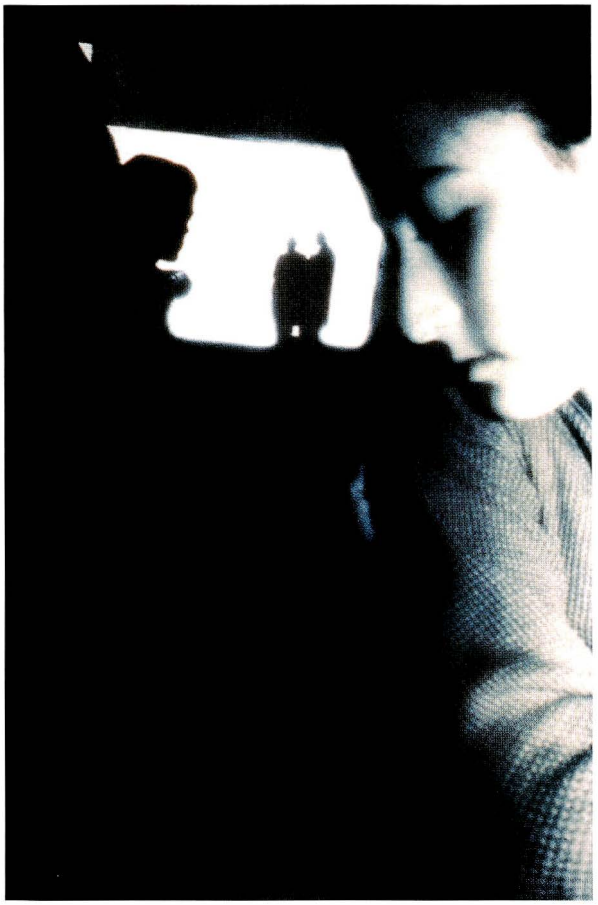


Figure 7–23
Grace Huang, *Portrait of Stefanie,* 1989
Grace Huang made this portrait of Stefanie London in cyanotype and then split toned it with a very dilute toning bath of sodium carbonate, creating the blue-yellow split. Both artist and model were students of mine at Harvard.
(Courtesy of the Artist)

Sodium Carbonate Bath for Reducing Density

As mentioned a bit earlier, if you find that you have significantly over-exposed your cyanotype, a difficult thing to do most of the time, you may want to try this last-gasp remedy as a fix because it works really well. Take 1,000 ml of water and add a "pinch" of sodium carbonate and stir thoroughly. Immerse your wet, over-exposed cyanotype into the solution and agitate gently for a few seconds. Then move to a clean water tray and wait for the results. If nothing happens, repeat the process but leave the print in the sodium carbonate a little longer. Eventually, your print will begin bleaching. Sometimes a lovely yellow split tone will form between the highlights and the shadows. Watch out for the first signs of yellow. Too strong a concentration or too long in the sodium carbonate solution will have a serious bleaching effect. If you feel you went too far with this idea, you can consult the toning section for techniques on where to go next. Tannic acid would be a likely option. If you opt to do nothing at all with your over-exposed print, save it for another day and try a Blue-Van-Dyke print or print a gum bichromate on top of it. One thing alternative process artists have in common is willingness and enthusiasm for making great work out of absolutely failed prints simply by extending their life with additional experiments.

Figure 7–24
Lucy Soutter, *Harvard Diptych,* 1990
Lucy is a great friend and author of the new and best-selling book (and one you should definitely read) *Why Art Photography.* This is a cyanotype diptych that Lucy made while a student of mine at Harvard in 1990.
(Courtesy of the Artist)

Cyanotype Fading

Some papers that you might consider for your cyanotype work, which includes nearly every variety you can imagine, are buffered with a mild base or alkali such as chalk/calcium carbonate. (See Chemistry Appendix A.) This is not unusual for any material that may end up being considered as archival. On occasion, the manufacturer of the paper does not provide this information, so you may be inclined, especially if the print is going to be collected, to test the pH of the paper yourself . . . as any alkali will cause a cyanotype to fade. You can buy an inexpensive pH-testing pen, like a highlight marker, from Light Impressions, Talas, or a similar store. There is more information about paper in the Paper chapter in this book.

CYANOTYPE TONING

Basic Cyanotype Toning Options

There will be times when you simply do not want a blue image but still want to use the cyanotype technique due to its flexibility with other media and its stunning simplicity. The following are some formulas for changing the color of your cyanotypes once they have completed the final wash. In general, it is a good idea to overexpose your prints if you intend to tone them, as reducing agents are common in the step sequences. Many of the following formulas utilize sodium carbonate or ammonia, which will reduce print density if the solutions are too strong.

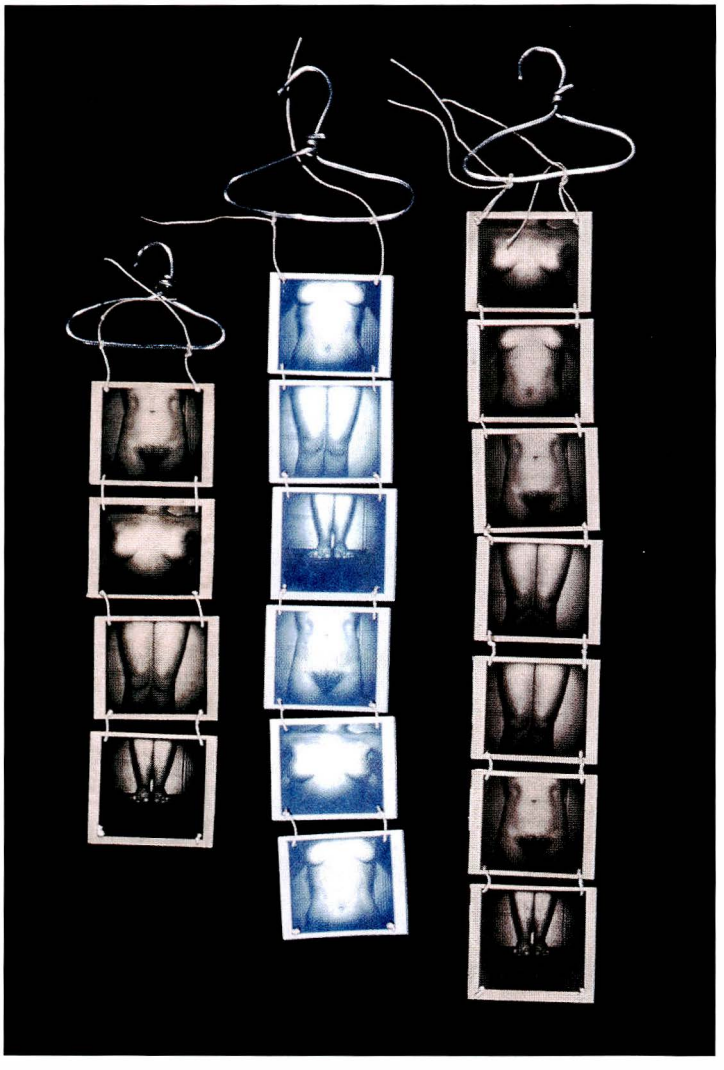


Figure 7–25
Amanda Bross, *What To Wear*, 2001 (cyan & V-D-B)
Amanda, a former student of mine, made this whimsical sculptural piece by contact printing medium format negatives and making prints in cyan and Van Dyke. These were stitched together and given tiny hangers to hang . . . presumably in tiny closets.
(Courtesy of the Artist)

Note: These toning suggestions are essentially variations on the theme of alkaline hydrolysis of the Prussian blue followed by the formation of ferric tannate or gallate that becomes a new color palette. They are interesting to play with and modify. Unfortunately, they almost always result in finished prints that look more vibrant when wet than when dry.

A word of encouragement . . . : many times the formulas will not work as you want them to due to water types, contamination, time of year, and an assortment of other things. Take these formulas with a proverbial large grain of salt and adapt them to your own esthetic. Very often, during workshops I will simply pour and sprinkle formulas together to reinforce the idea that the results from these toning suggestions are not set in stone, either alone or in combination with other toners. Besides, what have you got to lose? The process is simple and inexpensive, and accidents often become individual and unique techniques. Become famous for your failures!

There is the issue of permanence to consider. The cyanotype, in a pure Prussian blue state and handled correctly, is very permanent and one of the most stable of all alternative processes. Toning changes the chemical composition of the cyanotype image, and it is debatable if all of these formulas can be described as "permanent." I have found virtually no deterioration in the images I toned carefully with a variety of toners over the last 30 years. However, this is not the case with images "performed" during group toning demonstrations, where inadequate washing times between steps are often the rule . . . , especially with sodium carbonate.

It is a good idea to *dry* your cyanotype prints before toning them and to let them oxidize and age for a day or two. After they have been dried, you should re-soak them before toning. This soaking stage will allow the toning solutions to cover and penetrate the paper's fibers more completely and makes for a smoother-looking tonality in the print. The formulas given are equivalent in ratios. Please feel free to modify the amounts in order to adequately cover the size of your prints.

Figure 7–26
Cierra Butler, *Rebirth*, 2011
Ciera, a former student of Sarah von Kueren's, writes, *"Rebirth follows the rediscovery of origin. Combing sections of the nude body that is printed in palladium with the individuals country of origin in cyanotype is a way to bring them together . . . and separating them at the same time. Rebirth is a way remembering your roots, and also being a product of your own complexion."*
(Courtesy of the Artist)

Figure 7–27
Sam Wang, *Night Bloomer*, 2010 (PdCy5)
Sam Writes, "Night Bloomer, *wilted flowers from night blooming cereus plant scanned and combined with landscape, color separated into two negatives and printed with palladium and cyanotype in 2011. The warmth of the palladium plus the coolness of the cyanotype leaves a subdued range of colors that I particularly like. Variations in paper, palladium developer, and everything else influence the results more so than many other processes.*"
(Courtesy of the Artist)

Removing Blue: Getting Yellow

Many chemicals will alter the intensity of the blue and change the values of the whites in your cyanotypes. As previously mentioned, hydrogen peroxide, oxalic acid, nitric acid, and sodium carbonate will all cause the blues to change, as will solutions of chlorine bleach, sodium sulphate, sodium silicate, tri-sodium phosphate, sprays of bathroom cleaner, and commercial laundry soaps. You may elect to apply these selectively with a paintbrush or make up diluted baths to alter entire prints.

For example, to make a yellow and white print, make a solution of trisodium phosphate in a ratio of one tablespoon to every liter of hot water. Dissolve the trisodium phosphate in hot water in a plastic tub or tray, and then immerse the overexposed cyanotype in the solution until it fades to yellow. Rinse the print with running water for 30 minutes, or if using fabric, run the material through a cold wash cycle without soap. If you then immerse the print in a bath of warm Red Zinger® tea, the resulting image should be permanent and may remind you of a Hippolyte Bayard direct positive print of the windmills.

Yellow/Blue Split Tones

This is a very simple adaptation of the previous process and seems to work best in the city where there is a good deal of iron, from old pipes, in the water supply. Allow the over-exposed and washed print to age for a day or two. Re-soak the print and immerse it in a hydrogen peroxide bath for a minute or so followed by a 20-minute rinse. Then, place the print in a very weak solution of sodium carbonate (a pinch between thumb and forefinger to 1,000 ml of water). Immediately transfer it to a fresh water bath to observe the changes. To achieve the split, allow the changes to occur in the wash water. After you are satisfied, wash the print well for 20–30 minutes.

Basic Tea Toner

Buy some basic and inexpensive household tea (tannic acid) and make a very strong solution in hot water. Immerse your print in it until you have the desired tonality. Don't be in a hurry here; I remember overnight soaks in this solution yielding some pretty intense blacks. Using a solution of tea as a toner is a nice way to have the image highlights exhibit a pleasant tan color while the blue takes on a slightly warmer hue. If you don't want any blue, just go through the yellow toning stage with trisodium phosphate and then move on to the tea toning. Using green and herbal teas with less tannic acid in them does not work as well. However, if you boil onionskins, reduce the liquid a bit, and then soak the cyanotype in it for a while, you can get a lovely bronzing effect.

Warm Grey Toner

This is a sequence developed by Linda Stemer of http://www.blueprintsonfabric.com. Make a very strong cyanotype exposure. Age it for 24 hours. Then iron the fabric on a high heat while misting it with a

Figure 7–28
Linda Stemer, *Grey Feathers* (toned cyanotype)
Linda, owner and operator of http://blueprintsonfabric.com, writes, "Grey Feathers—*I don't have exact formulations but I do remember the process. The initial exposure was very dark blue—I ironed the fabric on a high heat with a vinegar solution, which faded the image to a dull blue color. I then tea stained it using a mixture of green and black teas. I ironed it again and then briefly soaked it in a borax solution. After rinsing and ironing a final time, the image came out this kind of faded grayish-brownish color.*"
(Courtesy of the Artist)

vinegar solution (you'll have to guess). This will cause the print to fade to a dull blue. Then make up a strong green and black tea solution and stain the print. Next, make up a mild borax solution and immerse for a short time. Then rinse and re-iron a final time.

Anthotype Toner Options

Just as boiling the onionskins will give you a reduced solution that will tone your paper, other options exist that are detailed in the Anthotype chapter. Solutions such as beet root and black current extracted juices will stain papers, as will wine, turmeric, and some deep green vegetables.

Brown Toning #1

Part A

6–12 ml	non-detergent, household strength ammonia added to 1,000 ml of water (you may have to modify this percentage, as the effect will be dependent upon your exposure)

Part B

60 g	tannic acid added to 500 ml of water and mixed well

Tannic acid mixing takes a little patience because it does not dissolve readily in water. Break up the clumps and keep stirring until the chemical is in solution. It smells like instant iced tea mix so it isn't an unpleasant task. Immerse the washed and wet print in Part A until it starts to exhibit signs of fading to pale. Rinse the print for 15 minutes. Then, transfer the print to Part B for the conversion to brown. In all of the toning formulas, too short a rinsing time between stages is the primary culprit in the discoloration of highlights and paper-base white discoloration.

Black Toning # 1

The success of this toner is not guaranteed. Sometimes it rocks; sometimes it doesn't. Immerse the print in a solution of Dektol (this is a black and white paper developer from the days of the wet lab). The stronger the Dektol solution, the more intense the goldenrod color that will present itself to you. When the blue is almost entirely bleached out, rinse the print for several minutes in water and then immerse it in a solution of tannic acid mixed to 50–100 g per 1,000 ml of water. You should see a smoky black color within 5 minutes. Wash the toned print for 20–30 minutes.

Eggplant/Red/Black Tones

Age your cyanotype print for 24 hours and re-soak before beginning the toning sequence. Use the Black Toning #1 procedure, and after the final wash, immerse the print in the strong Dektol solution again.

For reddish-rust tones, wash the print in a light sodium carbonate bath (a pinch to a liter of water). I've made violet by making an ammonia bath solution

Figure 7–29
Janet Matthews, *All Through* (gum over cyanotype)
This is a terrific example, created by Janet Matthews, of a gum bichromate pass over a completed cyanotype image.
(Courtesy of the Artist)

consisting of 250 ml ammonia to 1,000 ml water. Play around with this and see what happens.

Black Toning #2

Part A

6 drops concentrated nitric acid* added to 1 liter water
(*Never add water to acid!*)

Part B

55 g sodium carbonate added to 640 ml water

Part C

55 g gallic acid added to 640 ml water

- Begin by immersing the washed and wet cyanotype print into Part A (nitric acid) for 2 minutes. Be careful, and use tongs or nitrile gloves and wear eye protection.
- Then rinse the print for 10 minutes in running water, transfer it to Part B, and leave it in the sodium carbonate solution until the image disappears and then miraculously reappears as a very light orange image.
- Then rinse the print for 10 minutes and transfer it into Part C, where the black tones should become evident.
- Finally, wash the print for at least 20–30 minutes. Your tones may be in the gray to black area depending upon the original density of the exposure. Print accordingly.

Nitric Acid

Note: Concentrated nitric acid is not a chemical to take lightly. This is evident as soon as you take the plastic top off the bottle and see the white vapors rising toward the ceiling. Please do not be casual with this chemical. Be sure to read about it in the chemical section in the appendix, and wear proper protective lab gloves and a mask when working with nitric acid. When toning you can always work with a larger volume of more dilute acid for safety.

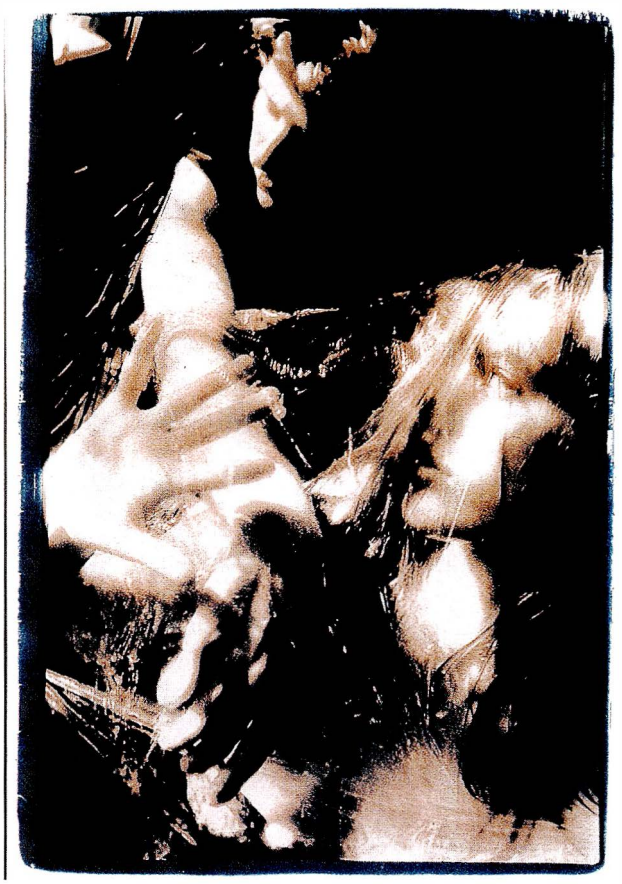


Figure 7–30
Grace Huang, *Thesis*, 1989
Grace Huang, a successful commercial photographer in Manhattan, made this sodium carbonate and tannic toned cyanotype while studying with me at Harvard.
(Courtesy of the Artist)

Blue/Gray Split Toning

This recipe is similar to Black Toning #2.

Age your cyanotype print for 24 hours and re-soak it before beginning the toning sequence. Then mix a solution of 6 drops of nitric acid in 1,000 ml water and immerse your print in it for 2 minutes.

Wash the print for 10 minutes. Then, immerse the print in a weak (a pinch to 1,000 ml of water) sodium carbonate solution until a yellow split occurs.

Then wash the print for 10 minutes. The next step is to mix up a tannic acid solution of 50 g to 1,000 ml water and immerse the print in it until a blue/gray split appears. Finally, wash the print well for 15–20 minutes.

Rose Toning

Follow the directions for the blue/gray split toning. After the last step in that sequence, immerse the print in a light sodium carbonate solution (a pinch to 1,000 ml of water) until the image becomes rose colored, and then wash the print for 20 minutes.

Green Toning

Age your cyanotype print for 24 hours and re-soak before beginning the toning sequence. This toner is a bit complicated if you don't have proper ventilation, and I absolutely do not recommend attempting it unless you can tone outdoors or under a serious chemical lab hood. Under no circumstances should you try this formula with children nearby. The reason is that sulphuric acid was appropriately named "oil of vitriol" back in the long ago by the Sumerians . . . for a very good reason.

Be really careful with the sulphuric acid, and be sure to note the strength of it before opening the bottle. Prepare a 1% solution of sulphuric acid. Photographer's Formulary has a 48% solution that it can ship, but you're going to need to fill out government paperwork, and the shipping will be expensive. The best bet is to be in a university setting and to make friends with the chemistry people. While you're there, use their chemical hood to mix this up. To make a 1% solution you need to add 1 ml of the concentrated acid to every 100 ml of distilled water.

Note: Although this rule doesn't apply to all acids, it is better to be safe than sorry, so REMEMBER: AAA = Always Add Acid to water... not the other way around, as acid may splatter upon contact.

You're going to need at least 500 ml of solution to immerse the print. Again, you can always work with a

Figure 7–31
Peter M. Lindstrom, *15, Walk With Me, No3*, 2011 (gum over cyan)
Friend and workshop student Peter Lindstrom created this spectacular gum over cyanotype.
(Courtesy of the Artist)

larger volume of a more dilute stock acid for more safety. When your acid bath is prepared, immerse your print until you like the color you see. A caveat . . . this toner doesn't always work, and I can't explain the reason since I don't particularly enjoy working with sulphuric acid and haven't done enough personal testing to sound intelligent about it. Wash the print afterward for 20–30 minutes.

Greenish-Blue Nickel(II) Sulphate

This is a formula from my friend, Mike Ware, and although I've never performed this toner I am including it because it looks interesting. Keep in mind that it is as equally dangerous as the sulphuric acid green toner formula. In truth, if you really want a green tone on your cyanotype I would recommend doing a normal cyanotype and then following it with a gentle green (oxide of chromium green is a good choice) pass using the gum bichromate process. It will look nice and be consistent in its green tones, and it is safer than the other green options. In any event, here's Mike's suggestion.

Immerse the cyanotype in a 5%–10% solution of a nickel(II) salt (e.g., the sulphate, chloride, or nitrate) for an hour or so. The color shift with nickel(II) salts is rather slight—toward a more greenish-blue. This treatment has the beneficial effect of making the cyanotype much more resistant to alkaline hydrolysis. There may be some loss of image density in this bath, so the cyanotype needs to be heavily printed. N.B. Nickel(II) salts are listed carcinogens. Consult the MSDS for this chemical before playing with it.

Eggplant Black #1

Dry your prints for a day or two and re-soak them in a water bath. Then begin by immersing your wet print into the first tray of sodium carbonate for a very

Figure 7–32
Xtine Burrough, *The Sky Is the Limit*, 2009
Great friend and former student xtine Burrough is now an author and professor in California and is constantly making me proud of her. She writes, *"I spent the summer printing cyanotypes. I had an idea for a series of images and once I started I couldn't stop. I'm working with digital negatives on Pictorico but more interestingly . . . I hope . . . is the concept: English idioms such as "the sky is the limit" or "a new lease on life" or "food for thought" and so on. Searched by keywords (sky and limit, or new, lease and life . . .) on the Library of Congress' Flickr photo-stream . . . everything there is soooo American and also in the public domain. The keywords are combined into a photo collage (my favorite way to spend hours in the zone) so, an abstract and downright silly expression is transformed into an abstract visual message."*
(Courtesy of the Artist)

brief time. In this first tray, you only need a pinch of sodium carbonate in a liter of water to make an active solution. Be aware of how much sodium carbonate you use, as very light dilutions are best. You will want the bleaching effect to be slower rather than immediate. The sodium carbonate acts on the iron blue quite quickly, so watch it closely. I like to slip the print into this solution and immediately remove it to a water bath for the bleaching effect to take place. Generally, this stage is pretty flexible, and the less iron blue that decomposes, the greater the possibility of a split-toned image. Attention to this will help with possible staining in the highlights later. Try a test piece of cyanotype. If it bleaches too quickly, make a more dilute solution by adding more water.

For the second tray, mix 10 tablespoons of tannic acid into a liter of water and stir for a while. This tannic mix may be much stronger than you need to get the job done, but it works for me. If you find it is too strong and you see evidence of staining, add water to the solution. You might also try a bath of oxalic acid after you wash the print for a while. The greater the concentration and the longer the time of immersion, the deeper the color. The darks are beautiful, but the highlights get hammered and will turn a sepia tone most of the time if the immersion is too lengthy. If you are seeking an image effect that feels like the Stone Age, this is your toner. Wash the print for 20–30 minutes when it's done with its chemistry journey.

Violet Tones #1

Prepare a weak borax solution and immerse the print in it until you see a color change that pleases you. The concentration of the borax to water is flexible, and you should play around with it. This particular toner often looks good in the wet state but has a tendency to flatten out after drying. This leads to the suggestion that it might be a good base for a first pass with gum bichromate. Water type will play a role in determining the degree of violet you might get. A caveat: often this lovely violet will revert back to the original cyanotype blue in a few days, so don't be upset if that happens. If you really like the violet, take a picture of your print for posterity when it's wet and then let it dry and possibly send it through a gelatin glyoxal hardening sequence and do a violet gum bichromate pass over it.

Violet/Gray Tones #2

You can occasionally get the violet/gray shift by making a solution of 5 g of lead(II) acetate in 100 ml of distilled water. Immerse the print in this solution until you see a color that you like. Then wash the print well for 15–20 minutes. Be cautious of the lead acetate because it is not one of the harmless chemicals.

As an aside, ancient Romans often used lead acetate, or Salt of Saturn, as a sweetener and made syrup by reducing grape extract in lead pots to make syrup they called *defrutum*. Overuse of defrutum led to lead poisoning, and this may explain some historically odd behavior by ancient Romans. That said, do not dispose of lead acetate down the drain and continue to reuse the toner formula until it doesn't do anything anymore. It is possible to continue this formula by immersing the print in a bath of citric acid following the wash. This bath will result in a very deep blue/violet and cleaner highlights.

Violet/Gray Tones #3

Make up the same 5% solution of lead(II) acetate that is described in Violet/Grey #2, but this time adjust its pH to 7.5 to 8 by adding a little ammonia to it. You can use a standard pH test strip to check on the degree of alkalinity. If you see a precipitate, pay it no mind, as it can be filtered off easily.

This solution will create a very nice violet-blue in 1–2 minutes. The color is permanent and stabilizes the Prussian blue against light fading. Keep in mind that lead(II) acetate is a seriously toxic heavy metal salt.

Violet Tones #4

Age your cyanotype print for 24 hours and re-wet before beginning the toning sequence. Prepare a tray with a liter of water and to this add a splash of household ammonia. Stir the ammonia into solution and immerse the wet print. You will get an immediate violet image that is really quite lovely.

Don't admire the color for too long a time, as it will begin to fade away. Remove the print before you get to the point where you love it and place it in a

Figure 7–33

Willis Odundo making his cyanotype, 2006, Kageno Kids, Kenya

Jayne Hinds Bidaut is a volunteer artist/teacher for Kageno Kids in Kenya, an outreach program that transforms communities suffering from oppressive poverty into places of hope. Kageno Kids focuses on the children, primarily orphans, living within those communities. One of her students is Willis Odundo, and she made this image of Willis showing his friends how to make a cyanotype. Willis lost both of his parents to HIV/AIDS and now lives with his grandmother and has recently been sponsored so that he can attend primary school. If you want to help this outstanding organization, go to http://www.kagenokids.org for information.

(Courtesy of Kageno Kids and Jayne Hinds Bidaut)

tray of warm water. Wash for 20–30 minutes and hang to dry. Enjoy it for a short time . . . it will not be permanent.

Purple-Brown Toning

Mix up a *hot* solution of tannic acid at 70 g to 1,000 ml water. To this solution add a drop or two of pyrogallic acid. Then immerse the print until the blue turns to a lilac color and rinse the print for 10–20 minutes. If you like the color, simply complete the wash stage and don't do any additional toning. If you wish to go on to the purple-brown, immerse the print in a caustic potash solution made with 15 g of caustic potash to 1,000 ml of water until the desired color is achieved. After toning, wash the print well for 20–30 minutes.

Purple-Brown Toning #2 (Ware Option)

Begin by soaking the print as you would all cyanotypes that you are interested in toning. Once soaked, immerse the print in a 1% ammonium hydroxide until the blue is a pale yellow. You can also use the more standard sodium carbonate: 5% solution or a more casual pinch to a liter of water. Interesting split tones can be seen if you don't take this stage to a total pale yellow bleaching. Then rinse the print for a minute in fresh water and continue by immersing it in a 1% solution of acetic acid. This bath neutralizes the alkali from the ammonium hydroxide or sodium carbonate. Rinse the print again for a minute.

To tone the print, immerse it in a 1% tannic acid solution for 10 minutes and finish by washing the print in running water for 30 minutes.

Figure 7–34
Willis Odundo, *Cyanotype Bouquet*, 2006, Kageno Kids, Kenya
This is Willis Odundo's finished cyanotype.
(Courtesy of Kageno Kids, Jayne Hinds Bidaut, and Willis Odundo)

Gray to Reddish Tones

Mix up a solution of 48 g of copper nitrate dissolved in 100 ml of distilled water. Then, add 5 drops of household ammonia and mix it well into solution. Immerse the print until the desired color is achieved and wash the print well in running water for 20–30 minutes.

Eggplant Black Toning with Dark Cyan

Begin with a dense and over-exposed cyanotype. Age your cyanotype print for 24 hours and re-soak before beginning the toning sequence. Immerse the print in a very weak sodium carbonate dilution (a pinch of sodium carbonate to 1,000 ml of water) until the lightest highlights open up. Immediately move it to a wash tray for 10–15 minutes.

Then immerse the bleached print in a strong tannic solution, 100 g to a liter of water, for another 5 minutes and wash the print again for 10 minutes. Return the print to the weak sodium carbonate bath, and a lovely rose color will appear. You may stop here if you want and rinse for 20–30 minutes.

However, if you want the eggplant black with deep cyan, take your print, after it has rinsed following the last sodium carbonate bath, and immerse it in a tray with a small amount of ammonia to a liter of water. Observe the changes and stop it when the color you want is reached. Finally, wash the print well for 20–30 minutes.

Figure 7–35
Christina Z. Anderson, *Traffic Jam*, 2009, (gum over cyanotype)
A terrific gum bichromate pass over a completed cyanotype by an outstanding artist and professor who inspires and educates at Montana State University.
(Courtesy of the Artist)

Violet-Black Toning

Age your cyanotype print for 24 hours and re-soak it before beginning the toning sequence. Mix up a weak solution of sodium carbonate consisting of a pinch of the chemical to a liter of water and immerse the print until it has turned a pale yellow. Wash the print for 10 minutes. Then mix a solution of 8 g of gallic acid, 0.5 g of pyrogallic acid, and 1,000 ml of water and immerse the print until the desired color is reached. Wash the print for 15–20 minutes and hang to dry.

Red-Brown Toning

Age your cyanotype print for 24 hours, re-soak it thoroughly, and then immerse it in a solution of non-detergent (also known as non-sudsy) household ammonia and water, mixed in solution at approximately 32–1,000 ml of water until the print turns a violet color. Wash the print for 15 minutes and then immerse it in a strong solution of tannic acid and water (50 g to 500 ml water) for 5–10 minutes.

After the tannic acid bath, wash the print for 5 minutes. If you like the brown color, stop the process at this point and wash for 20–30 minutes. If you feel like going on, immerse the print in a strong solution of sodium carbonate until a deep red-brown appears and then wash the print well for 20 minutes. If you decide to get more of a good thing at this point and repeat the sequence, you will get mud.

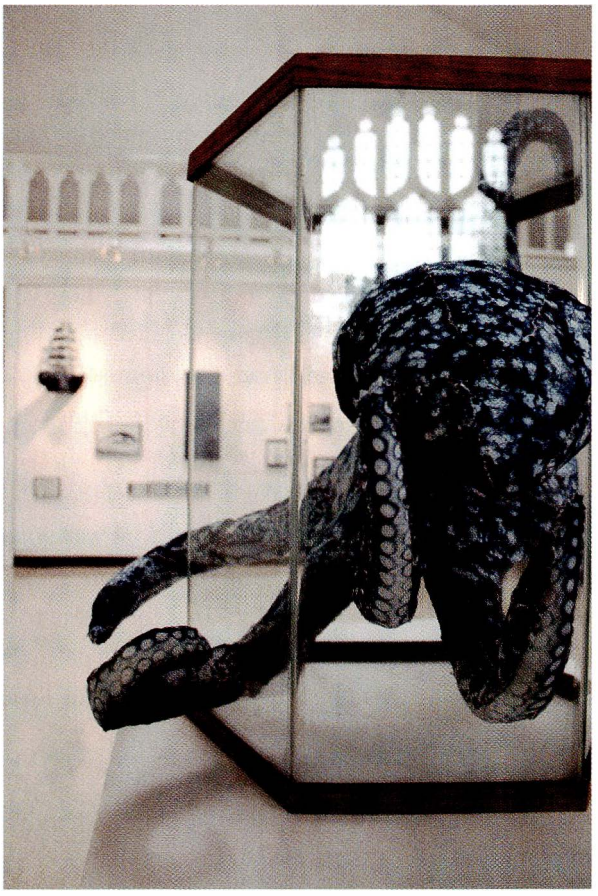


Figure 7–36
Tasha Lewis, *Octopus #04,* 2009 (cyan on fabric)
Tasha Lewis is one of the up-and-coming installation artists employing alternative processes in her work. *Octopus* is made from recycled paper and cardboard, masking tape, magnets, and cyanotype cloth. The skin is printed, collaged, and then hand sewn around the paper forms.
(Courtesy of the Artist)

Dark Blue/Blue-Violet/Rose Split

Follow the directions for the rich red-brown toner. After washing, quickly immerse the print in the strong tannic acid again and then wash the print for 5 minutes. Then immerse the print in the gold–borax toner formula used for salted paper toning (400 ml distilled water, 3 g borax, 6 ml 1% gold chloride) until you see the split. Finally, wash the print for 20 minutes.

LAST WORDS

In great portions of this book I am very specific about formula. However, the toning segment in this particular chapter is intentionally non-specific, as toning is a subjective exercise and the variables are many. As I wrote to a professor in Fresno, California, one try at conducting a toning session in a group and you will see that no two prints will behave the same after the first print enters the final rinse. You almost have to have separate trays for each student to be 70% accurate from one print to the next.

Toning cyanotypes, or any other alternative process, is about play and encouraging imagination and experimentation . . . about being an artist, not about having exact answers to every problem. As Winston Churchill put it, "Success is the ability to go from one failure to another with no loss of enthusiasm."

Cyanotype Variations & Inventions

OVERVIEW & EXPECTATIONS

The intention of this chapter is to provide inspiration and creative scaffolding for a vast menu of possibilities and options that can evolve from Herschel's brilliant 1842 invention of the cyanotype. I will be offering you ideas on how this process, like all others in the alternative process genre, can be integrated with contemporary and conceptual media.

I'll begin by exploring the possibilities of creating large cyanotype murals with cyanotype-sensitized fabrics. In that context, I'll provide you with a step-by-step guide of exactly how you can perform this process in under an hour from start to finish. This is especially important for K-12 teachers who generally have a 45-minute window to teach anything, no matter how important it is. Producing a cyanotype mural is a terrific way to make giant photograms with a group, especially of brand-new students in a first project, as the exercise allows them to play with translucent, transparent, and opaque elements in order to make a huge collaborative piece of art. A cyanotype mural activity teaches them in the best direct and personal way what photography is really all about, as they are both the creator and the subject of the piece they are making together. I'll add that taking a mural-sized, pre-sensitized, cyanotype fabric to a family outing really can be a "day at the beach" since you don't need anything but the ocean, a bottle of hydrogen peroxide, and a contractor-size plastic trash bag that protects the fabric on the way to the shore!

Once your mural has been realized, you will see how cyanotype on fabric printing is an opportunity to make photogram murals, unique clothing, installations, bed linens, quilts, costumes, or anything else that you feel might be improved if it had one or more of your images on it.

In addition, I'll discuss other variations and adaptations of this very flexible process such as Mike Ware's new cyanotype process, cyanotypes on alternative materials, cyanotypes combined with other alternative processes, beautiful *chemigrams* in which the crystals of the chemistry provide the image, and ways in which the process is incorporated into artists' books, sculptures, and ceramics. I'll also introduce you to a number of ways in which you can prepare non traditional substrates, such as glass and ceramics, for cyanotype impressions.

Figure 8–1

Christopher James & Peter Baryshnikov, *Last Night's Dream*, 2009

One morning during a workshop, I related a dream that I had had to Peter, who thought it would be a great idea to recreate it in a mural. We did, and following the workshop, Peter took the mural out into the woods of the Pacific Northwest and hung it up for this installation shot.
(Courtesy of the Artist/Author)

Figure 8–2
Christopher James, Cyanotype Mural with Bicycle, Maine, 1999
I begin every alternative process class and workshop, weather permitting, with a cyanotype mural. This exercise gets everyone involved and together immediately and provides me with a captive audience for 20–25 minutes, during which I can talk about art history, the influences of photography on culture and society, and what the chemistry in alternative processes is actually doing. It is also the perfect way to describe how photography works.
(Courtesy of the Artist/Author)

You are going to be introduced to the great concept of bringing photography to places where the medium has not normally been taught. In this chapter you are going to see examples of work done by children in Kenya with Jayne Hinds Bidaut and the Kageno Kids and in Nicaragua in Ronnie Maher's Project Nica. We'll also go into the woods in Norway to see Galina Manikova's installations. If you are inclined to make a difference in this world with your photographic work, you will find these ideas compelling and perfect.

THE CYANOTYPE MURAL EXPERIENCE: FOR TEACHERS

The next several pages describe how I typically conduct a first meeting and introduction to an alternative photographic processes class or workshop. My intention is to create a class bond as quickly as possible, and this initial exercise will guarantee that outcome while simultaneously meeting my intention of making the students fall in love with photography. This project welcomes the students to the world of alternative processes and taking responsibility for their handmade photographic art . . . something that fewer and fewer of them experience now that digital technology has replaced the wet labs in so many schools.

The most important task you have from the start is to communicate your personal enthusiasm for this process. The second task is remembering that your students' experience with chemistry has likely been pretty dry, perhaps a little intimidating, and usually for the purposes of passing a standardized test.

Introduce them to the chemistry as if you were discussing ingredients in a cooking demonstration, and be sure to make connections to the role *of each chemical and its effect upon the print . . . "In the following cyan mural exercise, the ferric ammonium citrate is the "light trigger" and is responsible for the light sensitivity of the sensitizer."*

Describe the people who came up with the idea of this thing you are about to do together, what made them interesting, the times they lived in, and the impact of their ideas upon our present day culture. For example, a young scientist by the name of Alfred Smee gifted

this chemical to Sir John Herschel after Herschel had asked him if he knew of any deeply colored salts that might be bleached by light. In reply, Smee sent him some bright red potassium ferricyanide and a small sample of a brand new substance called ammonio-citrate of iron (ferric ammonium citrate) that had only recently been available to scientists and was primarily prescribed by physicians as a drinkable tonic for patients complaining of low energy. It was Herschel, by the way, who first used the word *photography* to describe the act of marking with light.

This approach makes the knowledge more personal and engaging and gives your information a human context. Once your students are interested in your stories and context, they will be completely ready for your "cooking" demo, in which the process is laid out and executed perfectly by all of you together. My best advice . . . be involved with your students in the creative process of making the mural and have fun, as play is the only way to learn anything well.

The Lure

Have a completed cyanotype mural on the wall or floor or in the hallway when the students come to your class for the first time. If you have a large enough room, lay out a previous year's mural on the floor so that the students have to negotiate the floor space as well as put 2 and 2 together to see that there are life-sized, white, opaque photogram bodies lying down on deep blue fabric. This prevents them from being complacent about the piece as they enter the classroom and raises their curiosity about what's going to happen in class that day. A 9' × 18' cyanotype mural on the floor or wall can't be missed, and everyone, no matter how apathetic he or she might be, is always impressed by the size and dynamics of a piece of art that large. It is likely that not one of the students has ever created anything that large before. Don't explain a thing yet . . . let your students think about what they are looking at, and then ask them what they see . . . and listen.

Figure 8–3
Bayside Cyanotype Mural, Maine #1, 2004
As part of my Teacher's Workshops with Craig Stevens (SCAD) at the Maine Photographic Workshops, we used to take the participants to an old seaside vacation community called Bayside. We then told the teachers to inspire the vacationing children thereby teaching them how to produce a cyanotype mural. This is the first part of the process, the exposure. About 22 minutes later the kids race into the ocean with the exposed fabric, where the exposed salts are wash-developed in the Atlantic and the unexposed salts join other salts in the ocean. The final clean rinse wash is done with a garden hose on the dock.
(Courtesy of the Artist/Author)

Materials You Will Need To Be Amazing

- A pre-sensitized cyanotype fabric from http://www.blueprintsonfabric.com. Linda Stemer pre-coats and sells high-quality prepared fabrics (e.g., 100% cotton, raw silk, and Chinese silk). Prepared fabric comes in super sizes from 9' × 18' to 12" squares for quilting. In all of the years I have been demonstrating with Linda's fabrics there has never been a single flaw . . . very important when you're in front of a group of people expecting great things.
- Your makeshift washing sink will be a 42-gallon plastic trash can that is either very clean or lined with a contractor-grade plastic trash bag.
- You will need a garden hose that is hooked up to an outside spigot. You can also safely use the ocean or a river for the development wash in which you will be washing out the unexposed iron salts.
- For the "big-thrill" you need a quart of drugstore-grade (3%) hydrogen peroxide. A splash of this inexpensive liquid will accelerate the oxidation of the iron in the image and make the dark blues impressively deep and rich. At the same time, the comparison with the highlights make those elements in the mural seem to glow.
- You will need push pins or a clothesline to hang the finished mural for drying. If you have a nice lawn area or some clean beach, that will work as well.
- You definitely need a dry ground area to lay out the fabric and the students and the objects they are bringing with them to the mural. If the ground is damp the cyanotype mural will begin to develop-out during the exposure, making your highlights muddy and unexciting. If your location is a problem then lay down a large plastic tarp to lay the sensitized fabric upon.
- You will also need sunlight. In the summer months, at sea level, you can count on 22–24 minutes of mid-day sun to give you a perfect exposure. At altitude, say a workshop at Anderson Ranch in Colorado or the Santa Fe Photographic Workshops, you can expose for that time in the early and later part of the day. For high noon, you will be close to perfect at around 16–18 minutes. It's hard to fail by over-exposing.

Prepared Fabric: The Simple & Perfect Solution

I'm going to begin by making your life really simple. Instead of hand dunking or spraying your fabric with sensitizer and then hanging a huge piece of fabric in the dark and being speckled blue for the next week, make an inexpensive investment in a pre-sensitized fabric. This eliminates the hassles in the process just mentioned (which I did for many years) and not being 100% sure your fabric is going to work the next day or be completely dry in time for the demonstration. Trust me, you will be extremely happy you did this.

As mentioned earlier, go online and order a pre-sensitized cyanotype fabric, in sizes ranging from 12" squares for quilting to 9' × 18' for wall hangings and clothing. The site address is http://www.blueprintsonfabric.com. Linda Stemer runs the show and pre-coats and sells high-quality prepared fabrics (e.g., 100% cotton, raw silk, and Chinese silk). Linda is terrific and enormously helpful, so don't be afraid to get in touch with her directly.

Fabric: The Less Simple Solution

If you insist on coating your own fabrics, which is a good idea if you intend to make a cyanotype on your own pajamas, you will need 100% cotton, silk, or linen fabric . . . anything from clothes to bed sheets to canvas. It is imperative that you use the best fabric you can afford. Be sure to wash new material several times in complete hot water cycles to remove the manufacturer's sizing and brighteners. It is also a known truth that 100% cotton labels do not always mean that the fabric is 100% cotton. Just ask printmakers about how difficult it is to get true 100% cotton print-making papers.

Over the last few decades I have used several different types of king-size sheets from discount stores and catalogues. In each case, the thread count was between 230 and 300 and the material was labeled as being 100% cotton. The best results were Martha Stewart sheets purchased at a mall discount store with a label indicating that they were manufactured in Pakistan. A similar sheet, labeled "Made in the USA," felt "crispier" when wet but was indistinguishable from the Pakistani-made sheet after an identical exposure and development. However, when both sheets had "dried down" following the

exposure, the Pakistani sheet remained rich and saturated with the wonderful Prussian blue color. The "made in the USA" sheet, after dry-down, had faded by nearly 50 percent. We repeated the test with a longer exposure and more chemistry on the USA-made sheet and achieved only a slight change in color density. Bottom line, synthetic additives and sizing in cotton sheets will not provide a good cyanotype mural experience.

Synthapol: Sizing Remover

If you must coat your own fabric, there is a solution. To remove sizing from new fabric there is a product that fiber artists use called Synthapol. It can be purchased from the Dharma Trading Company. Synthapol is normally used to remove any loose dye particles to prevent the migration of dyes that may wash out. Synthapol may be found wherever fabric-dyeing chemicals are sold. Follow label directions closely.

If You Don't Have Any Synthapol

The first thing you should do when you bring home fabric is to run it through several complete hot water wash cycles in the laundry. The purpose of this washing is to remove the sizing put into the sheets during manufacturing. The hot wash with a little soap loosens the sizing, and a hot rinse clears it away. Note: if you rinse with cold water, you simply reset the sizing that remains in the fibers.

My last recommendation, if you are not going to be purchasing pre-sensitized fabric, is to try to buy used sheets and linens from hotels, as they have been washed hundreds of times and are probably perfect for your needs. You can also go online to a site like craigslist and ask for old, used sheets. I know it sounds a little kinky, but you can get anything there pretty quickly.

Development Equipment: Trash Can & Hose

Use a large 32-gallon plastic trash can that is either very clean or lined with a 42-gallon contractor's-grade plastic trash bag. You'll need the garden hose to fill up the trash can.

Or Better Yet . . . the Ocean!

You may not always be making your mural near an outside spigot that a hose can be attached to. In these situations, you always have nature. Keep in mind that one of the beauties of this process is that you can safely use the ocean or a river for washing out the unexposed iron salts in your cyanotype mural. Whenever I am asked by environmentally concerned passers-by about how our activity might be destroying the environment, I first invite them to join the mural-making fun and then point out that all we are doing is adding a little additional salt to the ocean. The idea of processing in a trash bucket with a garden hose or in a surf line at the ocean is so seductively low-tech that even if you have no interest in doing a cyanotype mural, you owe it to yourself to have the experience. This is also, I will add with a lot of experience, a great activity at the beach, a family reunion, a wedding reception, or a camping trip.

Figure 8–4
Bayside Cyanotype Mural, Maine #2, 2004
Here's the finished mural and the kids who made it. As soon as the documentation is done we have a raffle and one of the kids gets to take it home with instructions on how to care for it.
(Courtesy of the Artist/Author)

Instant Oxidation & Gratification

Bringing along a quart of drugstore-grade (3%) hydrogen peroxide for instant oxidation and gratification is a great idea. The instantaneous deep blue that is achieved in a hydrogen peroxide bath is exciting, but don't worry if you don't have any; the cyanotype will get deep blue on its own as normal oxidation occurs.

Drying the Mural

You will need some way to dry the mural after its final wash. If you have a fence or outside wall, pushpins work well. In the woods, a clothesline strung between trees will do the trick. You can also use a dry dock, a nice stretch of beach, a lawn, or a sidewalk. Post a guard if you dry your mural on a sidewalk in the city . . . it is not uncommon for someone to come along and like it enough to steal it.

CHEMISTRY: A & B

Chemistry: Homemade Coating Instructions

If you are not purchasing a pre-sensitized fabric and have chosen to coat at home, here are a few things to consider. The easiest and least expensive way to deal with the hand-coating task is to buy the chemistry in bulk form. Mixing the cyanotype chemistry is quite simple, and the chemistry is very inexpensive when purchased through a chemical supply. If you are pressed for time and don't object to paying more money than you need to, you can buy your solutions in wet or dry pre-measured kits from the Photographer's Formulary or Bostick & Sullivan.

On average it will take 3000 to 4000 ml of sensitizer to coat a king-size sheet with a dunk-style coating technique in a plastic tub from a hardware store. If you decide to be frugal and purchase the raw chemicals from a chemical supply, all you will need at home is an inexpensive gram scale. One pound (453 g) of both ferric ammonium citrate and potassium ferricyanide will cost less than $40 and will make more solution than you will likely use in a year. By comparison, an average prepared kit, yielding 500 ml of prepared solution, costs about $20. The following formula will yield 2000 ml of working solution.

Note: None of the chemistry in this process poses a serious health risk unless you are one of the very few people who may have an allergic reaction to the components. Ferric ammonium citrate is often found in iron and vitamin supplements, and potassium ferricyanide is a stable compound that only becomes a risk if it is heated above 300°F or if it is combined with a strong acid . . . which is something that you will not be doing. Wear latex or nitrile gloves when mixing the sensitizer and coating substrates to avoid becoming blue for a few days.

Cyanotype Stock A

200 g	ferric ammonium citrate
1000 ml	distilled water

Stir these two components into a uniform solution. Pour the solution into photo-type plastic storage bottles and label it "Cyanotype Part A—Ferric Ammonium Citrate."

Cyanotype Stock B

80 g	potassium ferricyanide
1000 ml	distilled water

Stir these two components into a uniform solution. Pour the solution into a different photo-type plastic storage bottle and label it "Cyanotype part B—Potassium Ferricyanide."

You now have two separate 1000 ml plastic storage bottles: 1000 ml of Stock A and 1000 ml of Stock B. Let the two solutions "ripen" for 24 hours. If you experience fading after your first test strip of fabric—because you are not going to commit your giant size piece to an exposure without knowing what will happen to it—your problem is most likely going to be either your fabric or that the length of your exposure was too brief for the level of UV light available. Don't stress: very little can go wrong with this process.

Figure 8–5
Detail from an Oklahoma O.S.A.I. Mural, 1999
This is a detail of a mural from one of my 1999 workshops made at the Oklahoma Summer Arts Institute (OSAI). The person in the detail is Paul Taggart, who later became a student of mine in Boston and who has had a stellar career as an international photo journalist.
(Courtesy of the Artist/Author)

Figure 8–6
Grace Huang, *Norman in Blue,* 1989
While a student of mine at Harvard, Grace made this stuffed cyanotype pillow of her friend and fellow classmate, Norman Gholson, on his flannel pajamas.
(Courtesy of the Artist)

Coating: The Spray Method

In a room with a low ambient light level, mix equal parts of the Stock A and B solutions together. This is your working sensitizer. If you're going to spray the fabric, fill a garden supply spray bottle or a washed out household cleaner spray bottle with the solution. If you intend to immerse your fabric, pour the entire 2000 ml into your plastic tub for an immersion technique.

Put on some old clothes you don't care about anymore, latex gloves (so you don't turn blue), eyewear, and a respirator. If you are planning to make a mural using the spray technique, hang the material on the line that you will dry on before you begin spraying. That way it can dry right where you sprayed it. The room you use must be able to become close to dark at least for an overnight drying period. It is likely you'll need to add drying time or use a hairdryer at some point. Allowing a full 24 hours would be a wise plan.

Coating: The Dunk Method

For large mural pieces using sheets or sizeable pieces of fabric I advise you to use the dunking method. With this coating technique the entire sheet goes into the solution at once, which nearly guarantees an even coating. Whether you are spraying, painting, or dunking a fabric area, lay down a heavy-duty tarp or plastic sheeting to protect the floor from blue staining.

Mix your prepared stock A and B solutions so that you have an adequate amount of liquid sensitizer to totally saturate the fabric. Remember that a king-size cotton sheet will absorb about 4000 ml of sensitizer, so plan accordingly. A flannel sheet will take twice as much solution as an Egyptian cotton bed sheet. Again, don't forget to

put on a pair of latex gloves and wear old clothes that you don't care about. I once gave a 40" × 60" paper coating demo in which I thought everything had gone really well. I walked home in a light mist and upon arriving discovered that my clothing and skin had turned a curious and semi-permanent speckled blue. The daylight had exposed the splattered cyanotype chemistry on my exposed skin and clothing, and the mist had "developed" it during my walk. The speckling on my skin eventually wore off. Don't be alarmed if your clothes or skin get stained a little.

Next, take a large plastic tub and pour the A and B cyanotype solution, in equal parts, into it. Turn down the room lights and immerse and knead your material into the solution until you are sure it has been completely coated. One immersion coating is sufficient as long as it is a saturating one. If you do not elect to use the dunking immersion method, I strongly advise applying a double coating to the material by either the brush or spray technique. Honestly, the dunking method is easier, cleaner, and much less of a hassle.

Your life will also be easier if you are coating in the same room where you will be hanging the coated material to dry. The dimensions of the room should be larger than your fabric. You will need to have installed a taut clothesline to hang the soaking sheet on for drying. This hanging part is much easier with helper friends, a ladder, and good quality clothespins. Hang the sheet and make the room as dark as possible for the dry time. If you are in a hurry, you can go into the room and begin to blow-dry the material. Be forewarned that this task is quite a tedious one and an annoying way to spend a few hours. Be sure to wear a respirator if you decide to blow-dry. Once the material is dry, it is UV-light sensitive. Bag it and hope that the humidity in the air doesn't begin to develop the material while it is in the bag. In this homemade coating situation it is best to use the material within a short time.

The Best Solution

If you want to avoid all of the work and time it takes to prepare your substrate by hand, let Linda Stemer do it for you. It will arrive boxed, in contractor's plastic bags, ready to be used, and it will be perfect.

The Process

Almost 100% of the time I do cyanotype murals with large groups of people: students, families, strangers I run into on the beach. It is simply more fun to have

Figure 8–7
Kageno Kids, Kenya, (preschool)
Cyan Mural, 2006
Jayne Hinds Bidaut is a volunteer for Kageno Kids, in Kenya, and this is a document of one of the murals she made with the preschool kids. *(Courtesy of Jayne Hinds Bidaut and Kageno Kids, Kenya)*

the mural experience with a crowd. Once summer I was teaching at the Oklahoma Summer Arts Institute and a group from a kindergarten came by all tethered together like a team of horses. I asked their teacher if they would like to make a mural with my workshop and she agreed. I should have realized that the very idea of keeping a dozen preschool-age children still for 22 minutes would be impossible, and sure enough, we ended up with a pure blue sheet.

It goes without saying that sunlight is your best UV source for murals of this size. It is possible to make an exposure under fluorescent lights, but it's going to take a very long time and will eliminate the possibility of using human beings as subjects. You can also take a long nap under an indoor agricultural grow-light system, but one that size will be precious in terms of cost. That's fine if you like irony and want to spend a $1000 to make a mural with less than a $100 worth of materials. One other source, besides an ancient and environmentally hazardous carbon arc lamp, would be a large bank of UV-CFL bulbs. They do emit a degree of UV light and are good for parties in your basement, but the exposure would take a long time. Best to use the free sunlight.

I begin by taking a group of people outdoors and explaining to them how we are going to create a cyanotype mural together. If these people are my students then they have already seen examples of the cyanotype murals in presentations and in real life on the floor or walls of my classroom or lab. I show them the black plastic bag that contains the pre-coated fabric and explain to them that the cotton material inside is coated with two simple iron salts: ferric ammonium citrate and potassium ferricyanide. I explain that these two chemicals are relatively safe and that they are iron salts that will reduce from a ferric to a ferrous state during exposure. I then explain the chemistry and its role in the process . . . : the ferric ammonium citrate is the "light trigger," and the potassium ferricyanide is responsible for making the piece cyan blue. I quickly explain what they will do, that they will be the subjects of the mural, that if they do it well the piece will last for several generations as long as it is not used as a flag, and that I will continue the conversation once we begin the exposure.

It is important to do this exposure on a large surface that is free of moisture. Cyanotypes are water-developed, and if there is moisture underneath the fabric during exposure, the process of development will begin resulting in highlights that will be less than sparkling white. I then ask everyone to go and gather objects to use when we make our giant photogram.

When everyone returns from collecting, gather the people and props together and make two people the creative leaders of what this mural's story will be. Make decisions as to whom and what will go where and for what period of time. You can move objects around during the exposure, which will provide ghost images,

Figure 8–8
Ronnie Maher, Project Nica/Nicaragua Project, 2006
In 2005, Ronnie Maher volunteered to visit Nagarote, Nicaragua, and conduct a photo workshop for the Jerónimo López Youth Project. Ronnie now makes several trips a year and is an N/NSCP board member. NicaPhoto stands for the Norwalk/Nagarote Sister City Project (N/NSCP), a partnership for sustainable community development between Norwalk, Connecticut, and Nagarote, Nicaragua. These young people are part of the López Youth Project, where most of the 200+ families struggle to get by on less than $2 a day. The Youth Project, which now has over 150 teens, provides year-round activities designed to offer young people an alternative to the gangs, drugs, and crime prevalent in their neighborhoods. To learn more about the project visit http://www.NicaPhoto.com.
(Courtesy of the Artist)

double exposures, and illusions of movement. In an Intro to Alternative Process summer workshop, we used an old bicycle as the central element in a mural. With an early morning light low on the horizon, the shadows of the bike, with one student appearing to ride it while another sat in the bike's basket, provided a wonderful illusion of depth and movement.

Various tie-dye techniques, such as small tufts of fabric tightly bunched with small rubber bands, will yield interesting star-like results. Think Grateful Dead tie-dye. Misted water spray and water droplets thrown from your fingers will also create interesting abstract drawing elements. Negatives will print positive, glasses will distort the light, and low-elevation objects will cast shape and shadow. Long hair, grasses, and plant life always look ethereal and impressionistic.

When everything is ready, assign one person to each corner of the fabric and whip the material out of the dark plastic bag that has been keeping it safe from light. Lay it out and immediately cover it with your objects and the people who will be *exposed*. I tell them to quickly find a comfortable position to remain still in. The exposure will take about 18–23 minutes, depending on the time of year and where you are. A standard time will be 22–23 minutes, between 10:00 a.m. and 2:00 p.m., in the summer months and 25–30 minutes in the fall.

Winter in the northeast is pointless.

Everyone on the sensitized fabric is now my captive audience, and I use this opportunity to entertain and educate. I begin to tell them the history of the process and to put what they are doing in context with the beginning of photography. I tell them about Sir John Herschel and the culture that influenced his life. You can refer to the A Little History section in the Cyanotype chapter for your script. I'll ask if anyone remembers the chemicals in the sensitizer and re-state what is happening to the iron salts under the influence of UV light. Ask questions about the history and chemistry constantly throughout the exposure, and by the end, everyone will be able to impress their friends with their newfound knowledge. This demonstration strategy also keeps everyone from thinking about how uncomfortable and hot they are during the long exposure.

I ask the people on the mural to look at the color of the fabric. I want them to make the connection between the original bright greenish-yellow chartreuse when we laid it out and the color as it changes during exposure. As the exposure time continues, the chartreuse color turns to a blue and then begins to lose that color and go lighter to a greenish-slate gray. This gray is the color we are seeking. I tell them that the only serious error they can make is to under-expose the mural. Please be patient and go the distance on the exposure . . . no matter how much your subjects complain.

With a minute to go, I quickly outline everything that is about to happen. I warn them that the exposure is about to end and that when I count to 10 they must leap off the fabric, grab any objects they have, and we'll race with the exposed fabric to the trash can filled with water, or to the river or ocean.

Wash Development

It doesn't take a lot of effort to process the exposed cyanotype, and the only way you can go wrong is to not wash all of the unexposed ferric salts from the fibers of your paper or fabric. Develop your image in an appropriate body of water or in a container large enough to hold a good deal of water and the fabric.

If you are on the beach then simply use the ocean, but bring along the contractor's-size trash bag, as you will need it for the hydrogen peroxide bath once the washing is complete. Do not let go of the plastic bag, as some sea creature might be curious about it as a food source and be harmed. Wash the fabric in refreshed, moving water until the highlights are pure white or close to the way the fabric looked prior to coating it with sensitizer. Clearing the unexposed (still chartreuse-colored) sensitizer will take between 3 and 4 minutes, depending upon your water source. You can safely use a swift running river, but do not use a still-water pond or estuary, as it is important that there is constant movement and flow in the water.

If you are using a hose and a trash bucket, 4 to 5 complete water changes with a lot of sloshing around should do the job. On a hot and humid day you might see an interesting sight. Some of the people who were props in the mural may have blue hands, faces, arms, and other body parts that were in contact with the sensitizer during the exposure. The person doing the rinsing will also get a little blue on the hands and feet.

I recommend taking off your shoes if you are the person emptying the bucket. Small children who jump onto the fabric with wet bathing suits will always pre-develop the fabric directly underneath them and usually a good portion of their bathing suit and wet exposed skin.

If anyone is concerned about getting a chance to have blue skin then you can place clear acetate, plastic, or food wrap between their skin and the sensitized fabric during the exposure. If someone does get stained, the blue can be scrubbed off easily with a phosphate-based soap. I personally use a tablespoon of sodium carbonate mixed with a liter or two of water. This takes the blue out pretty fast, and it's basically behaving like soap. It even feels like soap and soft water when wet. If some of the blue stays on the skin it should be gone in a day or two.

You will notice that the shapes in the mural where people perspired have very interesting edges: scalloped and similar to tone-line drawings. In almost all hot and humid day mural exposures you will be able to tell what kind of clothing, and under-clothing, your subjects are wearing because the extra layer of fabric where there are seams blocks their perspiration from reaching the cyan-sensitized fabric. This is always funny when everyone is examining the finished mural. Continue the water rinses until the highlights are clean and there is no more yellow-green washout of the original sensitizer visible in the water.

Hydrogen Peroxide: The Big Thrill

Now it is time for the big thrill. I make the last dump of the wastewater and re-fill the trash can with fresh water. If I'm working in a river or ocean, we'll all go in the water up to our knees and I'll have students hold the contractor trash bag open and fill it halfway with water while another student or two hold the rinsed-out mural. Once there is sufficient water to immerse the mural, I take the 3% hydrogen peroxide and casually dump a quarter to half of the bottle into the rinse water, explaining how precise measuring is critical to the success of this step. I do this to make everyone understand that this process is all about play and that it's OK to mess around with the rules. Once the hydrogen peroxide is mixed with the water, the mural is re-introduced to the water with the hydrogen peroxide, where a radical and impressive change takes place.

The blue in the cyanotype will darken immediately, in comparison with the highlight areas, making everyone who participated in the mural feel very positive about the entire experience. After 20–40 seconds, remove the material from the hydrogen peroxide bath and place it in clean, refreshed water for four to six complete fresh water exchanges.

When the time is up, just drop the sides of the plastic bag and continue with the washing cycle. If you are at the ocean you will want to eventually rinse the fabric in fresh water. Look around for an outdoor shower or

Figure 8–9
Kageno Kids, Kenya, With Their Cyanotypes, 2006
(Courtesy of Jayne Hinds Bidaut and Kageno Kids, Kenya)

a boat dock where there should be a fresh water hose. The rush to fresh water is not immediate, but you will want to do it when you're back in civilization.

Following the final wash, you can dry the mural by stringing it up on a clothesline, laying it out on the lawn, pinning it to the side of the house—you decide. This sets you up to begin toning, dying, combining techniques, sewing quilts, or whatever else you had in mind. Think about it; this is just the beginning of the possibilities.

Post-exposure Washing Care

If you decide to make cyanotype clothing, it may be socially appropriate to wash it on occasion. Cyanotypes will change to yellow if washed with phosphates. Try to avoid using detergents or laundry soaps containing phosphates. If you need to wash the fabric, use a product like Seventh Generation laundry detergent, Dr. Bonner's Peppermint Soap, or a dish detergent such as Ivory or Dove. Dry cleaning is not recommended.

Figure 8–10
Mike Ware, *Mandorla*, '87–'99 (New Cyanotype)
Although Herschel's was the first of the iron salt/non-silver processes, it has weathered the medium's transitions essentially unchanged since the year he combined the chemicals he received from Dr. Smee. Mike Ware decided to address the shortcomings of Herschel's original process in order to make it even better and ended up creating a New Cyanotype process that is user friendly and a fine addition to the alternative process menu.
(Courtesy of the Artist)

THE NEW WARE CYANOTYPE

A Little History

As you may recall from an earlier A Little History segment, Sir John Herschel developed the cyanotype process in 1842, three years after the politically "official" proclamations of the discovery of photography by Daguerre, Bayard, and Talbot. Although Herschel's was the first of the iron salt (siderotype) processes, it has weathered the medium's transitions essentially unchanged since the year he was inspired to invent it. My friend Mike Ware, in the United Kingdom, decided to address what he considered the modest shortcomings of Herschel's original cyanotype process in order to make it better. Mike is predisposed to these kinds of improvements and has done an incredible amount of work in the field of photographic science, including the modification of other iron-based processes, such as the argentotype and the chrysotype.

Mike is exceedingly generous and forthcoming about what he knows, and because I am under the illusion that he is Herschel's contemporary doppelgänger, I felt it would be a good idea to include his New Cyanotype process in this book. With Mike's permission, the following represents an abridged version of his adaptation and its practical application if you are interested in practicing the process. For a complete rendering of the entire New Cyanotype process I suggest that you see Mike's book, *Cyanotype: The History, Science & Art of Photographic Printing in Prussian Blue* (London, The Science Museum and National Museum of Photography, Film and Television, 1999). This excellent text is obtainable from http://www.siderotype.com.

The Six Shortcomings of the Traditional Cyanotype Process

1. The exposure times are often very long and tiresome.
2. Part A (ferric ammonium citrate) and Part B (potassium ferricyanide) must be stored in separate

bottles because Part A becomes an excellent environment for mold growth within a short period of time. This problem can be reduced with thymol crystals. Refer to the previous chapter for specifics.

3. The sensitizer, parts A and B, mixed in equal proportions is not absorbed completely, or very well, by the coated paper or fabric.
4. The traditional salt, ferric ammonium citrate, is notoriously inconsistent in its composition, stability, and performance, and supplier's samples often vary quite a bit from batch to batch.
5. Due to the colloidal nature of Prussian blue, a lot of the image, if not overexposed to the point of solarization, often washes away in development.
6. Highlights stain by transfer of colloidal Prussian blue in the wet processing.

Chemical Solutions for the Six Problems

If ammonium iron(III) oxalate (a.k.a., ammonium ferric oxalate or AFO) replaces the ferric ammonium citrate in the solution these three things happen:

1. The cyanotype sensitizer becomes more sensitive to light, and this results in shorter exposure times.
2. The sensitizer doesn't get moldy necessitating a filtering step before work commences in the lab.
3. The sensitizer penetrates and is absorbed by cloth and paper fibers more easily than the conventional sensitizer.

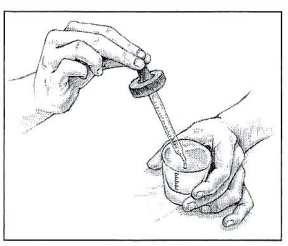
What's more, ammonium iron(III) oxalate is obtainable universally as a highly pure, consistent chemical, unlike ferric ammonium citrate. It is, however, a bit more expensive. Note that AFO (ammonium ferric oxalate) is paired with lithium palladium chloride in the Ziatype process and is readily available from Bostick & Sullivan.

The form of Prussian blue made with ammonium salts, rather than potassium, does not disperse so easily on wet processing, but it demonstrates a better binding property with the substrates. There is also less likelihood of stained highlights.

However, ammonium iron(III) oxalate, when mixed with potassium ferricyanide, tends to crystallize out potassium iron(III) oxalate, which is not very soluble, and this forms a "gritty" solution that may cause unwanted textures on the print surface.

Realizing this, Mike decided to substitute *ammonium ferricyanide* for the *potassium ferricyanide*. This, however, was a problem because the ammonium ferricyanide was unobtainable commercially and quite complicated to make. His solution was to eliminate the potassium ions from the formula altogether and replace them with ammonium ions, thus making the ammonium ferricyanide "in situ." Voila! All of the shortcomings could be addressed simply by eliminating the majority of the potassium ions in the formula.

To accomplish this, Mike added a hot, concentrated solution of potassium ferricyanide to a concentrated solution of ammonium iron(III) oxalate (AFO), allowing it to cool and create crystals. He then filtered off the solid potassium iron(III) oxalate that was the result of that action. A simple, single-part, sensitizer was created, and most importantly, Mike had successfully eliminated all the problems that he had identified as shortcomings in the original Herschel process.



Paper Options

There are few paper choices that will not result in a decent traditional cyanotype print. However, Ware's New Cyanotype requires a little more selectivity. As Mike says, *"The cyanotype sensitizer is a delicate test of paper quality—especially if the coated paper is left for some hours in the dark at normal relative humidity: any change of the bright lemon-yellow coating towards a green colour is an indication of impurities or additives in the paper that are hostile to this process."*

The best paper option for the New Cyanotype is a handmade Ruscombe Mills variety, and using it with this process is quite a pleasure. In 1992, Mike Ware and Ruscombe Mills' Chris Bingham collaborated to produce a handmade paper that would be ideal for the siderotype research that Mike has been so invested in

throughout his career. Together, they created a paper called Buxton whose primary attributes included 100% cotton alpha cellulose, wove laid (no watermark), internally sized with Aquapel for superb wet strength, no chalk alkaline buffer, natural white and no brighteners, no additives of any kind, and a neutral pH of 7.5 . . . essentially the perfect paper for the New Cyanotype and any other iron-based process.

Buxton paper is fairly expensive and is not easily obtained in the states except through serious paper businesses like New York Central Art Supply. If the cost is prohibitive, the paper options for the New Cyanotype can be expanded by the addition of a single drop of a 40% stock solution of citric acid to the sensitizer at a rate of 1 drop per ml. This addition of citric acid improves the stability of the sensitized coating and assists in clearing following exposure.

Figure 8–11
Mike Ware, *il Salvatore, Sicily,* '87–'99, (New Cyanotype)
This image is a representation of Mike Ware's New Cyanotype process that addresses the primary shortcomings of the traditional cyanotype process as created by Herschel in 1842. In this remarkable image, it is clearly evident how Mike's variant has greatly enhanced the ability of the process to render details in the darker end of the tonal scale while simultaneously providing the delicate details in the highlights. *(Courtesy of the Artist)*

Film or Ink Jet Film Contact Negative

The best negative is one with a long density range of at least 1.8, similar to, but a bit more dense than, one you would use for Pt/Pd. Mike Ware advises extending from base + fog (0.2) to a D-max of 2.0 or more for his New Cyanotype process. This is achieved by over-developing the negative by as much as 70% to 80%. Those of you making digital negatives can apply the same concept to your image saturation/exposure/ output. If you judge your negatives, using your experience via the filter of a traditional wet darkroom, you will probably end up with negatives that are too flat and thin. In the New Cyanotype, and other alternative processes, you are seeking density and contrast that will protect your image during a lengthy exposure facing the sun . . . think about it.

Once you get a great negative for the process, make a personal New Cyanotype curve in Photoshop and use it as your initial curve "load" adjustment place. There is no limit to the degree of digital sophistication that can be applied to making contact digital negatives, and there is a lot of information regarding this topic in several chapters in the book. See the Gum Bichromate, Digital Negative, and Platinum and Palladium chapters for variations specific to the process and how to go about making a basic contact negative, an adjustment curve profile and application, conversions from grayscale to RGB and CMYK, and a host of other digital negative options specific to each process without having a great degree of knowledge about Photoshop.

THE SENSITIZER

The Simple Solution: The New Cyanotype Kit

Photographer's Formulary, in beautiful Missoula, Montana, makes Mike's New Cyanotype Printing Kit in pre-measured and ready to use amounts. Each kit, for under $20, has a single sensitizer (the beauty of the process), comes in a 100 ml amount, and makes about fifty 8" × 10" prints when applied with a glass coating rod. The formula was first published in the January–February 1997 issue of *Photo Techniques.*

Now, buying a pre-made kit may not be as romantic as following the directions below, but it is a whole lot easier.

The Less Simple Solution: Make Your Own

Note: This sensitizer solution is toxic if ingested and it will stain skin and any other absorbent surface it encounters . . . be very careful; wear latex gloves, eyewear, and an apron; and don't splash.

30 g	ammonium iron(III) oxalate
10 g	potassium ferricyanide
0.5 ml	20% ammonium dichromate solution or 0.1 g solid ammonium dichromate. You can use potassium dichromate here instead.

Distilled water to make 100 ml of solution

Preparation of the Sensitizer

So there is no misunderstanding here, considering the fact that this formula is not the easiest to make the first time you try it, I am going to use Mike's specific words:

Figure 8–12
Vincent Carney, *#51*, 2005 (ware cyanotype w/10% citric dev.)
Vincent made this print using Mike Ware's New Cyanotype formula, developed in a 10% citric acid solution, and printed on handmade paper. *(Courtesy of the Artist)*

The preparation of this sensitizer solution calls for a bit more experience in chemical manipulation than is required to make a traditional cyanotype sensitizer, so don't undertake it unless you are fairly confident. This work should be carried out under tungsten light, not fluorescent or daylight. Please note that all of the chemicals in the formula are poisonous!

One more thing before the formula: if you are the least bit unsure about undertaking this chemical task but still want to try the formula, it is available in kit form, it's inexpensive, and someone with the right experience and lab has taken the risks out of your experience.

Preparation of Sensitizer: One Step at a Time

Step 1 Heat 20 ml of distilled water to about 110°F in a small Pyrex glass beaker. Add 10 g of potassium ferricyanide, *stirring constantly*, until it completely dissolves.

Step 2 Heat 30 ml distilled water to 110°F and dissolve in it 30 g of ammonium iron (III) oxalate.

Step 3 Add 0.5 ml of a 20% ammonium dichromate solution (*previously prepared by dissolving 4 g of the solid in distilled water and making up a final volume of 20 ml*). Mix thoroughly.

Step 4 Now add the hot potassium ferricyanide solution to the ammonium iron (lll) oxalate solution. Stir this well and set the mixture aside in a dark place to cool to room temperature and crystallize. The solution should take about 60 to 90 minutes to cool.

Step 5 Separate most of the liquid from the green crystals by decanting or filtration. The green solid potassium iron(III) oxalate must then be disposed of safely, as it is poisonous. The volume of solution extracted should be about 60 ml.

Step 6 Add distilled water to the olive-yellow-colored solution from step 5 to make a final volume of 100 ml. The sensitizer can be made more dilute (e.g., up to 200 ml). It will have a faster printing speed but will yield a less intense blue.

Step 7 Filter the sensitizer solution and store it in a brown bottle kept in the dark. It should have a shelf life of one year.

The contrast of the sensitizer can be *decreased* by adding citric acid, so it can even accommodate a negative density range of 2.6 or so. Conversely, the contrast can be *increased* by the addition of more ammonium dichromate solution, a standard contrast booster in many alternative processes.

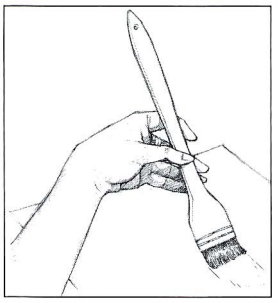
Sensitizer Color Warning: The Cure for the Blues

The dichromate can be omitted from the formula but with the consequence that your sensitizer may change color, going from the light greenish-yellow to a deep blue. Be aware that the deep blue is the result of impurities in your chemistry and that the chromatic strength of the sensitizer can be a staining agent. The easiest solution to a deep change of color is to let the solution sit unmolested in the dark for a few days and to let the dark blue precipitate settle to the bottom of your bottle. Then, very gently, filter your rested sensitizer through a coffee filter into a fresh, amber-colored glass bottle.

Of course, knowing what happened when you eliminated the dichromate, the solution for preventing the formation of dark Prussian blue precipitate is to keep a dichromate in the formula. The impurities in the chemistry can be counter-balanced with the addition of a tiny amount of either ammonium or potassium dichromate to the sensitizer, as in step 3. The dichromate will increase the contrast sensitivity of your sensitizer, so be aware that this will be the outcome of your cure for the blues.

To Tween or Not to Tween: Use of a Wetting Agent

Unlike the traditional cyanotype formula, in which a wetting agent (*a surfactant that facilitates the absorption of chemistry into paper by reducing the surface tension of that liquid*), Ware's New Cyanotype sensitizer solution is more readily absorbed, making the use of a wetting agent unnecessary. There are a few hard-sized papers, such as Ruscombe Mills' Buxton, where the surfactant, Tween 20, can greatly improve the ease of coating and the ability of the paper to retain the deep blue during the processing sequence. When working with a sensitizer that is showing signs of unevenness, I will often add a drop of Tween 20 solution for every 30 drops of sensitizer in my shot glass.



Coating Techniques: Puddle Pusher or Brush

For coating the sensitizer I recommend using a Richeson synthetic fiber brush 9010 Series because it can be used with all processes, is exceptionally well made, and is strong enough to be used on a wide variety of surfaces, while still keeping a split-proof and clean edge. The brush strokes are a little less romantic than the hake brush, but the extra control and lack of contamination over a long period of time is worth it.

The other options for hand coating are the Puddle Pusher and traditional hake brush. A synthetic Richeson brush coats more evenly than the hake and can be washed easily for the next sensitizer application or process. If you are "old school" and want to stay with your hake brushes, I recommend that each process should have its own brush. Be sure to place the brush in a holding beaker filled with distilled water after each coating and to blot it dry before the next application of sensitizer. Be sure to change the water frequently.

Coating with a brush is a relatively simple task and one that you can master within a short time. The key is to practice this art frequently with the following steps in mind. Drop-count your sensitizer into the shot glass and pour it in the center of your image area that you have marked on the corners with a hard pencil. With gentle speed, dip your brush into the sensitizer puddle and begin to spread it evenly throughout the marked section. Brush vertically from edge to edge, keeping a very gentle pressure on the brush hairs, and when you reach the opposite edge, begin to brush horizontally . . . again from edge to edge without stopping. Revert back to the vertical and with lighter brush pressure, coat from top to bottom, from one side to other, and then back to horizontal. When the reflective moisture of the sensitizer becomes a luster, stop brushing. Let your paper sit quietly for a

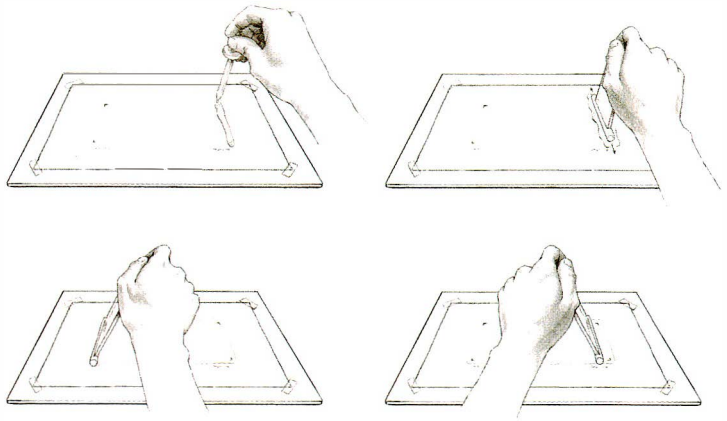


Figure 8–13
Joe Boyle, Illustration of Puddle Pusher in Use
(Courtesy of Joe Boyle)

minute or so and then gently use a cool setting hairdryer on the backside of the paper until it flattens out and has a subtle "snap" to it when you bend (not fold) it.

Coating with a Puddle Pusher

If you are not a fan of the handmade brush strokes on the outside of the picture area, your other coating tool option is to use a Puddle Pusher. A Puddle Pusher is essentially a small diameter glass rod with a fused handle that enables you to get a good grip and apply pressure to a sensitizer solution as it's being applied without harming the surface of the paper. Here's how you use it.

Obtain a nice heavy piece of ¼" plate glass or thick Lucite that will be larger than the biggest sheet of paper you think you will make a print on in the near future. Remember that your sensitized paper will have to fit in your contact frame, so be logical about your aspirations. The reason for the glass or Lucite is that you will always have a perfectly flat and clean surface to work on, and it is a very simple matter to wipe down the glass or Lucite between coating applications. My most serious students have their own personal sheet of white Lucite for coating, examining, and carrying their wet prints around between stages. It's a very inexpensive and sound investment, and it will never break like a sheet of glass. It's also great protection for a laptop in your bag.

Tape down the paper that is to be sensitized on the surface of the glass or Lucite. Write all of your pertinent information on the paper, mark out the dimensions of your negative and where you want it to be, and prepare your sensitizer. If you want really clean lines, you can use painter's tape that will not lift the paper fibers when you remove it. You can also use a gentle adhesive rubylith film, essentially a red adhesive safelight in film form, to prevent anything outside the sensitized area from being exposed.

Now, press your glass rod or Puddle Pusher to the paper just outside of the area that you will be coating. Then, pour the sensitizer, which you have deposited into a sturdy shot glass, along the top edge of the picture area you will be coating. You can also use a syringe like a turkey baster and apply the sensitizer in a nice clean line in the same location. Consult the Pt/Pd or Ziatype drop charts for an idea of how much sensitizer you'll need for the size negative you have. Keep in mind the humidity in the air and that you'll be using less sensitizer with this method. Arid climates will require more sensitizer than humid ones.

Keeping the glass rod pressed against the paper, adjacent to the puddle of sensitizer, quickly slide and wiggle the glass rod lengthwise from side to side in the solution until it is evenly distributed, via the liquid tension of the sensitizer and capillary action (this is a lab term for describing how liquid molecules like to stick together) along the Puddle Pusher's surface edge. Now, slightly raise the rod and lift it over the sensitizer and replace it along the back edge of the solution. Press down with significant force and smoothly push-drag the solution across the paper until your coating area is covered. At the end of the stroke, outside of your image area, lift the Puddle Pusher and place it behind the remaining sensitizer and repeat the same push–drag coating action. Think of it as you would if you were applying plaster to a wall, keeping your coating as smooth as possible.

Repeat this single stroke in the opposite direction until the sensitizer volume is reduced to zero. If you have too much sensitizer on the paper, pick up some of the excess with a brush and make a swatch of sensitizer

that could accommodate a test strip, like a Stouffer Strip tonal scale. Next time, use less sensitizer until you get it right. Using the glass rod or Puddle Pusher is the best way to avoid roughing up and disturbing the smoothness of your paper's fibers. This technique also presses the sensitizer deep into the paper, which enhances the quality of your final print. The possible down side is that you don't get to see the romantic brush strokes that actually please a lot of Pt/Pd printers.

Once your sensitizer is on the paper, let it sit quietly in the paper for 2 to 4 minutes in subdued light. I like to put it in a drying drawer and say pleasant and positive things to it as I put it away for a few minutes. During the waiting period, during which the sensitizer is penetrating into the paper, drying, and becoming acclimated to the karma of the moment, you can take time to clean everything that you've been working with as well as the glass in your contact-printing frame. Take your hairdryer, put it on a cool setting, and gently blow-dry the backside of the paper. If you are working in a space without excellent ventilation, wearing a dust mask is a sane idea since some ferric oxalate in the formula will become airborne during the blow-drying. The best thing for the paper, and you, is to allow the paper to dry naturally. It won't take very long, as there is very little sensitizer in the paper.

Stainless Steel Coating Rods

One additional type of coating tool that I've been fooling around with is a stainless steel coating rod made by R.D. Specialties in Webster, NY. The coating rods are 3/8" stainless steel, wire-wound coating rods #44 in 8", 10", 12", and 14" lengths with 2" unwound on either end for holding. They are beautifully made and come with a tube protector. Check out their info in the Resources section of this book.

Drying the Sensitizer

It doesn't really matter if you let the sensitized coating dry at its own pace or if you use a hairdryer. If you do use a hairdryer, dry from the back of the paper rather than the front, as this technique will draw the sensitizer deeper into the paper's fibers rather than to its surface. Print the sensitized paper as soon as it's dry or put it in a ziplock freezer bag and toss it into the freezer

Figure 8–14
Diana Bloomfield, *Dancer*, 2006 (cyan on Pt/Pd)
Diana's image of her daughter, Annalee, is part of a longer project that began in 2002. The image was made with a 4 × 5 pinhole camera and b&w film and then scanned and enlarged to an 10 × 8 digital negative, using an Epson 2200 printer and Pictorico OHP digital inkjet film. Diana then printed in Pt/Pd on Ruscombe Mills Buxton paper, and when dry, she re-coated the paper with cyanotype, re-registered the negative on the Pt/Pd image, and exposed it to UV light again.
(Courtesy of Diana H. Bloomfield)

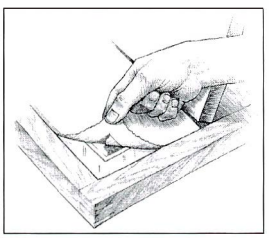
where it will be safe from any moisture. The shelf life is very long so you can print with this paper whenever the spirit moves you. Again, don't bother wasting your time if the coating has turned from its light greenish-yellow-chartreuse color to a deep blue-green . . . an indication that your sensitizer may have been compromised by either chemical contamination, dampness, or a poor choice of paper. Start over and consider using a higher quality of paper as the first step in making corrections. Adding a small amount of 5% citric acid to the sensitizer will also help suppress this problem.

Exposure and Development

No matter what light source you are using, sun or UV lamp, exposure for the new cyanotype is *significantly shorter* than is required for a traditional cyanotype

exposure. A 4- to 5-minute exposure in a standard UV printer or a 1- to 2-minute exposure under average sunlight will be normal. Nonetheless, it wouldn't hurt to do a step test before trying larger pieces.

Expose the print using a hinged-back contact printer so that you can monitor the exposure during the printing-out stages. Continue your exposure until your shadows and areas outside the sensitizer are a pale silvery greenish-gray, as in the traditional cyanotype exposure. Look at the shadow areas, and if they appear a bit "bronzed" or solarized then you are likely done . . . perhaps overdone a bit.



Development is the same as in the traditional cyanotype process. However, you can realize a significant intensification by developing your exposed image in a citric acid solution (below). Following development, wash the print with running water until the yellow-green tint is cleared from the highlights. The wash cycle will be complete after 20 minutes. If you are processing your exposed image in "hard" water, the kind that makes it difficult to get a lather going with soap, you should be aware that the alkalinity of this water type is destructive to the blue in your cyanotype. What I recommend in this instance is to process in distilled water. If that isn't possible, process quickly in regular tap water and then perform a good soak in distilled before hanging the print to dry.

Wet Development with Citric Acid and Options

Stronger shadow values can be obtained by immersing the print first in a 1% to 2% diluted citric acid bath. Immersion time in this bath should be limited to about 30 to 45 seconds. Be sure to change the citric acid bath every 5 to 10 prints. Follow this bath immediately with a 20-minute wash in running water. Remember, as in the traditional cyanotype, your only goal at this point is to eliminate the yellow from your print's highlights.

In his book on the New Cyanotype process, Mike notes that the citric acid may make the print more susceptible to light fading if it is not fully washed out. Therefore, he recommends using a 1% nitric or 1% hydrochloric acid bath in place of the citric acid bath. For group use in a classroom or workshop stick with the citric acid solution due to safety concerns. However, if you are working in your own lab, altering the acid type for this bath is a good idea.

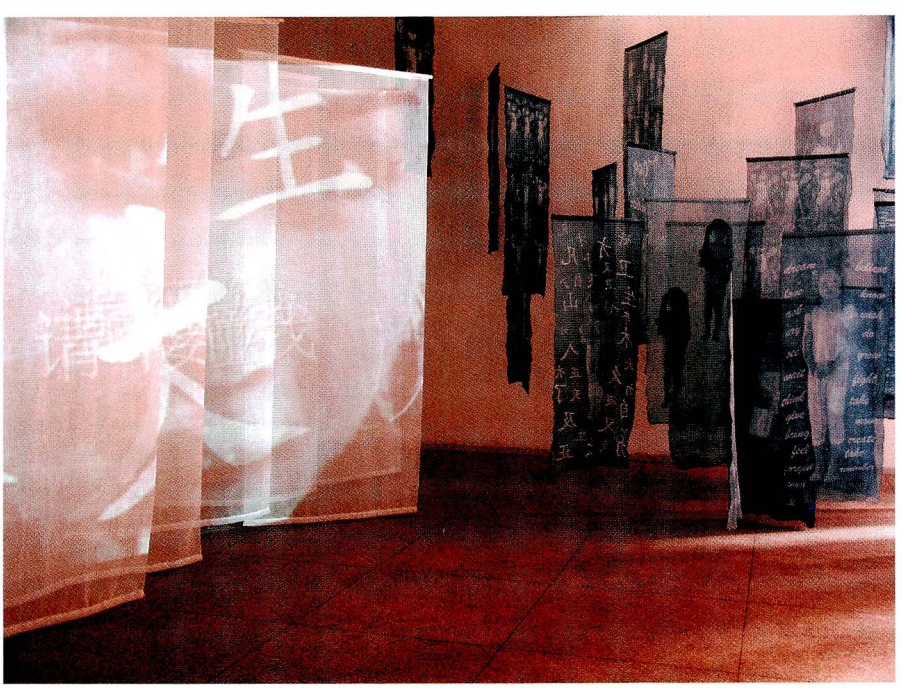


Figure 8–15
Galina Manikova, Xiamen, China, rm. 16, 2006
This is a sectional view of Galina's exhibition in Xiamen, China, made during her artist in residency there. See more on her website, http://www.wailingwall.no. The exhibition included about 50 silk panel cyanotype images, using digital negatives and exposed in the sun using a huge contact frame. *(Courtesy of the Artist)*

Final Wash Cycle

The yellowing in the print will go away during the acid bath and should be followed by a 20- to 30-minute water wash. If you still have stains, try a second immersion in the citric acid bath. Unlike prints made in the traditional cyanotype process, very little of the image will be lost and whatever does thin out, such as reversed shadow value, will return to a desired tonal saturation during the drying process. You might also consider an immersion in a 1%–5% oxalic acid bath to help with any highlight dullness.

Last Thoughts

I'm a big fan of Mike's New Cyanotype because it has elevated the cyanotype process to one that can be performed with more control, yielding a broader spectrum of tonalities. It rectifies many of the traditional cyanotype issues that have been difficult to deal with since Herschel, and although it may not be as unpredictable and fun, it does allow for a level of sophistication and control that will appeal to a large audience. I am sure Sir John would approve!

CYANOTYPE ON ALTERNATIVE SUBSTRATES

Cyanotype on Glass

Recently, Christine Baczek sent me her cyanotype on glass workflow, and I'm presenting elements of it in this section because it is a very nice overview of one of the solutions for adhering a liquid sensitizer to an emulsion layer on glass. As well, it works . . . at least in the hot and very arid environment of Salt Lake City where she lives.

Chemicals Needed

- Gelatin: 250-bloom gelatin from Bostick & Sullivan (B&S) or Knox from the supermarket.
- Glyoxal, a pre-mixed 40% solution that is prepared and shipped by Bostick & Sullivan. Glyoxal is used to harden and preserve the gelatin. It is toxic and should be handled with gloves in a well-ventilated space. Please see the Gum Bichromate chapter for more information.
- The cyanotype solution A and B that can be purchased mixed or in a dry chemical state. You can also use Ware's New Cyanotype, which is available through Photographer's Formulary and several other sources on the Internet. Christine prefers this version because it produces a more brilliant blue with fewer layers on glass.
- Sandarac varnish is the traditional sealing varnish for wet plate collodion ferrotypes and ambrotypes on glass. A less complex sealing solution would be to use a polycrylic clear gloss varnish from the hardware store. One other option may be protecting the image with a museum-grade product called Renaissance Wax . . . a product I've used with

Figure 8–16
Christine Baczek, *Sego Lily*, 2012 (cyanotype on white glass)
This is another example of Utah artist Christine Baczek's cyanotype imaging on white glass. She writes, "*I live in Salt Lake City, Utah—a dry environment that is very hot in the summer and cold in the winter. When working on Sensitive, for which I made cyanotype photograms on glass, I did my entire workflow outside in shade with almost zero humidity and temperatures ranging from 70 to 95 degrees Fahrenheit.*"
(Cyanotype on glass from the series Sensitive. *Courtesy of the Artist, Christine Baczek)*

success on completed wet plates in workshops when there is not enough time to allow the Sandarac varnish to season and dry properly.

Cyanotype on Glass Chemistry

- To make your base layer of gelatin on glass, add 3 grams of gelatin to each 100 ml water + 3 ml of 40% glyoxal. This amount will coat approximately six 5" × 7" plates. Measure your water in a lab beaker and sprinkle the gelatin on top to bloom for 15 minutes. Then, place the beaker in a hot water bath (be careful the beaker doesn't float and tip over) and stir the solution to dissolve the gelatin. Take the beaker from the hot water bath and let it stand and cool for 5 minutes. Finally, carefully add the glyoxal and stir. Use the solution immediately while it is relatively warm.
- To make your cyanotype layer to go on top of the first gelatin base, mix 1 part of your 3% gelatin solution (3g gelatin to 100mL water) to every 2 parts of prepared cyanotype solution. Follow the gelatin direction in the previous paragraph up to the "stand and cool for 5 minutes" part. In another beaker measure and combine the cyanotype solution to gelatin solution at a ratio of 2 parts cyanotype to 1 part gelatin. Stir and use immediately.

Varnish

To protect your cyanotype image on the glass you will need to seal it with an archival layer of varnish, acrylic, or wax. Your first option is to use the traditional wet plate collodion Sandarac varnish, which smells wonderfully of lavender but is notorious for gathering all dust in the area and being difficult to pour well on every occasion. Sandarac can be purchased in a pre-mixed form from Bostick & Sullivan. Please see the varnish instructions in the Wet Plate Collodion chapter.

Your second varnish option is to use a clear glossy polycrylic varnish that is readily available at a local hardware store. This provides a thicker coating of protection than Sandarac but also means the possibility of yellowing over time. Christine prefers this method over Sandarac because extreme fluctuations in temperatures make the glass and gelatin expand and contract over time. This may cause the gelatin to crack and peel. The varnish adds a level of stability to the finished plate.

The third option is sealing the glass-bound image with an archival Renaissance Wax that is used by the world's museums to protect objects of all kinds. Again, refer to the wet Plate Collodion chapter for specific instructions.

Cyanotype on Glass Workflow

- Put on latex or nitrile examination gloves to keep fingerprints off of the glass and chemicals off of your hands. Since you are using glyoxal, you will need excellent ventilation. I like performing this kind of workflow in a garage with the door open or under a chemical hood.
- The next order of business is to clean your glass thoroughly so that the gelatin has a totally prepared surface to adhere to. If you are really serious, please see the section on glass cleaning in the Wet Plate Collodion chapter. For basic glass preparation, wash the glass in very hot water with a dish detergent. Then take some cotton balls and saturate them with rubbing alcohol and clean the surface well. Finally, if you have a dishwasher, run the glass through a cycle using only Bon Ami as your detergent. That should do it.
- Mix the base layer of gelatin, water, and glyoxal. This layer provides a sticky foundation surface to receive the cyanotype and gelatin mix that follows. The gelatin, and the glass, must be warm to make this work properly.
- To apply the base gelatin layer to the glass, balance the warm glass with the fingertips of one hand and pour the warm prepared gelatin solution in the center. For the perfect technique, consult the Wet Plate Collodion chapter again and look at Fig. 17-34. For a more even coat, dry the plate vertically on a rack that will allow chemicals to cleanly drain from the glass. Dry the glass plate for at least 6 hours and then repeat this coating sequence two more times.
- Now, mix the cyanotype and gelatin solution in ambient light, being careful not to expose the dried cyanotype solution to UV light. Again, balance the glass with the fingertips and repeat your pouring technique from the gelatin–water–glyoxal base layer. (See the Wet Plate chapter for information and technique). For a more even coat, dry the

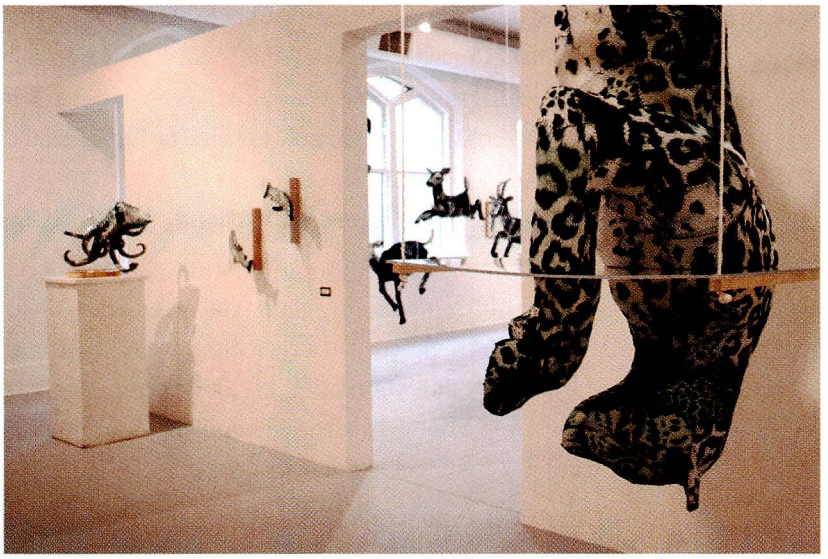


Figure 8–17
Tasha Lewis, *Falling Jaguar and the Herd*, Installation #1, 2012
This image is an installation shot of a recent exhibition by photographer/sculptor/installation artist Tasha Lewis. It illustrates her cyanotype creatures and the very real way they can alter a viewer's experience in an environment by illustrating the impossible.
(Courtesy of the Artist)

plate vertically on a rack that will allow chemicals to cleanly drain from the glass. You can also try drying on a level table, but you should expect puddles, or as we call them in the graduate program, "mannerisms." Dry the plate for at least 6 hours or until the solution is completely dried. Now, run a test-strip exposure with your contact negative. Depending on the density you desire you can print once or learn that subsequent second and third coats will be needed to get the density you want.

- To print the plate, place your contact negative and sensitized plate in a contact frame for exposure. If you are using an object for a photogram, place that object on the sensitized plate. Expose the plate in a UV exposure unit for 6–10 minutes depending on the density of your plate. If printing outside, the exposure may be longer; your test strip will provide this information. The longer the glass stays in the UV exposure unit, the hotter it becomes. Let the glass cool in a dark space or drawer before you submerge the plate in a water-development bath or you risk the emulsion cracking and peeling from the glass.

Gently submerge the glass in a tray of room temperature water, rocking the tray to clear the plate quickly. Do this gently but quickly, as the emulsion will swell and become more fragile the longer it is in water. Change the water often. Put the plate in a rack to dry when the plate is cleared and no cyanotype solution washes off in the water. You will know this because the water will be clear.

When it is time to varnish, either apply the Sandarac using the wet collodion pour method or use a vet supply oral medicine syringe to varnish the plate with polycrylic. To execute this step, fill the syringe with the varnish, balance the glass with your fingertips like a waiter carrying a tray, and push the varnish onto the center. Rock the plate gently to evenly spread the solution across the surface, and drain the excess back into the remaining varnish. Dry the final plate for 4 to 5 days.

NOTE: For additional solutions for applying emulsions and sensitizers to difficult substrates, such as glass and ceramics, please go to the Paper and Alternative Substrates chapter.

TREE STUMPS, CERAMICS, GUMS, B-V-DS, & CAMERALESS OPTIONS

I'll close out this chapter with a few ideas that you might find compelling enough to try out.

A Few Words Regarding Ceramics

All completed ceramic entities go through four basic stages: wet, dry, bisque fired, and, finally, kiln fired. One can apply sensitizer on clay at each of these points in the process, although some of the stages will require a bit more play and experimentation than others. Here are a few very brief and non-specific ideas for you to consider. I am being vague on

Figure 8–18
Galina Manikova, *Ceramics 01*, 1987–1989 (stoneware and cyanotype)
This is a stoneware ceramic panel about 70 × 180 cm with an unfired cyanotype image. It was made in the 1987–89 period prior to Galina's exhibition at the Henie Onstad Centre for Contemporary Art at Hovikodden near Oslo.
(Courtesy of the Artist)

purpose because being detailed would require both a new and different book and that you know a good deal about the chemistry and workflows in a ceramic studio environment.

Dry clay, unfired and essentially raw, can accept a good deal of sensitizer and gelatin-based emulsion. You might want to try impregnating cyanotype, Van Dyke, kallitype sensitizer into the very absorbent dry-state clay. It may be an enticing idea to prepare the surface of unfired clay with a coating of prepared gelatin and glyoxal to hold an image on a ceramic base. Dried clay may be an ideal surface for experiments with dichromated gelatin, gum bichromate, and gumoil.

Bisque-fired clay is also an excellent substrate for experimentation. This is the stage in ceramics that comes prior to glazing and a final kiln firing. A bisque fire is performed in order to drive off the water that is left in the clay. If you fail to remove the moisture from the clay before final firing, or if you bisque fire at too high a temperature, your ceramic object will explode and destroy everything else in the kiln (you will not be popular). Proper bisque firing is essential because even if the clay is very dry there is still moisture inside the clay molecules. It is important to fire bisque slowly and to have knowledgeable supervision of the task if you are not familiar with cones or trained to use a kiln.

Cyanotype, Van Dyke, kallitype, gum bichromate, wet collodion, and the salted paper process

Figure 8–19
Phoebe McCormick, *Shinto Views* (cyanotype & artist's book)
This is a lovely and delicate artist's book (by artist, scholar, motorcycle track racer, and mom), of cyanotype contact prints from a trip to Japan and bound with decorative paper.
(Courtesy of the Artist)

can be used directly with bisque-fired ware by contact printing from a full format negative, using UV, CFL, or enlarger light. As well, if you like working with hand-applied liquid emulsions or wet collodion, with direct projection, this is a good surface to play with.

Lastly, cyanotype, kallitype, and salt print sensitizers yield brown and black colors when fired onto clay in the final kiln firing. You're going to have to know a good deal about ceramics before you engage in this hybrid adventure . . . or you're going to have to collaborate with a ceramicist. Glazing chemistry and kiln use require training and are not to be taken lightly. If you were interested in having an inspiration in this area I would strongly recommend using Galina Manikova, in Norway.

Note: For details of Galina Manikova's workflow for printing Van Dyke prints on a ceramic substrate, please refer to the Van Dyke and Variations chapter.

Note #2: In the following chapter, Light Markings, please see Monika Ozog's detailed workflow for applying laser printer transfers on ceramic substrates using gum arabic and Mason's Stain for coloration.

Artist's Books

The term *artist's book* is often used to describe a collection of pages that are contained or restrained by a binding or box, made by someone who introduces him- or herself as an artist at dinner parties. An artist's book is actually a vehicle of exploration with the intention of communicating the complexity of personal exploration, ideas, and themes that simply can't be investigated or explained easily.

The creator of these one-of-a-kind works is often an artist but may be someone from just about any line of work or culture who has something to express and who has the skills to work with a vast array of bindings and materials. In my experience, artists generally use these book projects as a compliment to their "real" work and as a way to express ideas that their normal mediums can't accomplish well.

One of the benefits of using nice paper and making up your own sensitizers to apply on them is that you can easily adopt the concept of artist's books into your

Figure 8–20
Malin Fabbri, *The Big Eighteen Wheel* Bus, 2007
The Big Eighteen Wheel Bus is an illustration for a children's song and book called *Mamma Rushes In* written by Gary Fabbri. The book is about the dangers a child can encounter when growing up and how the child's mum is always there to save him. Malin used several different photographs of buildings, the street, and the boy and integrated them with scanned illustrations of the bus, the dog, and the driver. The image was then turned into a digital negative and printed as a cyanotype. The bus was finally hand colored to achieve a bright red color. Malin Fabbri is the editor of http://www.alternativephotography.com, a great source of information and research for alternative photographic processes on the web.
(Courtesy of the Artist)

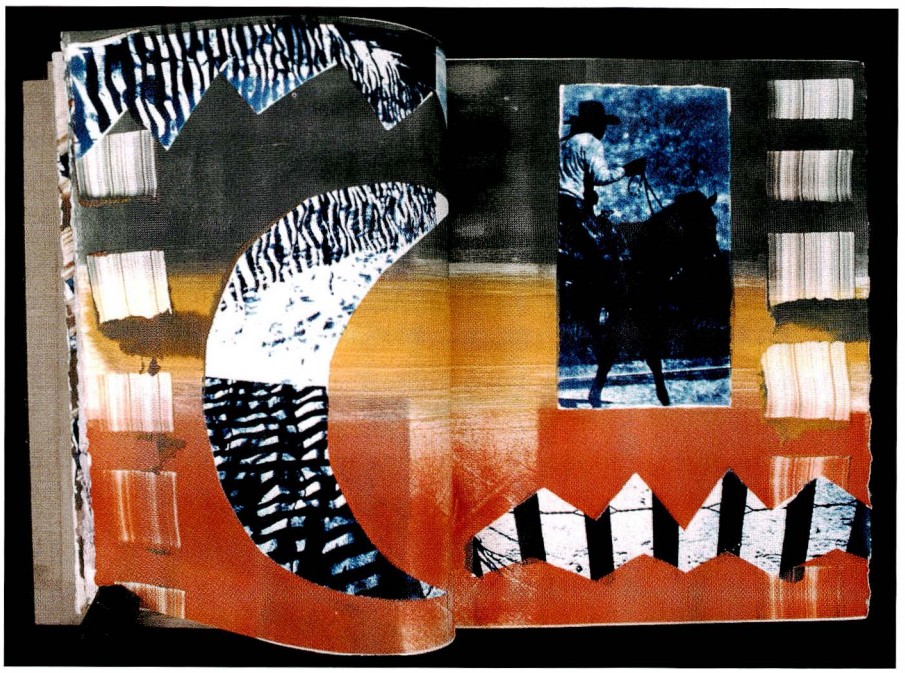


Figure 8–21
Laurie Snyder, *Sun & Pressure*, 1992 (cyan & monotype)
This is another fine example of Laurie Snyder's work in the genre of artist's books. The piece is 15" × 24" when opened and consists of 27 double-page spreads of ink monotypes with cyanotype. It is quarter bound in linen and handmade flax paper.
(Courtesy of the Artist)

Figure 8–22
Christina Z. Anderson, *Holiday Cheer*, 2006 (gum over cyanotype)
Six months after the 2006 hurricanes devastated the southern United States, Christina traveled there to document the aftermath. She wrote, "*To say I was unprepared for the extent of the devastation is an understatement.*" She translated this image into a combination of cyanotype and gum bichromate with a background layer of starry fabric to counterpoint the spray-painted Merry Christmas message on the wrecked car. The print has multiple layers of gum printed on top of the starry cyanotype layer. The gum layers are printed in tricolor gum, but with one negative, to achieve a complementary warm tone effect to contrast with the blue of the background.
(Courtesy of the Artist)

creative process. In particular, because the cyanotype is so flexible with other mediums and only requires water as a development wash, almost anyone, at any age, can make them. It isn't difficult to begin seeing your individual pieces as pages, and then it's just a matter of learning a few simple bindings and book construction techniques for covering, extending, stitching, containing, and display. Text can be added with your ink jet printer, rubber stamps, letterpress type, or a potato print. Think of the possibilities. In no time at all you will have become a creator of artist's books . . . a much more interesting way to introduce yourself at dinner parties, I think.

Combination Process Options

Variations of ways in which the cyanotype can be used and integrated with other processes, media, or substrates is virtually endless and really only limited by your imagination. In this category, combining processes is one of my favorite things to do. One of the most consistently positive combinations is the cyanotype/gum bichromate print, in which the cyanotype functions as the base, or first blue pass impression, before the subsequent gum bichromate sequences. Consider making a cyanotype as your first color impression. It provides a strong and finely detailed blue and provides an easily visualized "map" to register and work upon for all subsequent passes.

You may also consider making a cyanotype impression as a first or second impression when using a platinum/palladium process. This combination was quite popular with many Pictorialists in the early part of the twentieth century as exemplified by Edward Steichen's "other" *The Pond—Moonrise,* which is in the collection of the Museum of Modern Art. Steichen created this famous image, once the highest-valued photograph ever sold at auction (nearly three million dollars in 2006), using a combination of platinum and multiple gum bichromate passes in combination.

In this platinum-cyanotype example, Steichen intended to establish a painterly ambiance and enhanced his platinum print of the pond with the nocturnal blue of a cyanotype. As was the case with the gum bichromate and platinum version, the application of a compatible technique helped define the complex shadow details while providing additional depth to the image. If you want to experiment a bit, try running a cyanotype process on top of a high-quality paper ink-jet print or ink-jet-ready rice paper. In the Kallitype chapter I'll tell you how to combine it with Van Dyke.

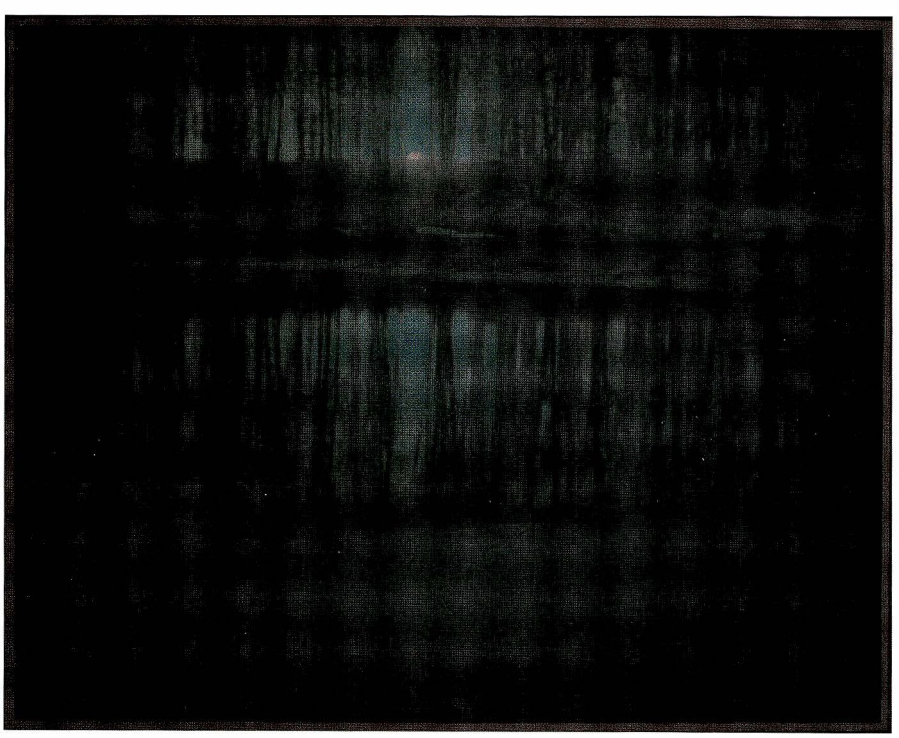


Figure 8–23
Edward Steichen, *Moonrise–Mamaroneck, New York,* 1904 (platinum and cyanotype)
On his way to Paris to study painting, 21-year old Steichen stopped in New York to see the vice president of the Camera Club of New York and the editor of *Camera Notes,* Alfred Stieglitz. Stieglitz bought three of his ambient-rich and moody platinum prints for $5 each! A similar print from this same negative sold at auction in 2006 for nearly 3 million dollars! Employing a combination of techniques, the detail and tonal perfection of platinum and the chromatic moodiness of cyanotype, Steichen became a disciple to the painterly and romantic vision of the Photo Secessionists. This view of a pond in the woods at Mamaroneck, New York, is subtle, indistinct, and suggestive to whatever meditation the viewer allows it to represent. *(© The Museum of Modern Art/Licensed by SCALA / Art Resource, NY; © PERMISSION OF THE ESTATE OF EDWARD STEICHEN)*

Figure 8–24
Sam Wang, *Apples* (PdCy4)
This is a terrific modular piece by Clemson professor and key figure in the alternative process world Sam Wang. The print is a palladium print with a secondary application of cyanotype for depth and coloration. *(Courtesy of the Artist)*

Figure 8–25
Sarah Van Keuren, *Audrey*, 1999 (gum over cyanotype)
Sarah's pinhole-cyanotype-gum bichromate is a terrific example of employing an assortment of alternative process options within a single image. *(Courtesy of the Artist)*

For the cyan-gum combination you need to think of the piece in stages. The simple way to conceive of the process is to produce a nice cyanotype and take it all the way through the process. Be sure to use a paper that will be able to hold up to a lot of gum-soaking abuse, such as Cot 320, Fabriano Artistico, or Lana Aquarelle. Do a single step gelatin-glyoxal sizing on top of the completed cyanotype and then move on to your gum bichromate process. If you intend to only use a single pass of gum, or several very light passes, you might be able to avoid the sizing step altogether. Remember, the purpose of gelatin-glyoxal sizing is to create a hardened surface on the surface of the paper so that the pigments from the paints wash out cleanly. This keeps your highlights from being stained by the pigment in your gum sensitizer. In gum printing, the color is hardened to the paper in proportion to the degree of exposure. Thus, a light exposure will only register in the most translucent portions of the negative, the shadows.

Cyanotype on Tree Stump

An interesting addition to your cyanotype menu would be to use alternative substrates for your cyanotype impressions with the intention of providing context to your syntax. (Forgive me; that's academic speak meaning the materials you work with and the way you choose to work with them . . . so that the stuff you use is visually compatible with your ideas.)

Elmar Stolk was a student of Philippe Moreaux's at the St. Joost Art School in the Netherlands. Passionate about his very specific natural materials, Elmar carried out extensive research into the supports for his images. Large sculpted tree trunks, for example, received a delicate cyanotype layer. Another option entailed saturating watercolor paper with a mixture of dichromated salts and cucumber juice pigmented with some mushroom spores. Phillipe wrote to me recently and related how Elmar had photographed a magpie and had then printed the image in a photo egg-tempera (the eggs acting as the colloid)

Figure 8–26
Elmar Stolk, Cyanotype on Tree Stump
Elmar Stolk was a student of Phillipe Moreaux's at the St. Joost Art School in the Netherlands. Passionate about his very specific natural materials, Elmar carried out extensive research into the supports for his images. Large sculpted tree trunks, for example, received a delicate cyanotype layer. He would impregnate watercolor paper with a mixture of chromate salts and cucumber juice pigmented with some mushroom spores. Phillipe wrote to me recently and related how Elmar had photographed a magpie and had then printed the image in a photo egg-tempera (the eggs acting as the colloid) made from the eggs of the same bird he had taken a picture of. *(Courtesy of the Artist)*

Figure 8–27
Sarah Lydon, *Horse Portrait in B-V-D*
Sarah Lydon made this very successful B-V-D image in my alternative process class at Harvard University in the late 80s. It accurately describes the effects that are possible when all the pieces in the B-V-D puzzle fit. *(Courtesy of the Artist)*

made from the eggs of the same bird he had taken a picture of.

Another variation that you might find very interesting is a combination of cyanotype and Van Dyke processes. The B-V-D (blue-van-dyke) process is an odd and charming hybrid. When everything goes well, you will get a wonderful split-toned image incorporating deep ultramarine blues that split with a variety of mid-tone earth colors that range from greens, grays, and blacks to golden yellows. At times, when the negative is not too high in contrast, the result is often a bas-relief-like effect. Rather than duplicate information I'll direct you to the Van Dyke chapter, where the instructions will be found.

Tea Toning

One of the simplest solutions for extending the options in a cyanotype is to employ a toning process with teas. Actually, nothing could be easier. You simply tone the paper first and follow it with a cyanotype or make the cyanotype and follow that stage with the tea. If you are chemically astute, you can incorporate assorted chemical stages such as reducing density with sodium carbonate first or following any of the cyanotype toning options and finishing off the print with a good soak of tea-inspired coloration.

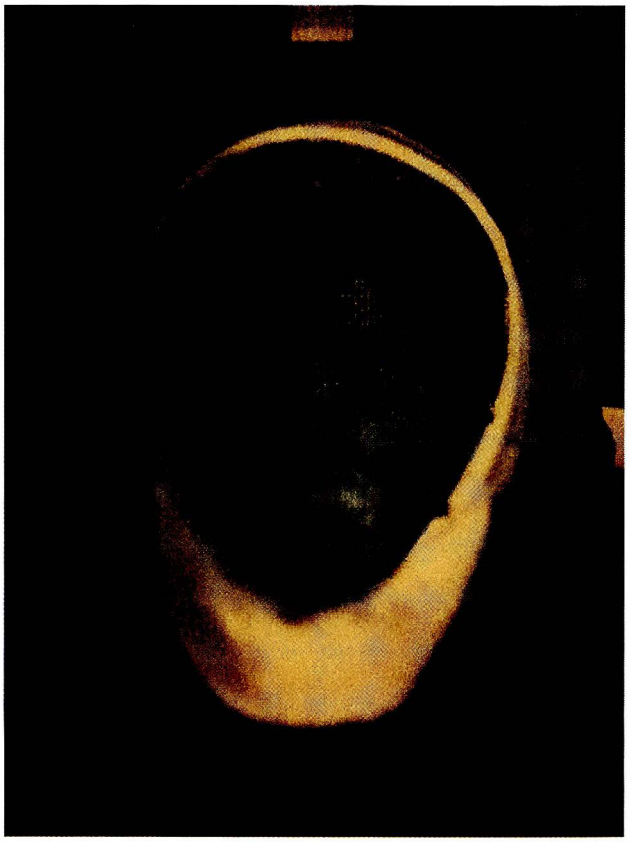


Figure 8–28
Jessica Berkowitz, *Fencing Mask*, 2011 (Lipton tea and cyan)
Jessica's *Fencing Mask* image is a contact print made from a digital negative. It was produced with cyanotype on 300 lb Arches paper and toned in Lipton tea.
(Courtesy of the Artist)

Natalie's Camera-less Cyanotypes

A few years ago I was in Philadelphia to give a lecture and critique to Sarah Van Keuren's students at the University of the Arts and to attend a great show of alternative process images from the last edition of this book. At the opening I met a young artist by the name of Natalie Cheung who was doing some interesting work with cyanotype and taking advantage of the salt crystallization that was inevitable with the cyanotype sensitizer.

The process Natalie used was to take her mixed cyanotype A & B sensitizer and to pour it directly on the paper. She then allowed it to sit undisturbed and to dry as a crystallized mass and relief that she then exposed to UV light for a complete exposure. The paper was subsequently wash-developed and presented as a one-of-a-kind photographic impression. It is, I think, the essence of "light-marking."

Natalie, who hasn't made a photographic image with a camera in over 4 years, told me that she was originally disturbed by only having one of a kind images but that now, making reproducible images is of little interest to her. Recently she wrote, "*I don't usually seek out new processes to apply them to my work. Generally I have always just stumbled upon some anomaly in what I'm doing*

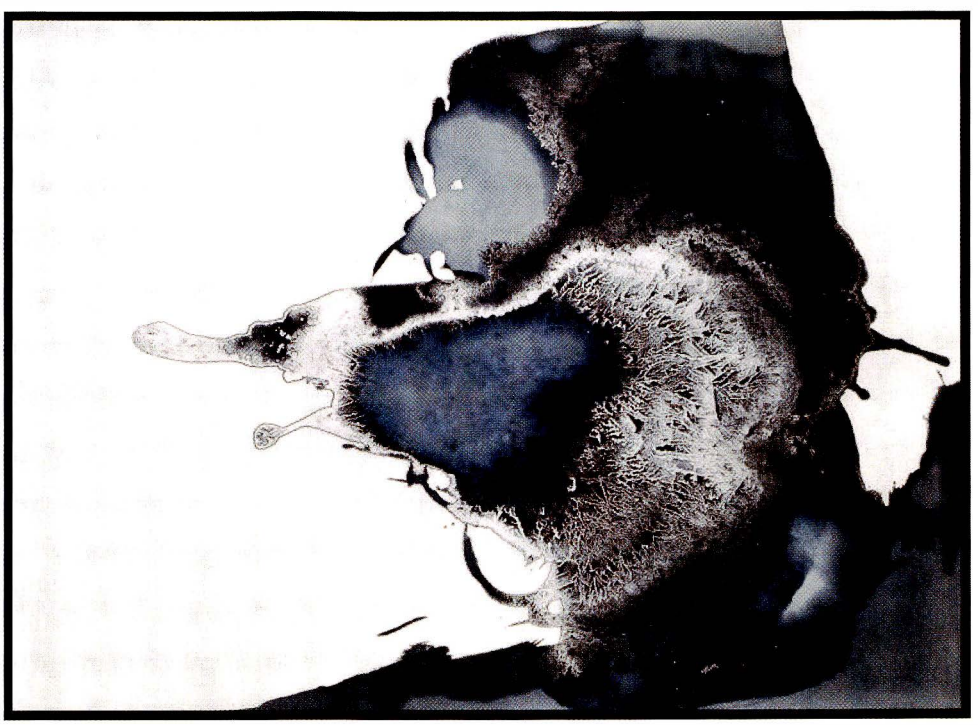


Figure 8–29
Natalie Cheung, *Intermediaries*, 2009
When I first saw Natalie's work from this series I wrote a note to myself: "*The cyanotype Intermediaries work, like an evolved Anna Atkins force, are beautiful drawings and I need to include examples of them in the next edition of my book.*"
(Courtesy of the Artist)

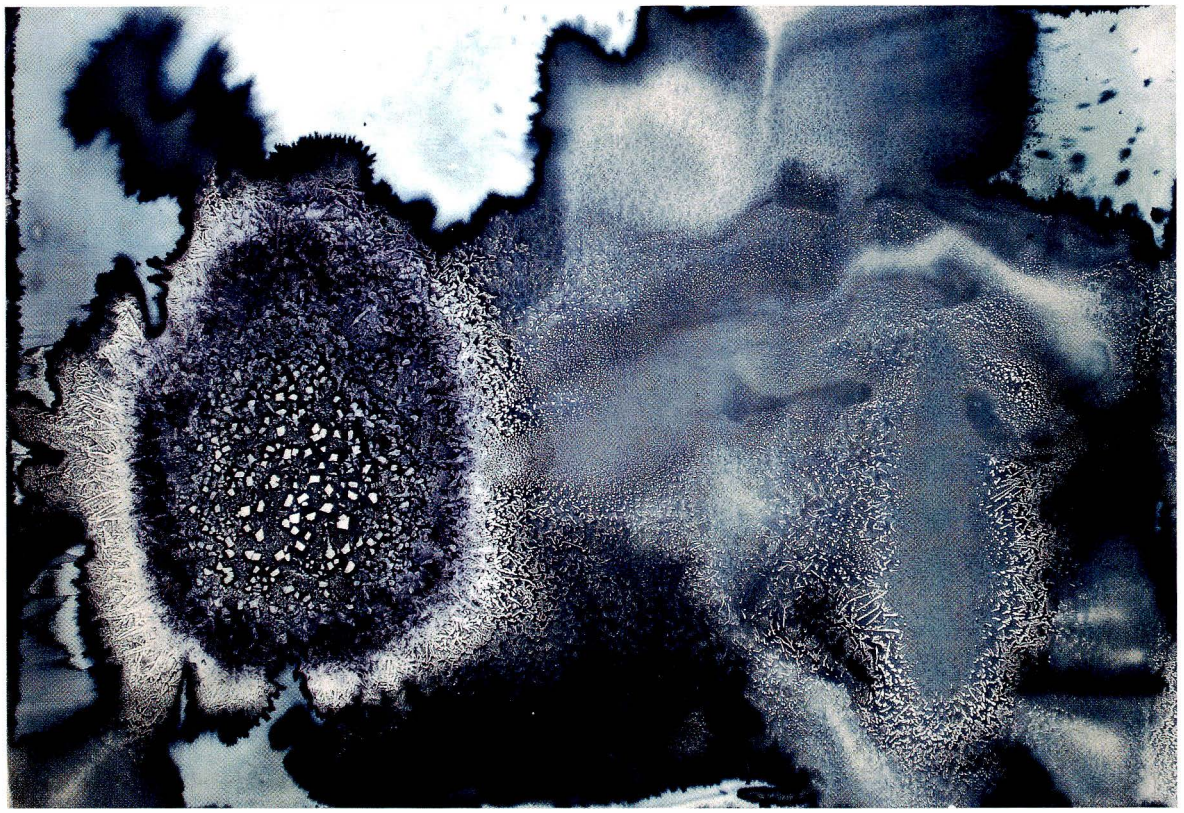


Figure 8–30
Natalie Cheung, *51 hours*, 2009 (cyan)
Natalie writes, *"The way I make these cyanotypes is to take the chemistry and pour directly onto the paper. The result after it dries is the crystallization. I expose it and wash it. It doesn't interest me to make things that are reproducible. It used to really bother me to only have one in the world. I haven't actually taken a picture with a camera in 3 years."*
(Courtesy of the Artist)

with a process and then conduct more experiments to try to somehow re-create the anomaly, with equal parts of success and failure. Chance keeps me interested in making work. Not only do the processes I use rely heavily on chance happenings, but one of the main purposes of the work is having a photographic medium to physically capture a moment of chance on paper."

Last Thoughts

The reason I got into alternative process image making, in my undergraduate experience at the Massachusetts College of Art and later in graduate school at R.I.S.D. in the early 70s, was because it was more fun than almost anything I had ever done. It made my work unique, was extremely flexible, and practically begged for adaptation and play. It was also my stubborn—and arrogant—graduate student way of showing my photographic independence when my work was criticized for not being photography in its purest sense; that is, I wasn't making documentary or pictorial images.

The reason was simple; no matter what direction I decided to travel as an artist, there was a way to facilitate what I wanted to do, in whole or in part, with an alternative process. And that is partially why there are two chapters dealing with this amazing process that Herschel conceived of in 1842. The cyanotype process has its own chapter on variations because it is more flexible than any of the others. It has two salts, is water processed, is unfailingly loyal in its ability to give you something nice if you follow a few simple directions, can be married to almost any other process, idea, or artistic discipline, and doesn't always have to be blue. All in all, it is the perfect process.

Figure 8–31
Galina Manikova, Galina Manikova, Xiamen, 2006 (Installation View, China)
An installation view of Galina's exhibition in Xiamen, China, in 2006, showing her cyanotype on silk works.
(Courtesy of the Artist)

The Argyrotype Process

OVERVIEW & EXPECTATIONS

As always, I will begin with A Little History to give you a bit of background on this beautiful but rarely practiced process. This will illustrate the argyrotype's chemical DNA connection to Sir John Herschel's argentotype, one of that distinguished gentleman's extensive menu of *siderotype* processes . . . a word first employed by Herschel to define an iron-based photographic image—but more on that in a moment. I will also describe to you how Dr. Michael Ware, Herschel's contemporary doppelgänger, addressed the shortcomings of the original process and modified its recipe and workflow so that it might be equal to the investment of time and materials an artist would have to dedicate in order to produce a first-rate argyrotype print.

I'll give you an overview of Herschel's 1842 argentotype process and then move on to the argyrotype, discussing this modern adaptation's chemistry, paper considerations, sensitizer-coating techniques, and toning options. I will also go into the importance of humidity to color, how to construct a simple humidity box, troubleshooting, and how to achieve a buffet of color tonalities by controlling the spontaneous marriages of toners and humidity. Finally I'll briefly describe how to combine the argyrotype process with a common inkjet print for a nice image variation.

The argyrotype is a process that is practiced by a select few at the moment, but I predict this is going to change quickly as alt pro folks discover how beautiful the tonalities and color are and how simple the process is to control with a bit of practice. The argyrotype process is a fairly new addition to the genre of alternative options, and now that Bostick & Sullivan is making the sensitizer, the major excuse for avoiding it—that of having to make the silver sulphamate—is no longer an issue. If you are seeking a relatively simple but endlessly variable technique in the siderotype arena, this is one that is well worth your time to explore. Its ability to provide values as perfectly as a kallitype have been well documented, and to me it is one of the best techniques available on the alt pro menu.

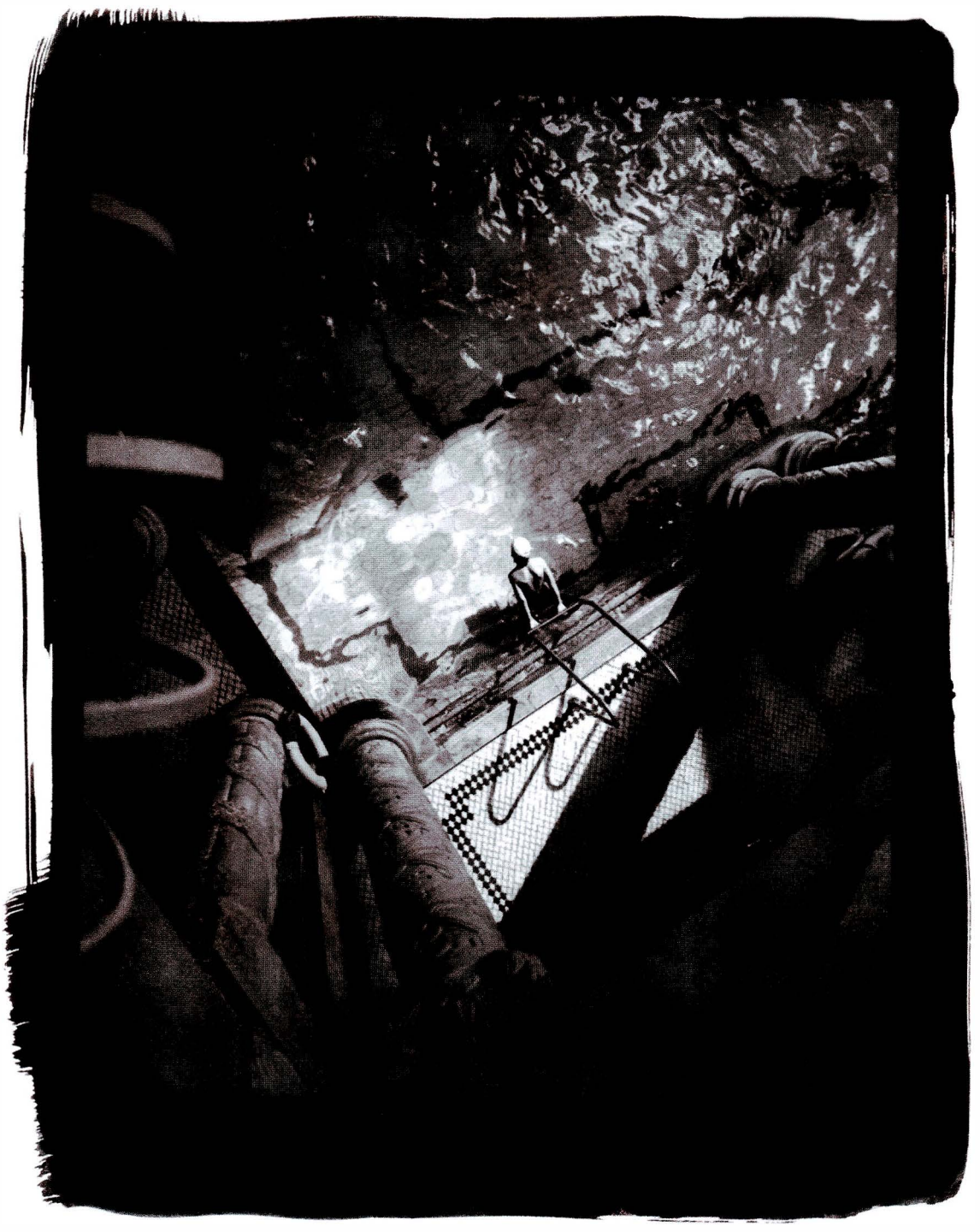
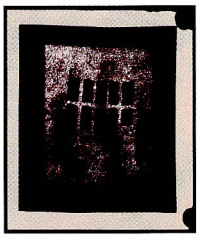


Figure 9–1

Christopher James, *Gellért Baths,* Budapest, 1983/2006 (argyrotype printed in heavy fog)

The argyrotype is another of Mike Ware's adaptations (Herschel's 1842 argentoype) and is rapidly gaining fans for its primary attributes: range of tonalities, controllable variations, color, and user friendliness. This print is one I made from a scanned 6" × 7" negative, printed out on Pictorico Ultra Premium OHP inkjet film and contact printed on a perfect day for an argyrotype . . . a glowing dense coastal fog, high heat, and humidity.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

Sir John Herschel had a sensational, creative, and productive year in 1842, creating three separate, iron-based photographic processes: the cyanotype, the chrysotype, and the argentotype. Herschel used the word *siderotype,* from the Greek *sideros,* to define an iron-based photographic print. Among the ones that are best known under this banner are argentotype, aurotype, chrysotype, cyanotype, ferro-gallic process, kallitype, kelaenotype, Nakahara's process, palladiotype, platinotype, satista, and Van Dyke. The kallitype, Van Dyke, and argyrotype processes are, for all intents and purposes, direct adaptations of Herschel's argentotype.

Herschel's 1842 Argentotype Process

Argentotype Sensitizer

Ferric ammonium citrate	20 g
Potassium oxalate	5 g
Distilled water	100 ml

Exposure in direct UV light: 2–5 min

Developer: Select for Color Tonality

Blue-Black Tone:

Potassium oxalate	20 g
Silver nitrate	1.5 g
Distilled water	100 ml

Black Tone:

Potassium oxalate	10 g
Silver nitrate	1.5 g
Distilled water	100 ml

Sodium Hyposulphite Fix:

10% Sodium hyposulphite (*Sodium thiosulphate*) 5 minutes

Wash: 10–30 min

Figure 9–2
Sir John Herschel, *The Honourable Mrs. Leicester Stanhope,* 1842, (argentotype)
One of 43 prints sent to the Royal Society for exhibition in 1842, the year Herschel discovered the cyanotype, argentotype, and chrysotype iron-based processes. The image is from an engraving that Herschel must have loved, as he used it often when testing new ideas. *(Photography Collection; Harry Ransom Center; The University of Texas at Austin)*

In Herschel's original argentotype recipe, he coated his paper with an iron salt of ferric oxalate (as in platinum/palladium and kallitype) or ferric citrate. This iron salt was subsequently combined with silver nitrate and dextrin, a simple starch used as a sizing if the paper required that step, and coated upon a piece of rag paper. The contact image was printed out (POP) in the sunlight, whereupon the *ferric* salts were reduced to a *ferrous* (metallic) state due to the influence of UV light. The exposed printed-out (POP) image was then wash-developed in a distilled water and silver nitrate solution that freed a precipitate of metallic silver from the silver nitrate to form the image. In some cases, the developer included 10–20 g of potassium oxalate, historically used as a platinum/palladium developer, in order to influence the color in the blue-black to a more black hue.

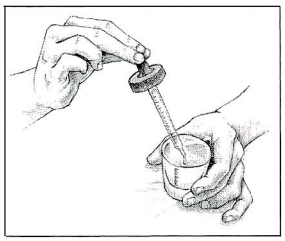
The argentotype was unique for a variety of reasons but primarily for the seductive richness of the darker tonalities that the process made possible. Don't forget, this is 1842 . . . a scant three years after the "official" announcement of photography—and photographic options were still somewhat limited. The technique's primary shortcoming was that it was perceived as being a process that would not generate a print able to meet archival criteria over a reasonable passage of time. This was partially due to the technique's post-print tendency to show signs of oxidization and sulphiding of silver when ferric iron remained in the paper after processing.

This was very often the case during Herschel's time, and the majority of these unstable argentotype prints have faded or disappeared altogether. Several decades later, in 1889, the argentotype process, with minor modifications, became the prototype for Arndt & Troost's Brownprint (Van Dyke and kallitype) process. An interesting bit of trivia . . . for a brief time, the term *argentotype* was used to describe all bromide printing processes.

Mike Ware, who is revered for adapting Herschel's original cyanotype process so that its less-than-ideal character traits have been corrected, came up with another process adaptation when he tackled Herschel's argentotype. Mike's intention was to adapt and simplify the original process so that it was more accessible and predictable. He accomplished this task by altering the historical chemical formula, thus making the process one that was significantly user-friendlier. He named the process the argyrotype.

What follows are essentially notes adapted from Mike's writings and our email correspondence over the past few years. These notes also incorporate observations I've written down during my classes, during my workshops, and in my lab. At the conclusion of the chapter there is a large section that details Amy Sue Greenleaf's argyrotype toner and humidity experiments, and I'm pretty sure you will find these more than helpful in your own experimentation. As for chemistry . . . you have an option here, as you do with Mike's New Cyanotype formula. You can order the required chemistry and play with the formula, or you can go the efficient route and get a perfectly excellent, fully prepared, and ready-to-go argyrotype solution in a bottle directly from Bostick & Sullivan.

Figure 9–3
Mike Ware, *Glade*, Stanton Moor, 1983–1991 (argyrotype on Silversafe paper)
This is a remarkable image made by the primary inventor of the new argyrotype process, Mike Ware, illustrating the delicacy and nuanced tonalities of this process.
(Courtesy of the Artist)



WARE'S ARGYROTYPE PROCESS

The Chemistry

Iron-silver-based brown images are made up of microscopic metal particles that are significantly smaller than those that give substance to a black-and-white silver gelatin print. As a result, these infinitesimal specks are far more susceptible to *reagents*. A reagent is a substance that causes a reaction in another substance (it essentially means to *re-act*) that *oxidizes* (decomposes) and bleaches out the silver.

Reagents, employed to *fix* the image in an iron-silver process, are necessary to prevent these same prints from holding onto residual ferrous and ferric (iron) salts in the print. When left behind they are, in great part, responsible for fading and loss of image integrity. On the other hand, if you let the reagents do their usual efficient thing, the image will etch or bleach away before you have a chance to show it off and enjoy it. Mike Ware's argyrotype process addresses this persistent problem. Here's how he explained it.

Mike's solution was to trade the traditional silver nitrate for a chemical that possessed, unlike silver nitrate, a non-oxidizing negatively charged ion (*anion)* that would not cause a degradation of the image during the wet stages of development and fixing. Mike's choice for this new chemical alternative was *silver sulphamate*. The change, however, presented a problem, as silver sulphamate wasn't available for sale and required some expertise to make at home or in the lab.

THE ARGYROTYPE SENSITIZER

Option #1: Buy It in Prepared Solution

To deal with this issue you have two options. Option #1 is by far the easiest and best idea . . . you simply purchase the argyrotype solution in prepared form from Bostick & Sullivan. You may or may not find it in the product index, but you can telephone and ask for it and B&S will make it up for you.

Option #2: Make It Yourself Method

Option #2 allows you to remain a purist and spend your time making the sensitizer in your lab . . . not an entirely easy task. If you're interested in going on with this process rather than purchasing the prepared argyrotype sensitizer from Bostick & Sullivan, here are the ingredients and directions for its preparation.

The Argyrotype Ingredients & Formula

7 g	Sulphamic acid (NH_2SO_3H)
7 g	Silver (I) oxide (Ag_2O)
22 g	Ammonium iron (III) citrate (green)
0.2 ml	Tween 20 (a surfactant that assists absorption efficiency)

Distilled water to make 100 ml of total solution

Step 1 Dissolve 7 g of sulphamic acid in 70 ml of warm distilled water. Please note that contrast can be increased by adding another gram of sulphamic acid (bringing it to 8 g) to the 100 ml of sensitizer solution.

Step 2 Add 7 g of powdered silver (I) oxide, in small portions, to the warm sulphamic acid solution, stirring as you go, until it is all dissolved.

Step 3 Next, add 22 g of ammonium iron (III) citrate to your warm solution, stirring constantly as you go. Then allow the solution to cool before going to step 4.

Step 4 Add 0.2–0.5 ml (a very few drops) of Tween 20 and mix it well into the solution. There is a debate over the effectiveness of Tween as an additive, and you may elect not to use it if you're not having any sensitizer absorption problems when coating your paper. You will know if you need it by the deterioration of the image in the sodium thiosulphate fixing bath.

Step 5 Finally, add ambient temperature distilled water to bring the total volume to 100 ml.

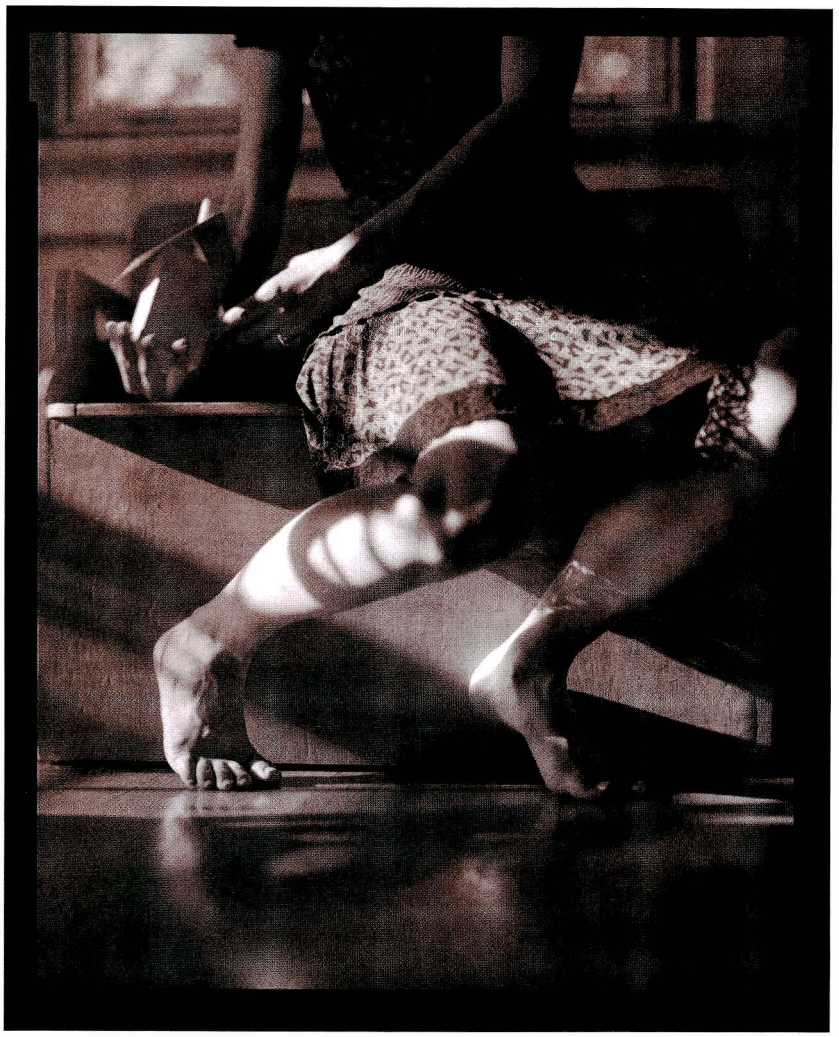


Figure 9–4
Amy Sue Greenleaf, *Self Portrait & Paperhouse #2,* 2003 (argyrotype)
Amy Sue, a Pennsylvania chemistry teacher with an MFA from the Art Institute of Boston (now College of Art and Design at Lesley University), was one of the first people I taught the argyrotype process to. She took the technique to a new level, doing an exhaustive study of the relationship of toners, humidity, and color. This is one of her best, I think.
(Courtesy of the Artist)

The solution, if everything is correct, will be a dark and clear olive green. If you see sediment you may strain the solution through a coffee filter. This will, of course, leave you with less solution.

Step 6 Store this olive-green sensitizer in a dark glass bottle. It has a shelf life of approximately one year and should be filtered if you see a dark precipitate. Be cautious when handling the sensitizer, as it may be irritating to the skin.

THE PROCESS

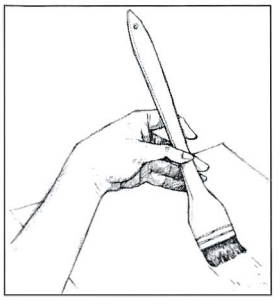
The argyrotype process is not terribly complicated once you have the sensitizer prepared, or delivered to your front door, and you'll find it similar in workflow and complexity to the kallitype. The contact negative you use should have an average negative density, in the 1.5 to 2.2 range, and have the characteristics you would consider appropriate when using a 0-grade paper in conventional wet-lab printing. I have found that the process is a pretty flexible and forgiving one and that it is often possible to make a perfectly fine print from a variety of negatives. The argyrotype does not generally punish you for having a negative that is not ideal for a UV exposure. Along with conventional large format cliché verre or calotype negatives, I will strongly recommend using Pictorico OHP Ultra Premium inkjet film for your digital negatives. You can affect contrast by adding a slight color layer to these in red or green that will influence density and contrast variations.

TABLE SETUP FOR ARGYROTYPE

- Prepared argyrotype sensitizer in a 25, or 100, ml bottle w/dropper cap
- A bottle of Tween 20*
- Krystal Seal envelopes or unscratched sheets of lightweight clear acetate for humidity control and to protect your negative
- Clean paper for the table surface
- Paper for coating**
- Shot glass— use the same drop counts as in the Pt/Pd and Ziatype drop count charts . . . more if it's very arid
- A synthetic Richeson brush or a fresh hake brush that is labeled "For Argyrotype Only"
- A Puddle Pusher or glass rod if not using a brush
- Clean distilled water in a beaker for brush washing
- Custom cat carrier humidifying box (I'll explain this a little later) or cool mist steamer
- Pencil
- Contact printing frame
- Silver gelatin or Pictorico digital negative for contact printing
- Paper towels
- A sense of humor

***NOTE: Tween 20 is a non-ionic surfactant that assists your sensitizer in finding a secure "home" in the fiber of the paper you have selected. It also helps to minimize the leaching of colloidal metal during the process. You'll know if you should use it as an additive (a drop or two to your sensitizer) if you see staining or if your image falls away in the fix.**

****NOTE: The right paper is very important. Ideally, it must be made of 100% cotton rag, sized, neutral pH, free of optical brighteners and alkaline buffering agents, and able to withstand extended immersion times. Some papers that work well include Bergger's COT 320, Ruscombe Mills Buxton, Atlantis Silversafe, Revere and Saunders Somerset Satin. Crane's Platinotype is not recommended for this process.**



Coating Argyrotype

Set yourself up in a comfortable working space, in low tungsten or subdued ambient daylight. Make sure that your coating surface is pristine so that when your paper is dampened with sensitizer it will not activate and absorb the surface contaminants beneath it. Select your coating method. Brush coating and rod coating each have their unique pros and cons. Brush coating with a first class brush like a synthetic Richeson, or a fresh hake brush, provides the romantic hand-applied edge but consumes more sensitizer than you need to use to make a print. Rod coating is economical and allows the sensitizer to be pressed deeply into the paper's fibers as you apply pressure with the rod. In the argyrotype process, that may be an important consideration depending on the state of humidity in your working space. In both brush and rod coating methods, it is often a good idea to use a drop of Tween 20 in your sensitizing formula.

I personally prefer brush coating, and I make up my sensitizer formula using drop counts in a heavy-duty short-barreled shot glass instead of dipping my brush into a beaker of sensitizer. With the shot glass method,

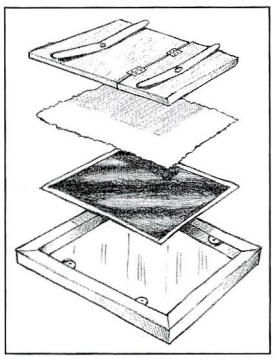
Figure 9–5
Peter M. Lindstrom, *Beware of The Dog-20*, 2012 (gold-toned argyrotype)
(Courtesy of the Artist)

I measure the sensitizer, using a pipette/eyedropper in the shot glass for each individual print. The sensitizer is poured in the center of the image area and brushed vertically and horizontally until the coating is complete and even. With the rod coating method, the sensitizer is poured along the rod at the top of the image area and then dragged, with pressure, to the other side of the image area. This is not only more economical but also alleviates the possibility of sensitizer contamination in the brush and in the beaker of sensitizer, where sizing and organic paper fibers can be introduced by repeated dipping of a coating brush.

Drop count charts, for size referencing, can be found in the Pt/Pd and Ziatype chapters, but to make this simple, a 4" × 5" negative will require approximately 20–24 drops of sensitizer in a low-humidity environment. Always use a plastic eyedropper, as the dropper hole is uniform from dropper to dropper. Glass eyedroppers, while lovely to use, are handmade and are inconsistent in their exit hole size. If you are using multiple eyedroppers in a single formula, such as in the ziatype or platinum/palladium process, this is important. When you have your drops of argyrotype sensitizer in the shot glass, and you have added a drop of Tween 20 to the solution to assist in paper absorption, you're set to begin coating.

Coat your paper with the sensitizer using a Richeson or hake brush or coating rod. Once the sensitizer is applied in an even and complete manner with no puddles, unevenness, or brush marks, allow the solution to "set-up" in the paper by leaving it alone for about 3–10 minutes, depending upon the relative humidity in the working space. The paper needs to get adjusted to the sensitizer, and if you force dry with a hairdryer your overall humidity (very important to the color and tonalities) will be uneven. I use an empty drawer or paper-safe in the lab for this purpose. When I can no longer see a damp reflective sheen

on the paper's surface, I consider the paper ready for printing. Humidity plays a significant role in the color of the image, but I'll deal with that aspect shortly.



Once the coating and semi-drying is complete, place your contact negative in a contact-printing frame with your sensitized paper and clear acetate sheets and expose to UV light. I like to use two sheets of clean and unscratched acetate in the frame setup. These two sheets are placed on both sides of the sensitized paper, and this acts as an "envelope" of sorts, keeping the humidity in the paper and protecting your negative from the dampness of the sensitizer. If you dry your paper well you might consider eliminating the acetate altogether. So the setup in the contact frame goes like this: glass > negative > acetate sheet > sensitized paper > acetate sheet > hinged back of contact frame. Again, when I do this process in my workshops at the Anderson Ranch Arts Center or the Santa Fe Photography Workshops, where altitude and very low humidity are a constant, it is the lack of humidity that is an issue. Ideally, your paper and ambient humidity should fall into the 40%–80% relative humidity range. Most of the time, in these environments I don't worry about it and dispense with the acetate. If I need humidity to influence color I can always use the cat carrier humidity box . . . don't worry, I'll get to it.

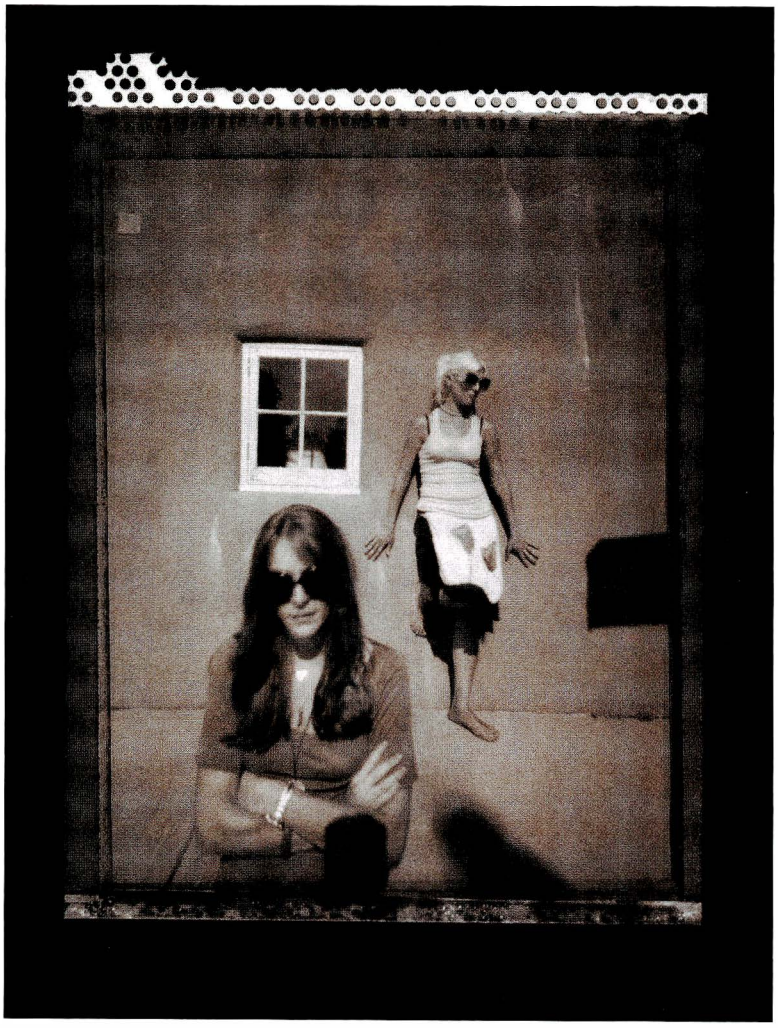
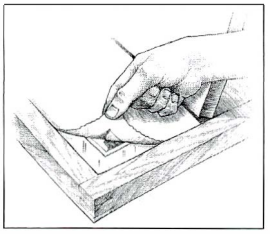


Figure 9–6
Christopher James, *Madeleine and Lisa*, Santa Fe, 2006 (gold-toned argyrotype)
This is a demonstration argyrotype print of Madeleine Patton and Lisa Elmaleh during an alternative process workshop in 2006 at the Santa Fe Photography Workshops.
(Courtesy of the Artist/Author)

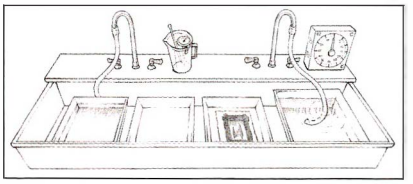


Exposure

The argyrotype image is *printed-out* as in a POP process rather than *developed-out,* and the tonalities you see following the exposure, and prior to toning and fixing, are quite close to what you'll get when the process is complete. Of course the toning, fixing, and drying will change the colors and densities, so this is an approximation. Print characteristics are also dependent upon the time of day, season of the year, type of water used throughout the stages, relative humidity, and weather conditions.

Your argyrotype exposure should run between 2.5 and 6 minutes, depending upon the time of year, day, and density of negative. At this stage in the process, the printed-out color will be an orange-sepia positive on an ochre background. I recommend that your UV exposure should continue until you overexpose your image by about 15%. This is often seen as a *bronzing* in the deepest shadow areas of the image. Although dry-down is significant, similar but not quite as extreme as in Van Dyke, you will lose density in the sodium thiosulphate fixing stage. My recommendation for over-exposure should not be considered gospel.

The first few times I demonstrated this process everything looked spectacular until the clearing stages . . . then a good portion of the image density washed away. Subsequent testing with different papers, adding a drop of Tween 20 to the sensitizer to increase paper absorption, and acidifying the first bath with citric acid did a great deal to correct the problems. If you're doing everything correctly, your decision on exposure time will be based on the relative humidity, the paper choice, and your adaptations, if any, of the sensitizer and development chemistry.



SINK SETUP FOR ARGYROTYPE

Tray 1 A very clean tray filled with *distilled* water. Agitate the print for a minimum of 10 minutes and change the water in the tray at least once during this stage. You might also want to have a lemon on hand to make the wash slightly acidic.

Tray 2 A second tray with clean distilled water

Tray 3 Gold ammonium thiocyanate toner
(*Toning is optional and done prior to the fixing stage.*)

Tray 4 2% sodium thiosulphate fixer
Mix 20 g to a liter (1,000 ml) of water
Time: 2–3 minutes with agitation

Tray 5 Final wash in fresh running water for 20–30 minutes

Argyrotype Wash—Development

Following exposure, your exposed print is wash-developed in *distilled* water for 10 minutes. It is important to use distilled water during this stage with a minimum of at least one change of fresh distilled water, as tap water will most often discolor the image due to chlorine content. The thing that must be avoided in the first wash is not chloride (Cl^-) but chlorine (Cl_2). Chlorine is a powerful oxidant and is used in bleaching solutions and disinfectants. It is often added to public drinking water as a way to purify that water and protect the population from the perils of nature and the various little microorganisms that reside in it.

Water Dechlorination

Here's the problem: this same purifying chlorine simultaneously oxidizes the silver metal image to silver chloride (AgCl). The result is often a paper tonality

that ends up with light, coffee-and-cream-colored tinting in the highlights. This, in turn, results in an image loss because that nice coffee-colored tint will then dissolve in the sodium thiosulphate fix. If you still have this coffee-and-cream color after 10 minutes, then extend the wash time another 5–10 minutes and strongly consider a squeeze of lemon or a hefty pinch of citric acid to lightly acidify the water.

Here's the same issue with a twist. If your image disintegrates in the fixer, it may not be silver chloride that is the problem. In recent years, many municipalities have switched over from chlorine to chloramines. Chloramines are a combination of chlorine and ammonia (both of which are toxic to fish life, by the way) and it's quite possible that silver chloramine compounds are even less soluble than silver chloride. This might explain why my argyrotypes behave very differently in urban and rural locals. If you are experiencing a persistent degradation of your image's integrity in the fixing stage, and you have acidified your distilled water and extended the wash-development time, then you may have to resort to a dechlorinator . . . a chemical that home aquarium and aquaculture enthusiasts use to dechlorinate their fish tanks and ponds. You can find this product at your local pet store. A few drops to a tray of tap water will probably do the trick.

Again, if you do not use distilled water or rainwater in your first wash-development bath, you will notice an abundance of milky white turbidity, or cloudy liquid, leaving the print. This is a silver chloride (AgCl) precipitate due to chloride ions in the wash water reacting with the excess silver ions of the sensitizer. This is totally normal for the first wash using tap water. You're going to see a little of this turbidity in distilled water, but you will not see as much, nor will your print be as likely to turn the coffee-and-cream color in the highlights and disappear in the fix.

A public or tap water supply is most often totally unsuitable for the argyrotype's wash-development. Another warning sign: if you see your highlight and mid-tone colors turn to a red or buff-brown in tap water, it probably means that the paper fibers may be failing to trap the tiny silver particles in the paper and you are going to lose your image in the sodium thiosulphate fix. It is also likely that insufficient Tween 20 has been used in the sensitizer preparation or that the paper is unsuitable for this process.

If you don't have a choice, or any distilled water, try re-humidifying the UV-exposed print for 10–30 minutes *before* the wash-development stage. Then, place the print face down in the distilled water and leave it alone. This may minimize the leaching and bleaching effects. Of course, you might also consider using a gold toner prior to the fixing stage, but this will not correct the entire problem.

Figure 9–7
Jesseca Ferguson, *Tome XXIV*, 2010 (pinhole argyrotype and old papers, book parts, ink)
Boston artist Jesseca Ferguson writes, *"This photo-object was purchased by the Fox Talbot Museum at Lacock Abbey. Curator Roger Watson has it hanging in his office! Seeing the oriel window and inner courtyard immortalized in Talbot's earliest photographs was deeply moving, as was visiting Talbot's grave in the tiny village of Lacock (adjacent to Lacock Abbey)."*
(Courtesy of the Artist)

TONING & FINAL WASHING STAGES

Argyrotype Gold Ammonium Thiocyanate Toner

Toning is optional and traditionally done prior to the fixing stage. One of the most effective argyrotype toners is a traditional formula used for POP toning: the gold ammonium thiocyanate toner. It is a simple process to make this toner from scratch, or you can purchase it, ready for dilution, in liquid Parts A & B from Bostick & Sullivan.

NOTE: Gold toner gets better over time as long as you don't make it fresh every time you need it. When it's time to replenish the standard toner mix, just add 50 ml of the 0.2% gold chloride and 50 ml of 2% ammonium thiocyanate to the used liter of toner. When you're done toning, save the toner and make the new toner for the next session with the old. Over time, as the gold toner filtrate is used to make the new toner solutions, the toner seems to get better, making more difficult tones easier to achieve.

Solution A

0.2% gold chloride
(Note: This is 0.2% and not 2%.)

Solution B

2% ammonium thiocyanate

These two solutions are mixed to make a working solution using the same formula you would use in POP gold ammonium thiocyanate toning.

A: 50 ml of 2% gold chloride
B: 50 ml of 2% ammonium thiocyanate
C: 900 ml distilled water

NOTE: Add additional gold chloride and ammonium thiocyanate to the working solution after every 5–6 toned prints.

NOTE: When you are finished with the gold ammonium thiocyanate toner, filter your working solution through a coffee filter in a funnel with a ball of cotton at the bottom of the cone. This will catch the smaller particulates. Keep the liquid and use it in place of the distilled water when making your new gold toner solution.

Fixer: 2% Sodium Thiosulphate

Following the toning stage, the print is immersed in a 2% (20 g to 1,000 ml of water) sodium thiosulphate fixer solution for 3 minutes. The fixer, as in the Van Dyke process, will cool off the color of the image as it removes insoluble silver salts. The sodium thiosulphate bath has an effective working capacity of about ten 8" × 10" prints, and you should change the solution regularly during a lab session. If you decide to fix the print and omit the toning stage, you will notice that your image will often intensify, demonstrate an increased separation in its shadow areas, and slightly change color. Consult the charts that follow for color shifts that occur when fixing before and after toning in this process.

Again, the recommended fixing time is 3 minutes. Extended fixing times will often result in loss of image density, especially in the highlights. This tendency may be used to reduce the density in an overexposed print. As an aside, the density of an overexposed print can also be reduced by briefly immersing the print in a hot selenium bath. I have had some success with a 1 part selenium to 80 parts distilled water bath. As always, be cautious whenever using selenium, and wear nitrile or latex gloves and protective eyewear.

One other consideration regarding your fixing bath: if you are working with an image that has a very delicate degree of highlight detail, you may find it beneficial to make your fixing bath slightly alkaline by adding a small amount of ammonia to it. Although this technique will diminish the degree to which the silver is reduced, the downside of this choice is that you may end up with too much residual iron in the print.

Wash & Dry: Final Print Tonality

The print is then washed in running water for 20–30 minutes and hung to dry. Be aware, the "dry-down" in argyrotype is significant and you should expose your print accordingly.

NOTE: Air-drying will result in the color staying in the range that you ended with your wet stage. Drying with heat will result in darker and cooler values in the print.

Your Image Fails in the Fixer: Part II

Here's the situation . . . you have done everything perfectly and have avoided the pitfalls with the chlorine or chloramines and your image has survived and looks terrific. However, other threats loom. Feeling pretty good, you move on to the sodium thiosulphate fixing stage and within a minute your image disintegrates and falls off the paper. What happened?

One of the causes could be a physical problem of the paper's fibers being unable to trap the silver nanoparticles when confronted with the power of the fix. This has happened to me in a demonstration when I had done everything perfectly. In the end it appeared to be a paper problem. The first thing I did to correct the situation was change to a higher-quality paper and one that I knew did not require sizing. That solved half of the problem.

Then I re-humidified in two ways: first with my cat carrier humidity box (instructions coming up in a minute) and second by dampening the paper's rear surface with a wet sponge before sensitizing the front. This helps embed a greater degree of sensitizer in the paper's fibers. On the downside, it also diluted, to a slight degree, the concentration of the sensitizer. Still, there was a problem with the sensitizer's ability to penetrate the paper's fiber structure.

If the sensitizer just sits in the paper's pores (the microscopic texture you can see in a sheet of paper if your eyes are still good), then it's bound to wash out. You need to get the sensitizer deep into the paper's fibers, and this is where Tween 20 comes into play. By adding a drop of Tween 20 to your sensitizer, say 1 drop to a 24-drop mix in your shot glass, you should solve your problem. By the way, two things to remember about Tween 20: only add Tween to a fresh coating solution, as it loses its effectiveness as it ages. Do not add Tween to the entire bottle of sensitizer; only add a drop at a time per shot glass sensitizer mix.

Controlling Image Color by Controlling Humidity

Image color can be enhanced and controlled by humidity. By humidifying your paper before you coat it, after you coat it but immediately prior to exposure, and again just before wet processing (which assists in bringing out highlight details), you help the sensitizer penetrate the paper's fibers and give yourself a far better chance of success. Humidity is a real working tool in the argyrotype process. Colors can range from warm browns to violet browns in an untoned print to a darker brown, orange, peach, or black in a toned print. In the summer, when humidity is normal except in the mountains, extra humidification is often unnecessary. You simply work slowly and the paper will gather in moisture from the air. There are a number of ways in which you can humidify your paper in any of the humidifying stages, and here are a few.

Finally, the Cat Carrier Humidity Box

This is a paper humidifying technique I used in graduate school at R.I.S.D. when I was doing a lot of intaglio and embossed printmaking on press. Since the argyrotype's color is so dependent upon the degree of humidity within the paper, you will want to add some control to the situation by constructing your very own personal cat carrier humidity box. Here's how to do it.

Go to a discount store, or eBay, and buy a decent sized cat or pet carrier . . . the kind made of plastic, with a carry handle and perforations in the sides, so the cat doesn't suffocate on the way to the vet. Construct a shelf about halfway from the bottom of the carrier, supported by wood blocks, and tack a section of heavy-duty plastic screening to the blocks with a staple gun. You now have a shelf that will accept humidity from top and bottom.

Next, get a large lawn or contractor's size trash bag and slide it over the unit, leaving the front entry door exposed. In the bottom of the carrier, place a glass baking dish or plastic tray that will hold a large car-washing-sized sponge. Soak the sponge in hot water, add a little bit of hot water to the tray, place the sponge in the tray, and slide it in the bottom of the carrier underneath your plastic screening.

Finally, place the paper you are using on the plastic screening shelf and seal up the cat carrier by closing up the plastic bag. Your paper will humidify evenly in a short time without becoming saturated. This is ideal in printmaking, as it softens the elasticity of the paper fibers, allowing the paper to be pressed into the etched and ink-filled lines of the drawing without tearing. In argyrotype, by controlling the humidity in this manner, you can control color and the evenness of the sensitizer, preventing the mottled appearance that sometimes occurs when the paper is unevenly damp.

Cool Mist Humidifier

You may decide to travel light and use a cool mist humidifier. These are available in many drugstores for about $20.00. My own Sunbeam Safety-Glow Cool Mist humidifier has a built-in green glow so you can observe the degree of reflective sheen on the paper while under low ambient light levels.

The Where You Are Technique

This is easy . . . if you are in the Midwest, South, or Southeast, in the summer months, working at low altitude in the summer along any coastline, or anywhere in the South Pacific, then you do not have to worry about humidity or building a humidity box. If you don't live in a humid climate, try to keep the relative humidity in your working space in the 50%–60% range with either a de-humidifier, or a humidifier, and you'll be fine.

Remember, if you humidify your sensitized paper prior to exposure (always a good idea), be sure to use a Krystal Seal envelope or two clear acetate sheets on both sides of your humid and sensitized paper. This is the same advice I'll give with another humid sensitive process, the ziatype. Without this protection, there is a chance that you will bake the argyrotype sensitizer into your favorite negative during the exposure. I have learned this lesson the hard way . . . more than once. If you are using Pictorico OHP Ultra Premium film to make your digital contact negatives, the problem is not as traumatic.

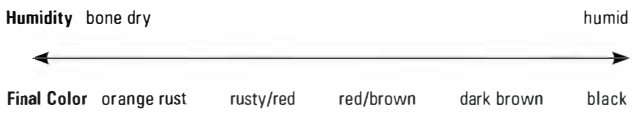
Figure 9–8
Amy Sue Greenleaf, *Snow*, Pennsylvania, 2002 (toned argyrotype)
This is another print by Amy Sue that nicely illustrates the split-toned color flexibility that can be achieved with the argyrotype process.
(Courtesy of the Artist)

NOTE: Allow me to repeat this once more: you may control the color of the print and the degree of highlight separation in the final image by humidifying the exposed print prior to development. After exposure, allow the exposed print to sit quietly in a low-light environment for 5–20 minutes. Or put the print into your cat carrier humidity box for a few minutes before going into the first of your distilled water baths.

AMY SUE'S ARGYROTYPE HUMIDITY & COLOR CHARTS

Note: The humidity charts that follow are provided as an approximation of what you might expect to see in your images if you use them. Time of year, type of humidifying box, degree of dryness before humidification, and the type of paper will all be variables. The color change during the exposure will be a good indicator of the degree of humidity in the paper. Pay attention to the color during the exposure and adjust your humidity to get the desired color change. Below is a chart to indicate the color change during the exposure for bone dry to very humid paper.

Color After Exposure Prior to Toning, Fix, & Final Wash

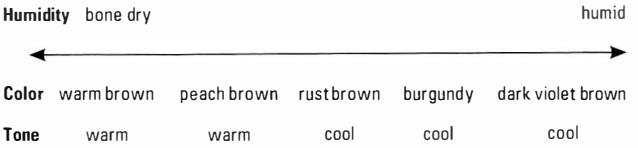


Retaining Humidity During Exposure

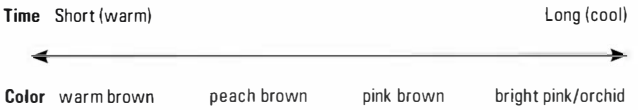
The process is very sensitive to humidity, so a visible line can easily show up on the print from the hinge back printer. I found that the paper was dehumidified even with tape over the hinge. It is best to enclose your sensitized paper with acetate, or a Krystal Seal envelope, on both sides of the paper when humidifying to create an "acetate sandwich." The acetate keeps the paper at an even humidity and protects your negative. The acetate sandwich is even more critical for papers that are thin, as they tend to lose their humidity more rapidly.

TONERS & COLOR OPTION CHARTS

No Toner



Dry Paper in Gold (Au) Toner



More time in gold toner results in a more pink/purple tone. Darks go from warm brown to cool brown.

Humidified Paper in Gold (Au) Toner

More Time in Gold Toner Equals a Cooler Set of Tonalities

Burgundy to violet tint > to dark brown > to black. As the darker tones become cooler and black, the white tonalities cool and tend to the blue-whites. This gives the added impression of depth when adjacent to warm tones.

Color Tonality Suggestions

Warm Brown to Peach (with no humidification)**:** Coat your paper with the sensitizer and dry it with a hairdryer. Dry beyond the point at which it appears to be bone dry. Expose your print and notice that during the exposure the color turns from a yellow green to an orange/rust color. Following exposure, wash-develop the print in distilled water for 10–15 minutes and then fix the exposed print in a 2% sodium thiosulphate bath for 3 minutes. The tones will darken in the fix and turn a warm, milk chocolate brown. The final wash is for 20–30 minutes in fresh water.

Brown Pink: Follow the steps for warm brown to peach, but tone in gold ammonium thiocyanate toner after the distilled water wash and prior to fixing. Immerse the print in the gold toner for 5–30 minutes. Visually monitor the change in tone. The color will go

Figure 9–9
Cig Harvey, *Pears & Radiator*, 2004 (argyrotype)
Maine artist and photographer Cig Harvey is well known and respected for her artist's books, editorial illustration, and fashion work. Cig is an inspiring mentor in her workshops and continues to excite students about the possibilities of alternative process printmaking
(Courtesy of the Artist)

from peach to pink. If you want some of the peach to remain, remove the print from the toner right before you see the pink color first begin to emerge. The longer the print is in the gold toner, the more pink it will become until it is almost an electric pink (pink/purple or orchid color). After toning, rinse in distilled water for 10 minutes and then fix the print for 3 minutes. The highlights will darken and the tone will cool down in the fix. The final wash is for 20–30 minutes in fresh water.

Dark Brown Peach (with humidification)**:** Coat and dry your paper. Humidify the paper for 5–15 minutes. During exposure, the color will turn from yellow green to a dark rust color. Following exposure, "develop-wash" the print in distilled water for 10 minutes. Immerse the washed print in fix for 3 minutes. The prints tones will darken in fix. The final wash is for 20–30 minutes in fresh water.

Cool Dark Brown: Follow the steps for dark brown peach, except place the exposed and washed print in gold toner for 3–6 minutes. Rinse in distilled water for 10 minutes. Fix for 3 minutes, and the tone will darken and cool down. The final wash is for 20–30 minutes in fresh water.

Dark Brown Burgundy: Coat the paper and humidify it for about 20 minutes. When exposed, the print color will turn from a yellow green to red brown. If it turns black it is over-humidified, but this may be something that appeals to you . . . keep good notes. Following exposure, water-develop the print in distilled water for 10 minutes and then go to the fix for 3 minutes. The fix will cool the tone down, and the burgundy tint should still be evident. The final wash is for 20–30 minutes in fresh water.

Black Burgundy: Follow the steps for dark brown burgundy, except place the exposed and washed paper in gold toner for a short amount of time. The burgundy tone should disappear quickly. As soon as you see a burgundy black tonality, remove the print and place it in the sodium thiosulphate fix for 3 minutes. Many times the fix will cool the tone down and the burgundy will not be evident. If it isn't, try again. The final wash is for 20–30 minutes in fresh water.

Warm Black: Coat your paper and humidify it for 20–35 minutes. When exposed it will turn from yellow green to dark brown. Again, if it turns black, it is over-humidified. Following exposure, wash-develop the print in distilled water for 10 minutes. Then immerse the print in gold toner for 2–3 minutes. You will see hints of violet/burgundy that disappear quickly and then turn a warm black. Fix the print for 3 minutes, and the tone will cool down. If that doesn't work the first time, it is because this is a difficult color to get . . . try again. The final wash is for 20–30 minutes in fresh water.

Warm Black II: Coat your paper with sensitizer and humidify it for 20–35 minutes. Following exposure, wash-develop the print in distilled water for 10 minutes. Immerse the print in warm selenium at a 1:100 dilution for a short time. Be sure to wear nitrile or latex gloves for this step. At this dilution you will not get an extreme color shift, but you will notice that your highlights may open up a little. Rinse the print for 5 minutes after you are done and then fix it in sodium thiosulphate for 3 minutes. The final wash is for 20–30 minutes in fresh water.

Cool Violet Black: Coat your paper and then humidify it for 40–60 minutes. When exposed it will turn from yellow green to black. Although extensive humidification is necessary, it is possible to over-humidify, resulting in splotchy values during the exposure. Wash-develop your print for 10 minutes in distilled water and then go to the fix for the usual 3-minute time. The fix will cool the tone down, and the violet should remain evident. The final wash is for 20–30 minutes in fresh water.

Cool Black: Coat your paper and follow the steps for cool violet black. After exposure, wash-develop the print in distilled water and then immerse it in the gold toner for 3–5 minutes. The longer the print is immersed in the gold toner, the cooler and more black the tonalities will be. Fix the print for 3 minutes and notice that the cooling down of tones is not as evident this time. The final wash is for 20–30 minutes in fresh water.

Selenium Toner: Selenium is extremely aggressive even at the 1:30 (1 part selenium to 30 parts distilled water) dilution. The shorter the time in the selenium, the better. The color tones in selenium will be different and can be combined with other toner types as long as you rinse adequately, meaning 20–30 minutes, between toners. Experiment, but be careful with selenium and wear gloves and work in a ventilated space. Remember that you can reduce density in an overexposed print with a selenium bath. A 1:100 as a dilution would be a judicious starting point to begin experimenting with this technique, and it is important to remember that selenium has a common tendency to continue toning in the rinse bath after the toning. For this reason, I always remove the print before I am happy with the results. The final wash is for 20–30 minutes in fresh water.

Black Yellow: Coat your paper and humidify it for 30 minutes. Expose in UV light and then wash-develop the print for 10 minutes in distilled water. Following the rinse, immerse the print in the gold toner for 3 minutes and then rinse again for 10 minutes. Next, immerse the print in a 1:30 selenium bath for 1–10 seconds. At this concentration, a lengthy selenium bath will eat the print. Rinse well again for 10 minutes and re-immerse in the gold toner until reaching the desired color. Fix for 3 minutes and then place the print in a fresh water final wash for 20–30 minutes.

ADDITIONAL ARGYROTYPE IDEAS

Combo Printing

Consider printing an argyrotype on top of over-exposed cyanotypes for blue, sepia, and metallic green splits. Also, try gum bichromate prints on top of argyrotype for additional color rendition. In this case, the argyrotype will give you detail and a nice warm color to use as a foundation for the gum passes to come. You will likely have a few toning tests that did not work out as hoped. However, they may have an interesting coloration that you can build into a personal palette or vision. Running a gum bichromate pass on top of an argyrotype is fun and thrifty. You may need to size your argyrotype paper with a gelatin glyoxal sizing if you intend to do many gum passes.

Argyrotype on Ink Jet Prints

This is a really nice idea that a few of the guys developed in an advanced alternative process workshop of mine a few years ago.

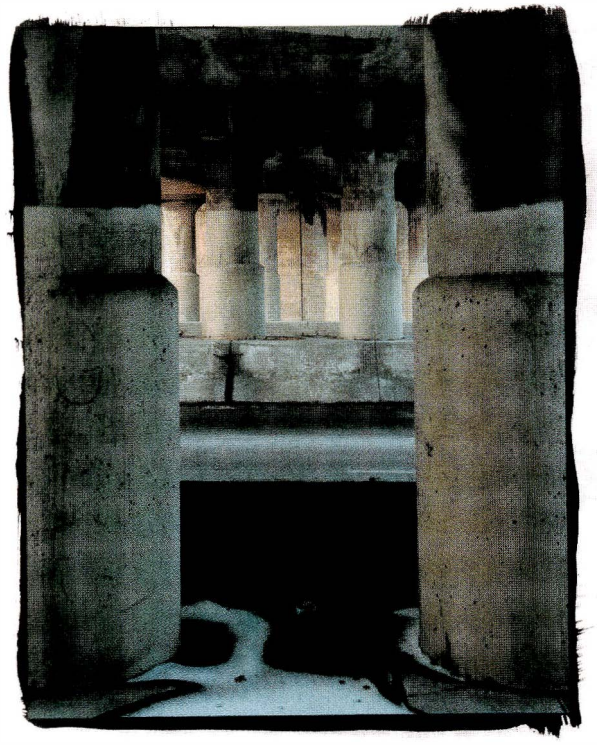


Figure 9–10
Matt Gehring, *untitled*, 2006 (ink jet & argyrotype print)
This print is a nice example of the effect that can be created when an argyrotype is printed on top of an inkjet print using water-resistant K6 or Ultra Chrome K3 inks.
(Courtesy of the Artist)

Step 1 Begin with a digital image, via a scanned negative or a digital file.

Step 2 Convert the image to CMYK in Photoshop and print everything (CMY) except the black channel on a Cranes Platinotype or similar paper. You may want to begin this experiment using a Hahnemühle or Photo Rag paper stock that has a ceramic dust coating in order to yield a higher-quality resolution of the carbon-based inks.

Step 3 Next, make a digital negative using Pictorico OHP film by inverting and printing only the black channel at 100% opacity.

Step 4 After the inkjet print has set for 24 hours, coat it with your argyrotype sensitizer and lightly dry it with a hairdryer from the backside of the paper or allow the paper to sit unmolested in a dark drawer for 5–10 minutes. Then expose the print to UV light for the normal exposure time in the 5-minute area.

Step 5 Once the print has been exposed, wash-develop the print in distilled water for 10 minutes. Finish by fixing the print for 3 minutes and final wash for 20 minutes.

Figure 9–11
Mike Ware, *Dies Irae, Scapa Flow*, 1983–1991 (argyrotype on Silversafe paper)
(Courtesy of the Artist)

The New Chrysotype Process

OVERVIEW & EXPECTATIONS

In this relatively brief New Chrysotype chapter I will offer you sufficient information to make your first chrysotypes and hopefully inspire you to continue your investigations in this very flexible, often beautiful, and rarely practiced technique. If it worms its way into your heart and becomes your chosen medium, you will be unique instantly. My friend, the brilliant Mike Ware, who resurrected Sir John Herschel's original chrysotype process (1842), has written two books relating to the process, and it would be absurd for me to try and replicate the depth of the information you can excavate by simply consulting them. As my former student and current friend and colleague, Dan Estabrook wrote recently, "I would love to borrow his brain for just one week!" In any case, if you want a lot more on the process, try these two manuals.

- Mike Ware, *Gold in Photography: The History and Art of Chrysotype,* Abergavenny: ffotoffilm publishing, 2006
- Mike Ware, *The Chrysotype Manual: The Science and Practice of Photographic Printing in Gold,* Abergavenny: ffotoffilm publishing 2006

Mike also has a dedicated web site that he and his editor–publisher, Paul Daskarolis, created that is dedicated to the *siderotype,* from the Greek word *sideros,* meaning "iron," a method of printing images utilizing light-sensitive iron salts in combination with *noble metals* such as gold, platinum, palladium, or silver. These metals are referred to as noble and are used when resistance to chemical action and corrosion is essential to the long-term health of whatever they are used for. The web site address is http://www.siderotype.com.

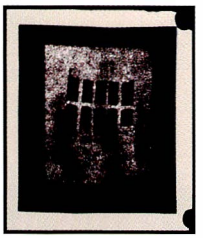
So, you may rightfully inquire, "Why another iron process in this book . . . and won't this one be hellaciously prohibitive due to the cost of gold?" The answers to both of these questions are precisely the reasons you should learn to use it.

Figure 10–1

Mike Ware, *Noto Antica*, Sicily, 1987/2002 (new chrysotype)

This image is an example of Mike Ware's successful adaptation of Herschel's original chrysotype process from 1842. In 1987, after several years of refined testing and seeking possible compounds that could bind to and stabilize the gold (ligands), Mike came up with a method of printing images utilizing light-sensitive iron salts in combination with salts of gold. This is likely the first new "alternative" printmaking process, utilizing noble metal, to be created in over a century.
(Courtesy of the Artist)

- Gold has a higher covering power than other noble metals such as platinum and palladium. As a result, you will use less of it making a print and will find that it actually ends up being less expensive in the long run.
- The new chrysotype can be thought of visually in the same way that you think about platinum and palladium. A new chrysotype print has a matte finish, and the tonal scale is equal in tonal delicacy, and scale, to its Pt/Pd siblings.
- The new chrysotype has a vast menu of tonalities that are easily realized. Whereas you are somewhat limited in hues of black, white, neutral grey and brown with platinum and palladium, the new chrysotype offers split-toned color options involving grays, pinks, magentas, browns, violets, blues, and greens. This vast range of color, as you will soon see, is predicated upon the chemistry of the sensitizer and the conditions of the processing.
- Lastly, among the primary reasons for making this a process to embrace is the elegance and archival permanence of the new chrysotype print.



A LITTLE HISTORY

The Chrysotype

A fair distance has been traveled in previous chapters on the historical siderotype trail, specifically in the sections involving the iron-based processes. In this section, I'll offer a brief description of Herschel's original chrysotype process and workflow and a few reasons why the process disappeared for so long . . . until Mike Ware resurrected it under the banner of New Chrysotype.

Most normal folk would be content to invent, or discover in their lifetime, a single new process to make photographic images and history. In 1842, Sir John Herschel created three of them: the cyanotype, the argentotype, and the chrysotype. Each of these techniques has a place in the *siderotype* family, a word first used by Herschel to describe an iron-based photographic print. A number of authors have pointed to the fact that the English summer of 1842 was meteorologically "brilliant," and this

Figure 10–2
Sir John Herschel, *JFWH #23*, 1842 (chrysotype)
Part of his set of forty-three specimens exhibited at the Royal Society in 1842 (now held by the HRHRC), this image was printed by Herschel from a positive source as an anthotype (#1) and as a chrysotype (#23). Please refer to Chapter 2 for instructions. This print is a chrysotype because it is a negative and because of the density of the purple color. The anthotype is a positive image and pale lilac in color. The image was originally published in *Friendship's Offering*, 1839, vol. 8, p.289 and titled *A Scene in Italy*, engraved by H. Cook from a painting by J.W. Wright. (See page 82 of Mike Ware's book, *Gold in Photography*, for additional details.) *(Photography Collection; Harry Ransom Center; The University of Texas at Austin)*

fact may have had a great influence on how much work Herschel was able to accomplish. Herschel had also recently moved from the smog of London to the crisp and clean air of Kent, and he was greatly inspired by his new environment.

Herschel was well aware of the work his friend and peer, William Henry Fox Talbot, had accomplished with the calotype and salted paper process and was enthusiastically capable of making images in various shades of brown. You may recall from the Cyanotype chapter Herschel's fortuitous correspondence with young Dr. Alfred Smee and Smee's generous gift of his deeply colored red salts of potassium ferricyanide . . . along with ferric ammonium citrate and the amazing weather in the summer of 1842, all of which led to an extraordinary creative period in which Herschel changed the very foundations of the new photographic medium.

One of the results that Herschel understood was that when sunlight fell upon his ferric ammonium citrate sensitized papers, the resulting ferrous iron could also be used to *reduce* precious metals from their respective salts. This meant that he could make images in silver (argentotype), gold (chrysotype), and mercury (celaenotype). It was Herschel's groundbreaking work in this area that eventually led to Willis's platinotype process. There were, however, problems.

Note: In this context, the word *reduce* describes reduction/oxidation and all chemical reactions in which atoms have their oxidation state changed.

In 2004, Mike Ware wrote an excellent piece for *Double Exposure, A Golden Legend: Chrysotype Re-invented.* He wrote,

> *"Owing to the powerful chemical reactivity of gold chloride, which is incompatible with the iron salt that he used, Herschel had to place this gold salt in a development bath, which rapidly accumulated impurities and decomposed—a highly uneconomic procedure. The expense of gold compared with silver, and chemical problems of image fogging, prevented the embryonic chrysotype process from gaining admission to the repertoire of photographic printing media."*

Besides the expense, another problem that continues to have weight was the fact that Herschel's chrysotype process announcement to the Royal Society was misreported in the August 1842 issue of *the Athenaeum,* a popular and important periodical of the time for scientific and literary news. The transcriber confused Herschel's chrysotype with his cyanotype process by indicating the inclusion of ferro-sesquicyanuret of potassium (potassium ferrocyanide) in the chrysotype technique. Herschel corrected the record two weeks later in a response to the *Athenaeum* (next section), in which he provided details for his chrysotype technique. Unfortunately, the misinformation had a life of its own . . . like a bad review.

In 1849, Henry Snelling's *The History and Practice of Photography,* got it wrong, and this source is still being referenced as historical fact:

> *"A modification of Mr. Talbot's process, to which the name of Chrysotype was given by its discoverer, Sir John Herschel, was communicated in June 1843 to the Royal Society, by that distinguished philosopher. This modification would appear to unite the simplicity of photography with all the distinctness and clearness of [Talbot's] calotype. This preparation is as follows. The paper is to be washed in a solution of ammonio-citrate of iron; it must then be dried, and subsequently brushed over with a solution of the ferro-sesquicyanuret of potassium.*
>
> *This paper, when dried in a perfectly dark room, is ready for use in the same manner as if otherwise prepared, the image being subsequently brought out by any neutral solution of gold. Such was the first declaration of his discovery, but he has since found that a neutral solution of silver is equally useful in bringing out the picture. Photographic pictures taken on this paper are distinguished by a clearness of outline foreign to all other methods."*

Note: Regarding ferro-sesquicyanuret of potassium. This important-sounding chemical name is also known as *potassium ferrocyanide, tetra potassium, or yellow prussiate of potash* and was described by Dr. Alfred Smee in a paper to the Royal Society in June 1840. It is important to note that potassium *ferricyanide*, used in the cyanotype formula along with ferric ammonium citrate, is manufactured by passing chlorine through a solution of potassium *ferrocyanide*. The potassium ferricyanide separates from the solution. You may recall that it was Dr. Smee who, in 1842, originally gave Sir John Herschel a sample of the brilliant ruby red chemical salt for his experiments, leading to the development of the cyanotype process.

Herschel's Chrysotype—From the *Athenaeum* August 20, 1842

Below is an excerpt from Herschel's dialog in the *Athenaeum*, with my comments in parentheses.

> "*The preparation of the chrysotype paper is as follows: dissolve 100 grains of crystallized ammonio-citrate of iron* (ferric ammonium citrate) *into 900 grains of water* (approximately 2 fl oz), *and wash over with a soft brush, with this solution, any thin, smooth, evenly textured paper. Dry it, and it is ready for use. On this paper a photographic image is very readily impressed: but it is extremely faint, and in many cases quite invisible. To bring out the dormant picture, it must be washed over with a solution of gold in nitro-muriatic acid, exactly neutralized with soda* (bicarbonate of soda), *and so dilute as to be not darker in color than sherry wine. Immediately, the picture appears, but not at first of its full intensity, which requires about a minute and a half to attain* (though, indeed, it continues to darken for a much longer time, but with a loss of distinctness). *When satisfied with the effect, it must be rinsed well two or three times in water* (renewing the water), *and dried. In this state, it is half fixed. To fix it completely, pass over it a weak solution of hydriodate of potash* (potassium iodide), *let it rest a minute or two* (especially if the lights are much discolored by this wash), *then throw it into pure water until all such discoloration is removed. Dry it, and it is thenceforward unchangeable in the strongest lights, and* (apparently) *by all other agents that do not destroy paper*."

Note: Herschel's formula for the chrysotype states that 100 grains of ferric ammonium citrate is dissolved in 900 grains of water. The best I can figure is that this weight is based on a system of liquid measure conversion established in 1618 in the London Pharmacopoeia, adopting the Roman gallon as a basic liquid measure converting units of liquid capacity into apothecary weights. This would mean that 900 grains is 58.32 g of water, which has a volume of 58.22 ml at 20° C, which is 2.05 fluid ounces.

Note: Nitro-muriatic acid is another term for *aqua regia*, meaning "king's water" in Latin. It is formed by freshly mixing concentrated nitric acid and concentrated hydrochloric acid, usually in a volumetric ratio of 1:3, respectively. It is one of the few reagents that dissolve noble metals such as gold and platinum.

In 1984, Mike Ware was awarded a Kodak Photographic Bursary to support an investigation of the iron-based methods of precious metal printing. This interest sprang out of his professional research as an inorganic chemist at Manchester University. In collaboration with Professor Pradip Malde, he developed an improved method of printing-out in platinum and palladium. This research led to Mike's interest in gold and his belief that there was a means of stabilizing gold prints within an iron-based sensitizer . . . rather than with the economically unfeasible developer that Herschel had originally used.

In 1987, after several years of painstaking testing, seeking possible *ligands* (see note), Mike came up with a solution using an inexpensive compound to reduce the gold. This was probably the first new printing process utilizing a noble metal to be created in over a century.

Figure 10–3
Mike Ware, *Poppies,* 1990–2002
Mike Ware has successfully adapted each of the three Herschel iron-based processes from 1842: the cyanotype, the argentotype, and the chrysotype. This example of his New Chrysotype process illustrates the wonderful split tone potential of the process.
(Courtesy of the Artist)

Note: A *ligand* is an ion, a molecule, or a molecular group that binds to and stabilizes another chemical entity (especially a metal ion like gold) to form a larger complex.

MIKE WARE'S NEW CHRYSOTYPE PROCESS

New Chrysotype Sensitizer

For a simplified solution to creating the New Chrysotype formulas go to the Gold Street Studios web site at http://www.goldstreetstudios.com.au. For those of you who prefer to explore the chemistry in person, read on.

There are three optional ways of creating a New Chrysotype sensitizer, and each offers unique degrees of complexity. In an effort to make you happy quickly, I will detail the least complicated of the three forms, what Mike Ware calls the S-version, or sodium method, and recommend that you investigate his book, *The Chrysotype Manual,* if you are interested in trying your hand at the other more challenging versions. Just for your edification, the two other versions are called the "M-version" (Methyl sulphoxide) and the "P-version" (for pH parameter).

Chemicals Required for the Chrysotype Sensitizer

Part A 3,3'-thiodipropanoic acid

(also known as *3,3'-thiodipropionic acid*)

Part B Either/or

B1—Sodium tetrachloroaurate (III) dihydrate

(also known as *sodium gold chloride or sodium chloroaurate*)

B2—Hydrogen tetrachloroaurate (III) trihydrate

(also known as *chloroauric acid or gold(III) chloride hydrate*)

Part C Ammonium iron(III) oxalate trihydrate

(also known as *ferric ammonium oxalate* [*AFO*] *or iron ammonium oxalate*)

Part D Either/or

D1—Sodium carbonate

D2—Sodium hydrogen carbonate (baking soda)

Part E Tween 20

Part F Distilled water

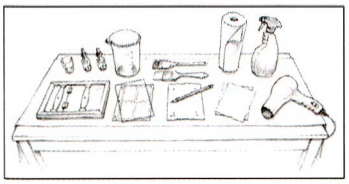
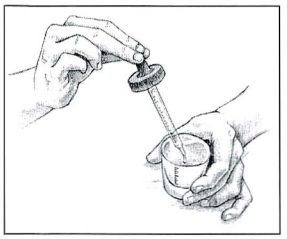


TABLE SETUP—MAKING CHRYSOTYPE SENSITIZER STOCK A-B-C

- One 50–100 ml graduated glass measuring cylinder
- One 100–200 ml Pyrex glass beaker
- One large plastic beaker (500 ml)
- One small filter funnel
- Filter papers (#1)
- Two glass stirring rods
- Plastic eye droppers/pipettes
- Gram scale
- Electric hotplate
- Plastic spoon
- Three brown glass bottles with screw caps (50 ml)
- Labels and marking pen
- Distilled water



The new chrysotype sensitizer is made up of three separate solutions.

- Solution A: ligand
- Solution B: gold
- Solution C: iron

Figure 10–4

Tom Hawkins, *Arashiyama Bamboo* Grove, 2012

Tom Hawkins is one of the early adaptors of Mike Ware's New Chrysotype. He writes, "The idea of 'cultivation' is the basis of my photographic explorations. My work is an examination of the marks we make, the things we plant, and the structures we build when we cultivate a place. This is why I make pictures." *(Courtesy of the Artist/TBH)*

PREPARING STOCK SOLUTION S-VERSION CHRYSOTYPE

Stock A: Ligand

Step 1 Weigh out 12.5 g of 3,3'-thiodipropanoic acid and transfer it into your 500 ml beaker or measuring cylinder.

Step 2 Weigh out 7.4 g of sodium carbonate (anhydrous) or 11.8 g of sodium hydrogen carbonate.

Step 3 Add 30 ml of distilled water to the thiodipropanoic acid and stir it into suspension with your glass rod.

Step 4 Slowly add the sodium carbonate powder, in small portions, to the thiodipropanoic acid in suspension. Carbon dioxide gas will form, and the solution will foam and effervesce—it is harmless. Stir this well and allow the foam to subside between additions of the sodium carbonate. Continue this until the sodium carbonate is in clear solution. Small residual bits and particles do not matter.

Step 5 Pour this solution into a small 50–100 ml measuring cylinder and make it a final total volume of 50 ml with your pure water. Stir this into solution.

Step 6 Filter the solution through a #1 filter paper directly into the stock bottle. The solution will be like syrup, so be patient. The bottle should be labeled

Solution A: Ligand—New Chrysotype "S"
(Disodium thiodipropanoate 1.4 molar)

Stock B: Gold (B-1)

Step 1 Carefully weigh out, or transfer, 5.0 g sodium tetrachloroaurate(III) into a Pyrex glass beaker with a 100 ml capacity. Use plastic to measure and transfer.

Step 2 Add 25 ml of distilled water, at ambient temperature, to the gold salt in the beaker. Use a little water, squirted from an eyedropper, to wash out and transfer any residual gold left behind on your plastic spoon.

Step 3 Filter the gold solution carefully into a measuring cylinder (50–100 ml) using the funnel and a #1 filter paper.

Step 4 Add distilled water, a little at a time, to the filter paper, allowing it to pass through to wash out most of the residual yellow solution and to make up the final volume to exactly 36 ml in the measuring cylinder. Mix this solution thoroughly.

Step 5 Transfer the solution carefully from the measuring cylinder to the stock bottle. This solution is stable indefinitely. Label the bottle with the date of the mix and the following:

New Chrysotype: S-Version, Solution B: Gold
(Sodium tetrachloroaurate 0.35 molar)

Stock B: Gold (B-2)

This B-2 option may be less expensive and more readily available than B-1. If hydrogen tetrachloroaurate(III) is cheaper or more readily available than the sodium salt, then you can make your gold solution from it. The following is the procedure for neutralizing this acid with anhydrous sodium carbonate or sodium hydrogen carbonate.

Step 1 Carefully weigh out, or transfer, 5.0 g of hydrogen tetrachloroaurate(III) into a Pyrex glass beaker with a 100 ml capacity. Use plastic to measure and transfer.

Step 2 Add 30 ml of distilled water, at ambient temperature, to the gold salt in the beaker. Use a little water, squirted from an eyedropper, to wash out and transfer any residual gold left behind on your plastic spoon. With gentle agitation the solid will easily dissolve into a yellow solution at room temperature.

Step 3 Weigh out 0.673 g of sodium carbonate (anhydrous powder) using a chemical gram scale. If you have trouble measuring such a precise amount, you may round the weight off to 0.7 g *or* use 1.07 g of sodium hydrogen carbonate.

Step 4 Slowly add the sodium (or hydrogen) carbonate, in very small portions, to the solution of

chloroauric acid. There will be a good deal of effervescence as carbon dioxide gas is created. Swirl the solution, and continue adding the solid to completion and no further effervescence.

Step 5 Add pure water from the wash bottle to make up a final volume of exactly 36 cc in the measuring cylinder with thorough mixing.

Step 6 Filter the solution carefully from the measuring cylinder to the stock bottle using a #1 filter. Label the storage bottle with the date of the mix and the following:

New Chrysotype: S-Version, Solution B: Gold
(Sodium tetrachloroaurate 0.35 molar)

Stock C: Iron Solution

Note: The following steps must be carried out under subdued indoor lighting . . . avoid daylight.

Step 1 Weigh out 30 g of ammonium iron(III) oxalate into a small 100 ml Pyrex beaker.

Step 2 Add exactly 33 ml of distilled water from a measuring cylinder at ambient temperature. If the solution becomes too cold, gently warm it in a bath of hot water to assist the dissolving.

Step 3 Within 5 minutes the solid will have dissolved to form an emerald green solution. The total volume should be 50 ml.

Step 4 Filter the solution through a #1 filter in a funnel directly into a dark brown storage bottle (50 ml).

Step 5 Store the bottle at room temperature. If, after several days, you see needlelike crystals, re-filter the solution. This solution is very close to saturated, and if it cools to below 68°F some crystals may form at the bottom of the storage bottle. Gently warm the solution to dissolve them. The solution will keep indefinitely. Date it and label:

New Chrysotype: All Versions, Solution C: Iron (Ammonium iron(III) oxalate 1.4 molar)

Figure 10–5
Roger Vail, *Easter Rainforest Sunrise,* Easter, 1983–2000
Roger was one of the first people to "road-test" the New Chrysotype in a Monterey, California, workshop he organized for his students and Mike Ware in 2000.
(Courtesy of the Artist)

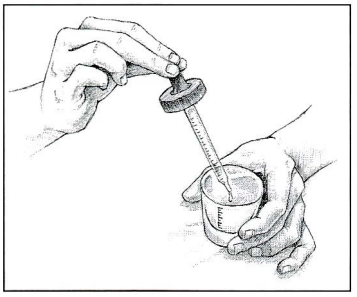


TABLE SETUP FOR MIXING SENSITIZER—VERSION S

- Six graduated syringes capable of measuring 1 and 2 ml
- Three to four 50–100 ml brown glass bottles for sensitizer
- Five clean trays
- Clean table surface or glass plate for coating
- Paper for coating (see note)
- Shot glass: short barrel and heavyweight
- A Puddle Pusher or glass rod
- Custom cat carrier humidifying box or hydration chamber
- Pencil and ruler
- Contact printing frame
- Negative for contact printing
- Paper towels
- Tape
- And a partridge in a pear tree (joke)

Note: The right paper is very important. It must be sized, free of additives, and able to withstand extended immersion. The best papers for this process include Ruscombe Mills Buxton, Atlantis Silversafe, Weston Parchment, and Bergger's COT 320.

Mixing the Chrysotype Sensitizer

Contrast is controlled by the molar ratio of the ligand to gold (A:B), which can be varied between 2 and 6. A "standard" value is 4 and is recommended for first trials with the sensitizer. The molar ratio of gold to iron (B:C) is always one. OK, this may be a bit complicated, but I'll try to make it clear.

Figure 10–6
Mike Ware, *Fragment from a Crucifix*, Tudia, Sicily, 1987
Mike Ware's New Chrysotype in this image is from a set of thirty-three images printed and titled *All the Colours of Gold: Metaphors for Sicily.* The dates are for the original camera negatives.
(Courtesy of the Artist)

The ligand (A) and iron (C) solutions have the same molar concentration of 1.4 molar. This is four times the molar concentration of the gold (B), which is 0.35 molar. The volume ratios for your standard sensitizer mix are determined by this information. This means that a standard volume ratio for the sensitizer would be set up like this: **Ligand : Gold : Iron = A : B : C = 4 : 4: 1.**

Volume ratios can be varied between the following parameters: **A : B : C = 2 : 4 : 1** to **A : B : C = 6 : 4 : 1.**

The lower than the "standard" value of 4 ligand (A) to gold (B) ratios, the faster the printing speed, but the less stable the sensitizer. The tonal range will be longer, and the maximum density will be higher. Highlights have a tendency to fog.

Higher ligand (A) to gold (B) ratios than the "standard" value of 4 provide a more stable sensitizer,

a slower printing speed, higher contrast, and slightly lower maximum densities with clean highlights. Increasing the value of iron (C) has no obvious benefit.

Mixing the solution must be done in the following sequence of steps.

Step 1 Deliver the volume **A** (ligand) solution into a shot glass using a graduated syringe.

Step 2 Add the volume **B** (gold) solution, drop by drop, from a separate syringe, swirling the shot glass. Allow time between drops for the gold solution to become clear and colorless.

Step 3 When Step 2 is complete, add the volume **C** (Iron) from a third syringe. The sensitizer will now turn a pale yellow-green.

Step 4 Mix the solution of **A : B : C** thoroughly using a fourth syringe.

An 8" × 10" piece of paper, using a "standard" volume ratio of 4 : 4 : 1, will require about 1.25 ml of solution per sheet if you are rod coating. Considering the expense of the sensitizer, I would strongly advise using a glass rod or Puddle Pusher. Please consult the Platinum/Palladium chapter for instructions on how to use the rod.

COMPONENT VOLUMES TO MAKE 10 ML SENSITIZER—VERSION S

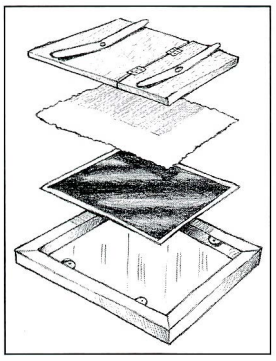
Ligand: Gold Molar Ratio	Volume A Ligand 1.4M	Volume B Gold 0.35M	Volume C Iron 1.4M
2	2.86 ml	5.71 ml	1.43 ml
2.5	3.33	5.33	1.34
3	3.75	5.00	1.25
4 (standard)	**4.44**	**4.44**	**1.12**
5	5.00	4.00	1.00
6	5.45	3.64	0.91

Note: Once the components are in solution, the sensitizer will be stable for about 30 minutes. Version S will be useable for approximately 2 hours.

Coating

Coat your chosen paper using a Puddle Pusher or glass rod rather than the traditional hake or Richeson brush method. This is far more economical considering the cost of the gold. Your coating technique should be smooth and accomplished, and I would strongly advise practicing with yellow-green watercolors before committing to the gold.

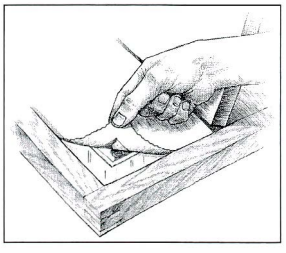
Figure 10–7
Roger Vail, Bridge, 1997
Here is another haunting and atmospheric image from Roger Vail in the New Chrysotype process.
(Courtesy of the Artist)



Humidity

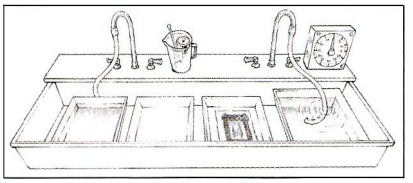
Predictable results for image color can be controlled by the relative humidity (RH) of the paper. Different degrees of humidity can be used as a control tool, and you should consider building the cat carrier humidity box described in the Argyrotype chapter or investing in a humidity chamber that is controlled. A high RH will yield neutral grays. Very low RH will give almost no image printout with faint values in the darkest shadows. In this case, the image is entirely generated via development.

The prints you achieve will show colors of pink to dull-red shadows and grey-blue high values. The mid-tonalities will show purple and magenta shadows evolving into blue highlights. Experimentation, your method of hydration, the season of the year, and where you live will all be relevant factors. Water hydration, where the print is humidified over distilled water for up to 30 minutes, is one method. Salt hydration chambers, where the RH is controlled by saturated solutions of specific salts, is a second hydration option, and details for building one can be found in Mike Ware's *Chrysotype Manual*.



Exposure

Exposure times are equivalent with those experienced when printing platinum/palladium. The times of exposure may be shorter and are somewhat dependent upon the ligand : gold molar ratio. Most exposures in UV light sources will run about 2–3 minutes. Higher RH in the paper means that the developer will have little to do and is equivalent to a step. Lower RH means that developer will have a four- to six-step influence on the final image. It would be wise to do test strips before committing to full sheets of paper and chemistry.



CHEMISTRY REQUIRED FOR CHRYSOTYPE PROCESSING

Developing Agents (One or More of the Following)

- 1% Disodium EDTA

  At low RH neutral brown tones in 5–10 minutes. High RH yields greens.

- 1%–2% Citric acid

  At low RH pinks, red shadows, blue highlights in 1–6 minutes—longer immersions intensify reds—may block up. High RH produces blues.

- 1%–2% Tartaric acid

  Neutral to red tonalities depending on RH.

- 1%–2% Oxalic acid

  Longest tonal range and dramatic red-blue splits depending on RH.

Clearing Agents

- Tetrasodium EDTA
- Sodium sulphite or sodium metabisulphite

SINK SETUP FOR CHRYSOTYPE

Tray 1 **Disodium EDTA—OR—alternative developer** options listed earlier. Mix 1% solution: 10 g to a liter of tap water. Each liter of developer is good for two to three prints. Do not use tetrasodium EDTA, which is less expensive and used later as a clearing bath.

Tray 2 **Rinse:** 30 seconds in running water.

Tray 3 **Tetrasodium EDTA—Clearing Bath #1** Mix 5% solution: 50 g in 1 liter of tap water—10 minutes.

Tray 4 **Rinse:** 30 seconds in running water.

Tray 5 **Sodium Sulphite—Clearing Bath #2** Mix 2.5% solution: 25 g in 1 liter of tap water—10 minutes.

Tray 6 **Rinse:** 30 seconds in running water.

Tray 7 **Tetrasodium EDTA—Clearing Bath #3** Mix 5% solution: 50 g in 1 liter of tap water—10 minutes.

Tray 8 **Final wash**

PROCESSING THE CHRYSOTYPE

Post-Exposure Hydration (Optional)

If you are seeking a lower-contrast image with the longest possible tonal scale, then post-exposure hydration is strongly recommended. This procedure, conducted in a warm water hydration chamber (such as a simple sealed box with a tray of warm water in it) will allow the print to develop almost to completion before the paper is immersed in the developer. Hydration can be from 2 to 15 minutes, and this step will shorten tray development to about 1–2 minutes. Tonalities will also be smoother.

Although this step gives a very long tonal scale, it does diminish the opportunities for dramatic split

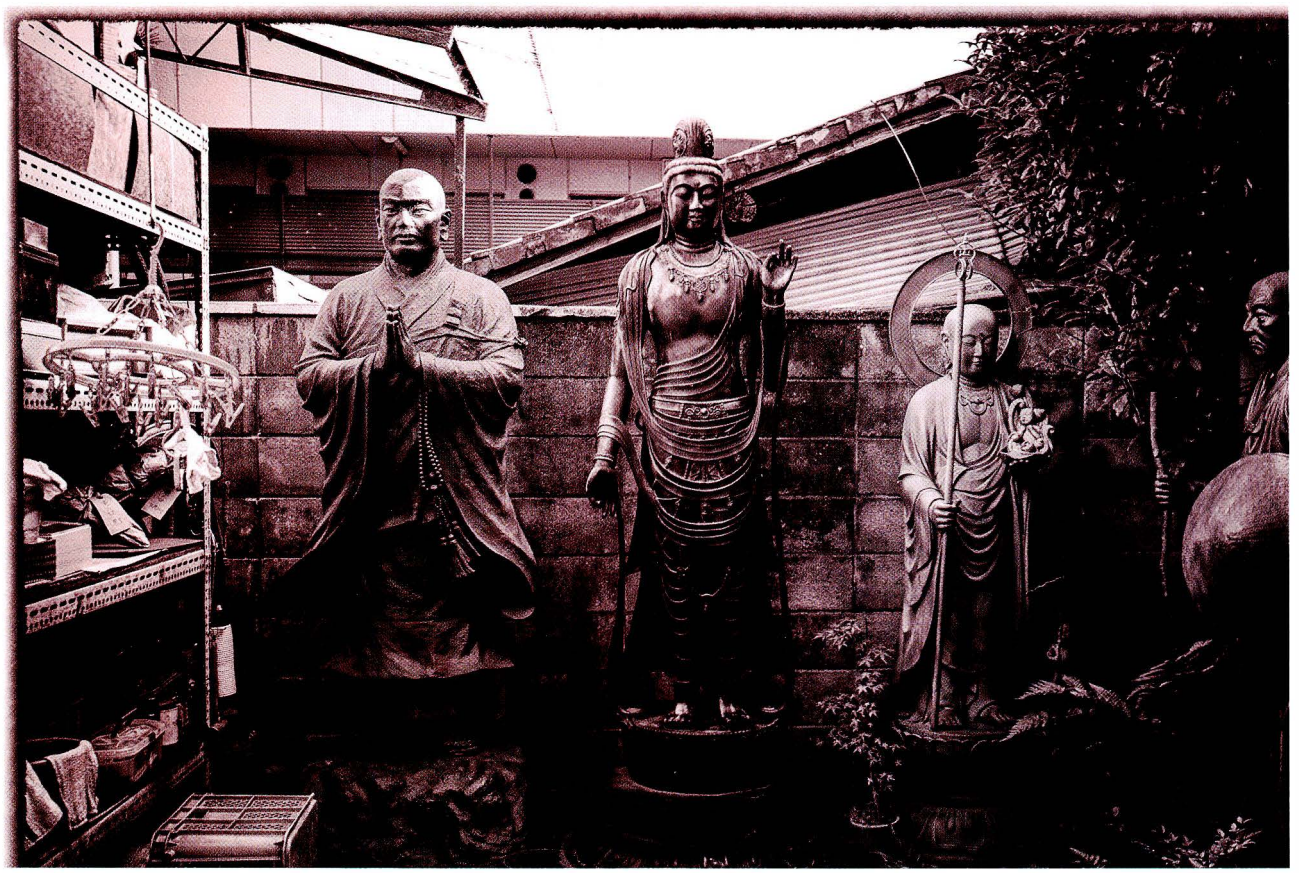


Figure 10–8

Tom Hawkins, *At the Temple* Supplier, 2012

Tom writes, "The physical act of making a print—weighing out the precious metals, mixing the solutions, painting the emulsion onto paper, etc.—is a very meaningful part of making a photograph. Though the materials I use are traditional, I also make use of contemporary methods of generating enlarged negatives for contact printing. I use both digital and traditional film cameras for picture making. Working in this way, I take advantage of 'old' and 'new' tools to explore the medium . . . as photographers always have."

(Courtesy of the Artist/TBH)

tones because of the lack of developer influence. Spot development, however, can be accomplished by breathing your own warm breath in localized areas of the exposed paper, creating an isolated and longer tonal scale.

Normal Chrysotype Processing

Step 1 Select one of the developers (disodium EDTA, tartaric acid, citric acid, or oxalic acid) and mix a liter of it in tray #1. Remember, the developer is good for only one to two prints before you will need to re-mix. The primary role of the developer is to clear the print. Develop with vigorous agitation for up to 10 minutes.

Step 2 **Rinse** the print for 30 seconds.

Step 3 **Clearing Bath #1**—Immerse the print in 5% tetrasodium EDTA for 10 minutes and you will see the red tones emerge and intensify. This bath can be used many times.

Step 4 **Rinse**

Step 5 **Clearing Bath #2**—Immerse the print in 2.5% sodium sulphite or sodium metabisulphite for 10 minutes. This bath should be made fresh for a single printing session only. Do not store it or re-use.

Step 6 **Rinse**

Step 7 **Clearing Bath #3**—Immerse the print in a second bath of 5% tetrasodium EDTA for 10 minutes. This bath can be re-used many times and can replace bath #1 when it is exhausted.

Step 8 **Final Wash** for 30–60 minutes.

Drying the Print

Lay the washed print on a near vertical piece of glass or clean Plexiglas and let the print drain. After it has shed most of its water, lay it down on a flawlessly clean plastic screen or hang on a line to dry. This decision will depend on the wet paper strength of the paper you are using.

Last Comments

This process is not an optimal one for those of you who prefer a process that offers instant gratification. Even if you know what you are doing, have a decent degree of chemistry knowledge, and can manage a working session in the lab without distraction, it will take you about 2.5 hours to produce a print. Be patient and enjoy performing the newest original alternative process.

Figure 10–9
Mike Ware, *Monastery Bells*, Patmos, 1982
Mike's New Chrysotype image is of monastery bells in Patmos, a small and perfect Greek island in the Aegean Sea, and is included in his series *All the Colours of Gold: Metaphors for Sicily*. In 2009, *Forbes* magazine wrote that Patmos was Europe's most idyllic place to live, due to the fact that "Patmos has evolved over the centuries but has not lost its air of quiet tranquility." This image of Mike's defines that sentiment.
(Courtesy of the Artist)

Fumed Silica

OVERVIEW & EXPECTATIONS

This chapter is a little unusual as it offers a pre-sensitizing paper-coating option for alternative processes, such as albumen, athenatype, and Pt/Pd, as a way to significantly enhance the richness and depth of the darker tonalities within a print. As a result, the comparative visual effect of highlight to shadow detail is also improved. This pre-sensitized fumed silica coating option, consisting of less than a teaspoon of fumed silica, applied with a mini "hot-dog" paint roller, creates a thin silica film on the surface of the paper that holds and suspends a liquid sensitizer . . . resulting in the sensitizer not being readily absorbed into the paper substrate, thus creating a more resolved and tonally richer print with sharper detail. The inaccessibility of this improved technology was the reason for the patent wars in the 1950s involving the usage of fumed silica in the manufacturing of blueprint paper for highly detailed line drawings required for industry. Indeed, one of the earlier applications for paper coating involved adding it to the cyanotype blueprint sensitizer solution for coating blueprint paper to make it less reflective and to reduce the fuzziness of the text in the blueprints. The following is from the beginning of the patent synopsis describing Edward Jahoda's dry fumed silica application from 1947 and the alternative additive patent of United Blue Print Paper of A.R.A. Beeber and Robert Gold in 1958. Further reading of the patent will provide the formula.

DEPTH OF BLUE A. R. A. BEEBER ET AL BLUE PRINT PAPER
U.S. Patent 2,852,377- September 16, 1958

Patent No. 2,433,515, of December 30, 1947, to Edward Jahoda describes the use of a pre-coating of silica on paper intended for the production of blueprint paper and other photo-sensitive papers. This patent represented a distinct advance in the art. However, the patent clearly teaches that the silica should be applied as a pre-coat before the light sensitive solution is applied implying that the same beneficial results would not be obtained if the silica were incorporated in the sensitizing solution. Furthermore, it is known, that others have

Figure 11–1

Dick Sullivan, *Fumed Silica and Albumen Test Print*, 2013

This is a comparative example of two albumen prints. The left-hand side is a traditionally prepared albumen substrate. In the print on the right, the paper was coated with fumed silica prior to sensitizing. In the latter example, a small quantity of fumed silica is rolled and spread evenly onto a piece of paper with a dry high-density foam paint roller, leaving a surface that is velvety to the touch. The fumed silica coating acts as a sizing enhancer and appears to protect the emulsion from alkali buffers, which often negatively affect many alternative techniques. Contrast increases but appears largely to be due to enhancement of the black tonalities.

(Courtesy of the Artist)

attempted to include silica in blueprint solutions without achieving the outstanding improvement obtained by the Jahoda pre-coat method probably because the silica was not used in sufficiently high concentration.

Now it has been found that results at least equal to those obtained by the pre-coat method can be obtained by incorporating silica in the blueprint sensitizing solution if the amount of silica deposited on the paper is high enough. With higher amounts of silica the new method can give results which are definitely superior to any results obtained by pre-coating. However, lower amounts of silica, while not giving as good results as may be obtained by pre-coating will give some improvement over non-pre-coated papers and may be of some value in getting improved results without the necessity of the pre-coating step.

Increasing the concentration of silica increases the velvety appearance of the print and the purity of the blue color, improves contrast and reduces bleeding when papers and additional ferrocyanide is added as described below. The presence of the silica in the sensitizing solution also inhibits crystallization of the blueprint salts as they are applied so that increased concentrations of these salts may be used; If sufficient silica is added, paper coated by this new method gives prints which are true blue (ultramarine) whereas the prints obtained from the usual pre-coated materials have a rather purplish blue color.

The major contemporary proponent of this technique is Dick Sullivan, of Bostick & Sullivan, and what follows is pretty much everything I've gathered from watching him work and applying fumed silica in my own lab. The majority of this section will deal with the dry application of fumed silica. There is also information on a wet fumed silica technique that was realized by Josh Partridge. I expect that you will be intrigued to try out the wet and dry variants and urge you not to be discouraged if you get a few initial prints that feature streaking and that are less than ideal. Pre-coating a paper substrate with fumed silica or fumed alumina will add a level of complexity to any process and must be learned by sight and feel before it is mastered. Perfection will come with practice, Grasshopper.

Figure 11–2
Wolfgang Moersch, *Fyrmarken Skye*, 2009/2012
This dramatic image is from master photo-chemist Wolfgang Moersch, who produces a vast menu of chemistry and alternative process products and toners. This is particularly helpful to our alternative process friends in Europe (http://www.moersch-photochemie.de). This is a kallitype that has been printed on a fumed silica substrate, toned with selenium and Wolfgang's iron blue toner.
(Courtesy of the Artist)

WHAT IS FUMED SILICA?

First, let's begin with the answer to the questions "what is silica?" and "what is fumed silica?" Crystalized silica is quartz and is a rock hard, non-reactive, and colorless compound that is a principal component of sandstone and similar rocks. The reason there is an interest in it as a pre-coating for paper used in many alternative photographic processes is that in its gel form it is a *desiccant,* meaning it *adsorbs* (not absorbs) and holds water. This essentially means that silica forms a thin film on the surface of a solid, like paper, that will hold and suspend a liquid, like a sensitizer. Silica is able to adsorb 40% of its weight in moisture.

Fumed silica is *amorphous* (meaning it has undefined shape and form), rather than crystalline, and is a vaporized form of clear solid silica that behaves as if it were a liquid. Fumed silica is made by flame hydrolysis of silicon tetrachloride. Silicon tetrachloride is a liquid

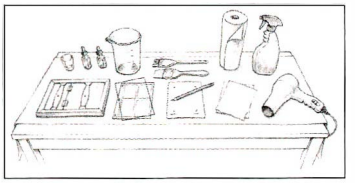
Figure 11–3
Gertrude Käsebier, *Joe Black Fox*, 1900 (gold-toned albumen with fumed silica pre-coating)
In 1898, Gertrude Käsebier sent a letter to "Buffalo Bill" Cody requesting permission to photograph, in her NYC studio, the Sioux Indians traveling with Cody's Legends of the Wild West Show. The project ultimately became so personally important to her that it continued on for more than a decade. In this 1900 image, printed by Dick Sullivan from an original glass dry plate negative generated from the Library of Congress files, Joe Black Fox reflects the ease of his friendship with Käsebier and poses, relaxed, with a cigarette in hand and a sly and playful expression. *(Source: Library of Congress)*

at room temperature. It is vaporized and then passed through a fuel/air flame at an extreme temperature to produce fumed silica. When I first used it I thought it was light enough in weight that I would be able to pick up a boxcar full of it, minus the boxcar.

Fumed silica is essentially a harmless non-carcinogen that is a primary thickening ingredient in fast food milkshakes and is used as an anti-caking agent in powders and kitty litter. It also features light diffusing properties, which is one of the reasons the dark end of the tonal scale looks so nice in an alt pro print that employs it as a pre-coating. It is also found in cosmetics like lipstick and toothpaste.

Fumed alumina is a twin sibling to fumed silica and is prepared in a similar manner: anhydrous aluminum chloride is vaporized and then passed through a flame to yield finely divided aluminum oxide and hydrogen chloride. Fumed alumina is too coarse to be used for milkshakes and lipstick. Crystalline alumina, or aluminum oxide, is used as an abrasive and found in sandpaper, polishing compounds, grinding wheels, etc. Fumed alumina, like fumed silica, is amorphous. What they have in common is almost everything except for the size of the grit. Both are used in the production of high-quality fine art inkjet printing papers. This became a common usage for the fumed alumina and silica following the introduction of pigment-based inks to replace the earlier dye-based inks, which resulted in the microporous quality of the higher-end inkjet papers.

In alternative process applications, the fumed silica is cooler in tone and slightly slower in printing speed. Fumed alumina is warmer in tone, is slightly acidic, and neutralizes alkali-buffered paper stocks.



MATERIALS AND APPLICATION

Table Setup for Fumed Silica/Fumed Alumina

- Fumed silica or fumed alumina
- High-density "hot-dog" roller
- Paint roller tray appropriate to the size of the roller (optional)
- A squeegee or wiper blade larger than the paper
- A respirator to avoid inhaling the fumed silica dust
- A pair of latex gloves to keep the paper fingerprint free
- Eye protection
- Heavy sheet of Lucite or glass for coating silica and sensitizer

Figure 11–4
Wolfgang Moersch, *Krüppelbaum* (VDB w/o and w/ fumed silica)
In this comparative example, Wolfgang Moersch has created a Van Dyke Brown print without and with a pre-coating of fumed silica. Crystalized silica is quartz and is a hard, non-reactive, and colorless compound that is a principal component of sandstone. The reason there is an interest in it as a pre-coating for alternative process substrates is that in its gel form it is a *desiccant*, meaning it *adsorbs* (not absorbs) and holds water . . . up to 40% of its weight in moisture. This essentially means that silica forms a thin film on the surface of a solid, like paper, that will hold and suspend a liquid, like a sensitizer.
(Courtesy of the Artist)

FUMED SILICA PRE-COATING PAPER PREPARATION

For an illustrated overview of the benefits of preparing your paper with a pre-sensitized coating of fumed silica, or fumed alumina, please refer to the Athenatype chapter, which explains this technique. A fumed silica application may be used with a variety of alternative processes to varying degrees of success . . . some of them very impressive. Here is a brief description.

Paper

The three best papers, to date, for these processes are Cot 320, Aquarelle, and Arches Platine. All three work well and do not exhibit a tendency to stain as do Revere and Stonehenge.

Paper Preparation: Optional Acidification

Pre-soak your paper for 3–5 minutes in a 5% solution of oxalic acid. The pre-soak acidification of the paper may be important when tap water that is alkaline is used in the washing stages. The addition of oxalic acid also ensures that the ferric oxalate fully reacts with the silver nitrate, resulting in increased contrast and tonality.

Silica Sizing Solution: Dry Version

Measure out approximately 1/2 teaspoon of silica for a 5 × 7 print or 1 teaspoon for an 8 × 10. Place the silica in the middle of the paper and gently roll to coat the roller. Roll the fumed silica on the paper vertically and horizontally for 2 to 3 minutes. There should be no residual silica on the surface of the roller. The surface of the paper is now delicate and almost has the feel of velvet. Be careful not to touch it or you could mar the silica coating. I strongly recommend wearing a dust mask or respirator fitted with a particle filter when working with fumed silica, as the particles do become airborne during this process and are easily inhaled.

Dick Sullivan's Fumed Silica Dry Coating Option

- You will need a high-density foam roller (often called a "hot-dog" roller) from any decent hardware or paint store. They come in 2", 3", 4", and 6" sizes from various manufacturers.

Figure 11–5
Gordon Mark, *Bound Chilies with Bit*, 2007
(Pd w/ fumed silica)
This is a nice example of a palladium print with a fumed silica pre-coating from my Santa Fe friend, and workshop partner, Gordon Mark.
(Courtesy of the Artist)

- You have the option of using a tray or applying the fumed silica directly on the paper. If you are using a tray, get one that is suitable for the size of the roller you are using. It is not mandatory to use a tray. Several practitioners of this technique simply put the fumed silica directly onto the paper and begin the tedious roll-out process for the next 3–4 minutes.
- You will need a fresh piece of Cot 320, Arches Platine, or Aquarelle paper to print on. I recommend using a sheet that is larger than the intended image and outside coated border to be sure of full coverage, giving yourself room to tape the paper down and to avoid having your fingerprints touch the intended print area.
- You will also want a pristine hard surface to attach the paper to before you roll out the silica. I recommend a sheet of thick plate glass or a quarter-inch-thick piece of Plexiglas.

Follow These Steps

1. For a 4-inch roller, place a small amount (about a heaping teaspoon for an 8 × 10 inch paper) of silica in the tray. You can also opt for placing the teaspoon full of fumed silica directly on the paper and rolling out from that surface.
2. Charge the roller by rolling it with some pressure in the tray, much as you would do if you were putting liquid paint on a paint roller.
3. Roll the roller over the paper, covering it completely with the silica in both horizontal and vertical directions . . . being sure to go from edge to edge in each pass for evenness of application. Apply more if the print is large. Surprisingly, the silica appears to go on very evenly. It will behave more like a fluid than a powder! And please be aware that this material is so light that there is bound to be dust in the air you are breathing. Please wear a respirator.
4. Use a squeegee with a good rubber blade and squeegee the silica-coated paper with a light swipe across it. Polishing with a cloth will pull silica up out of the valleys and dimples in the paper texture, while the squeegee appears to even the fumed silica out, leaving a completely filled surface on the substrate.

Josh Partridge's Wet Coating Option

- Mix the fumed silica by volume, not weight. Mix by adding 3 parts distilled water to 1 part silica. Ratios of 4:1 to 1:1 work, but 1:2 is too much; the excess falls off the paper after drying.
- Put the distilled water in a blender and make the speed fast enough to make a funnel of air down to the blades (or almost to the blades). Slowly pour the silica into the funnel (about 1 minute). It needs the high-speed shearing action to not settle out later. Figure about 5 minutes to get it right. Try using

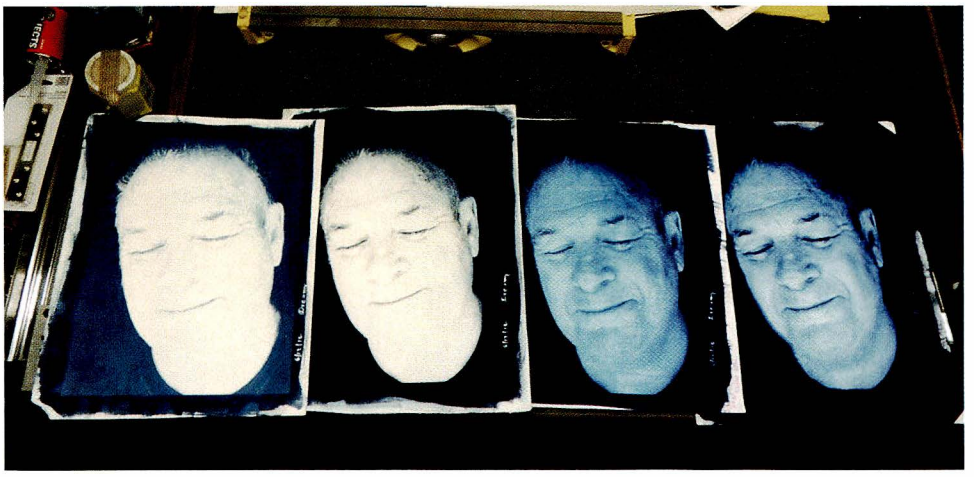


Figure 11–6
Fumed Silica Blueprints Compared
This cyanotype sequence demonstrates 1) a standard ferric ammonium citrate and potassium ferricyanide formula, 2) a standard cyanotype with a fumed silica pre-coat, 3) a pre-coat with silica (it is a developed-out print using a typical formula that is common in the blueprint industry), and 4) pre-coated with silica and sensitized with Super Blue formula using ammonium ferric oxalate, ammonium oxalate, and potassium ferricyanide in the sensitizer and a potassium ferricyanide and ferric ammonium oxalate developer. All coatings were identical and all images were exposed at 1,400 units on a 5,000 watt Olec unit. *Note: The oxalates in the Super Blue add a toxic ingredient to the process, so it is not acceptable for grade school and children's printing.*
(Courtesy of the Artist)

#5 on the variable speed of the VitaMix with about 1200 ml of water.

- Put this slurry mix in a tray larger than the paper you will be submerging in it.
- Put the paper in the tray and push it to the bottom with your fingers. Be sure the submersion is total in its coverage and saturation. Place the saturated paper on a hard, non-absorbent surface such as the sheet of glass or ¼" Lucite.
- Coat with a foam roller for 1.5 to 2 minutes, rolling slowly back and forth with just normal or light pressure. You are massaging the silica into the paper. A good soak in the silica soup is important to fully saturate the paper with silica.
- Hang the paper up to dry and then flatten it. If it refuses to flatten well, consider using a dry mount press at a low temperature.

How Does Fumed Silica Work?

Fumed silica particles are in the 5 nm to 50 nm size range. Howard Efner, PhD, one of the Sullivan research team members, calls it "smoke in a bag." Cigarette smoke runs in the 5 nm range. The particles are not only small but also have a huge surface area. Since they are basically quartz, they are hard and sticky. It is likely the particles are hanging up in the gelatin and cellulose fibers of the paper and behaving like the two sides of Velcro™. Sullivan and Efner conclude that if the paper is sized with a colloid like gelatin, any chemical reaction in the gelatin will further harden it and trap the silica.

According to Dick Sullivan, several things are going on, and at this stage of the game they can only make some educated guesses. Fumed silica seems to isolate the emulsion from the buffering in the papers that feature this quality. This is a good sign and one that makes sense since the silica behaves like a second skin and many alternative process techniques are negatively affected by alkali buffers in fine art papers. Fumed alumina is reported to negate the buffering in some traditional printmaking papers, as is the technique of pre-soaking and acidifying paper in a 5% bath of oxalic acid, drying, and then coating with silica and sensitizer.

Applying Sensitizer to the Fumed Silica Coated Paper

Whether you are performing a pre-coating of fumed silica on an albumen, Pt/Pd, cyanotype, athenatype, or another alt process, your issues are basically identical.

Figure 11–7
Gordon Mark, *Feather with Leaves and Mirror*, 1987
Here's another palladium print with a pre-coating of fumed silica on the paper by Gordon Mark, inventor of the Hobo 8 × 10 camera. Gordon writes, "*I found that you needed a teaspoon of fumed silica per 8 × 10 print. Roll it on with the 'hot dog' roller until you feel if it is coated . . . the extra will brush off. To print I used a dropper shoot of palladium and one of #1 ferric oxalate but no contrasting agent. The trick is to make sure that the mix is brushed completely in. If not it will leave streaks.*" *(Courtesy of the Artist)*

Use a foam brush, or a synthetic Richeson brush, with a width appropriate to the size of the coating area. Coat the sensitizer as you would normally but be aware that the fumed silica on the paper's surface will create "drag" that is similar to the way a coating of gum bichromate sensitizer feels after the gum arabic begins to set up while brushing. Don't automatically assume that you need additional sensitizer, as the silica will usually require less rather than more. The silica creates a far larger surface area than uncoated paper. This will cause the sensitizer to spread out more than you would expect. You will need to practice a bit before getting it down. The trick is to continue brushing until the paper is quite matte and the coating has smoothed out. At a certain point, if you go too far, streaks will appear. Proper coating takes a longer brushing time than you are used to with a non-silica dusted paper.

Streaking Issues with Fumed Silica

Streaking seems to be the big issue for many new users of this technique, and that's due to a variety of reasons. The most common problem is not rolling out the silica with enough pressure for a long enough amount of time. Make sure that the fumed silica, and the sensitizer mix that will follow, is thoroughly brushed in. The fumed silica will have the texture of velvet that you might find with a pastel of Elvis on it. Any excess silica can be brushed off with a synthetic brush or carpenter's workbench brush (a long-handled long brush with hundreds of soft hairs designed for cleaning dust from woodwork before finishing). Using a foam brush for applying the sensitizer following the pre-coating with fumed silica has come up a few times in conversation, and some people have had better results using the synthetic Richeson brush instead of the far less expensive utility foam brushes that are common in hardware and paint stores.

Last Fumes

Be patient when you begin to use this technique. Although it has been employed in industrial uses for 60–70 years, it is a brand new technique in alt pro. It takes a lot of practice and proverbial "touch" to figure out when the application of the silica is complete and then again when the sensitizer that follows is properly applied. Streaking is common in the beginning, and the type of paper you use will indeed have an impact on the outcome. It is unpredictable for a while and then, all of a sudden, you get pretty good at it and the density of your darks and comparative highlights begin to pop and it all becomes worthwhile. Try it with your favorite process, even simple watercolor painting, and see what happens. Also, be relatively careful with finished prints because the surface can be vulnerable to flaking. Again, have fun.

The Kallitype Process

OVERVIEW & EXPECTATIONS

In this kallitype process chapter I'll offer you three separate versions of the original 1889 to 1891 kallitype by the esteemed Dr. W.W.J. Nicol. You'll see their relationship to one another, as well as to the Herschel argentotype from 1842 and the Arndt & Troost Van Dyke/brown-print from 1889, which you will learn more about in the Van Dyke and Variations chapter. Via these comparisons you will see a direct link from the Van Dyke to the contemporary kallitype and to other variations in the iron-salt alternative process family.

As you will see in the overview section of the Van Dyke chapter, ferric silver (iron salt and silver) based alternative processes fit into two separate groups. One group incorporates ferric ammonium citrate within its sensitizer formula and prints out as a printing out process (POP) during the exposure. It requires only simple water development to complete the process. The other group uses ferric oxalate in the sensitizer as its *light-trigger*, prints-out to the visual equivalent of a *stage whisper*, and requires a chemical developer to become fully realized. This is referred to as a *developing out* process (DOP). Both POP and DOP iron salt processes yield prints that are similar in many ways, with minor exceptions having to do with specific toner and developer choices. Both fall into an overall iron-based family called *siderotype* . . . from the Greek root word *sideros,* which means *iron.*

By experiencing the uniqueness of the various kallitypes you will gain an understanding of how the process differs from the Van Dyke, with which it is often confused, and how its evolution is remarkably similar to qualities found in the platinum and palladium process that will come in the next chapter of this book. Kallitypes provide tonalities of sepia-brown, red, aubergine, and chocolate black. When used with specific developers, the black coloration and range of values is equal to platinum/palladium prints and can often fool even an expert when performed perfectly.

I will explain how to make a variety of kallitype sensitizers, how to use them, how to process the print, and how to tone and fix the image so that it will be more archival. This will be especially important to those of you who have tried it in the past and for those who are seeking an

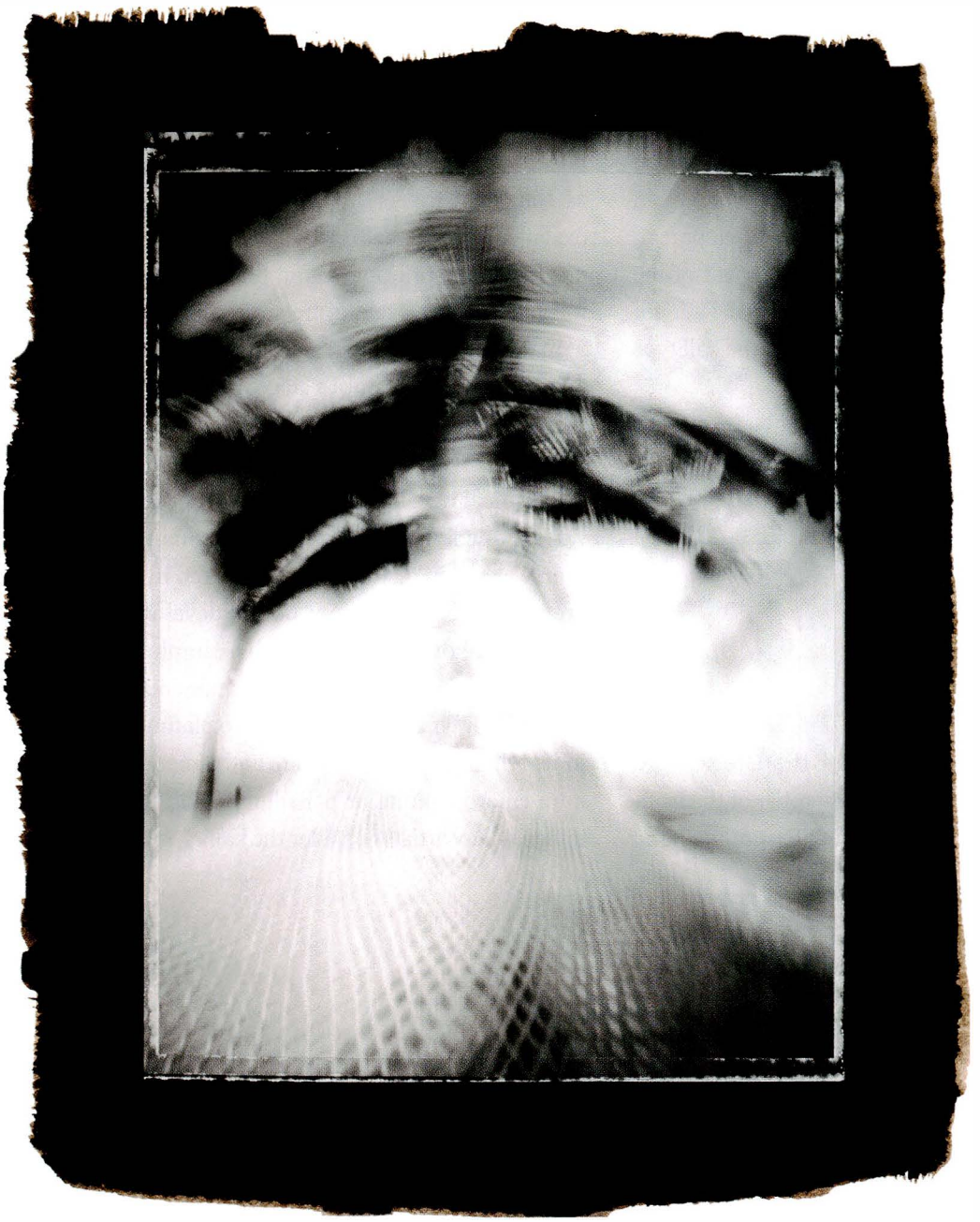


Figure 12–1

Christopher James, *Hammock & Palm,* Mexico, 2006

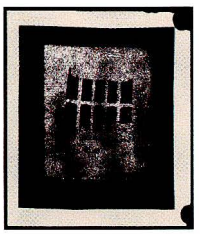
I made this image using a pinhole 4 × 5 at Jeff and Kassi's casita on a beach in San Pancho, Mexico. I was looking for a way to describe how I felt swinging in a hammock, under the palm trees, listening to the heavy surf breaking, with pelicans flying in formation overhead . . . and thinking about all the snow falling in Boston.

(Courtesy of the Artist/Author)

alternative to Van Dyke. One of the many new additions to this chapter will be a hybrid developer that I've been offering to my students for the past 10–15 years that virtually eliminates the chronic yellowing and coffee & cream highlights that are so common in the kallitype process . . . and that turn so many people away from it.

In the kallitype processes, the ferric ammonium citrate that you have become accustomed to using in several other processes will be replaced by ferric oxalate. You'll also find this light trigger chemical in the platinum and palladium process in the next chapter. The silver nitrate that you have been using consistently until this point will remain in the formula. Instead of a water-wash-development, we will be incorporating a chemical development of the image. Considering what you have learned so far, I doubt that you will have much trouble assimilating the kallitype into your alternative process toolbox.

A LITTLE HISTORY



The term *kallitype* originates from the Greek word *kalli*, meaning "beautiful," and is a member of the iron-based siderotype family that Herschel first named and explained in the "brilliant summer of 1842" (supposedly the last time the weather in England was sunny and perfect for an extended period of time). During this period he invented a buffet of alternative photographic techniques such as the anthotype, phytotype, cyanotype, chrysotype, and argentotype.

Although the Van Dyke and the kallitype processes are quite similar, being iron based, each has its own unique characteristics and idiosyncrasies. In Van Dyke, ferric ammonium citrate is the active UV-light-sensitive component in the sensitizer (I like to explain it to my students as the "light-trigger"), whereas in the kallitype, ferric oxalate performs that role . . . just as it does in platinum and palladium printing. A traditional kallitype sensitizing formula of ferric oxalate and silver nitrate is coated onto a quality rag paper stock using a brush or glass-rod and exposed to UV light until a stage whisper is seen.

The exposed stage-whisper image that has printed out softly on the paper is then developed in your choice of chemical developer options in order to determine a variety of color renditions and outcomes. The print is then washed in distilled water, cleared in EDTA (if you are using a borax/sodium borate developer), toned in your choice of toner, fixed with a simple sodium thiosulphate bath, and washed to permanence.

The kallitype is a close cousin to platinum/palladium in its reliance on ferric oxalate and a metallic salt (platinum chloroplatinite or palladium chloride) to make an image. Many artists consider the kallitype to be the equal

Figure 12–2
Philippe Moroux, *Le jour de l'éclipse*
This is another beautiful pinhole-generated kallitype, taken on the coast of Normandy during a solar eclipse.
(Courtesy of the Artist)

of Pt/Pd, and there are some knowledgeable folk who still have difficulty distinguishing between the two when the color and image tonality are consciously made to look alike. This was a major selling point of the process when it was first offered to the public. The problem . . . the two processes were not even in the same parade when it came to permanence.

Dr. W. W. J. Nicol's Kallitypes

By 1842, the techniques that would evolve into the kallitype and brownprint/sepia-print/Van Dyke processes, based on the work of Sir John Herschel's argentotype, chrysotype, and cyanotype techniques, had chemically evolved into promising and democratically available printmaking options for photographic image makers. Although Herschel had accurately described how the kallitype process would eventually work, it was not developed and patented until 1889 by Dr. W. W. J. Nicol.

Nicol's kallitype processes consisted of three variations on a theme and were creatively named kallitype I, II, and III. Nicol's kallitype I process came in two versions and incorporated a ferric sodium citrate (an iron salt) and potassium oxalate sensitizer (Pt/Pd uses potassium oxalate as one of its post exposure developers). It also required a developer made with silver nitrate and potassium oxalate to bring out the image. It's interesting to see the chemical relationships between Nicol's kallitypes, Herschel's argentotype, the Willis platinotype that preceded it, and the Van Dyke/brownprint that was developed at nearly the same time. For a historical/chemical perspective, here are Nicol's three kallitypes in case you want to try them out.

Nicol's Kallitype I Process

Kallitype I Sensitizer

20% solution ferric sodium citrate
5% solution potassium oxalate

Kallitype I Developer for Blue Black

20 % solution potassium oxalate
1.5% solution silver nitrate
.880 ammonia

Note: Saturated Solution of Ammonia—The aqueous solution of ammonia is basic. The maximum concentration of ammonia in water (a saturated solution) has a density of 0.880 g/cm³ (grams per centimeter) and hence is known as ".880 Ammonia." Be very, very careful if you ever work with this concentration, as it is very nasty stuff. Be sure that you are working in a real, honest chemistry lab with superior venting, or chemical hood, before attempting this Nicol formula. If you do not have the right environment for this experimentation, use the following alternative for fixing and clearing.

The instructions for mixing called on the artist–scientist to mix together the silver nitrate and potassium oxalate solutions and then, a drop at a time, add the 1% saturated ammonia solution until a *precipitate* (a physical solid that separates out of a solution) formed on the surface of the sensitizer. Then, while stirring continuously, he or she would add additional drops of the saturated .880 ammonia solution until the surface precipitate dissolved and the sensitizer showed clarity.

Nicol Kallitype I Clearing Bath

20% solution of potassium citrate
1–2 ml ammonia .880 1% solution

Fixing called for two successive clearing baths consisting of the potassium citrate and ammonia mix. Time in each tray was 5 minutes. If you intend to do this process I would go a slightly different route and recommend a first wash of distilled water and citric acid, followed by a light sodium thiosulphate fix and final wash.

A Contemporary Clearing and Fix Alternative for Nicol I

Begin with 1 liter of distilled water to which you've added a healthy pinch of citric acid and clear the print for 5 minutes. Follow this clearing bath with a 5% sodium thiosulphate fixing bath (50 g to a liter of distilled water) for 1 minute and a final wash of 30–40 minutes.

Nicol's kallitype II formula was patented two years later in 1891, and it incorporated the ferric oxalate salt and the silver nitrate into the same sensitizing formula. This, you will see very soon, is pretty close to the kallitype process we practice today.

Nicol's Kallitype II Process

Nicol's Kallitype II Sensitizer

20 g	ferric oxalate
8 g	silver nitrate
120 ml	distilled water
5–10	grains oxalic acid

Add the ferric oxalate and the water together in a Pyrex measuring beaker (kitchen measuring type will be fine) and place it in a saucepan filled with water. Put the saucepan on the stove, or hot plate, and slowly bring up the heat until the ferric oxalate dissolves completely. Next, add the oxalic acid and then filter the solution through cheesecloth, the foot of a pair of tights, or a coffee filter. Then add the silver nitrate to the filtered solution and store the final volume in a dark glass bottle in a low-light environment.

Kallitype II Developer for Black Tones

113 g	borax
85 g	Rochelle salt
29 ml	1% potassium dichromate
1200 ml	distilled water

Kallitype II Developer for Purple Black Tones

113 g	borax
57 g	sodium tungstate
1200 ml	distilled water

In Nicol's kallitype II developer you can see the first instance of the classic Rochelle salt and borax solution that is still used by many today. You can also see the addition of potassium dichromate in the developer. In many alternative processes, adding potassium dichromate is a choice you would make if you were trying to stimulate a chemically instigated boost in the contrast.

NOTE: At low percentage dilutions, however, potassium dichromate in the developer is added as a way of opening up shadows. One other bit of info . . . if you have trouble with crystallization in your developer, you can modify the formula with 3 g of tartaric acid.

Kallitype II Clearing and Fixer

Since the kallitype II process is so similar to the contemporary kallitype that we perform today I am going to recommend that you follow the clearing and fixing baths for the current version of the technique. Go to the clearing and fixing instructions for Development Method #1 (Contemporary Clearing and Fix Alternative for Nicol I).

Nicol's Kallitype III Process

Nicol never got around to putting a patent on his kallitype III variation. In this process, all of the chemistry was combined into a single solution, and once it was applied, and the paper exposed, it printed out completely . . . but only if the sensitized paper remained uniformly damp throughout the process. This was a difficult trick to pull off, although the concept is a very nice one . . . kind of like the argyrotype that does work quite well or the mid-80s ammonia salt prints that Mike Ware and Pradip Malde were making. Doing this process well is quite difficult, but I am sure that some of you are going to enjoy trying to become masters doing it. Here it is if you want to give it a shot and have a unique process that no one else is doing.

Nicol's Kallitype III Sensitizer

17 g	ferric oxalate
4.7 g	potassium oxalate
4.7 g	silver nitrate
120 ml	distilled water

Kallitype III Clearing Bath: The Alka-Seltzer Formula

30 g	soda citrate

NOTE: To prepare the citrate of soda, dissolve 112 g of citric acid in 20 oz of water and add 133 g of the dried bicarbonate of soda.

5 g	citric acid
1 liter	distilled water

If you read the ingredients in Alka-Seltzer you'll see that it is made of citric acid and sodium bicarbonate of soda. If clearing your highlights is causing indigestion you may want to consider giving yourself, and your print, an Alka-Seltzer.

Summing Up Nicol

Back to the history . . . in Nicol's kallitype I process, the paper was coated with an iron salt and potassium oxalate sensitizer and then exposed and developed in a solution of silver nitrate and potassium oxalate. This is quite different from the modern kallitype, in which the silver nitrate and ferric oxalate are combined in the sensitizer. By keeping the chemistry separate, Nicol's method overly complicated the procedure, as the increasingly exhausted silver nitrate developer could not be accurately replenished or counted on for consistent results.

As noted earlier, in 1891 Nicol secured additional patents for his iron-salt and silver nitrate sensitizer modification and for a developer using Rochelle salts (sodium potassium tartrate) that mirrors the contemporary kallitype process. Although these changes were positive, the widely attempted technique was considered complicated and exceedingly temperamental. As editor John Tenant wrote in the February 1903 edition of *the Photo-Miniature # 47*, "*. . . the Kallitype process appeals, with peculiar force, to those with a lot of leisure time on their hands.*" In that very same issue of the *Photo-Miniature,* Henry Hall countered Tenant's lack of enthusiasm for the kallitype process and attempted to stimulate a public confidence in the practice of the technique with his article entitled "The Kallitype Process."

For the next 15 years the kallitype struggled to achieve even a modicum of popularity. To the dismay of the kallitype's champions, the advent of commercially coated papers, generated from such processes as Willis's ferric oxalate and chloroplatinite platinotype (1873) and Pizzighelli's sodium ferrioxalate and sodium chloroplatinite POP platinum (1887), proved to be more seductive as an alternative to hand coating. Given the Byzantine complexity of the written directions, and its reputation for impermanence, the process did not appear to have a bright future.

The Issue of Permanence

A few separate things contributed to the permanence issues. One of the most significant had to do with the early procedure's high alkaline content developers, (i.e., those with a great concentration of borax/sodium borate). This difficulty was coupled with inaccurate fixing and wash recommendations in which a bleach-like ammonia fixer devastated the image while it was supposedly fixing it. In time, a mild sodium thiosulphate fixer (sometimes with a tiny amount of ammonia added) was substituted for the ammonia, but this change only partially corrected the problem . . . and did little to dispel the public's perception, or the reality, of kallitype image fading.

During this same difficult time for the kallitype, the process was also being touted as being *almost like platinum* in its use of ferric oxalate and metal and was, for a short while, commercially produced and sold as an inexpensive alternative to the much pricier platinotype paper. Unfortunately, the stability of the kallitype, with its silver, was no match for the platinum. In addition, because of flawed instructions and directions, the public saw kallitype paper as an inferior alternative instead of a less expensive one. Coinciding with all of its other marketing problems, the kallitype had to contend with the beginning of the gelatin silver chloride paper revolution . . . and it never had a chance. All of that has changed and you can make kallitypes that last simply by adopting a few minor changes to your workflow which we will get to shortly.

Over the years kallitypes have been adopted by photographic artists for short periods of time and have gone by several different commercial names, including polychrome, satista, sensitol, platinograph, and soline. Dick Stevens's 1993 *Making Kallitypes: A Definitive Guide* is a pretty good resource if you want a grand tour of the process. Also, today there are many artists doing wonderful work with all of the kallitype processes, including Elizabeth Turk, K.K. DePaul, Latvia's Karen Oganyan, and Philippe Moroux of the Netherlands, who creates mythical panoramic kallitypes with his handmade pinhole cameras.

THE CONTEMPORARY KALLITYPE PROCESS

In the kallitype process a 100% rag paper is coated with a mixture of ferric oxalate and silver nitrate. After the sensitizer has dried, it is coupled with a negative that will be the same size as the final print and exposed to sunlight or a UV light source. When the ferric oxalate

Figure 12–3
K. K. DePaul, *Dark Mirror*, 2010 (kallitype and mixed media)
One of my former graduate students K.K. DePaul's extended work has long explored a wide range of closely held emotions and secrets through the layering of paper, physical objects, and photographic images. She writes, " . . . *I see this as being similar to the way our mind organizes memory...at different depths...one over another...constantly shifting.*"
(Courtesy of the Artist)

and the silver nitrate sensitizer are exposed to the UV light, the ferric oxalate in the sensitizer reduces to a ferrous state (ferrous oxalate), which then reacts with the silver nitrate, changing the silver metal salt into a partially realized metallic silver. This exposed kallitype is then processed in one of a selection of developers that is determined primarily by the individual artist's preference for specific colors and tonal renditions. These developers can be traditional kallitype variations or those that you would use in other processes such as traditional platinum or palladium printing (i.e., sodium acetate or ammonium citrate). I will also give you information about an alternative developer to work with that I've had great success with in workshops and classes . . . a hybrid developer consisting of equal parts sodium acetate (a traditional black kallitype developer) and ammonium citrate (a low impact palladium developer). This new developer has been remarkable in yielding clear white highlights in situations where those highlights used to be a light buff. I'll also toss in suggestions for a few others to test out . . . among them an excellent sodium citrate developer.

It would be very easy to make this chapter complicated. One of the primary reasons why this beautiful process had such a short popular life was that the technique was explained in a far more complicated manner than was necessary. I've decided to provide a simple set of instructions and a few alternatives to get you started. If you really become enamored with the kallitype process you will find out how really complex it can be. The following silver nitrate and ferric oxalate formula is considered to be a standard and can be found in many historical and contemporary alternative process documents.

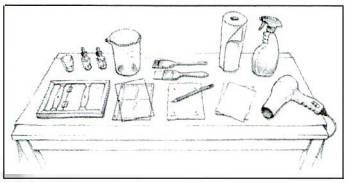


TABLE SETUP FOR KALLITYPE

- Kallitype A & B sensitizer (10% silver nitrate and 20% ferric oxalate)
- Tween 20
- Screw cap eye-droppers for A & B stock solutions

Figure 12–4
Christopher James, *Rockets*, Mexico, 1992 (kallitype)
This image was made with a plastic Diana camera outside Pátzcuaro, Mexico, during the annual Dia de los Muertos rituals and celebrations.
(Courtesy of the Artist/Author)

- Krystal Klear bags for printing and print storage
- Clean paper or Lucite for the coating
- Paper for sensitizing: COT 320, Crane's Platinotype, Arches Platine, and gelatin salted paper using salted paper sizing #1
- A heavy duty shot glass
- A new Richeson synthetic brush (http://www.jerrysartarama.com for best price)
- Clean distilled water in a beaker for brush washing
- Pencil
- Contact printing frame with clean glass
- Negatives for contact printing
- Paper towels
- A paper safe, drawer, or light-tight paper box for drying (allow 15–30 minutes of drying time in the box or drawer after coating)
- A Sharpie for labeling where your chemistry is placed in front of you

The Kallitype Sensitizer: A & B

Kallitype Part A

10% silver nitrate solution

Add 10 g of silver nitrate to 100 ml of distilled water and mix it into a uniform solution. Be very careful with silver nitrate, especially in relation to your eyes. Do not touch your face when working with silver nitrate. This chemical can cause blindness if you are careless about splashing or touching your eyes.

Kallitype Part B

20% ferric oxalate solution

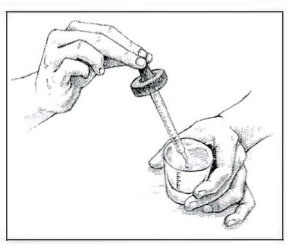
Add 20 g of powdered ferric oxalate to 100 ml of distilled water and stir into a uniform solution. Fresh and pre-mixed percentage formulas of silver nitrate and ferric oxalate can be purchased through Bostick & Sullivan. Please refer to the chemical section before using these chemicals.

Keep both kallitype solutions in separate, labeled, dark glass bottles, with separate dropper tops, and never mix Parts A and Part B together in amounts greater than you intend to use immediately because it does not keep well in a combined solution. Once silver nitrate is mixed with organic "stuff" it will have a short working life.

Silver nitrate, in fresh, white crystal and unclumped condition is quite stable but not when combined with other chemistry. As for the ferric oxalate, it has a mixed solution shelf life of about 6 months. I recommend

buying it in a bottled dry-pack powdered state versus the prepared liquid mix and preparing it 24 hours before use. Dry ferric oxalate powder will last for years.

In the event that you find old ferric oxalate responsible for the fogging of your image, there is a remedy. Go to the drugstore and purchase a 3% solution of hydrogen peroxide, the same percentage that you use for first aid and for accelerating the oxidation of a cyanotype. Do not use the beauty salon formula, as it is infinitely more concentrated at around 33%. Add several drops of the hydrogen peroxide to the ferric oxalate and swirl it around to mix it into solution. **Do not put the cap back on the bottle right away because the new solution creates a gas**, which like any other gas, will expand and exert a great deal of pressure in an enclosed container, and this may create a problem with an ordinary plastic cap. If you are pretty sure that your ferric oxalate is past due, just call up Bostick & Sullivan and buy some new ferric oxalate in the mixed 20% solution or dry-pack powder . . . and no, I don't own shares of the Bostick & Sullivan family business.



Working with the Sensitizer

You will be mixing your sensitizer with a plastic eyedropper and a decent quality shot glass. Always use machine-made plastic eyedroppers because they will give you a consistent drop size. Handmade glass droppers are unique per dropper, and this fact results in slight liquid volume differences between droppers.

Use a shot glass made for drinking in a bar rather than one with a picture of Niagara Falls, a stock car, or a lobster on it that's made for a display shelf. The reason is simple . . . a drinking shot glass is heavy, has a thick glass bottom so it won't tip over easily, and has a short barrel. The heavy weight at the bottom prevents it from falling over due to a clumsy gesture, and the short barrel reduces the amount of sensitizer left in the shot glass after you pour the sensitizer on the paper you are about to coat. This is economical and smart.

Figure 12–5
Rachel Brace-Stille, *Secrets*, 2006 (kallitype)
Arizona photographer Rachel Brace-Stille has been making kallitypes for many years and was one of my researchers when we were solving the problems of the process and its chemistry in 2006. At that time, Rachel's work centered primarily upon the women in her family . . . with the children as the principal storytellers and interpreters of the adult interactions. *(Courtesy of the Artist)*

Using separate Part A (silver nitrate) and Part B (ferric oxalate) bottles and droppers, add equal drops (1:1) of Part A and Part B into your clean, heavy-duty, shot glass. Swirl the solutions together as you would do when mixing a platinum/palladium formula. The hand and wrist gesture is similar to the way someone swirls wine when he or she is pretending to know something that you don't about the expensive wine he or she is evaluating. If you notice a precipitate of ferric oxalate on the surface of the solution you will have to filter it before applying it to your paper. Use a small and very clean funnel with a coffee filter for this task.

Generally speaking, a 4 × 5 negative on a good-quality paper will require 10 to 12 drops of Part A and an equal number of drops of Part B to cover the printing area and allow the signature hand-painted border area that is a common sign of hand-applied sensitizers.

Adjust the number of drops proportionally to the size of your negative. You can easily refer to the platinum/palladium and ziatype drop charts for a good idea of the total number of drops you will need for a specific size contact negative. Keep in mind that the number of drops needed will be predicated to some degree upon the relative humidity in the air and the thickness of the paper you are sensitizing.

Later on, if your kallitypes show signs of "bleach-back" (hydrolysis and fading of the image) you may try eliminating that particular problem with a modest sensitizer modification. Simply add a bit more Part A silver nitrate to your A & B formula and you should see a difference . . . providing your developer and paper choices are compatible, you are clearing properly, you are not over-fixing, and your chemistry is fresh.

Silver nitrate reacts to UV light once it is in a marriage with organic matter, even dust, so always be attentive to the luminosity and cleanliness in your lab. Air-dry your sensitizer application in the dark or blow-dry it, from the back of the paper, using the cool setting and working in low ambient light.

Tween 20

Tween 20 is a non-ionic surfactant that reduces the surface tension of fluid and assists your sensitizer in finding a secure home in the fibers of the paper you have selected. It also helps to minimize the leaching of colloidal metal during the process. You'll know if you should use it as an additive (a drop or two to your sensitizer mix) if you see staining or if your image leaches away in the sodium thiosulphate fixing solution.

Tween 20 is optional and can be added to your shot glass sensitizer formula to facilitate the absorption of the sensitizer into the paper substrate. Some say that it works great, enhances the D-max of their images, and yields a smoother-looking print. Others claim it ruins their work. As an example, when I print on a Cranes Kid Finish stationery I don't use Tween 20, as there appears to be no apparent need for it. However, when I switch to COT 320, a thicker paper, the paper requires the addition of a drop of Tween 20 to help emulsify the sensitizer. Tween 20 gets your sensitizer into the paper's fibers in a way that simple brush applications cannot. If you are using a Puddle Pusher to coat, adding pressure while spreading the sensitizer, rather than using Tween, may solve the problem.

To Make: a 5% solution, add 5 ml Tween to 100 ml of distilled water.

To Use: add one drop to every 20–30 drops of kallitype sensitizer.

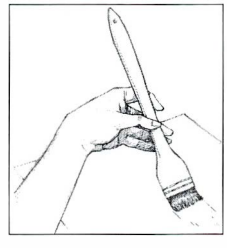
Gold and Mercuric Chloride Additives

If you really know what you are doing with photo chemistry you can experiment with tonal and color modifications to the kallitype formula by adding drops of an additional metal solution to your sensitizer. The two most common and traditional additives are gold chloride and mercuric chloride. Both yield a warm olive black, and of the two options I recommend the gold chloride because it is less dangerous to use and far easier to obtain in a prepared 1% solution. The normal working formula is 1 drop of 1% cold chloride to every 20 drops of A and B sensitizer mix.

Mercuric chloride is prepared by mixing 1 g to 30 ml of distilled water. This working solution is used like the gold chloride solution: 1 drop to each 20 drops of A and B sensitizer mix. Please do not be alarmed when your A and B sensitizer clouds up when the mercuric chloride is added, as this is normal. Be sure to dedicate a coating brush for this mercuric chloride–enhanced kallitype formula and prepare yourself for possible clearing and staining problems, especially if you gelatin-size your paper for this process.

NOTE: Mercuric chloride is seriously toxic and is very hazardous to your health. It is listed as a Schedule I poison, and all safety precautions should be attended to when using it.

COATING THE PAPER



The humidity in your coating area is going to play a role in the success of your kallitypes. Excess humidity may result in speckling and linear streaking in your

image. Do your very best to work in a low-humidity environment and get a dehumidifier for your working space if you get into the process. Remember to turn it off when you're done working. If you can't get rid of your humidity, (if, say, you are living in Singapore), then you might want to think about using Nicol's kallitype III process or Mike Ware's argyrotype instead.

Kallitype coating should be done under subdued light. Personally, I have always enjoyed working under multiple strands of miniature non-blinking Christmas or chili pepper lights because they provide enough illumination to see everything that is going on and they impart a festive atmosphere to the coating area. In truth, as long as direct sunlight, or fluorescent light, is not significantly illuminating your lab area, you are pretty safe until the final drying stage of your sensitizer, when you will want to be in a slightly darker environment.

When your brush is ready to use, *gently* coat the paper using long strokes, alternating between vertical and horizontal coverage, until the coating is even. As with Van Dyke, once the sensitizer begins to set up and ceases to be reflective it is time to stop brushing.

Coating with a Glass Rod Puddle Pusher

With the glass rod method, place the rod flat on the paper at the top of the marked-out negative area. Then pour your prepared sensitizer solution along the back edge of the rod. Without lifting the rod from the solution, move it side to side in the sensitizer until the solution is spread evenly across the rod. Next, pick the rod up slightly and lift it over, and behind, the elongated line of sensitizer. You are going to be pulling/pushing the sensitizer so that it covers the negative/print area. At this point, the rod is flat on the paper, behind the sensitizer, at the top of the paper. Now, with pressure, evenly drag the rod across the paper. If you have a puddle after the first "push," then repeat the step in the opposite direction. This is the same technique you would use when performing a platinum/palladium or a ziatype coating. Again, either way you coat your paper it is a good idea to practice on some scrap paper, ideally with some yellow watercolor in the same lighting conditions in order to get the feel of the coating technique.

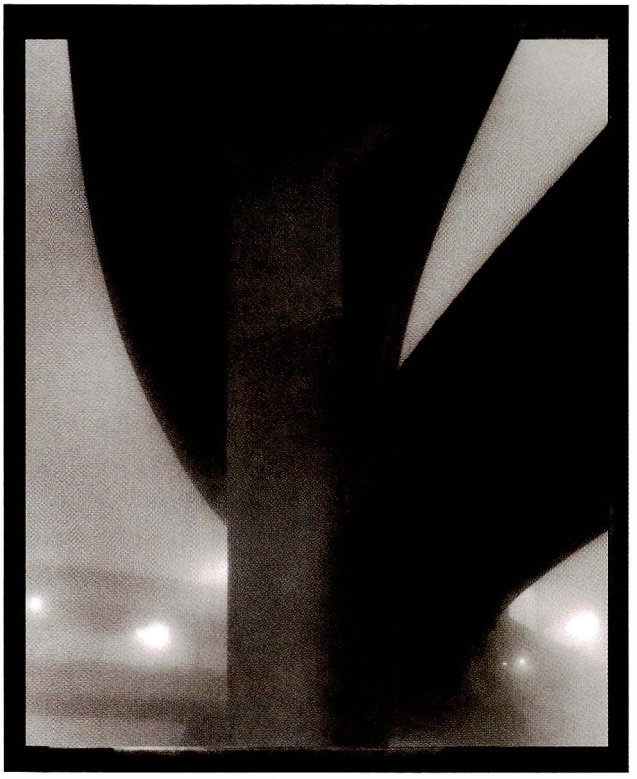


Figure 12–6
Tommy Matthews, *405 On-Ramp*, 2009
Tommy, a recent graduate of the MFA in Photography program that I direct at the College of Art and Design at Lesley University, made this extraordinarily beautiful kallitype of a negative he normally printed in Pt/Pd in one of my workshops in 2009. In this case he used his Pt/Pd curve profile for the negative on Pictorico OHP. If you are seeking a custom printer, Tommy is one of the best you'll find.
(Courtesy of the Artist)

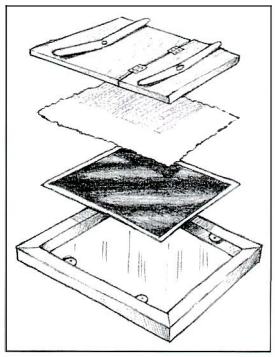
If you are planning on using a hairdryer to speed up the drying process, it is important not to blow hot air on the freshly coated kallitype-sensitized paper. Excessive heat will result in fogging and muddy highlight areas. Set the hairdryer on a cool setting and blow-dry the rear of the paper . . . pulling the sensitizer into the paper fibers. The print must be "bone" dry before printing or you'll get unpleasant texture surprises.

PAPER

The papers that I like for kallitypes are similar to those that I recommend for the Van Dyke and argyrotype. My top choices will include Bergger's COT 320 (using Tween 20 in the formula), as it has a luxurious finish and weight. It also tends to yield a cooler black when combined with a gold ammonium thiocyanate toner. It is a bit

expensive, but if you can afford to give yourself a treat, it is a nice experience. Other papers that work well include Stonehenge 90# white, Crane's Platinotype, Ruscombe Mills Buxton, Weston Parchment, Lenox 100 and Arches HP 90#, Arches Aquarelle, Saunders Somerset, Whatman's Watercolor, and Fabriano Artistico. Each of these papers exhibits a unique set of traits and colors.

EXPOSURE



The kallitype-sensitized paper must be exposed in contact with the negative in sunlight or in a plug-in UV printing unit of the type made by Jon Edwards (http://www.eepjon.com). Typical exposures will vary from 1 to 3 minutes in bright summer sun, or if you are seeking a more controlled kallitype experience, from 4 to 8 minutes in bright open shade with a short hit of bright sun at the end for shadow richness. This will boost contrast slightly by intensifying the shadows and giving the highlights some clean density. Of course this is totally dependent on the time of day and your negative density, which should be in the range of 1.5 to 1.8. You'll need to do exposure tests, but the best way to evaluate your progress during the exposure is to open your contact-printing frame and examine the paper in subdued light.

Unlike the Van Dyke, you are not looking for a resolved printed-out and over-exposed version of your image during the exposure stage. Instead, as in a platinum/palladium exposure, you will be waiting to see a pale positive image. In platinum/palladium I refer to this look as a *whisper*. In the kallitype process I describe the value I am seeking as more of a *stage whisper*. This means that there is a bit more density to the whisper. Test strips will give the most accurate results but will change in their informational meaning at different times of the day and season of the year. If my negative has the right degree of value separation and density, I can usually begin my exposure tests at around 7 minutes in open shade followed by 20–30 seconds of direct sun. After your paper has been exposed, develop it immediately.

BASIC DIGITAL NEGATIVE ON PICTORICO OHP

I find that using the platinum/palladium curve works quite well, and this is likely due to the chemical and workflow similarities that the kallitype process enjoys with Pt/Pd. You may find that the curve will not be quite dense enough, and you will know this because your printed highlights will be a bit flat and uninspiring. Sometimes the solution is to continue improving the contrast with your curve adjustment. Try this very simple solution to what can be a maddening and technical process of curve creation.

1. Open up your image, and if it's color, convert it to grayscale.
2. Invert the image so that it reads as a negative.
3. Go to Image > Adjustments > Curves and click it open.
4. Look for the little box next to the Preset band at the top and click.
5. Click Load Preset and your curve and action collection will open automatically. If not, go find it. I keep mine in a desktop Curves folder.
6. Click your best Pt/Pd curve and click Load.
7. Try it and make adjustments. You are seeking enough density to hold up to a strong UV exposure, give you a stage whisper, and appear to be too dark after exposure but perfect when it dries down.

This is supposed to be fun, so don't make it too technical right now; there is plenty of time for being compulsive later on. The best negative for kallitypes will need approximately 2–3 minutes exposure time in a shade and sun combination printing. This is a bit of a generalization, as the quality of the negative, time of day, freshness of the chemistry, type of paper, and season of the year will all play a role in your success. Begin with the shade and finish it off at the end with a straight shot of sun or some time in a UV-exposure unit.

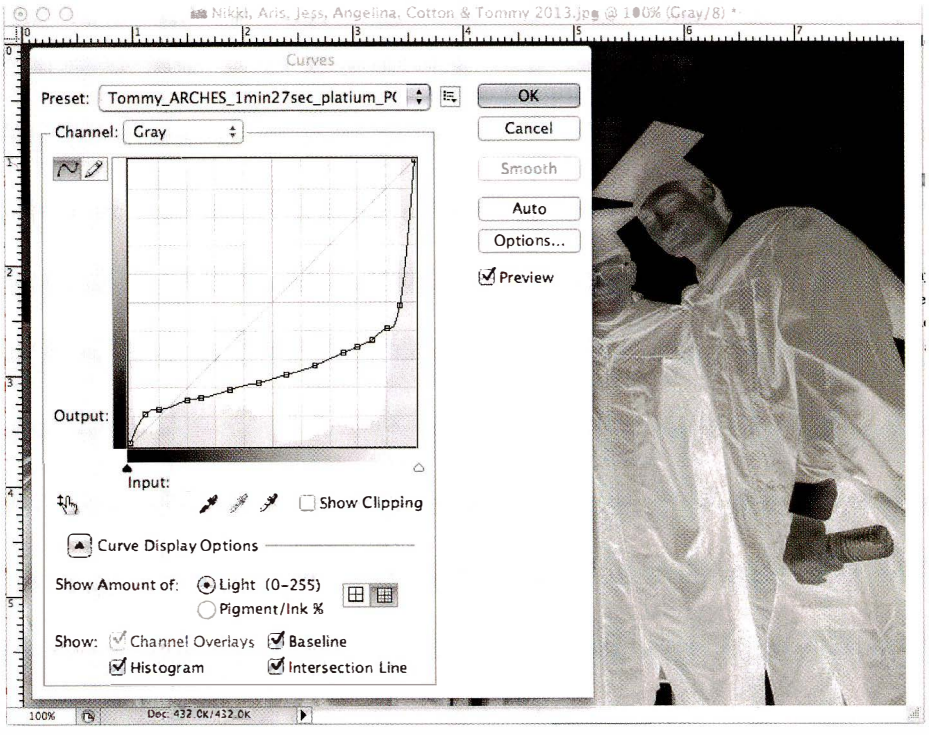
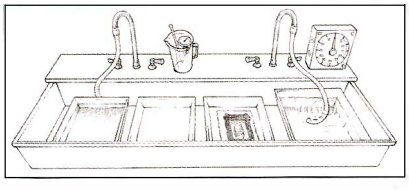


Figure 12–7
Pt/Pd Preset Curve Profile for Kallitype Illustration
This is a visual example of Tommy's Pt/Pd curve profile.
(Courtesy of the Artist)

Most alternative processes generally need negatives with excessive contrast and density. However, in my experience, processes with ferric oxalate in the sensitizer (Pt/Pd, kallitype, ziatype) are more successful when the negative has a longer tonal scale and your printing strategy is built on a shade and sun matrix.



SINK SET UP FOR KALLITYPE

Tray Sequence

Tray 1 A very clean and dry development tray and a bottle of prepared developer. Development time will be 8–10 minutes.

NOTE: Recommended Primary Developer—Combine prepared sodium acetate and prepared ammonium citrate developers in equal proportions. More on this developer shortly. Or, see the text for developer alternatives (e.g., 20% sodium citrate developer, Henry Hall's developer, ammonium citrate developer, and others).

Tray 2 A distilled water and citric acid clearing bath. For every liter (1000 ml) of distilled water add a very healthy pinch of citric acid . . . perhaps as much as a tablespoon. I once recommended just a running water bath, but too often I experienced a rust-colored fade on the print. Distilled water with a little citric acid appears to correct that problem. Rinse for 4–5 minutes.

Tray 3 **(optional) EDTA** clearing bath depending on the choice of developer. If you are using a borax–Rochelle salt developer then incorporating an EDTA clearing bath is probably a good idea. Mix EDTA 1 tablespoon to a liter of water. EDTA time is 5 minutes.

Tray 4 **Optional Toning Baths**—Kallitypes may be toned with a variety of *noble* metals. Toning is an attractive insurance policy to prevent bleaching of the image during the sodium thiosulphate fixing stage.
Toning must be done *before* fixing the print.
Toning baths will alter the image color and often aid in the archival properties of the print. Please refer to the text for specific formulas and times. My favorite toner for this process is one that is made of 0.2% gold chloride, 2% ammonium thiocyanate, and distilled water

Figure 12–8
Michelle Rogers Pritzl, *The Ratio of What is Remembered to What Is Reproduced*, 2012
Michelle, a recent graduate of my MFA in Photography program at the College of Art and Design at Lesley University, created this provocative kallitype print from a digital negative scan of one of her wet plate collodion plates from her series, *Soma*. *(Courtesy of the Artist)*

and is generally used for POP toning. The average toning time for a cooler-valued rendition of your image is anywhere from 10 minutes to as long as 30 minutes. Each liter of gold ammonium thiocyanate toner will handle about six 8 × 10 prints, and the toning time will increase with each successive print as the gold is consumed by the process. Stay with the print and be patient. It is always a good idea to have a control print nearby for comparison of how far the toning has gone during the process.

Tray 5 5% sodium thiosulphate fixing bath (2 minutes):
Mix 50 g sodium thiosulphate to 1 liter water
5 ml household strength ammonia

Tray 6 Final wash for 20–30 minutes

KALLITYPE DEVELOPERS AND DEVELOPMENT

The kallitype is developed according to the color one wishes to see in the finished print. Each developer formula results in varying tonalities of black, blue, sepia, reddish brown, and aubergine. I'll provide you with a few variations of development and clearing. Developer #1 is my favorite and is a 50–50 hybrid mix of an ammonium citrate Pt/Pd developer and a sodium acetate black kallitype developer.

I'm going to recommend that you make your life simple by using the ammonium citrate/sodium acetate combo developer or sodium citrate developer, as they generally yield very clean highlights. Notice that most classic kallitype developers contain tartaric acid, often used as an additive to assist in preventing ferric staining, or yellowing, in the highlights . . . a significant, and long-term, issue with this process. I have a cure for the problem with the combo developer.

I've also included traditional formulas like the classic borax–Rochelle salt that is much like Nicol's kallitype II recipe. With this one you must run the print through a clearing bath of EDTA prior to toning and fixing the print. Many of these developers are standard kallitype formulas and have been around for a long time. I am recommending that you read these formulas for informational value and then go and experiment.

A Developing Story

About a year ago, in the midst of a workshop, I was getting a bit frustrated with the fact that my students were unable to clear the highlights in their kallitypes. The prints looked great going into the first wash but soon lost their white integrity. Because of the brown leaching I recommended that we begin to add Tween to the sensitizer. That helped but didn't completely deal with the problem. I then made a change in the first wash, going from a running water rinse to a distilled water bath. This helped a little bit more. The problem was the iron and chlorine/chloramine in the public water supply.

I then went a step further and added a pinch of citric acid to the distilled water, and this action continued to improve the quality of the highlights but not enough to inspire the chorus of "oohs" and "aaahs" that usually accompany a new demonstration. Then I decided to try something new; I made up a new developer to go with the new wash cycles. I was also seeing a good deal of image degradation after the print had been saved to a portfolio, and although I expected this to some degree based on the reputation of the process, I was frustrated with the extent of it. As it was explained to me once, nitrates contain an oxidizing anion that has a tendency to degrade a colloidal silver image during processing. This is especially true when the conditions are acidic. To prevent a significant loss of image integrity the traditional kallitype process incorporated alkaline-buffered developers, like borax, with a high pH value. Unfortunately, this just created a different problem. Mike Ware explained it as a hydrolysis of the excess iron(III) in the sensitizer and the deposition of insoluble ferric hydroxide in the image, which ultimately resulted in image fading. There will be a quiz in the morning.

Two of the developers, ammonium citrate and sodium acetate, are often used as platinum/palladium developers (processes that also use ferric oxalate in their sensitizers and require a developer to realize the image), and they are fine options. What is really quite nice about these two developers is that when they are combined in equal volumes, and used as a single developer, the kallitype avoids the vexing and quite long-term problem of buff-colored highlights. And the two together appear, at least up until now, to also deal with long-term fade. Here are several developers to play with by themselves as solo developers and in combination. We'll begin with my favorite, the ammonium citrate and sodium acetate combo developer.

Ammonium Citrate and Sodium Acetate Combo Developer (My Favorite)

This is a really easy solution to a long-term problem. Mix together 500 ml of the sodium acetate developer and 500 ml of the ammonium citrate developer and blend them into a single solution. Use them in exactly the same manner that you would the other developers. This developer is wonderful to work with because it

Figure 12–9
Christopher James, *Pilar*, Mexico, 2005
This is a simple portrait of my friend Pilar, who makes the best soupa de pablano in all of Mexico. The image was made using a 4 × 5 pinhole camera and Polaroid Type 55 P/N film cleared in the ocean waters of the Baja de Bendares.
(Courtesy of the Artist/Author)

appears to solve the problem of buff-colored highlights and long-term fading of finished work. Average time in developer is 10 minutes in order to convert all of the residual ferric salts that are in the paper fibers. Replenish with fresh developer every 12 prints or as needed, and like a Pt/Pd developer, don't throw it out when your printing session is done. It will get darker with use, but it won't hurt your prints to keep using it as long as you replenish with fresh solution.

Ammonium Citrate Developer (*Warm Reddish-Maroon*)

There are two options for adding this developer to your chemical toolbox. The simplest option is to purchase a prepared bottle of ammonium citrate developer from Bostick & Sullivan. This is the company's kit developer for platinum/palladium, and it is a good option because it is pre-measured and can easily be dissolved in distilled water, it's reusable until it runs out, and it's safe. The other excellent advantage of this developer

is that it is very consistent and provides fine grain. Ammonium citrate yields a bright brown to warm reddish-maroon color depending on the paper you are using. It tends to be a contrasty developer. If you want to make it yourself, here is the recipe.

- Make up a 20 % solution of ammonium citrate by mixing 200 g of ammonium citrate to 1000 ml of distilled water.

Develop by inspection and don't worry about over-development. The standard development time will be 8–10 minutes. Replenish the developer at a rate of 400 ml for every 1000 square inches of paper surface.

Sodium Acetate Developer (*Neutral Black-Maroon*)

- Mix 75 g sodium acetate to 750 ml warm distilled water.
- Add 3 g tartaric acid to the sodium acetate and distilled water mix and stir into the solution.
- Finally, add warm distilled water to make a working solution of 1 liter.

This developer also can be purchased in pre-measured form in a bottle ready for distilled water and tends toward softer contrast than the ammonium citrate. Develop by inspection and don't worry about over-development. Development is at least 8–10 minutes in order to convert all of the residual ferric salts that are in the paper fibers. Replenish the developer as needed.

Sodium Citrate—20% Solution Developer (*Sepia Brown*)

200 g sodium citrate
1 liter distilled water at room temperature

I like this developer a great deal because it is simple and efficient and really clears in the highlights nicely. I'm not sure if it is any better than the combo sodium acetate/ammonium citrate developer, but at the very least it is another very good alternative. Development is at least 8–10 minutes in order to convert all of the residual ferric salts that are in the paper's fibers. Replenish the developer at a rate of 400 ml for every 1000 square inches of paper surface. If you don't replenish you will not be able to clear the paper well and staining will occur. This is also the developer that has been tested and used for adjusting contrast by adding potassium dichromate to it. Please refer to the test information to follow.

Figure 12–10
Lindsay Rogers, *Kallitype Test*, 2011
Lindsay Rogers, a graduate of the MFA in Photography program at the College of Art and Design at Lesley University, created this cool kallitype using a cold borax–Rochelle salt developer.
(Courtesy of the Artist)

Classic Borax–Rochelle Salt Black-Brown Developer

1000 m distilled water at room temperature
100 g borax (supermarket version is fine)
75 g Rochelle salts
3 g tartaric acid

NOTE: Less borax than Rochelle salt in the classic formula will yield a warmer image and vice versa. A heated developer will yield a warmer image as well, whereas a colder developer will process more slowly and will be cooler in tonality.

Step 1 Warm 750 ml of distilled water to about 80°F and pour it into a plastic beaker.

Step 2 To the warm water, add and dissolve 100 g of borax (sodium borate), stirring constantly.

NOTE: Some instructions, including some of mine from a previous edition, indicated that an anhydrous version of borax was needed. Forget it. The supermarket variety is fine.

Step 3 Dissolve 75 g of Rochelle salts (sodium potassium tartrate) into solution. Rochelle salts are very difficult to saturate, and you will likely have to filter the leftover sediment from the solution before adding it to the borax.

Step 4 Add 3 g of tartaric acid to the water–borax–Rochelle salt solution and stir until it is dissolved . . . good luck.

Step 5 Finally, add distilled warm water to make a 1-liter working solution.

Classic Kallitype Developer Warming and Cooling Control

Modify the formula to suit your taste. Use less borax and add more Rochelle salts and you will warm the print's coloration. If you use less Rochelle salts and add more borax to the formula you will cool the hues. It is advisable to work with a warm developer because borax will not always stay in solution under 78˚F. An electric slow cooker is an ideal warming tool that will keep your solution at a constant warm temperature. This slow cooker is not to be used for stews and soups after you are finished with it . . . it is now a lab instrument.

Color: Borax Versus Borax–Rochelle Salt Combo Versus Rochelle Salt

At room temperature, you can generally expect traditional color outcomes when using developers that employ borax and Rochelle salts. Borax yields a particularly cool black print and the Rochelle salts a much warmer one, with the combination of borax and Rochelle salts developer falling in the middle but leaning more toward brown than black. Your color result is dependent on paper, and though COT 320 displayed differences in color when wet, most dry down neutrally and it is difficult to tell the difference between a borax and a Rochelle developed print on COT 320 after dry down. I recommend using the Arches Platine for color shifts that are more pronounced.

Crystallization Issues and Borax–Rochelle Salt Ratios

Feel free to modify the proportions of the borax and Rochelle salts in these and the formulas that follow. If you find that you have a lot of crystallization going on in the developer, remember to add some extra tartaric acid to the solution. An example would be a formula consisting of 75 g of borax to 40 g of Rochelle salts in 1000 ml of distilled water. If this solution is left to age for 8 hours and a print is developed in it, it is likely that there will be a coating of fine crystals on the print when you remove it from the developer. If you add 15 g to 20 g of tartaric acid to the developer, the crystals will dissolve. Factors that will change your coloration will be the paper that you are using and the developer's proportions. Here are a few suggestions for beginning experiments.

Sepia Tones

- Use the classic black-brown formula, but use 50–75 g of Rochelle salts in 1000 ml of distilled water and eliminate the borax.

Cool Brown Tones

- Use the black-brown formula #1, but use 75–100 g of borax in 1000 ml of distilled water and eliminate the Rochelle salts.

Gray-Blue Tones

Step 1 Begin with 750 ml of warm (+80˚F) distilled water in a clean beaker.

Step 2 To the warm water, add 40 g of borax (sodium borate) and stir it into solution so that the chemical is dissolved entirely.

Step 3 Dissolve 40–50 g of Rochelle salts in the borax and distilled water beaker.

Step 4 Add 3 g of tartaric acid to this mix and stir it into solution.

Step 5 Finally, add warm distilled water to make 1000 ml. Stir this solution well and allow it to age for 6 to 8 hours.

Paper Effect on Print Color: COT 320 Versus Arches Platine

Lindsay Rogers, one of my MFA graduates at the College of Art and Design at Lesley University (formerly the Art Institute of Boston) experimented most extensively with these two papers. No matter what developer she used or what temperature, the prints on COT 320 turned out almost identically neutral after drying, a nice range of grays and blacks. This paper is consistent, but, as she wrote, consistently boring if you're looking for color shifts.

Arches Platine, on the other hand, is much more sensitive to changes in developer and temperature and yields a nice range of red-brown shades to brown-black shades. This paper also responded well to toning, allowing for the possibility of split tones.

Try developing an image on Arches Platine and developing with a Rochelle salt developer that is heated. The results may yield a warm and rich reddish-brown image.

Effect of Temperature upon a Classic Borax–Rochelle Salt Combo Developer

Lindsay Rogers ran a temperature test with the classic borax and Rochelle salt developer and found some predictable, and a few unexpected, results. When the water was cooled, placing a tray of developer in a tray of ice and water and yielding a developer temperature of approximately 35˚F–40˚F, the developing process was slowed significantly when development time was kept at a normal 10 minutes. The resulting image was very cool with almost no apparent brown and seemed to have a bit more contrast than ambient room temperature developer or hot developers.

Alternatively, when the developer was heated in a double boiler, with the resulting developer temperature at approximately 100˚F–105˚F, the image appeared almost immediately upon contact with the developer. The print required approximately 1–2 minutes less exposure time than a print destined for cooler development and delivered a pronounced warm, almost

Figure 12–11
Sophie Gibbings, *Spring Lamb*, 2013 (kallitype)
Sophie Gibbings, a student at the College of Art and Design at Lesley University and one of my workshop students, as was her mom in Santa Fe 20 or so years ago, made this beautiful kallitype as part of her documentary project in Haymarket Square in Boston. *(Courtesy of the Artist)*

reddish-brown color print with more subtle tonal shifts than with the cold developer. As you might surmise, the ambient room temperature developer yielded results somewhere in the middle, but the overall color looked more like the cold developer prints with a hint of brown.

It would be interesting to perform this experiment with the Rochelle salt developer. This developer is inherently warmer, so heating it might yield a very warm red print.

Henry Hall's Sodium Acetate Developer Option (1903)

This is a nice neutral black version of the earlier sodium acetate developer. It is Henry Hall's version from his article in the *Photo-Miniature #47* in 1903. In Hall's formula the sodium acetate is doubled to 150 g and the tartaric acid is halved to 1.5 g. The total volume remains the same at 1000 ml.

Those who use this variation describe the coloration of their prints as being blacker than they would be with the sodium acetate kallitype developer that was discussed earlier in this section of the chapter.

- 150 g sodium acetate in 750 ml of warm distilled water
- 1.5 g tartaric acid—add to the sodium acetate and distilled water mix and stir into the solution.
- Finally, add warm distilled water to make a working solution of 1 liter.

Sandy King's Kallitype Contrast Control: 5% Potassium Dichromate and Sodium Citrate Developer

Here is another way to control contrast instead of developer temperature. Make a 5% potassium dichromate solution and add it to the developer in various proportions depending on how contrasty you want your image to be. The basic rule with this technique is that the more potassium dichromate you use, the more contrast and less tonal separation you'll get. Begin by making up a few liter bottles of a 20% sodium citrate kallitype developer. Then add anywhere from 1 ml to 10 ml of the 5% potassium dichromate to that liter of sodium citrate

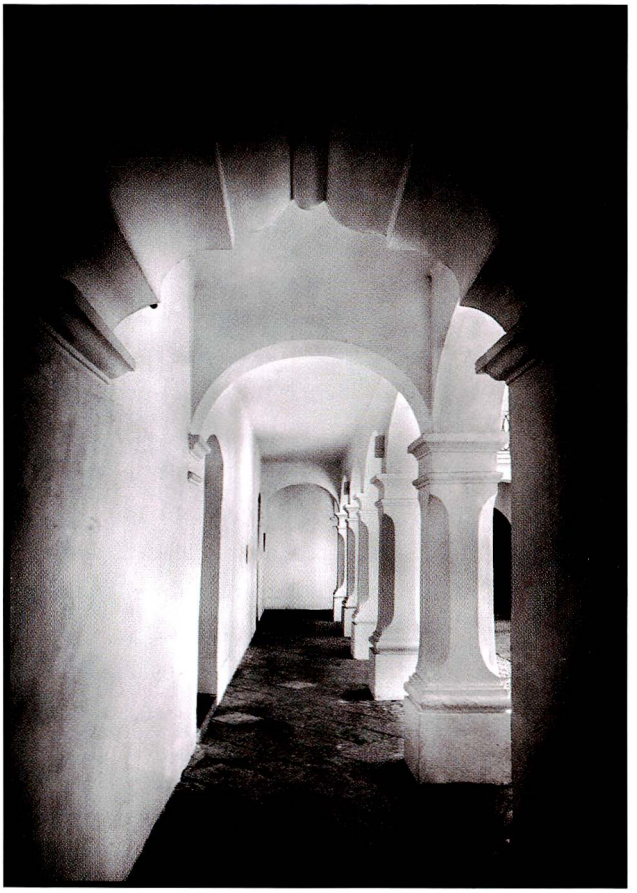


Figure 12–12
Sandy King, *Interior of Museum*, 2005
Sandy King is a photo historian and landscape photographer and the author of *The Book of Carbon and Carbro: Contemporary Procedures for Monochrome Pigment Printmaking* (2002). Recently retired from Clemson University, Sandy's current thinking about photography harkens back to the earliest days of the medium. This thinking is defined as the *neutral vision* . . . the idea that the lens is an artificial retina capable of revealing to us things independent of our senses.
(Courtesy of the Artist)

developer. Here are the results of a few tests that Sandy King made with Stouffer 21-step wedges.

Potassium Dichromate and Sodium Citrate Test #1

Sensitizer: 1 part ferric oxalate and 1 part silver nitrate
Expose 100 seconds in UV ULF 28 (for more information see this link: http://unblinkingeye.com/Articles/ULF28/ulf28.html).
Develop in 20% sodium citrate solution.
Add 1 ml of 5% potassium dichromate per liter in developer.
Result: 14 stops .15 dMax to paper white = 2.10

Potassium Dichromate and Sodium Citrate Test #2

Sensitizer: 1 part ferric oxalate and 1 part silver nitrate

Expose 100 seconds in UV ULF 28.

Develop in 20% sodium citrate solution.

Add 4 ml of 5% potassium dichromate per liter in developer.

Result: 12 stops .15 from dMax to paper white = 1.80

Potassium Dichromate and Sodium Citrate Test #3

Sensitizer: 1 part ferric oxalate and 1 part silver nitrate

Expose 100 seconds in UV ULF 28.

Develop in 20% sodium citrate solution.

Add 10 ml of 5% potassium dichromate per liter in developer.

Result: 10 stops .15 from dMax to paper white = 1.50

Looking for the Stage Whisper and Development Time

Once you have determined that the exposed sensitized paper has reached the visual equivalent of a stage whisper it is time to develop it in one of the developer formula options given earlier. The processing technique is a pouring action rather than an immersion . . . exactly like a platinum/palladium development.

I know this seems like taking excessive measures, but begin with a clean and thoroughly dry tray for each print. This may be a tad compulsive, but it is actually a great practice for developing platinum/palladium where the dryness and cleanliness of the tray is sincerely important. Place the exposed print in the bottom of the dry tray and quickly pour the developer over the image. Be sure that you don't stop to admire your image halfway through the pour. This is not as critical as it is in platinum/palladium, but get into the habit of covering the paper all at once with this development method.

You will see the resolved image in an instant, but it is not done developing yet. In fact, it's quite important to let the print develop-out. The developer needs this time to complete the reduction of the ferric salt to a ferrous state, and this process will take a little bit of time. If you fail to do this, the image will seriously degrade in the fixer and wash, and when you hang it up to dry you will see your image in liquid form dripping on the ground. No, this won't become a cool new technique . . . it simply doesn't look very good.

Be patient and give development at least 8 to 10 minutes for the full effect.

Don't be alarmed by the density of the image. You might notice that the image gets a bit "orangey" looking. On occasion the image will appear to be fading . . . don't panic . . . it will come back nicely and you actually want the print to be too dark at this stage. The density will diminish in the clearing and fixing stages as the print makes its way through the process. The dry down is pretty hefty (figure in the range of 15% to 20%), and you will get all of the densities back—in fact, you'll probably get more than you want.

After the development stage, immerse the print in a distilled water bath with a pinch of citric acid added to it. Also important . . . once your print is out of the developer, pour the remaining developer back into the developer bottle (you will not be throwing it away) and then clean, wash, and dry your development tray for the next print.

I am more than aware that a skilled practitioner can immerse a print in the developer without problems simply by using the rocking action of the tray to create a wave and then, like entering big surf, sliding the paper under the wave so that it is covered all at once. This is a technique that once you see it, and perform it, will be your technique of choice. However, if you are new to alternative processes please follow the initial instructions, and I will continue to recommend that you get into the habit of processing this way for a few reasons. First, it is good practice for the very fussy development process you will experience in platinum and palladium printing. Second, it reduces contamination problems that are a big part of the kallitype's difficulties when processing in a class or workshop setting. Third, it allows you to keep better track of your developer usage so that you can replenish with more accuracy.

Figure 12–13
Galina Manikova, Kallitype on Ceramic, 1999
This is an example of Galina Manikova's extensive work with alternative process sensitizers on ceramic, metallic, and fiber substrates. In this case, kallitype on ceramic. For more of Galina's work, please see the Paper and Alternative Substrates chapter.
(Courtesy of the Artist)

RINSING AND CLEARING

Special EDTA Clearing for Borax–Rochelle Salt Developers

For developers that contain borax and Rochelle salts, it is important to run the developed print through an EDTA clearing bath prior to toning and fixing.

With sodium acetate, ammonium citrate, a combination of the two developers, or the Henry Hall developers, it is possible that the EDTA clearing steps required will be unnecessary. That said, it may still be a good idea to do them anyway. Rinse your print in an acidified distilled wash bath and then follow it up with an EDTA bath. It is essential that you remove all of the ferric salts that remain in the paper or your print will fail . . . eventually. Your first tray rinse should be a liter of distilled water and a hefty pinch of citric acid. Rinse with agitation (not because you're angry, but with agitated movement of the tray and rinse water) for about 4–5 minutes.

EDTA

The second clearing bath is going to be made up of EDTA and water. EDTA (ethylenediaminetetra acetic acid tetrasodium salt) crystals are very effective in clearing the highlights in kallitype and platinum and palladium prints. EDTA is safe, and it is not flammable or reactive. It is a low-impact chemical that is commonly used as a food preservative in yogurt. In the EDTA clearing bath, unexposed ferric salts are removed from the print and prevent, in part, the possibility of unsightly brown staining relatively soon after you hang your print up to dry.

Preparing the clearing bath is simple: cup your hand, and add what looks like a tablespoon or two of the EDTA crystals and drop them all into a liter of distilled water. You will notice that it is pretty alkaline (you will have a slick feeling on your fingers). If you feel better about measuring, make a 4% solution. Next, immerse and agitate your print for 5 minutes. You should see the color of the water becoming slightly yellow as the unconverted ferric iron salt is washed out of the paper. When you see the yellow, change the bath. EDTA crystals are easy to find and inexpensive and can be purchased from the same source as your developer chemistry. In a clearing bath emergency—say you are out of EDTA or citric acid—go to the store and buy some 7 Up® soda. This solution will work pretty well and is fun to use in a demo.

KALLITYPE TONING OPTIONS

Following the clearing stages, *and prior to fixing*, you are able to tone the kallitype image. These unique toning steps in the process create a change in the print's color, tonalities, and values as well as assisting the preservation of the print from long- and short-term deterioration. Toning is an option and is not required if you like the color of your print after the development, fixing, and dry down. Toning will, however, give you options and will make your print last longer.

The first toning recommendation is the same POP gold toner found in the Van Dyke chapter. It will help prevent the print from suffering the ill effects of "bleach-back" in the fix and will make it more permanent than a conventional kallitype print. Think of it as gold plating each of the silver metal bits in the print. One additional benefit of toning is that toners will often correct an over-exposed shadow area by converting it from a solarized-appearing density to simply a dark one. In most cases, the toners that you would

Figure 12–14
Lisa Elmaleh, *Individual*, 2006 (kallitype)
Friend, teacher, and amazing image-maker Lisa Elmaleh made this montage from a series of photo booth–generated picture strips and translated them into a composite kallitype.
(Courtesy of the Artist)

use for salted paper, POP, or platinum/palladium will work with the kallitype. Please refer to those chapters for the individual formulas. The following represents a few recipe options to add to your toning "toolbox." Split tones, where two or more colors are visible within the image, are possible if you play with the toning dilutions, toning sequence combinations, toner temperature, and/or type of developer used to process the kallitype print.

A Basic Noble Metal Toner for Kallitype

To 1 liter of distilled water add 5 g of citric acid. To that solution, add either 5 ml of 5% gold chloride, 5 ml standard palladium solution Part C (the metal), or 5 ml of standard platinum solution Part C.

5 g citric acid
1000 ml distilled water
5 ml 5% gold chloride

Following a first rinse wash, and prior to fixing, immerse the print in the toning solution and gently agitate the print until you like the color and tonal shift. This change is faster when the toner is fresh and takes longer to realize as the toner is used and the noble metal salt in the toning bath is depleted. You will normally get 6–7 average size prints out of a liter of toning solution. Rather than re-make the entire solution, try replenishing the used volume with fresh noble metal. This is the same strategy that is commonly used in other toners such as Gold 231 gold ammonium thiocyanate toner, one of the tried and true standard toners in alternative process work.

Palladium Toner

2 g sodium acetate
2 g citric acid
400 ml distilled water
30 drops of 20% palladium chloride

Gold or Palladium Toning Sequence for Kallitype

Sensitize and expose your kallitype print in the traditional manner and then go through the double-wash cycle beginning with the citric acid acidified distilled water. Next, mix the toner by combining the ingredients listed in the recipes given earlier.

Tone the print in either of the solutions until you like what you see. This could take up to 30 minutes. Then, immerse the toned print in fresh running water for 5 minutes. When that rinse step is done, immerse the print in your 5% sodium thiosulphate fixer for 1 minute. Then, immerse the print in a silver gelatin type hypo-clearing agent for 1 minute (1% sodium sulphite if you can't find this hypo-clearing solution), final wash the print for 30–40 minutes in running water, wash it for 5 minutes in distilled water, and hang it on a line to dry. Presto! A beautiful gold-toned kallitype in which the highlights are tending to cool grey blue and the shadows are heading to black.

Black Toning Formula

To 100 ml of distilled water add
0.5 g sodium acetate
0.5 g citric acid or sodium chloride
7 drops of palladium chloride (20%)

Immerse the print in this solution for 5 minutes with constant agitation. Then, rinse the print for 1 minute in distilled water. Go to the fixing stage and fix the print for 1 minute in a fresh 5% sodium thiosulphate fixer. Then, remove the print from the fix and place it in a clean water bath. If you wish, you may immerse the print in a hypo-clearing agent for 1 minute to shorten the final wash time. Wash the print for 20 minutes in running water, followed by a 5-minute soak in distilled water, and hang on a line to dry.

Platinum Toner

5 g sodium citrate
5 ml platinum solution #3 (20% potassium chloroplatinite solution)
1 liter (1000 ml) of distilled water

Tone your print for not less than 1 minute. Your image will lose about 1/2 step of density during toning . . . this is normal.

Gold-Ammonium Thiocyanate Toner: Salted Paper Formula (*Blue-Gray Tonality*)

800 ml distilled water
25 g ammonium thiocyanate
2 g tartaric acid
5 g sodium chloride
20 ml 1% gold chloride
distilled water to make 1 liter (1000 ml)

Tone in the same manner as you do with the gold–borax formula. This toner will give you much colder values and an immersion of 6–15 minutes in a fresh ammonium thiocyanate toning bath will yield blue-gray tonalities. This toner does not keep well, so only mix the amount that you intend to use during a single working session . . . about 8 prints. If you use a thiocyanate toner, be aware that the sodium thiosulphate fixing bath may precipitate sulphur. If this is a problem, and you will know it by the aroma, you can easily fix the problem by adding 5 g of sodium sulphite to the sodium thiosulphate fixer formula and replace the fixer every 4 to 5 prints.

Gold-thiocyanate toner is particularly compatible with platinum toner and a range of colors, from warm red to slate gray to sepia, and it can be achieved by adjusting the times of the salt print in each toner and in the sequence they are used.

Gold-Borax Toner (*Warm Reddish Color*)

800 ml distilled water at 100°
6 g borax
12 ml 1% gold chloride solution

Dissolve the borax in the distilled water and add the prepared 1% gold chloride to the solution. Gold chloride in a pre-mixed state can be purchased from most chemical suppliers. Toning will take 15–30 minutes of gentle agitation depending on the tone you are seeking. Generally, the color of the image becomes cooler the longer you have the print immersed in the solution. Keep in mind that a dry print looks cooler than a wet print. Prepare this toning solution at least an hour before use and work with it at room temperature. If you find the toning less than active, add or replenish the toner with additional gold chloride solution. One way to be economical about gold chloride is to trim off any parts of your paper that you will eventually over-mat. This will cause less of the gold to be absorbed by the paper. For a black tonality, check out the gold–borax combination with platinum toner in this section. Note that this formula is very similar to the gold–borax albumen toner except that it is half as concentrated.

If you are seeking a deep burgundy color then try the gold–borax toner for 30 minutes followed, after a rinse, by the 30-minute gold ammonium thiocyanate toner.

Gold-Ammonium Thiocyanate Toner: POP Formula (*Bostick & Sullivan Pre-Mixed Solution Gold 231 A & B*)

This toner cools the image, notably the blacks, and imparts a bluish glow to the highlights when it is fresh and the immersion time is more than 15 minutes.

Stock Solution A

10 g ammonium thiocyanate
500 ml distilled water at 120°F

Combine the ingredients into a uniform solution, store in a clean plastic or glass bottle, and allow the solution to sit for 8–12 hours before use.

Stock Solution B

1 g gold chloride
500 ml distilled water at 70°F

To use, mix 50 ml of Stock A with 50 ml of Stock B and 900 ml of distilled water. The toner is good for about 6 to 8 prints before it begins to wear out. When you need to replenish the solution simply keep what is in your toning tray and add 50 ml Stock A and 50 ml Stock B to it. The toning time is subjective and usually between 10 and 30 minutes. The longer you tone, the cooler the mid tones and highlights.

Selenium Toner

Make up a very dilute solution of this toner, say 1%, to begin testing (e.g., 10 ml of Rapid Selenium Toner to every 1000 ml of distilled water). As always, avoid touching the selenium toner with bare skin as the body absorbs this liquid and keeps it. When you are ready, tone the immersed print until you see what you like. There is a chance you will not be immediately pleased . . . be patient. If it's too aggressive, tone the print in gold first, rinse for 20 minutes, and then go to selenium.

Next, using tongs, remove the print and place it in a water bath for 1 to 2 minutes. Next, go to the fixing stage and fix the print for 1 minute in the 5% sodium thiosulphate fixing bath. Remove the print from the fix and place it in a clean water bath. Immerse the print in a hypo-clearing agent for 1 minute and then wash the print for 20 to 30 minutes in running water, wash it for 5 minutes in distilled water, and hang it on a line to dry. You can make selenium a more active toning option by heating your selenium, dipping it into the toning bath until you see the mid-tones begin to change color, and then moving it to a bath of hot water, where the toning will continue for a while longer. Sometimes the effect is quite dramatic when the tones within the print are clearly defined and the contrast is good.

Figure 12–15
Shannon Castleman, *Self in Maine*, 2006 (kallitype)
Former workshop student, and longtime friend, Shannon Castleman's self-portrait in kallitype from a Polaroid Type 55 P/N contact negative.
(Courtesy of the Artist)

FIXING THE PRINT

This is the part of the process that contributes to the kallitype's poor reputation for fading. The majority of literature on the technique, old and new, recommends concentrations of sodium thiosulphate fixer that are too strong and immersion times that are too long. The bottom line is that you need to rid the print of unexposed silver salts. The difficulty with that job is that if your fixer is too strong and/or your immersion time is too long, your print is going to fade away eventually. Take your pick . . . now or later. If you do it right, the print will be fine for a very long time.

Chances are that if you have followed the procedure to this point your print is looking pretty good, so it makes sense to do the final steps perfectly. This includes a sodium thiosulphate fix that will adequately remove any traces of the ferric salts, or the effects of chlorine in your tap water (making silver chloride), from your print.

5% Sodium Thiosulphate Fixing Bath *(with an added alkali)*

Step 1 Dissolve 50 g of sodium thiosulphate into 1000 ml of distilled water.

Step 2 When the sodium thiosulphate has dissolved, add 5 ml of *non-detergent* household ammonia, or 3 grams of sodium carbonate, and stir it into the sodium thiosulphate solution. This makes the fixer slightly alkaline and helps prevent *bleach-back* or the loss of your image in the fixer. Bleach-back is just a nice compound word for a terrible moment in the process when your print disappears.

Just for your kallitype toolbox, another way of reducing this problem is to increase the amount of silver nitrate in the sensitizer.

Step 3 Fix your print for 1 minute with constant agitation. A 1-minute fixing time should not cause your print to fade. My own 30-year-old

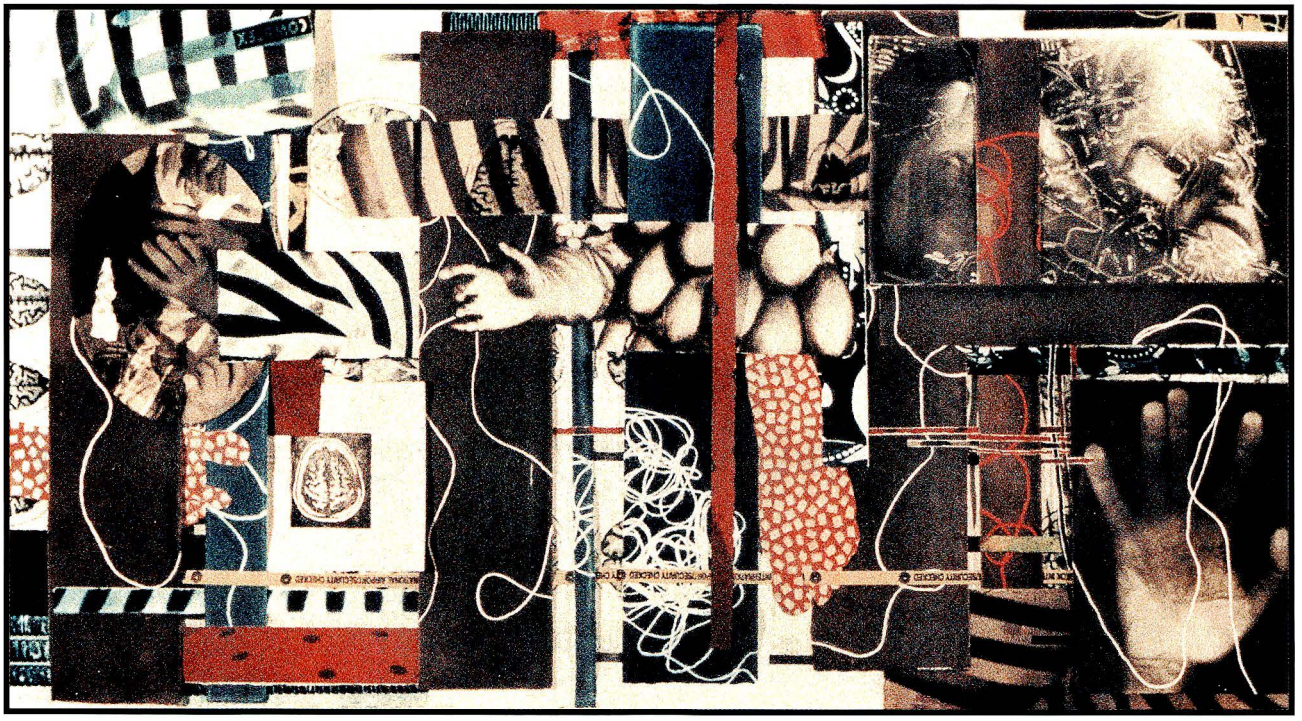


Figure 12–16
Yvette Dubinsky, *Here and Gone*, 1998
This is the work of former workshop student, friend, and St. Louis artist Yvette Dubinsky. The cyanotype, kallitype, gum bichromate, and mixed media piece measures 45.5" × 23.5" and is an excellent example of the interdisciplinary options in alternative processes in the hands of a skilled artist.
(Courtesy of the Artist and Bruno David Gallery)

Figure 12–17
Jess Somers, *Time Will Lose Us*, 2010
This is an excellent kallitype print from former workshop student, MFA graduate, friend and colleague Jess Somers.
(Courtesy of the Artist)

kallitypes, gold toned with an alkali assisted fixer and a short 1-minute fixing time, still have their original integrity. Even when printed on the cheapest newsprint possible, they have held steady.

HYPO CLEARING OPTION

If you wish to accelerate the removal of the residual sodium thiosulphate that has permeated the fibers of your paper, you may use either a half-strength dilution of a gelatin silver paper-strength hypo-clearing agent, Perma Wash, or a 1% solution of sodium sulphite . . . these are the same thing, only one costs more than the other. In both cases, immerse your fixed print for 1 minute.

FINAL WASH

If you have used a half-strength hypo clearing, or sodium sulphite bath, then your final wash time will be 20 minutes long. If you have not used these baths, then wash your prints for about 30 to 40 minutes, depending on how well you like your print.

Following this tap water wash I am going to recommend that you give your print a 1-minute soak in distilled water. I started doing this in New Mexico in my workshops when it became annoying having beautiful wet highlights turn off-white after the print had dried. This was most pronounced in salt and albumen processes, both of which use silver nitrate in the sensitizer, and the 5-minute soak made a difference. It might have been the Santa Fe municipal water system and very hard water, with lots of minerals and chloramine, but it worked and so I'm tossing it in this chapter as a possible "Get Out of Jail Free" card quick-fix.

Again, the most chronic problems in kallitype are those of over-fixing, under-washing, and leaving the iron salt and silver chloride residues behind in the paper's fibers after the washing stage. The reason iron remains in the image is that insoluble compounds of iron (ferric salts) have formed in a wash that is too alkaline . . . this is why we throw in the pinch of citric acid and use distilled water in the first rinse after exposure. Don't be discouraged if the first few kallitype attempts are not what you had in mind when you decided to try this process. Play around with the technique; make a few free associations with the alternative cousins, cyanotype, Van Dyke, and platinum/palladium; and see how your own experiments and adaptations change the final image.

The Platinum/Palladium Process

OVERVIEW & EXPECTATIONS

Up until wet plate collodion became a fervent passion in alt pro, platinum/palladium (Pt/Pd) was the process that surfaced first when I asked students, "What process do you want to learn more than any other?" Perhaps it's the controllable beauty of this nearly perfect alternative printmaking technique. Possibly it's the meticulous way a Pt/Pd print is analyzed, deconstructed, and realized. Maybe it's simply the romantic cachet of using "noble" metals, sunlight, and water to make an image...that alone does it for me. Whatever "it" is, there is no contesting the fact that the process is beautiful to work with and that it resides on a very high perch in the alternative processes pecking order. Historically, as referenced in Mike Ware's *The Eighth Metal: The Rise of the Platinotype Process, "In 1900 the Platinotype process could justly claim the pre-eminent place among the media for photographic printing. As quantitative evidence for this claim, we have exhibition statistics from the relative numbers of prints in three media—platinum, carbon and silver—shown at the Annual Exhibitions of the Royal Photographic Society between 1893 and 1901, it can be seen that between a half and a third of the work exhibited during those years was in platinum. . . "*

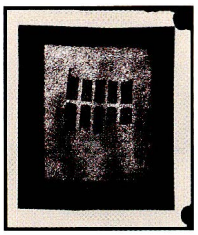
In this chapter I'll begin with the usual "A Little History" section. Then I'm going to make a conscious effort to demystify the process. You will learn the chemistry and sequence of the various stages to a finished Pt/Pd print. I will suggest alternatives to traditional Pt/Pd chemistry and provide you with an easy-to-comprehend sensitizer "drop chart" that is based on the type of negative you have in your hands rather than the print you would like to make . . . just like real life. I'll also offer a trouble-shooting list to assist in hunting down problems that may show up in your work. Finally, you'll get some brief suggestions for combining Pt/Pd with techniques such as Van Dyke, cyanotype, and gum bichromate.

Figure 13–1

Christopher James, *Dying Man*, Mukti Bhavan, Benares, India, *1985*

There isn't enough room in this space to tell you the whole story of this image. If my home were on fire, and I had time to grab one negative, after family and dogs, this would be the one.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

Historically, with the exception of the first inspirations, every refined alternative process evolves over a lengthy period of time and through the efforts, and serendipitous accidents, of many artists, scientists, and entrepreneurs. Platinum/palladium is no different in this regard.

In 1804, Adolph Ferdinand Gehlen (1775–1815) was the first to observe and record the reaction and effects of light on platinic chloride salts. He noted that UV light altered the color of the platinum salts and caused the ferric salts to precipitate out into a ferrous metallic state.

In Captain W. de Abney's (1843–1920) book, *Platinotype* (Sampson Low, Marston & Co., London, 1895), and in its American version, *Platinotype* (Scovill & Adams of New York, 1898), Abney credited Gehlen for initially documenting the photochemical property of platinic chloride. He wrote, "*Gehlen found that an ethereal solution of platinic chloride, when exposed to light, first turned a yellow colour, and eventually threw down metallic platinum in the form of a thin film on the sides of the vessel.*" So far, so good, except that the actual color was more of a dark brownish red that eventually went to a straw yellow color as it was exposed to UV light. In a subsequent paragraph, Abney writes, "*Gehlen, as far back as 1834, showed that an ethereal solution of platinum, after a short exposure to light, was reduced by ferrous sulphate.*"

Two problems need to be pointed out because this inaccurate information is often repeated in photo history texts. The first problem with the attribution by Abney is that Gehlen had been dead for 19 years when he made his observations . . . that may explain why he is able to see an ethereal solution. The second problem is that the ferrous sulphate would have reduced the platinum salts even if they hadn't been exposed to light.

My friend, Dr. Mike Ware, in a correspondence with me during the writing of this chapter, sent along the following reference, which I would not have been able to comprehend even if I had stumbled on it . . . and for that I am grateful. Mike wrote, "*Gehlen's publication of these observations is well-documented. The full reference is: A. F. Gehlen, Über die Farbenveränderung der in Äther aufgelösten salzsauren Metallsalze durch das Sonnenlicht*. Neues allgemeines Journal der Chemie, III, 566 (1804). *Gehlen was editor of this*

Figure 13–2
Pierre Troubetzkoy, *Amélie Rives*, 1904 (gum over Pt. printed by Alvin Langdon Coburn)
This romantic photograph is a collaborative creation between the photographer, Pierre Troubetzkoy, a Russian portrait painter; his model and wife, Amélie, a novelist and playwright from a prominent Virginia family; and Alvin Langdon Coburn, who, when printing the image, deliberately increased the density and dark mystery of the foreground's dark mystery . . . making a more painterly and photo-secessionist–like representation of a day spent sailing.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

journal at the time. He showed that the chlorides of iron, uranium, copper, and platinum, dissolved in ether, were all photo-sensitive."

That is a nice reference and does much to explain the various paths that led from Gehlen's investigations. Then Mike wrote, "*You owe me—for all of those umlauts.*" For the non-Teutonic, an *umlaut* is a diacritic pair of dots placed over a vowel to instruct the pronunciation of that vowel in German and a few other languages. It is also a really affected add-on to the names of romper-stomper bands to make them a little more unpleasant sounding to parents . . . but how does one repay an umlaut? I digress.

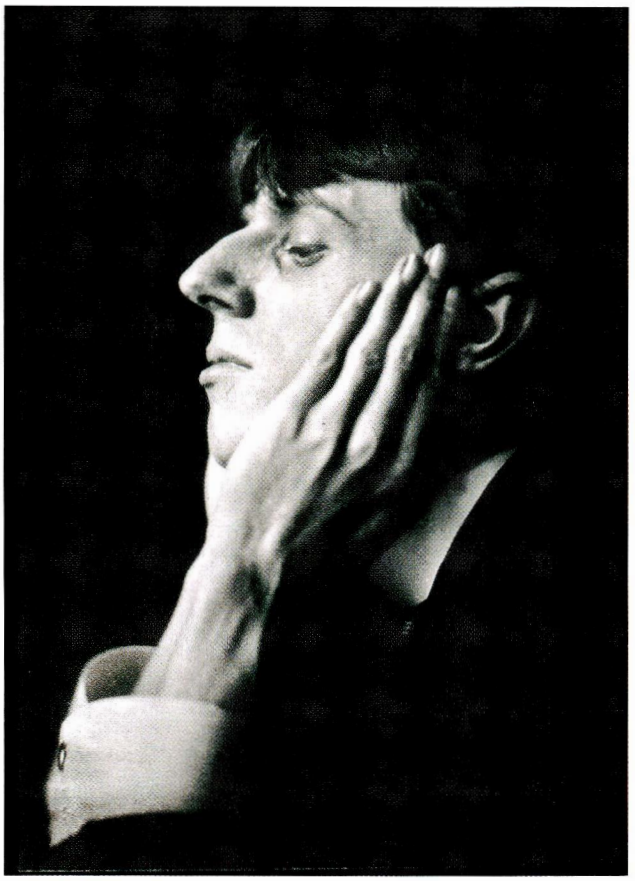


Figure 13–3
Frederick Evans, *Aubrey Beardsley*, 1895
Evans was a photographic purist (some would say a zealot) who scorned any artist who strayed from the truth and essence of the medium. His subject, Aubrey Beardsley (1872–1898), was a self-taught illustrator influenced by Japanese woodcuts, the silhouette simplicity of Greek vase painting, and the flamboyance of French rococo. Beardsley enjoyed a brief career with his erotically decorative, monochromatic illustrations and died of tuberculosis at the age of 27. The confluence of personalities between Beardsley and Evans is why this image has always been one of my favorites. *(Courtesy of George Eastman House, International Museum of Photography and Film)*

The first known preparation of platinum(II) chloride is credited to Heinrich Gustav Magnus (1802–1870), a German chemist and physicist who, in 1828, discovered the first of the metal complex platino-ammonia compounds (*Magnus' Green Salt* or, if you feel like showing off, *tetre-ammineplatinum[II] tetrachloroplatinite[II]*). These compounds were relatively unknown until the 1870s when a simple method of preparation, utilizing a menu of reducing agents, was finally devised. It is this modern compound, potassium chloroplatinite (or potassium tetrachloroplatinite), that is essential to the success of the process, as its reduction to a metallic state is a simple one of platinum(II) chloride and ferrous oxalate leading to black platinum tonalities.

At approximately the same time, in 1831, Johann Wolfgang Döbereiner (1780–1849) observed the decomposition of ferric oxalate upon exposure to UV light and scientifically calibrated its sensitivity. He found that a solution of ferric oxalate was decomposed into carbonic acid (carbon dioxide) and ferrous oxalate by the action of the blue-violet ends of the spectrum . . . but not by the rays of red or yellow . . . a finding that was quite compatible with the experiments of Sir John Herschel with tincture of rose leaves that same year. Döbereiner also recorded the light sensitivity of platinum salts, manganic oxalates (containing manganese) and tincture of iodine. His scientific observations are relevant because they form the foundation on which many non-silver processes, especially those that incorporate iodine, have been built.

Aqua regia (royal water) is a mixture of concentrated hydrochloric and nitric acids and is one the few reagents (*reagent meaning a substance or compound used in chemistry to begin or confirm a chemical reaction*) that is able to dissolve metallic gold and platinum. In 1831, Sir John Herschel noticed that when he neutralized a platinum solution in aqua regia with calcium hydroxide (lime) and then placed it in a dark environment . . . nothing happened. However, when he exposed it to sunlight, a precipitate was formed. In a report to the British Association at Oxford in 1832, Herschel reported that when this solution was subjected to light it clouded and then "*threw down a white, or, with excess of platinum, a yellow precipitate.*"

Robert Hunt (1807–1887), a Herschel contemporary, conducted experiments in the early 1840s using platinum chloride on silver iodide–coated papers. Later, when he mixed platinum chloride with a solution of potassium cyanate it yielded a faint *whisper-like* latent image upon exposure to sunlight. Hunt then placed the paper in a solution of mercury salts (*mercurous nitrate*) that allegedly gave him a lovely image that, like everyone else's lovely images, faded away over time . . . even if kept in the dark. According to Mike Ware, it is unlikely that this image contained platinum. It is far more likely that it contained silver and/or mercury. As an aside, Hunt is recognized for his discovery of ferrous sulphate as a developing agent (1844), for his work on the influence of the spectrum on light-sensitive materials, and for being one the founders of the Royal Photographic Society.

In 1858, C.J. Burnett was the first to demonstrate a semi-controlled adaptation of these previous experiments using sodium chloroplatinate. His platinum-based experiments were, according to Burnett himself, not entirely successful. However, his uranium prints, developed with a solution of silver nitrate and toned with gold, platinum, and palladium, delighted Burnett, and he happily exhibited what could legitimately referred to as the first palladiotype prints.

There are significant references to Burnett's research in Abney and Clarke's *Platinotype* (Scovill, 1898), and among them is this: "*In the Liverpool and Manchester Journal of May 15, 1858, Burnett proposed to prepare paper, either plain or collodionized or gelatinized, with ammonio-ferric oxalate, and develop it with gold or palladium, or develop silver and tone with platinum, gold, or palladium, fixing with ammonia or oxalate of ammonia.*" Abney then added this somewhat snide remark: "*It is difficult to know exactly what merit is to be assigned to Burnett; his papers are very numerous, and it is not easy to distinguish actual experiment from mere suggestions.*"

Abney's snippy tone aside, he did write that it was quite evident that Burnett was engaged with toning silver prints with platinum and had shown them as early as 1855. It is significant that Burnett came so close to actually discovering a truly accessible and practical Pt/Pd process . . . one that was essentially a mirror of the Willis "platinum in the bath" method that is our contemporary version. Burnett was using ammonio-ferric oxalate, fixed with ammonio oxalate, and he already knew that platinum salts could be employed as developers with paper "so prepared." Had Burnett not been so inquisitive, experimenting with every type of salt in existence, he would undoubtedly have arrived at the solution to the Pt/Pd process nearly two decades before Willis.

In 1872, William Willis (1841–1923), seeking a way to make a photographic print that was both stable and user-friendly, conducted an involved series of experiments using potassium chloroplatinite and ferric oxalate. He was successful in reducing the ferric oxalate to ferrous oxalate by exposure to UV-containing light. Then, by using a warmed potassium oxalate developer, he was able to make soluble the ferrous oxalate, which consequently reduced the platinum salt to platinum metal. Later on in this chapter you will get more information on the warming effects of warm developer on the look of the print.

Between 1873 and 1887, Willis was granted several patents for his work and discoveries and successfully

Figure 13–4
Gertrude Käsebier, *The Sketch* (Beatrice Baxter Ruyl), 1903 (Pt)
Gertrude Käsebier was a prominent member of England's the Linked Ring (she was its first American woman) and one of the primary influences in the Pictorialist movement. Stieglitz was a fan of hers, publishing her in *Camera Work* (1903–1917) and exhibiting her work in his 291 Gallery. Like the majority of the pictorialists, she was devoted to ideal, romantic, and nostalgic visions of life. This is an image of Beatrice Baxter Ruyl, a children's book illustrator and a frequent model for F. Holland Day, in Hingham, Massachusetts. *(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)*

Figure 13–5

Peter Henry Emerson, *Gathering Water Lilies*, 1886

This is Plate #9 from Peter Henry Emerson's landmark monograph, *Life and Landscape on the Norfolk Broads*. Among the more interesting things Emerson said is ". . . only a vandal would print a landscape in red or in cyanotype."

(Courtesy of George Eastman House, International Museum of Photography and Film)

launched the first commercial platinum paper enterprise, the Platinotype Company. More than a decade later, in 1892, he introduced a cold development process that resulted in his work gaining immediate acceptance as an accessible photographic printmaking technique that lived up to his claims of being both permanent and user-friendly. One additional important element relating to Willis's investigations, and defined in Ware's excellent article, "The Eighth Metal," was evidence that as early as 1880 Willis was aware that his platinotype chemistry was inhibited by the gelatin sizing in paper and that to achieve success it was necessary to avoid paper sized with that additive. Ware speculates that the eventual success of manufacturing platinum papers, in 1892, indicates that Willis had solved the problem with the possible use of alum-rosin sizing.

In the early 1900s, commercially produced platinum and palladium papers were available in Europe and the United States (even Kodak made them) and were quite popular due to the beauty of their tonalities and advertised permanence. The palladium process, which is essentially the same as platinum, with the principal exceptions of cost and color, was introduced during World War I. This was fortuitous because platinum was virtually impossible to purchase after the beginning of the Great War's hostilities, as it was a strategic metal in weapons manufacturing. With the advent of the commercially perfect and readily available papers, hand-coating techniques became a non-issue and the process became *the* most popular way for both photographic artists and amateurs to make prints. This was encouraged, in great part, into the 1920s by the popularity of the "Pictorialist" aesthetic.

Pictorialism

Prior to the Hill and Adamson landmark calotype portfolio of the members of the newly formed Free Church of Scotland (1843–1847), images were evaluated on their technical craft alone. Subsequent to this portfolio, the personal and expressive intentions of the photographer were incorporated into the evaluation of the imagery. This has a parallel in the way Caravaggio personalized his subjects with dramatic chiaroscuro sidelight.

The first scientist to officially adopt the subjective side of image making was the outspoken, and quite curmudgeonly, English physician Dr. Peter Henry Emerson (1856–1936) who, by virtue of his revisionistic views of art history and demonstrative ego, was able to spawn a movement in photography that led away from the evidentiary virtues of science to the less-defined and subjective righteousness of fine art. This pictorialist movement, identified by its romantic association with painting, continues to this day and is, in some photographic circles, an aesthetic force in contemporary photography.

Emerson spent much of his self-important photographic life tormented by the debate between those who believed photography could be distilled into a set of hard and fast rules and those who believed it was a flexible form of expression and impression. In 1886, Emerson began a series of lectures defining the correct, naturalistic, approach to the new medium. Trashing such image-makers as Henry Peach Robinson, he laid out a position in which a photograph always aspired to represent an artist's true aesthetic inner vision, as painting did in the Impressionist movement.

Figure 13–6

Henry Peach Robinson, *Fading Away*, 1858

One of the leaders of the Pictorialist movement, Robinson was torn between the passive relationship of the camera to the subject and his deep compulsion to influence the compositions . . . in the manner of a painter. *Fading Away* is his most well-known piece and a composite image from five separate negatives. The interesting thing about this work is how angry it made people. It seems that the theme was fair emotion for a painter to interpret but far too sensitive for the reality, reflection, and accuracy of a camera. When viewers were told that their emotions had been manipulated by photographic shenanigans, they were livid.

(Courtesy of George Eastman House, International Museum of Photography and Film)

Figure 13–7
Alvin Langdon Coburn, *Flatiron Building, NYC, Evening*, 1912
One of the founders of the Photo-Secession movement, and a member of the Linked Ring, Coburn was an articulate warrior against conventions and rules that restricted the new medium of photography. Attracted to Cubism, he was one of the first to apply that genre's style to photography in his vortographs, created by attaching a kaleidoscope mirror to his camera. This image of the Flatiron Building is one of his more romantic images and was also made as a Pt and gum bichromate print.
(Courtesy of George Eastman House, International Museum of Photography and Film)

Emerson made up a lot of camera club–like rules for photography, including centralized subject matter, differentiated focus, natural settings, and candid posing. He once said, in reference to a cyanotype print, "*no one but a vandal would print a landscape in red or in cyanotype.*" In 1889 he published his grand thesis of artistic photography in a book entitled *Naturalistic Photography.* The following year . . . he changed his mind.

Emerson's idealism came to an abrupt, and ironic, halt in 1890 when Ferdinand Hurter (1844–1898) and Vero Driffield (1848–1915) published their findings on a direct quantitative linkage between the amount of exposure, given a film and the resulting corresponding densities on that film following controlled chemical development . . . the characteristic curve of film. In addition, they devised a theory of controlling the development of the latent image.

Emerson was aghast. Convinced that this "scientific proof" cast his own beliefs in doubt, he withdrew his claim that photography was art and promptly released a new book titled *The Death of Naturalistic Photography.* But it was too late; many photographers had already become disciples of the pictorialist vision he had championed.

Shortly after Emerson's first book, *Naturalistic Photography,* more than a few photographers began to identify with their artistic self-reflections as their respective efforts often mirrored the styles and ideas of the Impressionists. Groups of photographers bonded together with like-minded photographers to ensure that their voices would be respected and their work shown. They established "clubs" such as the legendary Brotherhood of the Linked Ring (London, 1892) and the Photo-Secession (New York, 1902), which achieved its singular strength through the peculiar and dominant

personality of Alfred Stieglitz and the reach and reputation of his magazine, *Camera Work* (1903–1917). These two groups were the strongest advocates for what would become alternative process image making and the concept that it was appropriate for photographers to have hands and heart . . . as well as eyes.

Ironically, the pictorialists became bloated with their own inflexible theology that defined what a proper image *must* be, and the Photo-Secessionists became the rebellious entity to be rebelled against. Their often beautiful and romantic aesthetic made a home for itself in obsequious camera clubs and floor-to-ceiling generic salon competitions. The modern understanding of the word *pictorial* most often applies, positively or negatively (depending on who is speaking), to a work of art that is *"painterly,"* hand-made, romantic, a cliché, and often personally idyllic. In a contemporary sense, a romantic and conservative vision describes an ideal rather than a conceptual representation of information, which requires an educated viewer for interpretation and critical analysis.

With the advent of George Eastman and Henry Strong's Eastman Dry Plate Company (1880), small format rolled film (1883) and small format cameras (1888), and Eastman Kodak's "*you press the button and we do the rest*" enterprise (1892), photography became a democratic reality. Social documentation, photojournalism, and work with commercial intentions slowly replaced the classical large-format pictorialism that was perceived by many as a privileged and elitist visual Camelot within the medium. As an aside, in later years, the West Coast became a haven for the large-format aesthetic, while the East Coast embraced the small-format street and personal document genre.

In addition, significant changes in conceptual and perceptual thinking in the arts (e.g., the Bauhaus [1919–1933]) put an aesthetic dagger into the once unchallenged and metaphorical pictorialist heart. At this point in history, the use of platinum and palladium as the primary vehicle for photographic printmaking ebbed, and silver gelatin became the vehicle of choice for nearly all working in the medium. Within the last twenty years, the Pt/Pd process has experienced an unprecedented re-birth in response to the loss of traditional silver gelatin materials, the mushy hands-free democracy of digital photography, and a critical criteria based increasingly upon a social networking aesthetic. Perhaps as a reaction to all of these things, the extraordinary beauty of the hand-made Pt/Pd print, on paper or vellum, has stirred the sleeping heart of the medium.

Figure 13–8
Marie Leon, *Portrait of Henry and William James*, London, 1905
This is a rare (Pt/Pd) portrait of my great uncle, author Henry James, side by side with his brother, and my great grandfather, philosopher William James. It was created in Marie Leon's Regent Street studio in London in 1905.
(Courtesy of the Artist/Author)

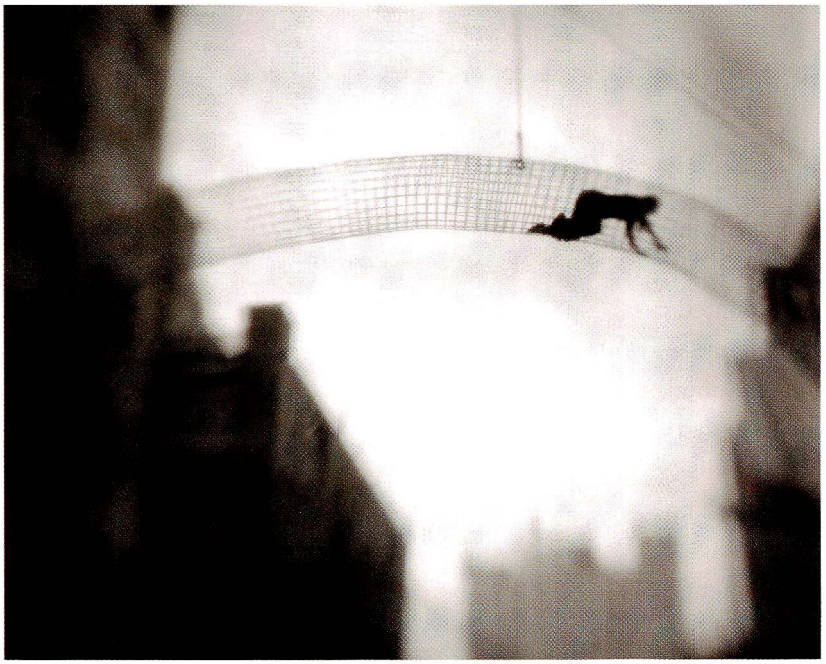


Figure 13–9
Bryan David Griffith, *Traverse*, 2010
Bryan David Griffith wrote, "*. . . couldn't resist the metaphor of a difficult, uncomfortable journey across a precarious void, destination unknown, held up by a thread of hope—the journey we have all made as artists. There is a bit of perspective illusion with the camera low and buildings a bit farther away than the playground my wife is crawling through. But she really is a couple stories up in a playground made by crazy artist metalworkers, and I owe her one for being a good, and brave, sport!*"
(Courtesy of the Artist)

HOW PLATINUM/PALLADIUM WORKS

This is how it works. Pt/Pd is based upon a working premise that platinum or palladium salts, in a combined solution with an iron (ferric) oxalate sensitizer, can be applied to a piece of paper, dried, placed in contact with a negative, and exposed to ultraviolet light until a whisper-like image is evident, causing a reduction of the ferric oxalate to a ferrous oxalate that then reacts with the Pt/Pd salts to create a pure Pt/Pd metal. Once the exposure has been completed, the newly formed ferrous salts can be solubilized by development utilizing a menu of developer options that you select for color and rendition personality. Development is almost instantaneous and is quickly followed by a series of diluted acidic clearing baths such as EDTA, hydrochloric acid, or citric acid that clear out any unexposed and undeveloped residual ferric salts that are still within the paper and image. The paper print is then washed in fresh water, and if this part is done well, the print will last as long as its paper support.

Get through this easily managed system and you will get images that are among the most stable in photography, have an extraordinarily long tonal scale and sensitivity to delicate values, allow for a wide range of tonal and color temperature choices, and can be made on an equally wide range of papers and vellums. In the eyes of many, it is the perfect alternative process.

Figure 13–10
Michael Kenna, *Huangshan Mountains, Study 21*, Anhui, China, 2009 (Pt)
Ever since seeing one of Michael's images in Chuck Rynd's Equivalents Gallery in Seattle, several decades ago, I have been a fan of his work. He is, in my opinion, a consummate artist and craftsman with very few peers when it comes to the scope and perfection of his craft.
(Courtesy of the Artist)

During the Exposure

Once you begin to expose your negative and Pt/Pd-sensitized paper to UV light, a reaction occurs that reduces the ferric salts in the formula to a ferrous state. The image at this point would be visible even if no platinum or palladium salt was present in the solution. This image, unlike those produced by many other iron-based processes, cannot be evaluated in a printing-out manner. Where you were seeking a "stage whisper" in the kallitype process, you will now be looking for a very faint "whisper" of your intended final print. This means that the image is simply undistinguished, a little more than latent, and a hint of what you are hoping for following the development stage. If you can see the image clearly prior to development, you have badly over-exposed your print and it will be necessary to think about an alternative way of developing it using distilled water or the rather difficult glycerin method.

Following exposure, the paper is developed in one of several developer options whereby it is instantly reduced to a metallic platinum, or palladium, to the degree that the negative density has permitted exposure. At first, the image you will see is ferrous iron-based but will convert to platinum or palladium metal in the developer. The developed print is then cleared in an EDTA bath sequence to remove any leftover iron salts, leaving an image made entirely of platinum or palladium. The print is then washed for permanence.

The Pt/Pd process has an extremely satisfying tonal range that many practitioners feel is significantly able to render values well beyond that of a traditional silver gelatin paper. It is also able to provide incredible depth and detail in the shadows. These very long tonal ranges, regardless of lengthy exposure times, are partially the result of an odd and beneficial exposure characteristic called "self-masking," a term that describes what happens during long exposures when light continues to expose highlights after the shadows have reached a degree of exposure that essentially transforms them into a blocking filter, slowing down additional exposure in the thinner (shadow) portions of the negative.

Figure 13–11
Nancy Marshall, *Deer Offering*, 1995
To make this image, Nancy used an 8" × 10" Deardorff and a Taylor Hobson Variable Softness portrait lens. For her work with the Deardorff, Nancy has also used a zone plate pinhole lens; a Conley portrait lens, which will cover 5" x 7" and thus vignettes; a Turner-Reich convertible lens; and a Schneider lens for a 4" x 5" in order to create circles.
(Courtesy of the Artist. Copyright 1995, 2007)

Similar in many ways to the kallitype, the Pt/Pd process is far more consistent and easier to work with. While not as simple or instantly satisfying as the Ziatype, it's very close. Platinum/palladium print color ranges from cool to warm and is controlled by a number of factors, including developer selection, developer temperature, chemical additions to the sensitizer formulas (such as gold chloride), and mixing the two different Part 3 Pt/Pd (or Ziatype's LiPd—lithium palladium chloride) sensitizers together. Palladium is warmer than platinum, but their respective tonal ranges are essentially identical. Both "noble" metal variations are as permanent as your attention to good technique, fresh chemistry, and the paper they are printed on permit.

Figure 13–12
David Michael Kennedy, *Rain Luna County*, 1989 (Pd)
David Michael Kennedy is well known for his extraordinary platinum/palladium work and documentation of the landscape and culture in the southwest. Anyone who has spenttime in this amazing landscape will recognize this moment. Justfor the record, this is my favorite landscape photograph of the Southwest.
(Courtesy of the Artist, David Michael Kennedy)

PLATINUM ANO PALLADIUM NECESSITIES

Platinum/Palladium Formula Ingredients

There are three primary ingredients that go into a standard platinum or palladium sensitizer. Each is kept in its own separate dark glass bottle, and the sensitizer is created on a print-by-print basis using an eyedropper count formula into a shot glass. A separate contrast-controlled Pt/Pd process, which has been meticulously tested and championed by Dick Arentz, is the Na2 contrast control version of the process that I will address a bit later in this chapter. Na2 (sodium chloroplatinate) is a contrast-control additive to the traditional Pt/Pd process and is used in place of ferric oxalate–potassium chlorate Part B as a contrast control without the lumpy grain that potassium chlorate causes when too much of it is used. For now, we'll go with the traditionally tested workflow. One quick thought, which will be repeated in the chapter: the platinum and palladium process is traditionally noted as "Pt/Pd," as the two are nearly identical in all respects with the exception of color and expense . . . platinum being cooler and more expensive. There is also a slight difference in the percentages of ferric oxalate and potassium chlorate in their respective formulas.

Platinum Sensitizer

Solution # 1	Part A: ferric oxalate
Solution # 2	Part B: ferric oxalate–potassium chlorate
Solution # 3	Part C: potassium chloroplatinite/ sodium tetrachloroplatinite (II)

Palladium Sensitizer

(Note: a different Part C)

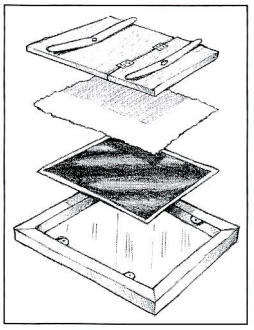
Solution # 1	Part A: ferric oxalate
Solution # 2	Part B: ferric oxalate–potassium chlorate
Solution # 3	Part C: sodium chloropalladite

Regardless of whether you are working with platinum or palladium, each of these three ingredients is added to a shot glass using an eye dropper. The specific drop count you select will dictate contrast, grain, mid-tone recognition, shadow density, and a host of other visual markers that will be analyzed by you during the work session. Along with exposure time, your drop count formula is critically important depending upon the changes you wish to make in the print. The solutions, when precisely combined, form a UV light–sensitive solution that is infinitely less sensi-

Figure 13–13
Tommy Matthews, *The Wrecking Light*, 2013
This deeply mysterious image by artist Tommy Matthews illustrates a platinum/palladium image generated from multiple digitally produced negatives and custom curve profiles.
(Courtesy of the Artist)

tive than the light from an enlarger. This means that you can work comfortably in a non safelight environment as long as UV light is not directly illuminating your workspace. I prefer festive chili pepper lights. When combined in the shot glass, the droplet mixture is then gently swirled together and deposited in the center of the paper (if you are coating with a brush) or along the edge of the image area if you are using a Puddle Pusher (a glass rod).

Once the sensitizer is on the paper it is necessary to execute your coating efficiently. You will be working with a very small amount of liquid, and it is imperative that you cover the image area with the sensitizer solution in the shot glass quickly, gently, and evenly using a brush or Puddle Pusher. Any unevenness in your coating will make itself evident in your final print. Once the paper is coated, it is allowed to sit for a minute, or two, to adjust to the shock of being coated (this is when I talk nicely to my paper) and is then cool air dried. The coated paper is then placed in contact with a negative in your hinged back contact printer and exposed to UV light.



Contact Printing Frame

As with the majority of alternative printing techniques, you will need a hinged-back contact-printing frame in order to create a tight bond with your negative and sensitized paper. These frames can be purchased from a variety of sources such as Bostick & Sullivan, private craftsman like Steve Keen who hand-make beautiful cherry contact printing frames for photographers involved in large-format or alternative processes, or eBay where old restorable ones are easily found. All of my personal frames except those I have from Steve have been from eBay, and one of those once belonged

to the Matthew Brady Studio. The purpose of the split hinged-back frame is to be able to check on the exposure while maintaining the registration with the negative should you need to add additional time.

UV Light

The summer sun is my favorite light to print in. However, a UV-light box printer is consistent and necessary for printing at night, during the winter, on overcast days, and in colder climates where sitting outdoors with your printing frame is simply unpleasant. The sun is by far the better option because it is free and surrounds the Pt/Pd experience with a nice romantic ambience. When printing with an open shade/direct sun split exposure strategy, working outside in the sun can be a very effective natural contrast control tool.

Figure 13–14
Karin Klint, *Self Portrait #2* (2011)
A surreal self-portrait by Swedish artist and MFA candidate in my graduate program at the College of Art and Design at Lesley University, Karin Klint. *(Courtesy of the Artist)*

Chemistry

It is critical that you purchase fresh platinum or palladium chemistry from a reputable supplier. Freshness is essential for Part A (ferric oxalate) and Part B (ferric oxalate-potassium chlorate), as both have a relatively short 6-month shelf life when mixed in wet solution. If you get the dry-pack, where you add the distilled water to the ferric oxalate A & B before you use it, shelf life is considerably longer. Without question, it makes a great deal of sense to purchase your A & B ferric oxalates from a chemical supplier who makes it for a living rather than making it by yourself at home. Purchased in a liquid solution, ferric oxalate Part A and ferric oxalate-potassium chlorate Part B will be past their prime in 6 months, even if refrigerated. The Pt/Pd Part C solution, the precious noble metal salts, will last for years in liquid form.

I recommend the purchase of the pre-mixed wet pack or dry pack kit where all you have to do is add distilled water and wait 24 hours before using it. A kit from Bostick & Sullivan will come with the developer (ammonium citrate), a clearing bath (EDTA), and the three A, B, and C solutions in amber bottles with eyedropper caps. Remember that plastic eyedroppers are preferable to glass because their opening is machine-made, making each drop, from any dropper, the same size. Glass eyedroppers are most often handmade, as is most glass labwares, and the drop size will not be as consistent.

The Negative

Entire books have been written about making the perfect negative for the creation of a perfect Pt/Pd negative, and I sincerely recommend getting one, such as Dick Arentz's *Platinum & Palladium Printing,* 2nd Edition or Dan Burkholder's *Making Digital Negatives for Contact Printing,* if you are looking for that kind of perfection. My personal approach to this part of the alternative process equation is to make a great looking negative that will give me what I am looking for in my final image, based on the processes I'm working with and my intentions for that image.

I love making a perfect film negative in-camera. Often, however, the film negative is too small for the impact I'm looking for, and that's when I take the

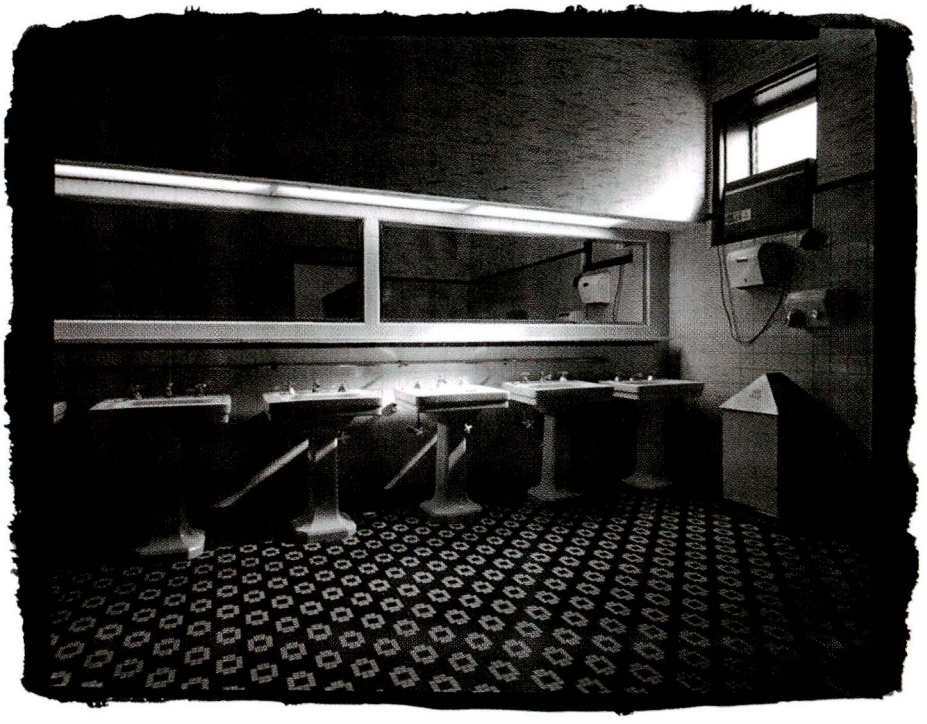


Figure 13–15
George Tice, *Men's Room, Hotel Shelburne, Atlantic* City, 1975
George made this platinum print as part of his extensive portfolio documenting his home state of New Jersey. One of the acknowledged masters of the platinum medium, George has demonstrated a lifelong commitment to photography and to teaching others the beauty of the platinum/palladium process and fine print making.
(Courtesy of the Artist, George Tice)

Figure 13–16
Christopher James, *Vatican Bride*, Rome, 1987 (Pt/Pd)
Vatican Bride is a Diana plastic-camera-generated image. The negative was translated, via direct duplication film SO-132 (sadly, no longer available) and printed in platinum.
(Courtesy of the Artist/Author)

negative to a scanner, put it into Photoshop, and forward it to an inkjet negative stage using the excellent ceramic-dust-coated Pictorico Ultra Premium OHP digital film. Again, there are excellent books dedicated to performing the negative stage with absolute perfection. Sometimes, however, perfect has nothing at all to do with expression and visual power . . . sometimes, perfect simply means predictable and redundant, and that doesn't interest me in the least.

From my perspective, there is plenty of room in alt pro for both the perfect and the less-than-perfect negative. I believe that you need to produce the contact negative that will best match your concept and intentions. This is often a negative that demands breaking the traditional rules of perfection to make the print you have in mind. I think of the negative in the same way I consider the ingredients in a recipe . . . they represent the potential of the meal to be cooked and presented to my guests. If I don't know what kind of meal I want to make, or what I want that meal to represent, then it will hardly matter how great the ingredients may be. The essence of this paragraph is to point you in the "right" direction for your perfect negative. Dick Arentz; Dan Burkholder; or my most excellent former student, xtine Burrough, have written the books to lead you safely in that quest. The alternative "right" direction is to encourage you to set yourself free and see what kind of mess you can make. This is, after all, mostly uncharted territory, and you might as well see what the potential of digital negative production might be. While you're at it, think about what the word "negative" means and how you might change its meaning.

You must have a contact negative that is the same size as your desired print. This is essential for printing due to the incredibly slow speed of the sensitized paper . . . a constant characteristic of all alternative processes. Negatives can be made in-camera on film with a traditional large-format camera or using Pictorico Ultra Premium OHP digital inkjet film in combination with a Photoshop-prepared digital file. Most often this is created with a scanned film negative or positive or a digitally made image. As of this writing, it is still possible to use an inter-negative process with an inter-positive multistage duplicating film, but seriously, what's the point when the film or digital negative options are so superior? Again, if you really want to be a rock star with

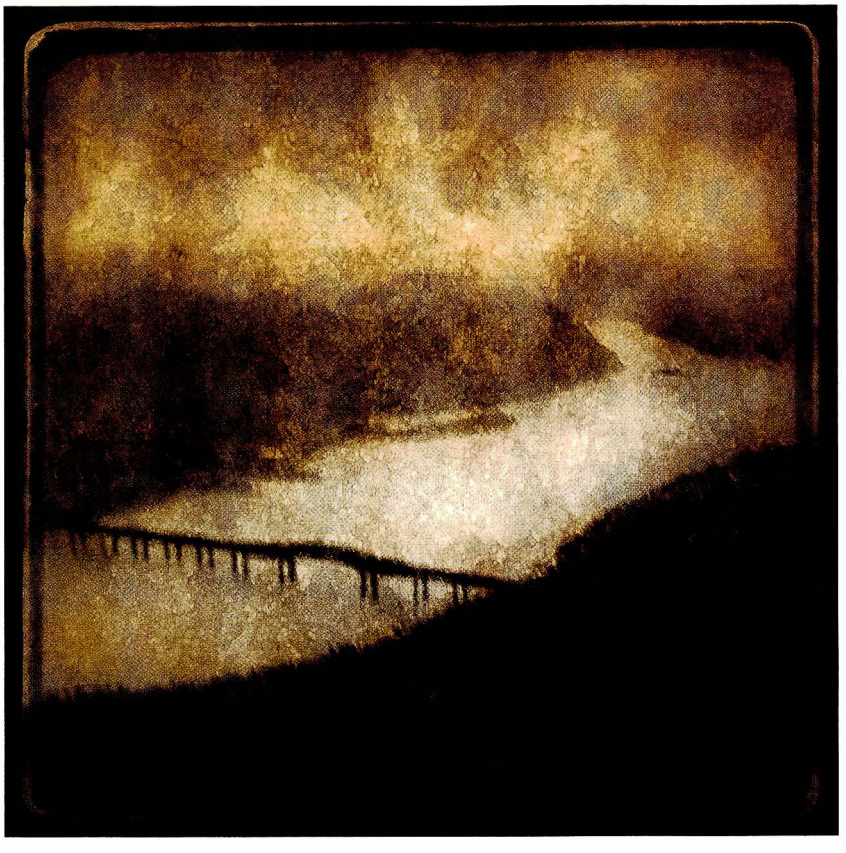


Figure 13–17
Dan Burkholder, *Newburgh–Beacon Bridge over Hudson River*, 2011 (Pt/Pd on vellum over gold and Pd leaf)
Dan Writes, *"In my most recent work, I combine 24k gold leaf with palladium leaf. Grinding these two precious metals into a powder, I'm able to selectively coat parts of the print to get seductive split tone effects.* Newburgh–Beacon Bridge over Hudson River *is a good example. Here I applied the powdered mixture of pure gold and palladium to the foreground water areas, leaving the rest of the print to be backed with pure gold. This locally applied combination of metals adds depth and dimension to the final print."*
(Courtesy of the Artist)

Figure 13–18
Dick Arentz, *Grand Canal, Venice*, 1996 (palladium)
Dick literally wrote the book on platinum/palladium printing and is one of the world's leading authorities on the technique . . . clearly evident in this superb example of the art.
(Courtesy of the Artist)

your negatives then you are going to have to dedicate yourself to the highly technical specifics found in highly detailed books like Dick Arentz's and Dan Burkholder's.

Ideally, the finest-quality negatives will be produced in-camera on film where you have total control of exposure and development. However, in recent years, the output from a great Epson printer and ink set (I'm using a 3880 for this edition) and the much-improved Pictorico Ultra Premium OHP digital inkjet films in combination with process-specific curves and ink profiles make that option very attractive. Generally speaking, if you can make a good silver gelatin print from your negative, the chances are excellent that this same negative will be inappropriate for Pt/Pd printing. It will be far too thin. Your negative should have an average negative density range between 1.5 and 2.0 and would, if you were printing in a conventional wet darkroom, be best suited for grade 0 silver gelatin paper. For more on this topic, please refer to the Negative and Digital Options chapters.

Papers and Sizing

There is an entire chapter dealing with the subject of paper and paper making that I recommend visiting for a lot more information on this theme.

The bottom line is that inexpensive, poorly made papers with mysterious ingredients, like buffering agents and brighteners, may frustrate you when working in almost any alternative process. There are exceptions to this, of course, and even newsprint might be successful as a substrate for a cyanotype or a Van Dyke, but it is best to always work with the best quality paper that you can afford. The paper must be free of impurities and have a surface that is compatible with your intentions. Ideally, it is 100% cotton rag stock, mold made or handmade, and internally or surface sized, with no optical brighteners, little to no buffering, and a pH between 5.5 and 7.5.

Often you will find a lovely handmade paper that simply will not hold up under the lengthy wet stages of the process, or will have ingredients accidentally blended

into it (for instance, metallic bits) that are incompatible with the Pt/Pd process. Occasionally, when you use a metal utility knife or paper cutter to trim the paper to size, metal shavings from the cutting instruments may get on the paper and confuse the process. For all alternative process techniques it is best to tear the paper by hand using a heavy ruler and ripping the paper stock to achieve the classical looking deckle edge.

I go into paper specifics in far greater detail in the Paper chapter, but for the moment I will recommend a list of papers I have had good experiences with in Pt/Pd. I will also briefly mention that you are most often going to be pleased with papers that are mold made, 100% cotton rag, and unbuffered . . . meaning they are slightly alkaline, which is great for archiving but not so great for Pt/Pd, which prefers a slightly acidic paper for the best results.

Acidifying Platinum/Palladium Paper

It is not uncommon for advanced Pt/Pd printers to slightly acidify different types of paper in order to prevent an acid–base (alkali) reaction that occurs when an acidic ferric oxalate comes into contact with a buffered alkaline paper. The first thing you will want to do is verify whether or not you have an alkaline paper, and this is easily accomplished by reading the manufacturer's production specifications or testing the paper with a pH testing pen, which is easily obtainable on many Internet chemistry sites. Don't assume that because the manufacturer states that the paper has a neutral pH that it does. A simple truck shipment through any metropolitan area in high heat and humidity can change that claim in a hurry. A simple method of acidifying your paper if it is alkaline, is to make a 2% citric acid solution and to soak your paper in it or brush coat

Figure 13–19
Luis González Palma, *Guardaespaldes #2*, 2009 (platino on Gampi paper)
The first time that I saw an image by Luis was a moment that has stayed with me for over 20 years. In 1992 I was walking through a cavernous exhibition space of Foto-Fest in Houston. On the floor below, an enormous photographic exhibition was opening to the public. In this maze of images, from a considerable distance on the floor above, the brilliant and piercing eyes of a young Mayan girl stopped me in mid stride. I had not been affected by a photographic image in that way since encountering Eugene Smith's image of Tomoko from Minamata at the Museum of Fine Arts in Boston. Luis is now a longtime friend and a visiting artist in my MFA program, and on the wall of my studio hangs a companion piece from this series, *Tu Mirada me distorsiona sin saberlo. Guardaespaldas. . .* a part of my everyday life. *(Courtesy of the Artist)*

it on your paper's surface. If soaking, allow 1 to 3 minutes, rinse for 10 minutes, and then allow the paper to dry overnight.

If you don't happen to have any citric acid or the more recent but untested favorite, oxalic acid, around the house, use straight household vinegar for 2 minutes, wash for 10 minutes, and hang to dry overnight before using. This vinegar pre-acidification (or de-calcification) works best with Fabriano and Cranes papers when you are using an ammonium citrate developer. In all acid bath situations, watch the surface of the paper during a soaking or brushing with an acidic solution. Surface sizing may begin to fall away from the paper, and this is not what you want.

Some Recommended Papers

Bergger Cot 320, Buxton by Ruscombe Mills (acidification is unnecessary with this paper), Arches Platine, Crane's Platinotype, Cranes Kid Finish AS8111 Stationary, Fabriano Artistico, Gampi, Kozo, Bienfang 360, and Revere Legion Platinum. Please refer to the extensive paper listing in the Paper chapter.

THE CHEMISTRY

There are essentially three areas of chemical focus in the Pt/Pd process: the sensitizer, the developer, and the clearing agents. For the purposes of walking you through the process we'll be working with the ingredients in the traditional Pt/Pd sensitizer, using ammonium citrate as a developer, and clearing with EDTA. Later we will get into an overview of the more contemporary Na2 contrast-control variation of this process using the drop count charts developed by Dick Arentz.

The A-B-C Sensitizer

- Part A: ferric oxalate
- Part B: ferric oxalate-potassium chlorate (contrast control)
- Part C: 20% potassium chloroplatinite (Pt) or palladium chloride (Pd)
- *Optional*: drops of 1% gold chloride solution

The primary differences between the platinum and palladium chemistry are the price of the *noble* metal and the color of the finished print. Palladium yields a print warmer in tone, while the platinum yields a cooler black and white image. The ferric oxalate solutions serve two functions. It is responsible for reaction to UV light, subsequent reduction, and contrast control. The specific percentage and drop-count combination of the ferric oxalate solutions will be slightly different depending on which Part C (platinum or palladium) you select and will proportionately change during the normal working session. The best thing about the prepared kits is that the proportions have been worked out for you with designated drop-count charts, and the ferric oxalates are fresh. Another benefit to buying a prepared kit is that you can also add an optional 1% gold chloride in solution, paper, bottles, and droppers at the same time.

The Developer

During exposure, the ferric oxalate in the sensitizer is converted to a ferrous oxalate state that influences the conversion of the platinum or palladium from a salt to a metallic state. Once the exposure has been completed, the newly formed ferrous salts can be solubilized by development with an assortment of different developer options that will be chosen for color and tonal rendition. These developers are basically salts of weak organic acids commonly found in nature and the foods we consume on a daily basis. These include citric acid, a principal ingredient of lemons and limes; oxalic acid, commonly found in cruciferous dark green leafy cabbages; acetic acid in vinegars; and tartaric acid found in wide assortment of fruits and vegetables that have a particular sour taste to them. For the most part, developers are easily created. For instance, if you take sodium carbonate (washing soda or soda ash), a sodium salt of carbonic acid, and add it to one of the acids just listed, it will result in a bubbling reaction that will stop when the acid is neutralized. If you take sodium carbonate's cousin, baking soda (sodium bicarbonate) and add it to citric acid you will get sodium citrate, a perfectly fine Pt/Pd developer. Development is always an instantaneous and exciting event in which

Figure 13–20
Catherine Harris, *Fresno*, 1986 (Pt/Pd)
This Pt/Pd image was made by Catherine when she was a student of mine at Harvard University. Catherine, if you see this, please get in touch with your address so that I can send you a copy of the new edition.
(Courtesy of the Artist)

platinum or palladium is removed from the ferrous oxalate sensitizer and precipitates those metals into the paper as pure platinum or palladium. This conversion begins during the exposure to UV light but requires the developer to complete the process.

The traditional developer for this Pt/Pd development is potassium oxalate, a toxic chemical soup, and a continued favorite among Pt/Pd printers due to its ability to yield extraordinary rich tonalities. This salt was a mainstay in photography for a long time and is now primarily used in medical testing to prevent blood samples from clotting. A variation of potassium oxalate is described as a bitter and poisonous acid salt found in oxalis and rhubarb and that is used to scour metal and remove ink stains. You get the picture . . . it's aggressive.

Other developer options include sodium acetate and ammonium citrate. As an aside, a combination of these two developers mixed 50%–50% is a perfect developer for deeply rich kallitypes with the added benefit of clear highlights. I recommend ammonium citrate (ammonium carbonate neutralized with citric acid) for workshops and home labs, as it is a lot more amiable than potassium oxalate. It's also safer for an environment with children around. Each developer provides a slightly different print color, and the one that you select should match the intentions that you have for the image. Ammonium citrate yields a cooler color, in both highlights and shadows, than potassium oxalate.

I personally have a preference for the potassium oxalate, due to its defined and densely rich shadow renditions. I also like the ability of potassium oxalate to reflect a color shift when the temperature of the developer is changed . . . a cooler print when processing with a cooler than ambient developer or a warmer print when the developer is heated. When heating, or cooling, keep the developer in its Nalgene or photo-chemical bottle and submerge it in a larger vessel with heated or cooled water. Keep your developer in a Nalgene wide-mouth chemical storage bottle for safety and for easy developer pours and stability. These are available at Bostick & Sullivan and chemical supply stores.

Like bakers with their favorite sourdough starters, all Pt/Pd printers keep the same base developer stock forever and refresh it with new developer when the volume drops as a result of paper absorption and evaporation. You may wish to remove the sludge that collects on the bottom of the developer container. If you find it necessary to decant the developer, simply pour it into a non metallic container, using a plastic

Figure 13–21
Laura Bennett, *Jivan at Nineteen*, 2005 (Pd)
Laura made this 8" × 10" palladium image of her oldest daughter, Jivan's, belly-button piercing . . . presumably to preserve the moment.
(Courtesy of the Artist)

funnel lined with a coffee filter. Remove the filter holding the sludge, and decant back into the original Nalgene bottle.

Never throw out your developer; it gets better with age. Although this is conventional wisdom, there is evidence that developers, like everything else, deteriorate with advanced age. You will know when your developer is not behaving well, as development takes longer and the richness you crave is impossible to achieve in the developed print. This is evident during the clearing bath cycle. Until then, keep recycling, decanting, and adding fresh developer to your stock bottle.

A SHORT LIST OF PLATINUM/PALLADIUM DEVELOPER AND FORMULAS

Potassium Oxalate Developer

Potassium oxalate is used in a 35% solution, and as mentioned earlier, its toxicity is not to be ignored. If you do decide to use potassium oxalate, due to its reddish-brown-black warmth and richness, I recommend that you work in a well-ventilated space and that you wear Nitrile gloves and keep the splashing to a minimum. Heating this developer will result in even warmer values in the shadow areas of your image. Here's the formula for making a full liter plus of the developer.

350 g	potassium oxalate powder
1000 ml	distilled water

Potassium Oxalate Extra Warm Tone Developer

This developer recipe, given to me on the back of a napkin in a diner, is a variation of the standard potassium oxalate developer but with added ingredients and instructions to make the resulting images extra warm in coloration. The trick here is to warm your developer to 120°F, or warmer, to realize the extra warmth. Be aware that with certain papers, the addition of the oxalic acid in this formula may be the cause of fogged highlights.

280 g	potassium oxalate
20 g	sodium phosphate dibasic
6 g	oxalic acid
800 ml	distilled water heated to 140°F
water to make 1 liter	

Ammonium Citrate Developer

This is a common, and relatively safe, developer and one that I use in classes and workshops. Ammonium citrate yields a cool-brown to ochre-brown tonality with palladium and a cool-black tonality with platinum.

You can make it warmer by heating it to about 100°F prior to developing. It is an excellent solution and can be purchased pre-mixed from Bostick & Sullivan. You can also buy the ammonium citrate powder and easily make it yourself. Here's the mix:

250 g ammonium citrate
1 liter distilled water

Sullivan's Cold Bath Developer

150 g potassium oxalate
75 mg potassium monobasic phosphate
distilled water to make 1 liter

Sodium Acetate Developer

Sodium acetate is the sodium salt of acetic acid. To make you feel better, it is also the primary flavoring in salt and vinegar potato snacks in your local convenience store. This developer will give you a cooler tonality than a developer like potassium oxalate, so if you enjoy a cooler black, this will satisfy you. Mix the sodium acetate into 750 ml of warm distilled water. Add 3 g of tartaric acid and stir. Finally, add warm distilled water to make a total volume of 1 liter. You can use this developer for kallitype, which also uses ferric oxalate as its light-sensitive "trigger."

75 g sodium acetate
750 ml warm distilled water
3 g tartaric acid
warm distilled water to make a working solution of 1 liter

This developer tends toward softer contrast than does the ammonium citrate. Used as a kallitype developer, you can develop by inspection. With Pt/Pd, development is instantaneous. Replenish the developer as needed.

Sodium Citrate Developer

This is another acidic developer that delivers a cooler value to your Pt/Pd prints. This mix may be a little slower than the potassium oxalate or ammonium citrate developer, but that will generally result in faster clearing in the three EDTA clearing baths.

300 g sodium citrate
1 liter distilled water

Figure 13–22
Beth Moon, *Last Comes the Raven*, 2007
Beth Moon's *Last Comes the Raven*, a 22" x 26" print from her series *Thy Kingdom Come* focuses on totem-like beliefs and practices connecting man to animal. Beth writes, "*In a twilight world, united under a banner of ritual, we see evidence of devotion where all things are connected.*"
(Courtesy of the Artist)

THE CLEARING BATHS

The traditional Pt/Pd clearing bath was a dilute solution of hydrochloric acid. A gentler alternative is citric acid. The most common clearing bath is tetrasodium EDTA (ethylenediaminetetra acetic acid tetrasodium salt), a preservative often found in commercially processed foods such as yogurt. Tetrasodium EDTA is significantly less hazardous than hydrochloric acid, whose fumes are unpleasant. Hydrochloric acid also makes the fibers in the paper too brittle. This clearing stage is critical because it is absolutely vital to remove the unconverted ferric salts from the finished print. The EDTA clearing formula is not compulsively exact and should be set up in three separate and consecutive 5-minute baths.

A Two-Stage EDTA Clearing Setup

There are two types of EDTA. The one that is now most common is *tetrasodium* EDTA, which has an alkaline pH of 9. This high pH can lead to the retention of iron(III) and yellow staining in the highlights. As a remedy for this problem, prepare a first tray with *disodium* EDTA, which is slightly acidic and has a pH of 4–5. It is also more expensive, but since we're printing in platinum and palladium, it hardly seems like a reason to not use it.

- **TRAY #1:** 30 g disodium EDTA into 1 liter of water
- **TRAY #2:** 30 g tetrasodium EDTA into 1 liter of water
- **TRAY #3:** 30 g tetrasodium EDTA into 1 liter of water

Formula for EDTA Clearing Bath: Kitchen Blend

1 heaping tablespoon of tetrasodium EDTA (30 g)
water to make 1 liter
sodium sulphite (25 g) (for a post EDTA bath if highlights are yellow)

Old School 1% Hydrochloric Acid Platinum Clearing Bath

Add 15 ml of 37% hydrochloric acid to
1 liter of distilled water.

Simple Citric Acid Clearing Bath

20 g	citric acid
1000 ml	distilled water

Hypo Clearing Agent (Sodium Sulphite) Clearing Bath

Another emergency option is Kodak Hypo Clearing Agent. I know of one Pt/Pd printer who clears his prints by giving them a short freshwater rinse and then immersing them in a standard hypo-clearing bath (sodium sulphite and water) for 5 minutes.

30 g	EDTA
25 g	sodium sulphite
1 liter	distilled water

Figure 13–23
Sam Wang, *Seated Figure*, 2005
This is an excellent example of Sam Wang's multi-process technique combining palladium and cyanotype. Sam writes, "*. . . color separated into 2 negatives and printed with palladium and cyanotype. The warmth of the palladium plus the coolness of the cyanotype leaves a subdued range of colors that I particularly like. Variations in paper, palladium developer, and everything else influence the results more so than many other processes.*"
(Courtesy of the Artist)

Convenience Store Emergency Clearing Bath

In an out-of-clearing-bath emergency, you can go to the convenience store and buy 7 Up® soda or make a very dilute solution of Lime Away® tile cleaner . . . which is used to remove calcium deposits in hard water areas.

THE SENSITIZER FORMULA

I will again recommend that you purchase the pre-measured, wet or dry pack, fresh chemical kits that are available from commercial suppliers. This allows you to spend more time making prints rather than rambling around in your lab weighing and compulsively mixing chemicals with gloves on your hands and a respirator on your face. It isn't that difficult, but it's nice to count on the consistency of chemical quality that is guaranteed by ordering pre-measured kits from a single reputable supplier such as Bostick & Sullivan, Artcraft, or Photographers Formulary. However, if measuring makes you happy, here is the traditional formula for platinum and palladium.

Platinum/Palladium Part A (*Ferric Oxalate . . . This is Your "Light Trigger"*)

55 ml distilled water at 120°F
16 g ferric oxalate
1 g oxalic acid (optional)

Platinum/Palladium Part B (*Ferric Oxalate and Potassium Chlorate . . . This is Your Contrast Control*)

55 ml distilled water at 120°F
16 g ferric oxalate
0.3 g potassium chlorate (for platinum)
(or . . . 0.6 g potassium chlorate for palladium) *
1 g oxalic acid (*optional but helpful for the blacks*)

A short time ago, I was having a conversation with a friend who was recommending using ferric ammonium oxalate (the same chemical as in the Ziatype process) in place of the traditional Pt/Pd ferric oxalate. This strategy resulted in a warmer image with a softer contrast, but it required a longer than normal Pt/Pd exposure time. Recent work with this idea has resulted in delicate coffee-and-cream-like tonalities throughout the entire print.

I consulted with my friend, Mike Ware, who responded to this notion by expressing the thought that there was a risk of ferric potassium oxalate crystallizing out of the sensitizer if you simply substituted the ammonium salt. This was the primary reason for the "all-ammonium" formula in the Ware-Malde version of the platinotype. Keep this idea in mind if you feel like experimenting someday.

Another formula modification that you might wish to explore is Willis's addition of lead oxalate to the formula. Willis's mix is 0.44 g of lead oxalate to each 60 ml of A and B sensitizer. Platinum images with this formula are cooler, show more contrast, have crisper edge definition, and are richer in tonality. Be careful with lead oxalate if you decide to experiment; it's toxic.

Platinum Part C

50 ml distilled water at 100°F
10 g potassium chloroplatinite

The following are two different recipes for palladium print Part C mixes.

Palladium Part C—Option # 1

51 ml distilled water at 100°F
9 g sodium chloropalladite

Palladium Part C—Option # 2

50 ml distilled water at 100° F
5 g palladium chloride
3.5 g table salt (sodium chloride)

Mix all of the individual solutions, Parts A, B, and C, and put them in dark-brown glass bottles with eye-dropper screw tops. Label each bottle with the date the formula was mixed, or received, from the supplier. This is important because Part A and Part B have a short shelf life, while Part C can go forever. Label each bottle with the letters A, B, and C, and let them sit for at least 12 hours. The platinum solution is supersaturated at room temperature, so it will deposit crystals on cooling. Parts A and B have a shelf life of 4–6 months. Part C is good, as I said, forever. Store your A-B-C mixed chemistry in a dark and cool place to extend the shelf life.

Note: I have heard practitioners recommend the refrigerator as a fine place for the storage of Pt/Pd chemistry, but I advise against it, especially if there are children in your home. Aside from the obvious lethal danger of ferric oxalate, this chemical may also form into insoluble chunks in the refrigerator. If you are going to refrigerate your chemistry, go buy a small dorm room–size unit and keep it in your lab. If you have children, put a lock on the unit. You can also get lockable chemical storage safes that look like dorm refrigerator units but that are specifically made for the storage of acids, alkalis, and other chemist-specific ingredients like ether, 190 proof alcohol, and bromides.

** Please note that the amount of potassium chlorate changes in the Part B mix depending on whether you are making a platinum or palladium image.*

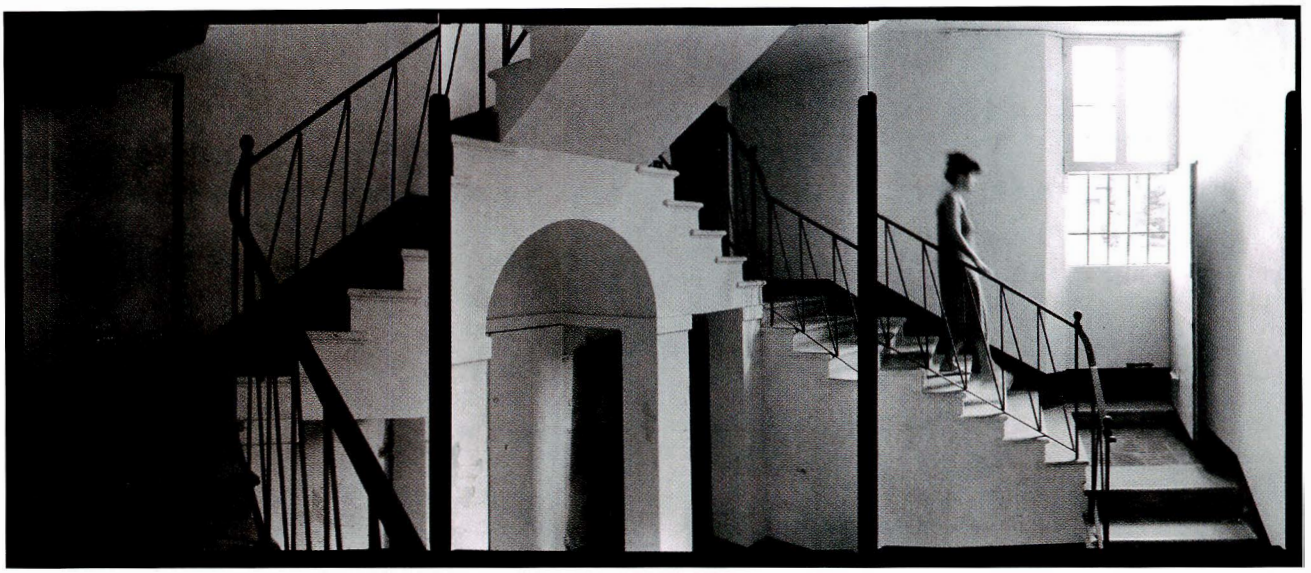


Figure 13–24
David Strasburger, *Ferrara*, 2004 (Pt/Pd)
David writes, *"This image of my friend Chiara was made in Ferrara, Italy. She is the city's archeologist, and anybody who does any serious digging has to ask her for permission. Once the city was tearing up a downtown intersection to put up new traffic signals when the backhoes unearthed a practically intact wooden ship. When she told this story the part that got to me was the location—what's a ship doing there? Chiara was totally matter-of-fact: in the Middle Ages, the river Po ran through Ferrara, not around it. We took Chiara and her husband to Fenway Park to see the Red Sox, and Chiara fell in love with Johnny Damon. She wouldn't let anyone else use the binoculars for the whole game."*
(Courtesy of the Artist)

PLATINUM/PALLADIUM DROP CHART

The emulsion formulas in the following Pt/Pd drop chart are dependent on the density and contrast of the contact negative you actually have in your hands . . . not the way you want your print to turn out. This is an important distinction because the majority of previously published drop charts were formatted to achieve the contrast of the print you desire and hope to finish with. They assumed that your negative was always appropriate and perfect for the process, which is seldom the case unless you are using custom curve profiles, producing digital negatives for contact printing, and are dedicated to negative perfection (a lovely oxymoron). It has been my experience that the reading of the negative is more relevant than wishful thinking about what kind of print you would like. By setting up the drop chart for the negative in-hand I am allowing for flexibility in the learning process. I assume that not everyone who wants to print platinum or palladium has the ability to fine-tune each negative for perfection. In addition, most people do not have a densitometer sitting around the house.

In the drop chart, please notice how the proportions of Part A and Part B change to deal with the contrast of the resulting print. Also note the total number of drops of Part A and Part B to the drop count of Part C and how the ratio of A-B to C is constant in all formulas. Be mindful that the greater the drop count concentration of Part B (ferric oxalate–potassium chlorate) in the formula, the more contrast and grain your print will demonstrate. Part B is the primary control of the contrast in your final print; *the more Part B in the formula, the more contrast and granularity in the print.*

Nearly every text I've read uses a drop chart formula based on the print desired. I suspect that the proportional recommendations in the following chart originated with Paul Anderson, who was the accepted authority on non silver and special processes in the early part of the twentieth century. The concept goes back to Pizzighelli and Hübl. To my knowledge, only Nancy Rexroth, in her great pamphlet, *The Platinotype 1977*, constructed her chart as the following one was constructed . . . based upon the type of negative that the artist will be working with.

Figure 13–25
David Michael Kennedy, *Debbie Harry*, 1985
David Michael Kennedy is arguably one of the best platinum palladium printers in the world and the creator of many of my favorite images. He writes about this image of Debbie Harry, *"So Debbie was photographed by the Hudson River down by the piers in October of 1985. What can I say—a beautiful girl, a Hasselblad camera and Tri-x film made into a palladium print. What could be better?"*
(Courtesy of the Artist, David Michael Kennedy)

5% Gold Chloride Add to the Formula

You can elect to add 1 or 2 drops of 5% gold chloride to your formulas. This change will slightly elevate the contrast and will have a modest blue/cool effect on the color of the final print. As well, after you fall in love with this process, you may wish to experiment with sensitizing formulas that incorporate both Pt/Pd salts as in the Na2 contrast control that I'll explain a bit later. A good way to begin thinking about this is to learn the Ziatype process that comes later in the book, in which these drop-specific additive changes are a normal part of the process.

	4 × 5	5 × 7	8 × 10
Extremely Soft Negatives:			
A	0 drops	0 drops	0 drops
B	5 drops	11 drops	22 drops
C	6 drops	12 drops	24 drops
Soft Negatives:			
A	1 drop	4 drops	8 drops
B	4 drops	7 drops	14 drops
C	6 drops	12 drops	24 drops
Average Negatives:			
A	3 drops	7 drops	14 drops
B	2 drops	4 drops	8 drops
C	6 drops	12 drops	24 drops
Contrasty Negatives:			
A	4 drops	9 drops	18 drops
B	1 drop	2 drops	4 drops
C	6 drops	12 drops	24 drops
Very Contrasty Negatives:			
A	5 drops	11 drops	22 drops
B	0 drops	0 drops	0 drops
C	6 drops	12 drops	24 drops

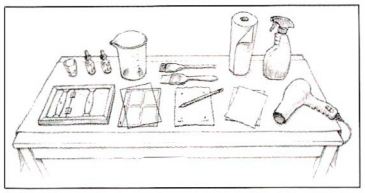


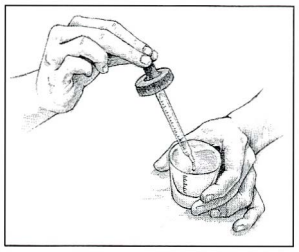
TABLE SETUP FOR PLATINUM/PALLADIUM

- Three dark, glass bottles w/prepared platinum or palladium chemistry A-B-C
- A—ferric oxalate (*label and date*)
- B—ferric oxalate and potassium chlorate (*label and date*)
- C—palladium or platinum solution (*label and date*)
- Three screw cap eye droppers for A, B, and C
- Pt/Pd drop chart (*see text*)
- Clean paper or a sheet of ¼" Lucite for the coating surface
- Paper for sensitizing: COT 320, Crane's Platinotype, and Arches Platine are good
- A heavy duty shot glass (*not the tourist type with a lobster picture*)
- A new Richeson synthetic brush (*www.jerrysartarama.com for best price*)
- Clean distilled water in a beaker for brush washing (*change it often*)
- Pencil for writing details of that print
- Hairdryer
- Contact printing frame
- Negatives for contact printing
- Paper towels
- A Sharpie for labeling where your chemistry is placed in front of you

Figure 13–26

Molly Rapp, *Untitled*, 2010/2011 (Pt/Pd on vellum)

Molly wrote, "*I'll never forget the date I shot it, which was December 30th 2010. The process was an experience as well, because I did this while attending your workshop which I believe was in June 2011. I wanted to print this triptych on vellum to translate the fragility of the subject matter. It spoke of the vulnerability of the time. Platinum palladium gave such tonality that satisfied the complexities of the relationship between my mother and I.*" *(Courtesy of the Artist, Molly Rapp)*



PREPARING AND COATING SENSITIZER

Prepare an area in your lab with subdued light, and be sure that it is absolutely clean and dry. It's not necessary to be under safelight . . . just avoid direct UV rays. Prepare yourself for some moderately compulsive behavior.

Set up a coating area and have a good quality shot glass (for swirling the drops of Parts A, B, and C together) with a short and heavy barrel. This type of shot glass is important for several reasons. First, the short barrel prevents you from leaving too much of your expensive sensitizer solution behind when you dump it on the paper for coating. Secondly, a "real" shot glass, one designed for someone at a real bar, has a heavy base and will not, as a result, fall over easily. Also, you will need a pencil for marking the area of the paper that these drops will have to cover, writing your formula, and writing your printing information.

Richeson Series 9010 Brush

For coating you will need a brush or a "Puddle Pusher." In the last few years I have become quite fond of using a Series 9010 Richeson 1.5" synthetic brush and have been converted from the more romantic hake brush and its propensity to leave little hake hairs in the sensitizer. I also love how much less sensitizer I need, how smooth the coatings are, and how I can wash the brush and use it in a variety of techniques without worrying about contamination. These are amazingly well made and expensive but can be found on the web sites of Internet art suppliers, like http://www.jerrysartarama.com, at great discount from a brick and mortar art store.

Hake Brush

For decades I've been recommending the use of a Pt-/Pd-specific hake brush without a metal ferrule in the interest of process purity. I've since given up and moved to the superior coating ability of Richeson, but just in case you need to go "old school" here is a little info. The hake brush is a hand-stitched brush with a graceful wooden handle and continuous ferrule (the part of a brush that is usually metallic and that holds the brush bristles in place). This brush is one that you will reserve just for a single technique to cut down the risk of contamination. It should be labeled accordingly and not be used for any other process.

Figure 13–27
Pradip Malde, *Rachel–Gloaming*, Sea Island, GA, 2010
This very personal platinum/palladium print, on 100% cellulose vellum, was created by Pradip Malde, from the original negative. Pradip writes, *"As a part of the photographic moment, heavy in all its stillness, this gaze becomes even more perplexing and multifarious. It is simultaneously vital and engaging, static and unresponsive, transparent and silent. It is of the moment but, as the photograph is looked at, becomes timeless. The gaze becomes ancient in its ability to persist. The person in the photograph is both fully present and fully absent, as is the viewer."*
(Courtesy of the Artist)

Puddle Pusher

An alternative to the brush, especially if you feel brush impaired, is a glass-coating rod with an attached handle called a Puddle Pusher. The essence of the Puddle Pusher is to use the smooth surface of the glass, with applied pressure, to create an even application of sensitizer on the paper without disturbing the delicate surface of the paper. I'll have more on this technique in a few paragraphs.

You also need paper towels and two beakers of clean distilled water . . . one for wetting your brush

prior to coating and the other for cleaning it afterward. You may also want a hairdryer set on a cool setting if you are not in a completely arid environment. You will also need a way to time your exposure.

Finally, you will need your labeled A, B, and C formulas in their individual brown bottles with droppers and a decent quality paper to coat upon. When you are making up your sensitizer always remember to replace the top on the bottle before it spills. It is a time-honored laboratory fact that little bottles filled with precious, or dangerous, chemistry will always fall over if you forget to put the top back on. Of course you will never mean to knock it over, so just always get in the habit of replacing the cap.

Write Down the Information You Need

The first thing you will do with your paper is take your pencil and write everything you will need to know when you evaluate the print at the end of the process. I set up my information in a line at the bottom front of the sheet of paper I'm going to coat with this menu of information:

> The process > the paper > weather and approximate humidity > sun or sun and cloud emoticon > the date > time of day > the drop count > sun and shade exposure times as a contrast control tool > where you are > your mood because P/Pd, like wet plate collodion, knows when you're grumpy

Mark the Negative Area

The next thing I will do is lay my negative on the sheet of paper and place it where I want the image to be. I then go to just outside the edges of the negative and place a small L-shaped bracket at each corner. This shows me the area that I will be coating and where the middle of the coating/image area will be. This is where I will be depositing my sensitizer from the shot glass. It also assures me that I won't be wasting any sensitizing formula.

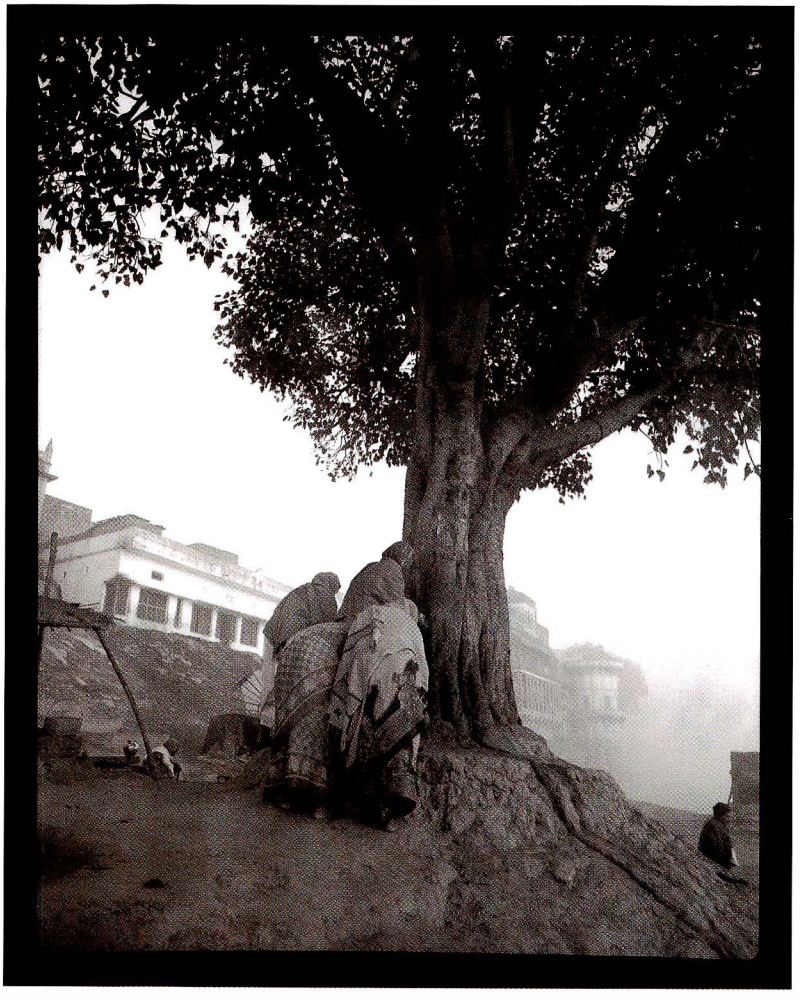


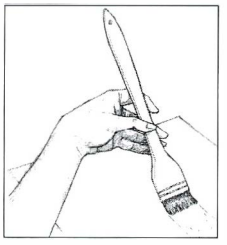
Figure 13–28
Christopher James, *Sacred Tree on the Ganges*, Benares, India, 1985
This is an image I made early one morning on the Ganges River at Assi Ghat, in Benares (Varanasi) . . . just down the road from the room that I was staying in.
(Courtesy of the Artist/Author)

Drop Count the Sensitizer

Under low ambient light, look at your formula and proceed to add the appropriate number of drops of Part A (ferric oxalate) to your shot glass. Return the bottle to its safe location and replace the top. Next, if your formula calls for it because you need some contrast, take the Part B bottle and dropper and add the drops of B (ferric oxalate–potassium chlorate) to the shot glass. This is the component in the sensitizer formula that will function as your primary contrast control. It will, however, also give you a grainy image, depending on the number of drops you require. Replace this top as well.

To complete the sensitizer formula, take the bottle of Part C and add drops from C to the shot glass containing Parts A and B. Part C is your precious noble metal salt...either platinum or palladium. You will notice that it may appear that you do not have enough solution to coat the negative area of your paper. Don't worry; with a little practice, you will discover that the amount is quite adequate. In the beginning, if you find that this is not the case, simply work with a drop count that is proportionately greater. Coating is especially complicated in arid and high-altitude environments. I tell my students to use the 5 × 7 formula drop count for 4 × 5 negatives when they are first learning how to coat during my workshops in Santa Fe in the summer.

Dampen your brush in the distilled water and blot it dry with a paper towel. Avoid using a white paper towel for an extended period of time because of the bleach used in manufacturing to make the towels white. Do not shake out your brush with a sassy snap of your wrist, as that action will almost always result in random spray on someone's print or flesh. The wetting and blotting in distilled water steps are done to prevent the brush from completely absorbing the emulsion, to add a little moisture to the paper, and to give you a decent chance of applying a smooth coating with your very small quantity of sensitizer solution. Be careful that your brush is not too damp because that is an even bigger problem. You will know if the brush was too wet because you will see dull streaks in the print where the water diluted the sensitizer and the tonal values will be pasty and flat. A little practice with a yellow watercolor paint and your chosen coating brush will show you the way.



Coating the Paper

Swirl the A-B-C solution around in the shot glass and do one of two things. Your first option is to pour the shot glass solution into the center of the marked-out print area and begin by lightly brushing over the entire area with complete horizontal coverage, followed immediately with complete vertical coverage of your negative area. Try hard not to greatly exceed your print area, as that simply wastes sensitizer. You'll get nice deeply rich black borders but often at the expense of the image.

Quickly repeat this sequence until your coating is smooth and free of obvious brush strokes in the image area. Keep your strokes light and airy and avoid pressure, as that friction will simply disrupt the fibrous paper surface once it is damp with sensitizer. Do not be concerned if your brush strokes exceed the dimensions of your negative area. Those roughly painted edges are the "signature" look of the hand-coated print. In addition, do not fuss over any hairs from the hake brush that might fall out of your brush during the coating. These hairs can be easily removed during or after the drying stage with a flick of your fingernail. Do not remove them with the pads of your fingers because those fingertips contain oil. Again, be sure to be light on the pressure, fast, and delicate with your brushing technique.

Coating with a Puddle Pusher

If you are not a fan of the hand-made brush strokes on the outside of the picture area, your other coating tool option is to use a Puddle Pusher. A Puddle Pusher is essentially a small-diameter glass rod with a fused handle that enables you to get a good grip and apply pressure to a sensitizer solution as it's being applied without harming the surface of the paper. Here's how you use it.

Obtain a nice heavy piece of ¼" plate glass or thick Lucite that will be larger than the biggest sheet of

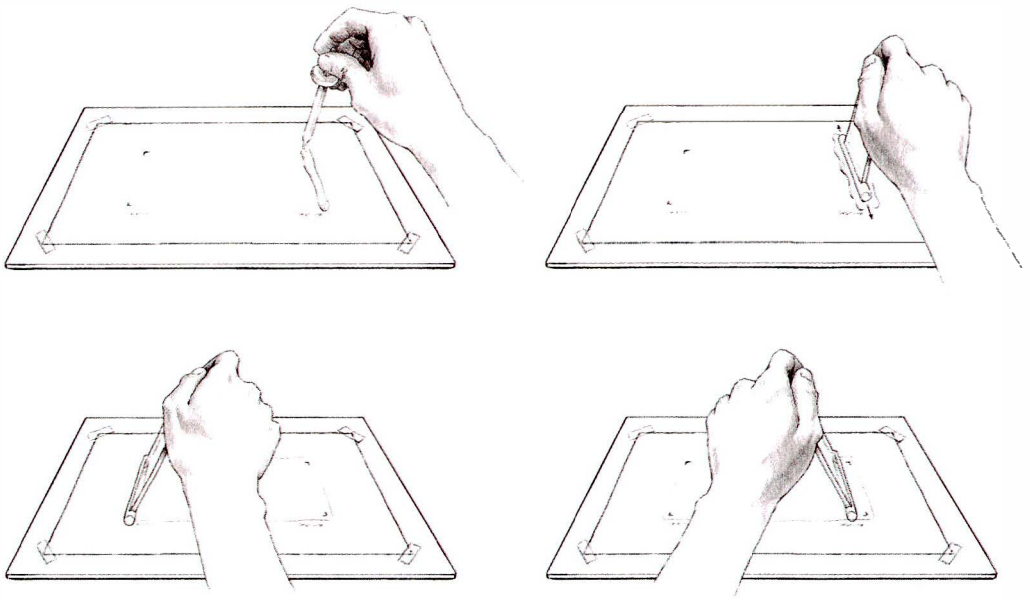


Figure 13–29
Joe Boyle, Illustration of a Puddle Pusher in Use
For those who prefer a nice clean edge on their prints, a Puddle Pusher or glass rod application of the sensitizer usually fills the requirement.
(Courtesy of Joe Boyle)

paper you think you will make a print on in the near future. Remember that your sensitized paper will have to fit in your contact frame, so be logical about your aspirations. The reason for the glass or Lucite is that you will always have a perfectly flat and clean surface to work on, and it is a very simple matter to wipe down the glass or Lucite between coating applications. My most serious students have their own personal sheet of white Lucite for coating, examining, and carrying their wet prints around between stages. It's a very inexpensive and sound investment, and it will never break like a sheet of glass. It's also great protection for a laptop in your bag.

Take the paper that is to be sensitized and tape it down on the surface of the glass or Lucite. Write all of your pertinent information on the paper, mark out the dimensions of your negative and where you want it to be, and prepare your sensitizer. If you want really clean lines, you can use painter's tape, which will not lift the paper fibers when you remove it. You can also use a gentle adhesive rubylith film, essentially a red adhesive safelight in film form, to prevent anything outside the sensitized area from being exposed.

Now, take your glass rod, or Puddle Pusher, and press it to the paper just outside of the area that you will be coating. Then, pour the sensitizer, which you have deposited into a sturdy shot glass, along the top edge of the picture area you will be coating. You can also use a syringe like a turkey baster and apply the sensitizer in a nice clean line in the same location. Consult the Pt/Pd or Ziatype drop charts for an idea of how much sensitizer you'll need for the negative size you have. Keep in mind the humidity in the air and that you'll be using less sensitizer with this method. Arid climates will require more sensitizer than humid ones.

Keeping the glass rod pressed against the paper, adjacent to the puddle of sensitizer, quickly slide and wiggle the glass rod lengthwise from side to side in the solution until it is evenly distributed, via the liquid tension of the sensitizer and capillary action (this is a lab term for describing how liquid molecules like to stick together), along the Puddle Pusher's surface edge. Now, slightly raise the rod and lift it over the sensitizer and replace it along the back edge of the solution. Press down with significant force and smoothly push-drag the solution across the paper until your coating area is covered. At the end of the stroke, outside of your image area, lift the Puddle Pusher and place it behind the remaining sensitizer and repeat the same push-drag coating action. Think of it as if you were applying

plaster to a wall, keeping your coating as smooth as possible.

Repeat this single stroke in the opposite direction until the sensitizer volume is reduced to zero. If you have too much sensitizer on the paper, pick up some of the excess with a brush and make a swatch of sensitizer that could accommodate a test strip, like a Stouffer Strip tonal scale. Next time, use less sensitizer until you get it right. Using the glass rod, or Puddle Pusher, is the best way to avoid roughing up and disturbing the smoothness of your paper's fibers. This technique also presses the sensitizer deep into the paper, which enhances the quality of your final print. The possible down side is that you don't get to see the romantic brush strokes that actually please a lot of Pt/Pd printers.

Once your sensitizer is on the paper, let it sit quietly in the paper for 2 to 4 minutes in subdued light. I like to put it in a drying drawer and say positive things to it as I put it away for a few minutes. After the waiting period, where the sensitizer is sinking into the paper and becoming acclimated to the karma of the moment, you can take the time to clean everything that you've been working with as well as the glass in your contact-printing frame. Take your hairdryer, put it on a cool setting, and gently blow-dry the backside of the paper. If you are working in a space without excellent ventilation, wearing a dust mask is a sane idea since some ferric oxalate in the formula will become airborne during the blow-drying. The best thing for the paper, and you, is to allow the paper to dry naturally. It will not take very long, as there is very little sensitizer in the paper.

STAINLESS STEEL COATING RODS

One additional type of coating tool that I've been fooling around with is a stainless steel coating rod made by R.D. Specialties in Webster, New York. The coating rods are 3/8" stainless steel tightly wound with a thin wire that holds the solution. The recommended coating #44 comes in 8", 10", 12", and 14" lengths with 2" unwound on either end for holding. They are beautifully made and come with a tube protector. Check out R.D. Specialties info in the Resources section of this book.

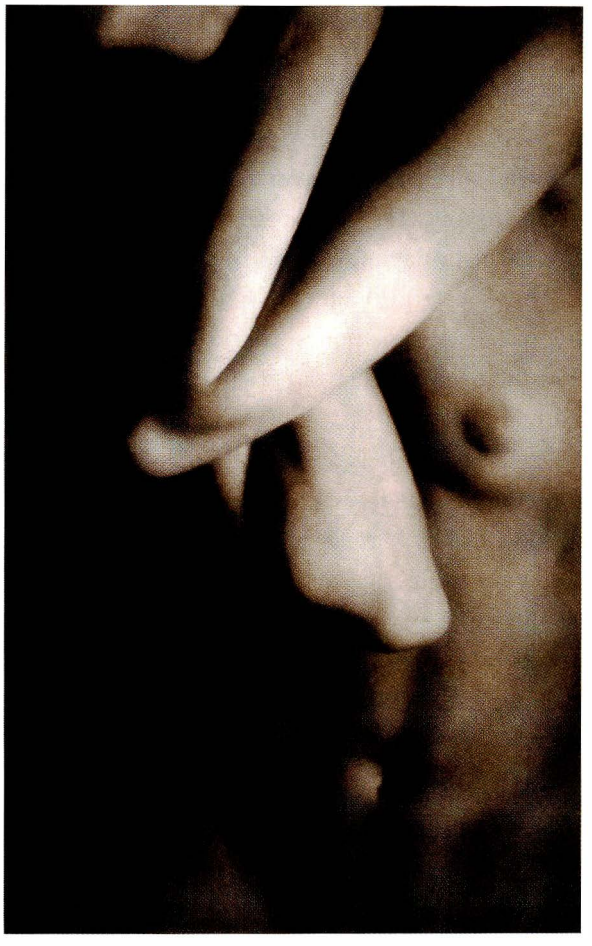
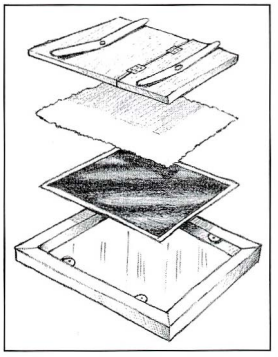


Figure 13–30
Laura Dietz, Cambridge, Massachusetts, 1987 (palladium)
Laura made this elegant palladium image while a student of mine at Harvard. She made the original with infrared film and then translated that image to ortho film processed with a continuous tone developer for her contact negative.
(Courtesy of the Artist)



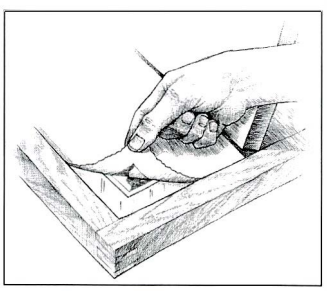
EXPOSURE

Exposing the Platinum Palladium Image

When your paper is "bone" dry and has a snap to it when you flex it . . . you will hear the sound clearly once you know what to listen for . . . take your negative and

place it on the dry sensitized paper so that the final print will be "right-reading." Put the negative and the coated paper into a hinged-back contact printing frame so that you can monitor the exposure and get ready to go sit in the sun . . . or less romantically, beside your UV exposure unit. It's best to work with this process during the peak daylight hours in the middle of the day . . . between 10:00 a.m. and 3:00 p.m. Exposures outside of those prime hours will be longer. However, that low light can also be your friend when it comes to embedding more contrast. Longer shade or low luminosity exposures, followed by a quick hit of mechanical UV unit for the shadows, can give you a lot of non-chemical flexibility in regard to Pt/Pd printing.

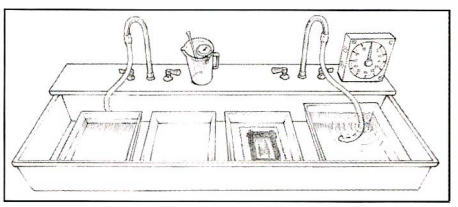
If you are using a UV unit, do not look at the light source during the exposure (it is like a high-intensity tanning booth) and turn the unit off before checking on the exposure. Printing times will be dependent on the negative's contrast, density, and the formula you are using. A high-contrast sensitizer mix may require as much as a 50% increase in exposure. A higher contrast formula will result in more grain in your final print. Try your best to control your contrast via your negative and sun/shade printing times rather than A-B-C formula and exposure time.



Looking for the Whisper

Expose your paper until you see a "whisper" of detail in the print. This process does not have the same personality in its printing-out stage as many other iron-based processes. This is why keeping track of your progress with notations on the paper is so important. With an average negative, in summer sun, your exposure will run in the 3- to 7-minute range if you are working between 10:00 a.m. and 3:00 p.m. At high altitudes, in places like Santa Fe or Aspen, the exposure will be shorter than it will be at sea level. If you use a UV-exposure unit figure on an exposure time that will be a bit longer than summer sun. This is all relative, of course, and it has a great deal to do with your negative, formula, and many other small considerations. You might want to print a Stouffer film gradation value scale to see what levels of tonalities you will be getting with the formula and exposure time you've selected. Write all of your information down and take the print through to completion . . . then make adjustments and do it again. Within a print or two you will be pretty close and you will not have driven yourself crazy with formulas, charts, and graphs.

Exposure analysis is more dependent on experience and watching the subtle changes that occur during the UV-printing experience. In other processes, it is often possible to look at the exterior brush stroke application and see the color shift that will indicate how close you are getting to completion. In Pt/Pd, you can see the outside coating area change, but it doesn't always look the same, unlike a process like cyanotype that goes from greenish yellow to light blue to silver. In Pt/Pd it often looks irregular, sometimes bronzed, sometimes brown, and usually not quite ready for development. When checking on it in the frame, you can see shadow details, but highlights are invisible. If you saw them it would mean that your final print would be severely over-exposed. This is why you keep copious notes while working with a single negative and making your changes with formula drop counts and exposure times.



SINK SETUP FOR PT/PD

Tray 1 **Labeled "For Pt/Pd Only."** A very clean, and always dry, development tray and a wide mouth bottle of prepared developer nearby. Developer is generally chosen based upon your color choice . . . ammonium citrate, potassium oxalate, sodium citrate, etc.

Tray 2 Distilled water tray (*agitate for 1 minute*)

Tray 3 Disodium EDTA clearing bath

Tray 4 Tetrasodium EDTA clearing bath

Tray 5 Tetrasodium EDTA clearing bath

Tray 6 Final wash in clean running water for 20–30 minutes.

PROCESSING THE PLATINUM/PALLADIUM PRINT

Development

After the exposure, take your closed contact frame into the sink area. You can work easily in normal ambient room light at this point . . . just not direct sunlight. Have a very clean, and very dry, tray waiting for you that is only used for developing platinum and palladium prints. I want to emphasize the importance of an exclusive tray for development, because chemicals from other photographic procedures may be present no matter how well you wash your trays, especially in a communal lab.

Take the exposed paper from your contact printing frame and place it face up in the bottom of the absolutely dry Pt/Pd tray. Notice the pale whisper of the image. If you can see the image clearly, as in a POP printing-out process, then you may want to forget about the chemical development and use distilled water to bring out the image instead. If you opt for this technique, instead of starting over with the correct negative or exposure,

Figure 13–31

Vaughn Hutchins, *Oak Pine Rock*, 2005–06

This image is a fine example of why Vaughn is so well respected and regarded for his elegant craftsmanship in both Pt/Pd and carbon. *(Courtesy of the Artist)*

bring up the image in the distilled water, remove it, add some developer to the water bath to slightly bring up the blacks, and then go on with the process as you would have if everything had been done correctly. My best advice is to toss the badly exposed print and start over . . . or use your badly exposed print as a base for a gum bichromate or cyanotype.

If your pre-developed image looks correct with just a hint of the image to come, with speed and grace, pour the developer on the entire surface of the print. Any hesitation, or partial coverage as you pour your developer, may result in uneven development. This unevenness will show itself as a distinct linear flaw in the image. For development, I prefer using a wide mouth Nalgene bottle that I also use for developer storage. Development is nearly instantaneous. You may leave the paper in the developer for up to 2 minutes if you want, but it really isn't necessary. Examine the print and you will notice that its highlights are yellow. This is normal, and this yellow will clear after the three 5-minute clearing bath stages.

Never throw your developer away. Always pour it back into its storage bottle and save it for the next printing session. It gets better with age.

First Wash and Clearing Baths

The purpose of the clearing baths is the removal of residual iron salts. Historically, this has been done with an acidic bath like a 1% solution of a 37% hydrochloric acid. However, because of the chelating* properties of EDTA, and the EDTA and sulphite options, they are effective in their alkaline state.

I like to put the developed print into a bath of distilled water for a minute before going into the clearing bath sequence. This provides me with an opportunity to evaluate whether I want to bother going through the 15 minutes of clearing and the 20–30 minutes of final wash. It also gives me an idea of what I will change in the subsequent formula that I'll be making while my print clears. Also, this distilled water bath gets a good deal of the excess developer and residual ferrous salts out of my print and helps to keep my clearing baths fresher longer. I normally change the clearing baths between 8–10 prints.

Preparing Three Trays with the EDTA Clearing Bath

Tray 1 30 g disodium EDTA into 1 liter of water

Tray 2 30 g tetrasodium EDTA into 1 liter of water

Tray 3 30 g tetrasodium EDTA into 1 liter of water

In the past this clearing step was done with an acidic 0.5% to 1% hydrochloric acid dilution. This is a little strong for our needs, so we will be using an alkaline EDTA clearing formula that I justified in the previous paragraphs. This is a kitchen-casual clearing bath formula and is quickly made and near goof-proof. As I wrote several paragraphs back, the common method of using EDTA is to prepare 3 separate baths of disodium

Figure 13–32
Richard Jurus, *Don't Touch Baby* (Pt-Pd)
Richard's *Don't Touch Baby* belongs to a series of diptychs created to reveal nuances of daily life with a weimaraner. As many friends attest, weimaraners quickly become your best friend and make an indelible mark on the lives of those who live with them. The images were made using an iPhone and negatives manipulated via Photoshop and Pictorico OHP Inkjet film and then contact printed using traditional palladium printing methods.
(Courtesy of the Artist)

* A chemist who wishes to control metals in solution, through the coordinate bonding of an organic compound with the metal in question, will use a chelating agent to take the metal element out of play. EDTA is a common hexadentate (six coordinating atoms) chelating agent.

and tetrasodium EDTA by mixing 1 generous tablespoon—about 30 grams—of EDTA to a liter of water. Occasionally, if yellowing is persistent in the highlights or you are processing palladium with potassium oxalate, you can use one of the EDTA and sodium sulphite options.

EDTA Mix Option When Using Potassium Oxalate Developer

When printing with palladium salts, versus platinum, and using EDTA as your clearing bath, you will occasionally experience an irritating inability to get perfectly clear highlights. My own experience with this has shown the problem is more often seen when using an old and favorite developer. The solution is to make an EDTA and sodium sulphite mix.

30 g EDTA tetrasodium
25 g sodium sulphite
1000 ml distilled water

Sodium Sulphite Option #2

If highlights are still showing signs of yellowing after the third and final EDTA bath, try this solution. **Mix** a 4% solution of sodium sulphite (4 g of sodium sulphite to each 100 ml of water). **To use**, rinse the print following the last EDTA bath for 2 minutes in running water and then immerse it in the sodium sulphite solution for 5 minutes. Follow this with a 20-minute running water wash and a short soak in distilled water before hanging it up to dry.

Normal EDTA Clearing Workflow

In the normal EDTA tray setup, prepare three separate trays of EDTA, but make the first tray a disodium EDTA. Disodium EDTA is a little more acidic than tetrasodium EDTA and may be a cure for the yellow that sometimes presents itself when the print has completed the clearing process. If not, go to the EDTA sodium sulphite options presented earlier. Fortunately, the EDTA clearing bath formula is very flexible, and anything close to the 30 g per liter recipe will be satisfactory.

Place the print into clearing bath Tray 1 (disodium EDTA) for 5 minutes and periodically rock it gently. During this first 5-minute clearing time, pour your developer back into its storage bottle or holding beaker. NEVER THROW YOUR DEVELOPER AWAY! Also, because you have the time, wash and thoroughly dry your development tray so that it is ready for the next print or the next person in line for development.

Refreshing the Clearing Baths

After 5 minutes, place the print in clearing bath Tray 2 (tetrasodium EDTA) for another 5-minute soak. You should begin to see highlight and shadow definition clearly at this stage, and the yellow tint in the highlights should be nearly gone. After another 5 minutes, place the print in the final clearing bath Tray 3 for an additional 5 minutes. Change your clearing baths often . . . about every 8–10 prints.

Final Wash

After the clearing bath sequence, wash the print for 20–30 minutes in fresh running water, followed by a 1–2 minute soak in fresh distilled water, and hang it on a line to dry. As with any alternative process, screen drying is just asking for trouble because other people in the lab may not have the same compulsive lab habits regarding cleanliness that you do. If you intend to make another print from the same negative it would be a good idea to force dry the first print so that you can adequately evaluate what you did. Dry down on Pt/Pd is significant, and trying to evaluate the formula you used, without this dry-down step, will be difficult without some experience.

NA2: CONTRAST CONTROL METHOD FOR PALLADIUM

The Na2 Method

Another modification that is well worth looking into, and one that is fast becoming the favored method of contrast control for palladium printers (it is not effective for platinum printing) who have taken the time to investigate it, is a method of contrast control with sodium hexachloroplatinate(IV) . . . often referred to as the *magic bullet*. The groundwork of Na2 was done by Dr. Howard Effner (über-chemist in Santa Fe), Dick Sullivan of Bostick & Sullivan and Dick Arentz,

Figure 13–33
Dick Arentz, *Hinton, WV*, 1989
In the late 1980s Dick won an Issac Bernheim Fellowship and began a 3-year project documenting living and working in the mid-southern states and Appalachia. He was focused, like scholars such as J.B. Jackson and John Stilgoe, on the human impact and influences upon the landscape and environment. *(Courtesy of the Artist)*

who has been its champion for a long time and who authored the best book on the technique, *Platinum & Palladium Printing*: 2nd Edition.

Na2 is indeed an interesting tool to have in your alternative process toolbox. It works on the theory that by substituting drops of one of the several different pre-mixed percentage solutions of sodium chloroplatinate (Na2) in place of Part B ferric oxalate–potassium chlorate, the traditional contrast control, the process, and the fine-tuning of the contrast, is greatly improved.

I had to make a decision at the onset of this chapter as to how deeply I wanted to go into this rather complex and formula-heavy technique, and I decided to provide you with enough information to get to work with the technique and then, if you wanted an advanced conversation, to send you to Dick Arentz's excellent book, where you will find an overabundance of charts, graphs, equations, formulas, citations, and everything else you could possibly hope for . . . all focused on this method of being the master of contrast in your platinum palladium printing. As an aside, the best way to handle your contrast is to begin with the correct contact negative. Since that seemingly simple task eludes most of us, this Na2 contrast control option is a wonderful option for your work.

One of the primary advantages of employing Na2 (sodium chloroplatinate) in place of the traditional Part B ferric oxalate–potassium chlorate solution is that the blacks are rendered especially deep and velvety in appearance. This is the result of the platinum preventing the palladium from solarizing (turning a metallic/electric-looking bronze) in overexposed areas of the print.

Another huge plus is that there is not a trace of grain in the print, other than that provided by the negative . . . the chief gripe of all who control contrast with the traditional Part B formula. When teaching Pt/Pd printing I urge my students to avoid Part B whenever possible due to the reticulation it brings to the image. One more thing, according to Dana Sullivan: contrast in a Pt/Pd print can be extended well beyond what

could be achieved with the traditional "contrasty" Part B by substituting more drops of sodium chloroplatinate solution for drops of palladium solution C.

Other advantages . . . the Na2 has a significantly longer shelf life than the traditional ferric oxalate–potassium chlorate, which generally becomes "iffy" after 6 months in a liquid solution. The actual brown sepia of the palladium print stays true throughout the process, and the tonal scale is far smoother across the dilutions.

I've also noticed that the "whisper" that I look for in the traditional Pt/Pd method doesn't work the same way with Na2. The pre-development exposure is more like a kallitype's "stage whisper," and even, in some cases, is as dense as a printing-out process. Don't be alarmed by the depth of the exposure.

Dick Arentz writes in his book that a disadvantage is that exact percentage concentrations are necessary to achieve predictable results due to the potency of the Na2, and that this necessary perfection is difficult to achieve.

That said, I am overwhelmingly impressed with the scope of Dick's investigation and work with Na2 and doubt that I can improve upon it in any way. Therefore, I am going to give you his brief summary of how it works, the contents of the Na2 kit that is sold by Bostick & Sullivan, and Dick's drop-count chart so you can get to work and see if you like the technique.

The reduction/oxidation of palladium salts and the ferric oxalate parts of the Pt/Pd formula are the same regardless of the oxidizer employed in the process. Dick writes, "*Sodium Chloroplatinate (Na2PtCl6), when used with the palladium salt (Na2PtCl4), has the effect of consuming the ferrous oxalate, which normally would reduce the palladium salt to metallic palladium. The net result is a disproportional slowing of the process of reduction, more at the highlights than the shadow areas of an image. This decreases the exposure scale of the paper, increasing its contrast.*"

Na2 Shopping List

The following ingredients are available from Bostick & Sullivan and Photographer's Formulary. You can order the Na2 kit from Bostick & Sullivan and build your own

Figure 13–34
Dick Arentz, *Lager, WV*, 1989 (Pt/Pd Na2)
Dick Arentz has long been a champion of the Na2 palladium technique and has authored the best book on the process, *Platinum & Palladium Printing:* 2nd Edition. Na2 is an interesting tool to have in your alternative pro toolbox, working on the theory that substituting drops of different percentage solutions of sodium chloroplatinate (Na2) in place of traditional Pt/Pd contrast control Part B ferric oxalate–potassium chlorate will greatly improve the fine-tuning of the contrast and finished look of the print.
(Courtesy of the Artist)

Standard Negative Contrast Ranges for Palladium: The Na2 (Sodium Chloroplatinate) Serial Method (for a 4" × 5" negative)

Mixture	Negative Contrast	Solution	Drops
No. 1s*	**Very Contrasty (1.85)**	A	6
	Palladium	Pd	6
	Na2 (Sodium Chloroplatinate)	2.5%	1
No. 2s	**Very Contrasty (1.75)**	A	6
	Palladium	Pd	6
	Na2	5%	1
No. 3s	**Contrasty (1.60)**	A	6
	Palladium	Pd	6
	Na2	10%	1
No. 4s	**High Medium (1.50)**	A	6
	Palladium	Pd	6
	Na2	5%	3
No. 5s	**Medium (1.40)**	A	6
	Palladium	Pd	6
	Na2	20%	1
No. 6s	**Low Medium (1.30)**	A	6
	Palladium	Pd	6
	Na2	10%	3
No. 7s	**Thin (1.20)**	A	6
	Palladium	Pd	6
	Na2	20%	2

Standard Contrast Ranges for Na2 (Sodium Chloroplatinate) Method adapted from Dick Arentz 2011

configuration. The standard Na2 kit, about $170.00 at the time of this writing, includes

- 10 ml of 20% sodium chloroplatinate (Na2) for contrast control
- 25 ml of palladium in liquid form—Part C
- 50 ml each Part A ferric oxalate
- Plastic eyedroppers

Because the 12-drop system is traditionally used in Pt/Pd printing, that format has been the standard. Each supplement of Na2 is *in addition* to the 12 drops of standard coating for a 4" × 5" size negative, which includes 6 drops of ferric oxalate Part A and 6 drops of palladium salt Part C. Note that ferric oxalate Part A, as in the standard method, contains *no chlorate*. Na2 concentrations of 2.5%, 5%, 10%, and 20 % are used. The 5% and 10% concentrations are doubled in some cases to 2 drops per 12 to reach intermediate contrast ranges. For the greatest contrast, the 20% concentration is doubled or tripled to 2 or 3 drops per 12 of coating.

TROUBLESHOOTING & OTHER STUFF TO CONSIDER

Only Change One Thing at a Time

If you are running into problems, it is prudent to alter only one factor at a time. If you change both the exposure and the sensitizer formula simultaneously you will be hard pressed to figure out which change made the difference. Later, when you are more proficient with the process, you can make multiple minor corrections with more confidence. As a rule, when giving a demonstration in a class or a workshop with a brand new negative, I explain to everyone that I'll probably have it nailed down by the 3rd attempt, and that is after working in the process for over 30 years. Be patient. . . . With apologies to the Broadway show *Annie,* "The sun'll come out tomorrow . . . bet your bottom dollar . . . that tomorrow . . . . there'll be sun!"

Coating & Humidity

It's a good idea to print coated paper soon after it is dry or near dry. The hygroscopic nature of paper means that it will always collect moisture from the air, and this may occasionally result in foggy tonal values in your print. A little humidity is fine, so don't get too compulsive about it. Cold and dry weather can also have a less-than-pleasing effect on your printing. In the winter, humidify your workspace to about 50% to 60% humidity. Light Impressions sells an inexpensive hygrometer to measure the relative humidity level in your workspace (see Resources). In addition, if your image looks great in the developer but looks weak following the washing and clearing baths, there may have been too much humidity in the lab. Try to coat and dry within a 10-minute time period . . . including the 2 minutes you let your print meditate after the coating step.

* May need one drop of 3% hydrogen peroxide to prevent fogging

Figure 13–35
Craig Stevens, *Alabama Trees #1*, 1984
Craig Stevens is my oldest friend and colleague, and I owe him a lot. It was Craig who, in 1984, in a small and insufferably hot garage in Fontvielle, France, introduced me to the chemistry and beauty of platinum/palladium . . . thanks Craig.
(Courtesy of the Artist)

Sometimes Humidity Is a Good Thing

On occasion, especially when working with potassium oxalate developer, humidity in the paper during exposure may result in a significant increase in D-max (maximum density).

Tween 20

Tween 20 is a non ionic surfactant that assists your sensitizer in finding a secure and deep "home" in the fibers of your paper. Some papers don't require it, while others benefit greatly. Tween 20 also helps to minimize the leaching of colloidal metal during processing. You'll know if you should use it as an additive (a single drop of 20% concentrate to a 5" × 7" size sensitizer mix) if you see staining or if the image seems to wash off quickly in the clearing baths.

Open Shade Exposure for Contrast

A longer printing time, in open shade, out of direct sunlight, will increase your contrast in a non chemical way. This is my favorite method of printing most alt pro work. One of the best demonstrations I ever gave was at the Maine Photographic Workshops, where my exposure time, in a dense fog, was nearly 45 minutes.

Flat and Anemic-Looking Prints

This is a pretty constant lament, and there are quite a few things to consider when seeking a remedy. The most common problem is that the negative was

too flat, soft, and unexposed for the process, and in an effort to see anything in the print, the exposure was shortened. Even a great contrast control like Na2 will not save a bad negative. Re-scan and work the negative in Photoshop, and print out on Pictorico Ultra Premium OHP. Or re-shoot the negative if you can.

Other causes of anemic prints include outdated ferric oxalate, which prevents a complete reduction of the Pt/Pd salts (see the Testing Ferric Oxalate section).

Other reasons to investigate feeble prints include working on a cheap paper without sizing, not having enough sensitizer to coat your image area, and underexposure. I also see the problem of too much moisture in the coating brush in first time alt pro workshops. Additional, and unwanted, moisture in the brush simply dilutes the sensitizer.

Testing Ferric Oxalate

Ferric oxalate doesn't last forever . . . especially when it's in solution. In a dry state it is good for 25–30 years. Once mixed with distilled water, however, it has a shelf life of less than 6 months. Here's a simple test to see if it has turned on you. Make up a normal sensitizer formula and coat your paper. Once the paper is dry, just develop and clear it in the normal fashion and hang it up to dry. If you see any coloration in the paper you can attribute this tone to one, or all, of the following: your coating area is too bright with UV light, your clearing bath is exhausted or improperly mixed, or your ferric oxalate is too old.

To see if it is the ferric oxalate, add 1 to 2 drops of drugstore-grade 3% hydrogen peroxide to ferric oxalate Part A and run the test again. Do not use hair salon strength 33% hydrogen peroxide. **DO NOT PUT THE CAP BACK ON THE BOTTLE** to which you added any hydrogen peroxide because a gas will build and you do not want the bottle to explode. If, at the end of the second test, you see a yellow tint, then it is either the ferric oxalate or ineffective clearing baths. If the tint is more grayish, then your coating area is too bright. Always date your chemistry as it is mixed to see when it is too old to be effective. Have a dry pack of ferric oxalate Part A in the lab for emergency use . . . it is not expensive.

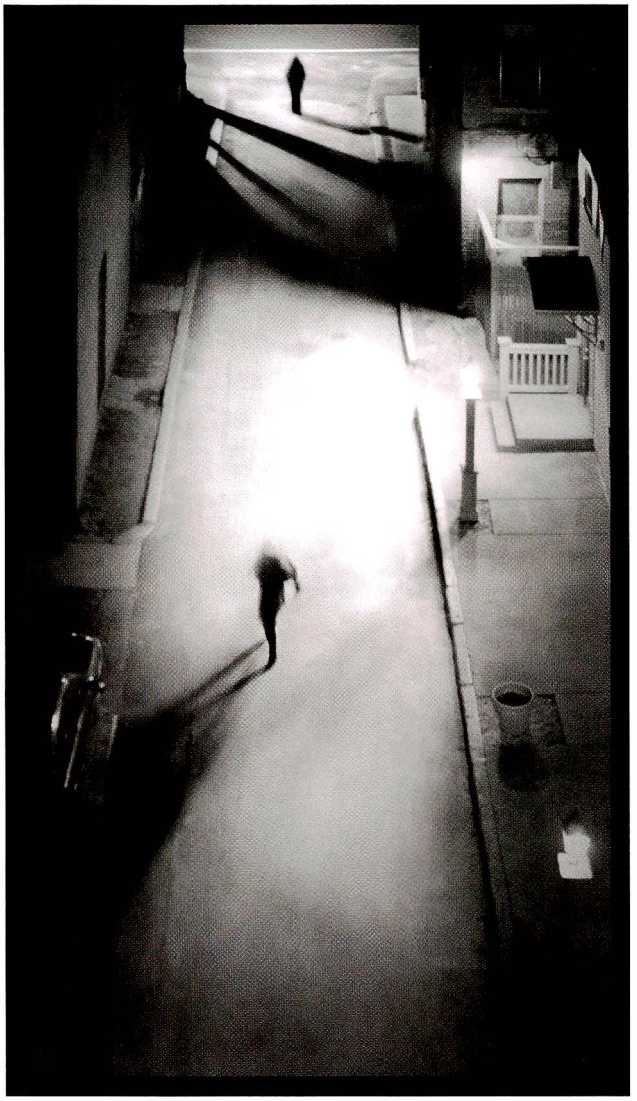


Figure 13–36
Tommy Matthews, *Prey*, 2012
Another beautiful Pt/Pd print generated from a Pictoico OHP digital inkjet film negative, from my friend and former MFA student, Tommy Matthews. *(Courtesy of the Artist)*

Warm & Cold Developers

Cold developer is appropriate whenever you have over-exposed your print. Cold developer will give more contrast to your image than a warm developer, and it will render a slightly cooler tonality. Warm developer is appropriate whenever you have under-exposed your image. It was not unusual, according to Pizzighelli and Hübl's writing, to place an under-exposed print into boiling developer to make up for an inadequate exposure time. A warm developer will give a slightly warmer image. A warm developer may also help with any staining problems you may be having. Heat to around

100°F. If using a warm potassium oxalate developer, remember to clear with an EDTA and sodium sulphite clearing bath.

Your Print Looks Sand-Blasted and Grainy

If your original negative has a lot of grain, so will your print. Many times, grain that surprises you is due to using too much ferric oxalate–potassium chlorate Part B as your primary contrast control. To fix this problem, make a better negative, using a Pictorico Ultra Premium OHP digital film, or start controlling your contrast with Na2.

Other grainy problems are caused by working in a lab that is too cold to be comfortable in and working with cold chemistry.

Over brushing is another cause of a rough look in your print, as the paper fibers begin to get damaged once they are wet. If your paper is buffered, meaning too alkaline, that situation can be a cause of grain. Also, working with a formula with too much ferric oxalate in proportion to the noble metal can cause similar-looking issues.

Too Much Exposure

If you radically over-expose your print, you can develop it in distilled water. You may also add a little developer to this water bath at the end of the wash-development to "punch" it up a bit. There is a technique, covered in several historical texts, concerning localized brush development with glycerin. If you're interested in glycerin development, there is a good description of the technique in Nancy Rexroth's *The Platinotype* (1977). I don't practice this technique and so will pass on incorporating it into this text.

Black Spots

The first question I ask when I see black spots is "how was the paper cut?" Little metallic bits from metal rulers and matt knives rubbing against one another during paper cutting are common, and they cause black spots. Also, in this same category, using a lever arm paper cutter where the lever rubs up against a metal guide can cause similar issues. Always hand-tear with a ruler to avoid this problem.

Old natural hairbrushes are a cause of black spots due to contaminants that do not wash out. Change to a nice synthetic Richeson brush to avoid this problem. The last things to look for are holes in your negative that may be printing out black.

Metal Bits and Old Hair Dryers

As hairdryers get older they begin to break down. Often you can see the sparks. Sparks mean metal, and you do not want little metal shards shooting onto your newly sensitized paper. This causes little black spots. If you are going to use a hairdryer, blow only on the back of the paper and only on a cool setting.

Bronzing

You may, from time to time, see an effect that is referred to as "bronzing," especially with palladium. This is an almost solarized metallic look in the darker values of your print and is often the result of either dampness in the paper or an inappropriate negative density for the process, resulting in your exposure being far too lengthy. The biggest reason for bronzing is that you have not coated your sensitizer well and it is puddling up on the paper and drying too thickly.

During the exposure this puddle area bronzes, and if it is in an area of the negative that is thin, and the exposure is too long, then the problem leaps out at you. It looks cool before development, so don't get too fond of it. This bronzing occurs in many alt pro techniques and can be rectified, to a degree, by toning and/or changing the sensitizer formula. You can also up the humidity in the lab. In kallitype, toning will often take care of the problem. In palladium, 1–3 drops of platinum Part C will often fix the problem. One last fix you might want to try is cutting back on Part B (ferric oxalate–potassium chlorate) contrast control. If you can eliminate Part B altogether, all of the time, that would be good. Bronzing is sometimes confused with solarization, an electric look caused by too low humidity in the working environment, UV-light exposure outside of the contact frame before development (I've only seen this once), or poor coating.

Fluorescent Light Fog

Try not to let your sensitized coated paper sit out under fluorescent light because this type of light does indeed emit a degree of UV and may contribute to fogging.

Fogging Fix with Hydrogen Peroxide

If you are experiencing fogging in your image and have tried everything you can think of, including exchanging all of your old ferric oxalates for fresh ones and changing papers, you might want to give 3% hydrogen peroxide a try. When mixing up your sensitizer, add a single drop of 3% hydrogen peroxide to every ml of sensitizer in your shot glass. This action slightly narrows the exposure scale and makes the image a bit brighter.

Fogging & Drying Temperature

Another cause of "fogging" is that you may have dried your sensitized paper at too hot a temperature. Try to print in a manner that permits you to let your paper dry on its own or, at the very least, to sit quietly for at least 2 minutes in subdued light after you coat it. I like to lay a freshly sensitized paper down in a clean drawer in the lab and let it dry peacefully after saying some kind words to it. When it's time to finish the drying stage, be sure that the hairdryer is set on a cool setting and dry from the back of the print in an effort to pull the sensitizer into the paper's fibers.

Grey Highlights

If you have foggy grey highlights in your print, here are some of the reasons: ferric oxalate contamination, you have residual iron salts that haven't cleared well (this happens in group printing sessions a lot), the paper was fogged by strong light before exposure, the ferric oxalate is old and it's time to replace it (use wet mix within 6 months), your negative was too thin, your exposure was too long, the sensitizer formula you selected was an incorrect analysis of what your negative required, the clearing bath is worn out, there was moisture in the paper, your hairdryer setting was too hot, cold and dry weather dominated your lab space, or . . . bad karma.

Yellow Stains

Yellow stains are most often chemistry related. If you have a yellow-stained print it is the result of an active pH flux (the pH is too high) due to the formation of insoluble iron oxide complex. The stains might be there because your ferric oxalate is no longer good (see the test for ferric oxalate in this section), you forgot the clearing bath, your clearing bath is exhausted, your clearing bath is not the right one for the paper you are using, or your developer has become too alkaline . . . possibly due to the papers you are using containing alkaline buffering agents. A small amount of citric acid can slightly adjust the developer back to an acidic state. Another reason would be that you are using EDTA that is used up or that you didn't use a first EDTA bath with disodium EDTA. There are a lot of other reasons . . . but karma has very little to do with yellow stains in Pt/Pd printing.

Saving & Decanting Developer

Never throw your developer away. You can filter it with a coffee filter when it gets too "sludgy," and you can add fresh developer to it at any time to keep the container full and prevent evaporation. It is good lab practice to refresh your developer at the conclusion of each lab session. Think of this in the same manner that you would think of sourdough starter for sourdough bread. Some developers last for decades and simply get better with time. From personal experience, if you teach alt processes, never take your prized developer, the one you've been using for a decade, to a demo for common use. Inevitably, someone will try to be helpful and pour it down a drain to help clean up. I still shed tears.

Emergency Part C Palladium Replacement

If you are all of a sudden out of Part C palladium . . . you can always replace it with some lithium chloropalladite from a Ziatype kit. It isn't ideal, but it works well enough and will increase your contrast without adding to the Part B drop count.

Alternative Clearing Baths

In most cases, a clearing bath must be acidic in order to remove residual iron salts. EDTA possesses unique chelating properties (*chelate* comes from the Greek word *chele*, meaning "great grabbing claw of a crustacean," which makes you consider that the job of EDTA is to grab unwanted metal from a solution) in which the residual iron salts are bound to the EDTA's atoms. EDTA is made more effective, even though it is alkaline, when sodium sulphite is added to it. Read a more thorough description of this in the clearing bath section of this chapter.

Be very cautious about the concentrations of your clearing baths and about keeping track of the time that your print is immersed in each of them because of their bleaching potential. Five minutes in each bath is standard. Besides EDTA there are other choices for clearing, including the following:

- **Citric Acid:** 1% solution
- **Oxalic Acid:** 1% solution
- **Phosphoric Acid:** 2% solution

  (*Be careful . . . this comes in a 75% solution, and you must remember to always add acid to water and not water to acid.*)
- **Perma Wash/Hypo Clear:** This clearing bath is used at regular strength, but you should add 30 g of EDTA to it before use. The hypo clearing solution itself has citric acid and either sodium sulphite or sodium metabisulphite in it (this is also used to clear gum prints) and is effective at clearing papers that seem resistant to clearing. Be extra vigilant when clearing palladium, as it is more susceptible to bleaching out than platinum.

If Your Image Is Too Weak

If your image is too weak and thin it might be because your coating brush had too much moisture in it, the paper was too damp when you made your exposure, your chemistry was not fresh, you made an incorrect evaluation for your Part B concentration and added too much, you used an exposure time that was too short, you used a negative that was either too flat or too dense, or . . . bad karma.

5% Gold Chloride to Sensitizer

The most elementary way to alter your print color is to add gold to your sensitizer. Adding 1 to 2 drops of 5% gold chloride to every ml of sensitizer will cool the values of your print. The process in which this cooling effect is really evident is the Ziatype, in which the sensitizer is composed of lithium palladium chloride (LiPd) and ammonium ferric oxalate (AFO).

Gold Toning

Gold toning, following clearing and washing, can create some interesting changes of color in your prints. Palladium becomes somewhat reddish purple, while platinum becomes more bluish purple. Here's a simple gold toning formula.

Part A:	4 g	sodium formate
	1000 ml	distilled water
Part B:	10 ml	5% gold chloride (*you can get this pre-mixed*)

Mix A and B together and pour the solution into a clean tray. Immerse your recently cleared, washed, and damp print in the toner and observe. You will notice that the darker values change color and that the highlights are cooler. The toning time is subjective, but the print will normally be done in 10 minutes with fresh toner. Subsequent prints will take longer as the gold solution weakens.

When you are satisfied with the print, put it into a bath of film or paper developer (called a clearing bath in many texts) for 1 minute and then do a final wash for 30–40 minutes.

- HC-110 mix: 50 ml HC-110 film developer to 1000 ml water
- Or Dektol: 250 ml stock solution to 1000 ml water

Art Wax

One last thing: I have found that a finger-rubbed application of Renaissance Wax or Dorland's Art Wax to your alternative process prints, after they have dried, will always enrich the blacks and soften highlights that may be a bit hot. This is very simple and a nice way to finish off a print. All you need to do is lay down your

Figure 13–37
Craig Barber, *Paul's Place*
Craig wrote, "*This was one of those end of the day, light looks great, but not much of it, shots. This is a 60-minute exposure. It was dead calm with darkening skies; no sooner did I finish my exposure, and put my gear away, when the skies opened up and it began to rain in torrents.*" Craig works with a 25% Pt/75% Pd mix and develops in ammonium citrate at 100°F.
(Courtesy of the Artist)

dried print on a hard and flat surface and then, with gentle swirling action, rub a very even and thin layer of Dorland's Art wax over the entire print area. Once that is done, take a hairdryer and begin to gently blow hot air onto the wax-coated area. You will see the wax melt and then dry down into the paper texture. What is different is that you now have a protected image where the darks have been intensified by the wax application. You'll like this a lot, and the organic wax is entirely beneficial to your print.

HAVING A BAD DAY? TRY THESE OPTIONS

There are explanations for almost every problem one might encounter with the Pt/Pd process, but sometimes even the best Pt/Pd printers have bad days and can't explain what it is that is going wrong. That's life, and sometimes you just have bad karma . . . so relax, go watch a movie, change processes (cyanotype always works), and live to print another day.

Figure 13–38
George Seeley, *Winter Landscape*, 1909 (gum and Pt)
One of my favorite photographers from the Photo-Secession group is George Seeley. His influences were strongly rooted in painting, and this Pt/gum bichromate image is a perfect example of how he married his two passions.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

Some days, everything you print seems just a bit off. On these special occasions you might want to take your less-than-successful prints and experiment with them after they have been washed, dried, and flattened. Try other alternative processes in combination with your recent not-so-successful Pt/Pd. Many alternative processes can easily be applied on top of Pt/Pd prints, and it has been quite common, throughout the technique's history, to combine delicate gum bichromate or light cyanotype prints on top of a Pt/Pd print for additional coloration and depth. For the last few years I have made a habit of applying short, dark pigment, gum exposures to any print that seems weak in the shadows and have actually salvaged quite a few that I would otherwise have normally trashed. This particular technique, by the way, was a favorite of such historical luminaries as Edward Steichen, George Seeley, and Alfred Stieglitz.

Cyanotype & Platinum/Palladium

Cyanotype is often effective in adding density to weak shadow areas. Make up a standard A and B cyanotype formula, dilute it a bit with water, and coat your dried and flattened Pt/Pd print. Briefly expose your negative in registration with the original and follow the traditional cyanotype process. I would recommend a

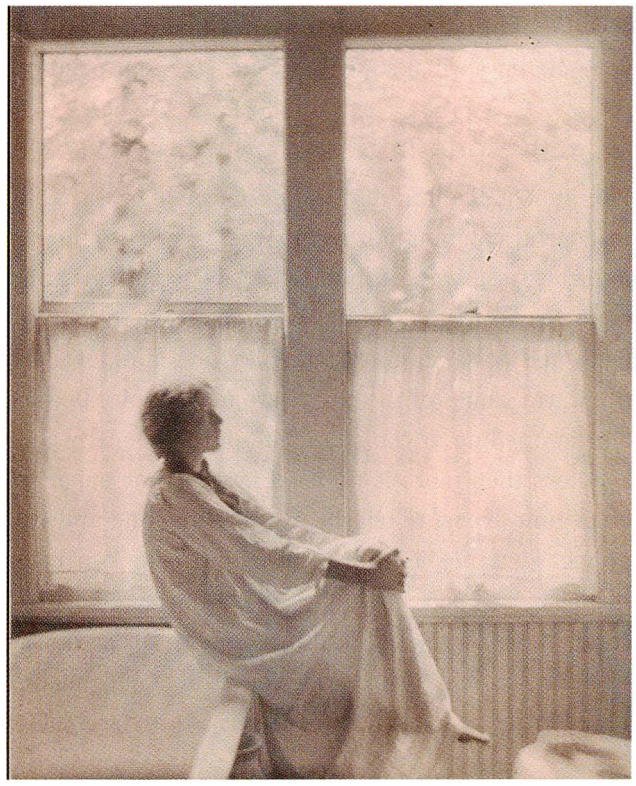


Figure 13–39
Clarence White, *Morning, the Bathroom*, 1906
This romantic and sentimental platinum print is typical of Clarence White's work . . . finding subtle elegance and beauty in the customs and life of rural America.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

Figure 13–40
Edward Steichen, *The Pond, Moonrise*, 1904
(Pt and gum bichromate)
On February 15, 2006, an astonishing price of $2,928,000.00 was paid for this Steichen print by an unidentified collector at a Sotheby's auction. The Met had acquired the print as part of the magnificent Gilman Paper Company collection (*The Waking Dream*). The museum already owned another version of the print, hence the decision to deacquisition. A third print from this negative (Figure 8–23), but in platinum and cyanotype, is in the collection of MOMA.
(Image copyright © The Metropolitan Museum of Art. Image Source: Art Resource, NY.
© PERMISSION OF THE ESTATE OF EDWARD STEICHEN)

specific dilution, but the degree of blue you want in your shadows will dictate that choice for your print.

Gum & Platinum/Palladium

Platinum/palladium and gum bichromate is a really wonderful combination technique, and I recommend it highly as a way of intensifying your shadows and adding color to an essentially monochromatic process. Gum and palladium are made for one another since the warm values of the palladium make a nice bed for almost any hue. If you simply intend to intensify your shadows then there is no need to size your paper, as your gum exposure will be a very short one and will only harden the dichromate, gum, and color sensitizer in the most open shadow portions of your negative. If you're going to do a number of gum impressions I would recommend hardening and sizing your finished Pt/Pd print and using a relatively sturdy weight of paper for the initial Pt/Pd print. For complete instructions on paper preparation and gum printing, please see those chapters.

Intensification in Palladium & Gum

If you really want to see a beautiful intensification in your palladium prints try doing a gum bichromate coating with just a mixture of thalo green and lamp black watercolor, gum arabic, potassium dichromate, and water. Make the exposure a quick one but long enough to hold the gum to the paper through the hardening of the gum and bichromate by UV light.

Van Dyke & Platinum/Palladium

I began experimenting with the Van Dyke/palladium process around 1990 after making an aesthetically impaired Van Dyke during a demo for my alternative process class at Harvard. Although it still provides

Figure 13–41
George Seeley, *The Burning of Rome*, 1906 (gum over platinum)
In the first decade of the 1900s George Seeley was a distant participant in the new Photo-Secession group. From his home in the Berkshires of western Massachusetts, he regularly sent romantic and soft focus tropes to Alfred Stieglitz for publication consideration in *Camera Work*. Seeley was a scholar of Greek and Roman history, and like members of the Cornish Art Colony in nearby Cornish, New Hampshire, Seeley created classical tableaus with family and friends with titles referencing classical history and legend.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)

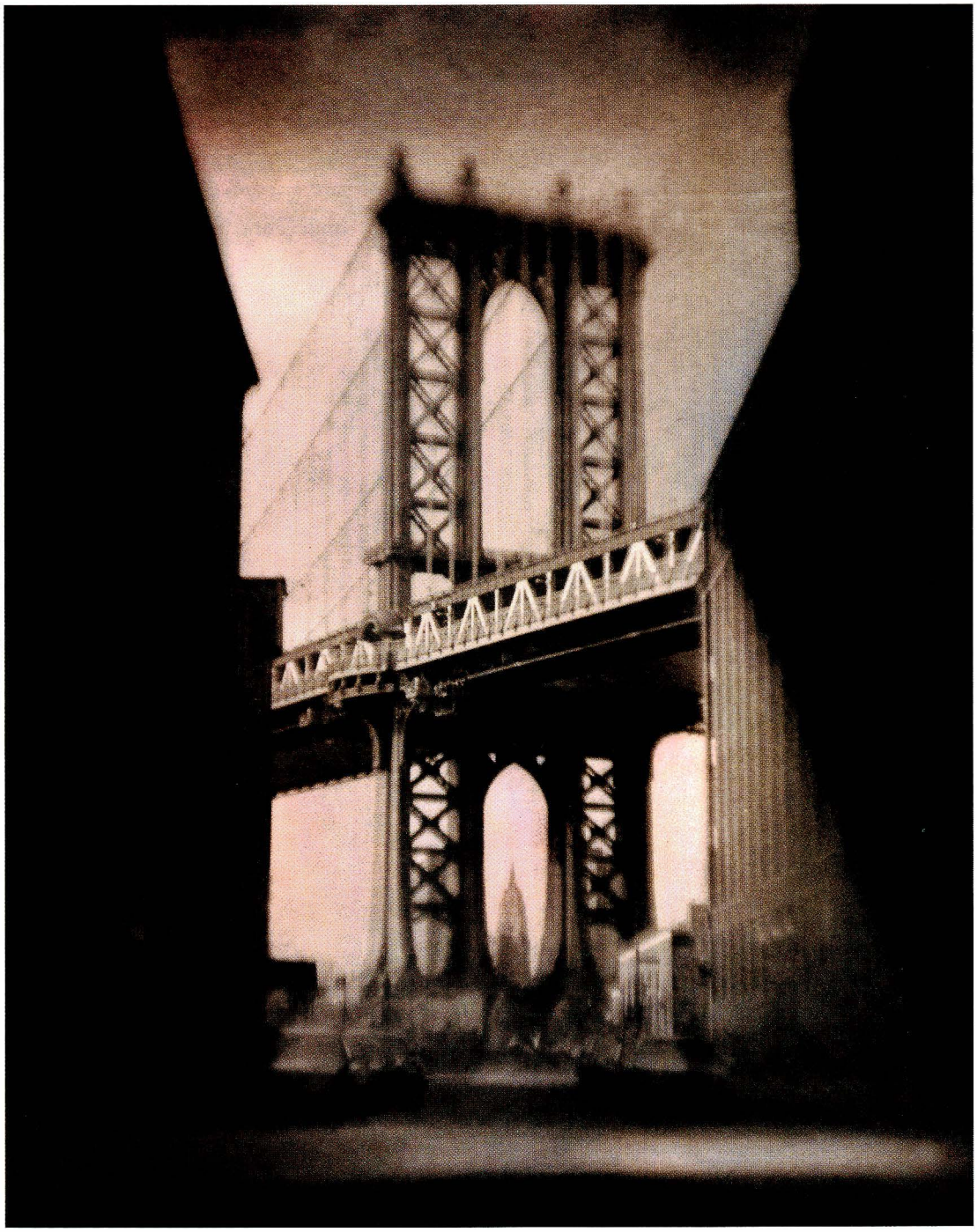


Figure 13–42

Peter Liepke, *Manhattan Bridge at Sunset*

Peter's *Manhattan Bridge at Sunset* image was first printed in platinum only. He then tried it as a gumoil print but eventually felt that a three-coat gum bichromate over platinum would be the best combination to produce what he had envisioned when he originally took the photograph.

(Courtesy of the Artist)

surprises from time to time, like any experience with a second process in combination with Pt/Pd, it is a technique that can produce absolutely beautiful tonalities and color variations. The primary elements to look for in a successful Van Dyke brown and Pt/Pd print are warm and deep shadows and luminous highlights . . . provided you clear your print well. When wet, the highlights seem to glow from the inside of the paper. The technique works best when you begin with a Van Dyke and over-expose the image. The over-printing with Pt/Pd will often open up the shadows and give life to the highlights. My best advice, if this idea calls your name, is to use the Na2 adaptation in place of the standard Pt/Pd workflow. This will give you better control of your contrast and an even chance of a successful piece. If you don't have the Na2 ingredients and still want to give the technique a try, limit your Pt/Pd drop count to Parts B and C of the sensitizer formula. Theoretically, your Van Dyke will supply the details in the highlights that your lack of Part A would normally handle.

Don't be surprised to see the image bleach to yellow and fade when you first coat the palladium on top of the over-exposed Van Dyke. Don't worry. Once the paper is dry, register your negative to the original Van Dyke and expose the recoated paper to UV light. You will have to test to see what your exposure time will be, but look for the whisper before going to the development stage. Process the palladium image normally, paying close attention to the recommended EDTA clearing bath times of 5 minutes per bath. After the clearing, wash your print in cool running water for 30 to 40 minutes and hang it up to dry. In most cases, if the print looked great when it was wet then there is a possibility that it may dry-down a bit flat. Print for an image that is a little underdone in the wash, with good contrast and nice highlight detail, and you should end up happy when all is said and done.

Platinum/Palladium with Digital Inkjet Printing

It may seem a bit odd closing out this chapter with a few sentences about combining the beautiful noble metals of platinum and palladium with digital inkjet printing, but it, like many other hybrid processes, actually can be quite successful, artistically rigorous, and beautiful.

It's important to begin by making several contrast variations of your digital negative on a digital inkjet film like Pictorico Ultra Premium OHP. In doing so, you will have a negative for the Pt/Pd step of the process that will be in exact registration with the digital inkjet print you will be making with your desktop printer. Of course, you don't have to use identical negatives, and this may be a way of exploring image layering to intensify the intentions and critical discussions that your work is dealing with.

Figure 13–43
Margaret Mateskon, *Maggie Pool*, 2006
Maggie, a former student of Christina Z. Anderson's at Montana State University, began her redheaded woman series . . . because she has red hair. That instigated her interest in the iconic pin-up and its projected strength, sexual awareness, and independence . . . qualities she found in the World War II–era pinups when women were raising families, running every industry, and building airplanes, bombs, and tanks for the war effort. This piece is a marriage of a twentieth-century pinup, printed on a nineteenth-century platinum, on top of a twenty-first-century inkjet print.
(Courtesy of the Artist)

I enthusiastically advise you to experiment with different papers including high-quality digital, ceramic dust-coated, fine art papers such as Hahnemühle Photo Rag. Also, try fine art papers that are appropriate for alternative processes such as Arches Platine, Bergger Cot 320, Clearprint, Revere Legion, Kozo, Gampi, and Bienfang 360 vellum. Experiment with color and content . . . and simply enjoy the additional opportunities that digital offers to the time-tested perfection of platinum and palladium printing.

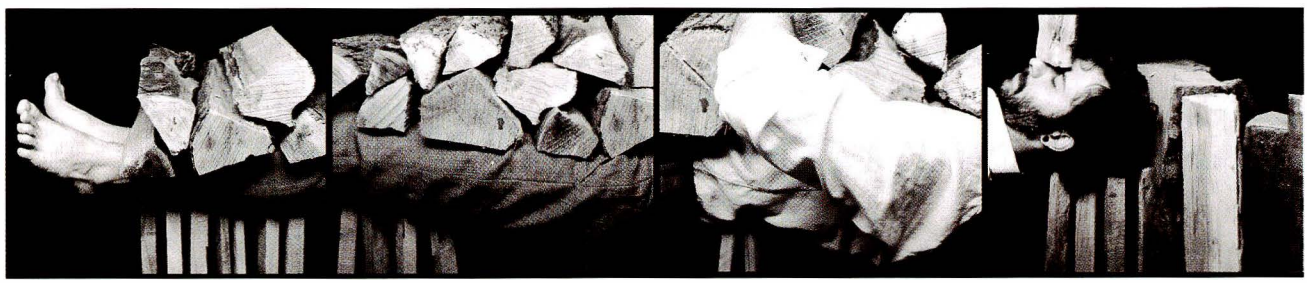


Figure 13–44
Adam Brochstein, *Pressure,* 2010 (Pt/Pd)
A self-portrait of former student Adam Brochstein trying to decide whether to enter the family business of manufacturing drumsticks. Adam decided to go to grad school.
(Courtesy of the Artist)

The Ziatype Process

OVERVIEW & EXPECTATIONS

In this chapter I'll offer a little history about how the Ziatype came into being and show, as I do in nearly every chapter in this book, how connections from the past play an instrumental role in the development of the specific processes we practice today. I'll describe how the Ziatype works, how its chemistry can be used to create a wide variety of expressions, and where to get it. I'll provide you with a drop chart that works in the same manner as the platinum/palladium chart you used in the previous chapter. From these Ziatype formulas you will begin to see how slight variations in the drop counts and individual chemicals will impact the colors and contrast relationships within your finished prints.

You will go on to learn the idiosyncrasies of the process and how to mix and apply the sensitizing formulas to your paper. I'll describe exposure considerations and what to look for in a Ziatype printing-out process (POP), as this process features a wonderful "what-you see-is-what-you-get" printing-out personality that makes the process controllable and fun. I'll conclude the chapter with additional considerations and suggestions as they apply to the technique.

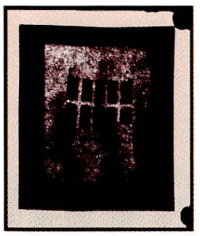
The Ziatype is one of the most accessible and user-friendly processes I've worked with in the past few decades. It is also one of the most flexible and open to individual invention and inspiration. Nearly every time I teach this process to a class or workshop I end up seeing an interesting adaptation and a new way for me to think about working with the technique. Have fun!

Figure 14–1

Christopher James, *Painters*, Rangoon, Burma, 1982 (Ziatype)

This is a Zatype print I made from my 1982 Burma Project. The original 6" x 7" negative was translated to a sheet of Pictorico OHP inkjet film and contact printed with Ziatype chemistry.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

Just for fun, it would be informative for you to visit the Platinum/Palladium Process chapter and scan its A Little History component, as the Ziatype can be seen as sitting upon a foundation of that process. What you will find is that the two processes have much in common but their differences are unique and provocative.

Pizzighelli-Hübl

In 1882, Captain Giuseppe Pizzighelli (1849–1912) and Baron Arthur Von Hübl (1852–1932) modified and expanded upon the research of William Willis who, in 1872, conducted a series of experiments using potassium chloroplatinite and ferric oxalate in which he reduced the ferric oxalate to ferrous oxalate by exposing it to UV light. Then, by using a warmed potassium oxalate developer, he was able to make the soluble ferrous oxalate reduce the platinum salt to stable platinum metal.

In 1887, Pizzighelli, while working alone in his lab in Banjaluka, Bosnia, discovered an iron formulation that yielded a printed-out platinum image directly from exposure and that required no development . . . only a dilute acidic wash followed by a final wash in water. The key to this printing-out event was the use of a "double salt" sodium ferric oxalate (sfo) sensitizer as a substitute for the ferric oxalate in the Willis formula. Although Pizzighelli tested ammonium ferric oxalate (afo) as well, his preference, according to Mike Ware, was for the sfo. Pizzighelli humidified the paper prior to exposure, and because the humidification created an environment conducive for a printing-out performance, he was able to eliminate the need for the potassium oxalate liquid development in the Willis technique. The process was a POP that required only humidity to ensure the resolution of the image.

In a draft of Mike Ware's thorough, but not yet published, book on the platinotype process he writes, "*Of the double salts experimented with, the sodium-ferric oxalate proved the most satisfactory, the corresponding potassium salt giving less sensitiveness; while the ammonium salt, although giving greater sensitiveness, gives less brilliant images than the sodium salt, and, moreover, images having a tendency to a cold, bluish tone.*"

The informational importance of this discovery was immediately translated and presented to the English readership in the February 1888 edition of the *Amateur Photographer* by Alfred Stieglitz, in an article titled "Pizzighelli's New Platinum Process."

During this adaptive process, the platinum salt in the sensitizer was reduced and converted into metallic platinum *during* the exposure rather than as a result of a *developing-out process (DOP)*. Following exposure the image was immersed in an acidic 1:80 solution of hydrochloric acid for clearing and then washed for permanence.

Pizzighelli continued to experiment with other double salt formulas and discovered that with the addition of sfo, potassium ferric oxalate, or afo, he could alter the sensitivity as well as the color of his prints. At the completion of an exposure, Pizzighelli's image appeared exactly as it would in the finished print stage of the process following the successful clearing and final washing steps.

Pizzighelli went into business, commercially marketing his Pizzitype printing papers using sfo, and he enjoyed a short and modestly successful run as an entrepreneur. Also in his catalogue was Dr. Jacoby's platinum Printing-Out Paper . . . a reported favorite of Alfred Stieglitz. In time, due to several vexing and insurmountable technical issues in the manufacturing process, and a relatively brief shelf life due to its super absorptivity, the POP platinum papers disappeared from the marketplace.

Ware–Malde: Contemporary Variations

In 1982 Professors Mike Ware and Pradip Malde entered into a collaboration to dust off and refine the Pizzighelli work and to share the individual research that they had been involved with since 1981. The result was the successful development of an ammonium-based method of Pt/Pd printing that was realized by substituting Pizzighelli's potassium chloroplatinite with

ammonium chloroplatinite/ammonium chloropalladite, which is more soluble in water. These are referred to as *ammonium salts of platinum and palladium* and were integrated into the process in order to realize a greater degree of chemical solubility and a more *hygroscopic* (meaning it attracts and retains liquid . . . like a paper towel) paper surface. In the Ware–Malde variation, the color of the print, and that print's variable contrast, is dependent on a balanced formula and the degree of humidity in the paper prior to exposure.

In recent correspondence I've enjoyed with Pradip Malde he wrote, "*Once we* (Mike Ware) *established the variables in the potassium Pt/Pd print process* (the traditional process, in other words), *we realized that after locking everything down, the one variable that seemed to have a dramatic effect on the image was hydration. Pizzighelli had alluded to this, but almost as an aside—he was more interested in the use of ammonium compounds for their richer image quality. Mike hypothesized, amazingly just by thinking about it, that ammonium salts would do two things:*

1. *Being more soluble, they would render a more efficient sensitizer and*
2. *Being more hygroscopic* (related to solubility, of course), *sensitized papers may be more responsive to hydration controls.*

"*That realization laid out the course of our research from around mid-1981 on, as we tested the hypothesis and began to formulate the most effective ways of coating and hydrating prints. By the way, in trying to remove variables, we arrived at coating paper with a glass rod rather than using brushes.*"

In subsequent correspondence, Pradip added additional context to the information concerning significant markers in the research timeline. One was meeting Mike Ware in 1982 and teaming their talents to come to a working model that defined the understanding, harmony, and control of substrate hydration and contrast.

Pradip Malde, Data, 1982-12-15

"*NOTES: from my printing records, this sheet indicates the date when I stopped using potassium oxalate as a developer and shifted to a full-blown ammonium-based sensitizer and print-out approach, using disodium EDTA as a clearing agent. I had met Mike Ware in September—he was already working with ferric ammonium oxalate and making lovely prints with ammonium tetrachloropalladate. The challenge of printing similarly with ammonium tetrachloroplatinate, and understanding and controlling the relationship between hydration and contrast, however, kept both of us occupied for at least another year.*"

Pradip Malde, Test Data, #141, 1983

"*Almost a year later, and after much experimenting with additives (potassium and sodium dichromate, hydrogen peroxide, even glycerin, and many others) we began to understand that one way to maintain peak image quality with some contrast control was to control the water molecule content of the dried paper.*

Print date: September 25, 1983

Platinum print on Fabriano 5, 300gsm

No extra sizing

"*Paper was 'pre-wet' with 0.4 cc of distilled water, by two 'passes' with a glass-coating rod. The paper was allowed to dry in ambient temperature (16°C) and ambient relative humidity (60%). By the way, the earliest record I have of using a glass-coating rod is March 21, 1983, although I have evidence of Mike coating with a 'k-bar' in September of 1982.*

"*The sensitizer was a 1:1 mix of ferric ammonium oxalate and ammonium tetrachloroplatinate, combined from stock solutions just prior to coating. 1 drop of wetting agent was used—I cannot recall exactly what this was or at what dilution, but it was probably Tween 20 at 1%. No other additives were included in the sensitizer.*

"*The area coated was approximately 10.3 × 12.8 cm, with 2 passes. The print was dried in a sealed box containing fresh silica gel, for 35 minutes at room temperature. It was then given a second coat, and dried again in the same conditions as before, for 30 minutes.*

"*The print was exposed immediately after the second drying under a mercury vapor lamp, with a 27-minute exposure.*

"*It was given a 1-minute rinse in water, then cleared in disodium EDTA. While there is not a note of*

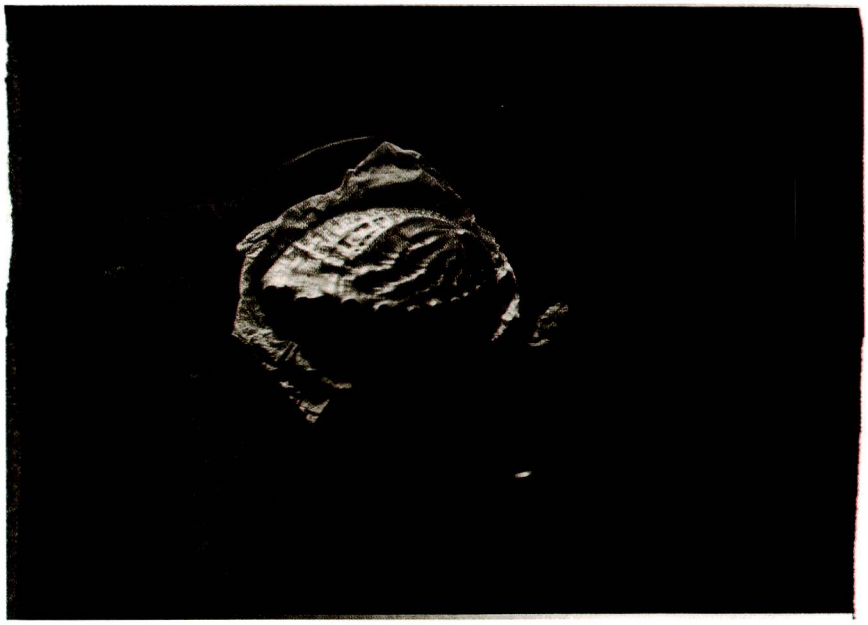


Figure 14–2
Pradip Malde, *Print #141*, 1983
Pradip writes about test #141, "*Almost a year later, and after much experimenting with additives (potassium and sodium dichromate, hydrogen peroxide, even glycerin, and many others) we* (Pradip and Mike Ware) *began to understand that one way to maintain peak image quality with some contrast control was to control the water molecule content of the dried paper.*" For this image the sensitizer was made with a 1:1 mix of ferric ammonium oxalate and ammonium tetrachloroplatinite. The resulting printed-out image was cleared with EDTA.
(Courtesy of the Artist)

this in the data sheet, there was some print-out, due to only partial drying of the paper in the silica gel box. We began to fine-tune the drying and rehydration process in the ensuing months.

"This is the print from this particular test. It was scanned without any color correction, and the only manipulation has been to rotate and crop the scan in Photoshop."

Note: Glass Rod Coating—The first use of a glass rod for coating sensitizer is lost, as Dick Sullivan would phrase it, "in the mists of time" but there is evidence from Charles Long's calotype instructions in his book, *Practical Photography, On Glass and Paper* (1854), in which he writes, *"Having selected a sheet of paper, as free as possible from blemishes of any kind, pin it by two of its corners to a soft wood board, and, laying it flat on a table, place a glass rod along its upper end, next the pins that retain the paper, holding it with the right hand; then with the left hand pour some of the double iodide of silver immediately in front of the glass rod, and move the same down the sheet of paper in such a manner that the liquid may follow the rod, and give an even coating. If this be not accomplished the first time the rod is passed over the surface, a repetition of the movement will generally secure this end. Care must be taken not to press too much on the rod, otherwise the surface of the paper is liable to become injured."*

Note: Mike Ware writes, "*Regarding the use of glass rods or tubes for coating, I began this in 1981, after trying a whole range of devices. At the time, Pradip and I thought we'd invented something new! It certainly surprised Thomas Shillea who was extremely skeptical about all our innovations, and swore by his brush. What he failed to appreciate was that we used 0.25 cc to coat a 4" × 5" and he used 0.9 cc! Of course, much later we discovered 'there is nothing new under the sun' and glass rods had been used since the mid C19th.*"

Sullivan–Weese: Contemporary Variations

In the early 1980s, Bostick & Sullivan, founded by Melody Bostick and Dick Sullivan, was a fledgling enterprise and not yet the powerhouse alternative process merchandizing business it is today. Coincidently, Dick Sullivan began his own investigation into the work of Willis, Pizzighelli, and Hübl. He happened upon a reprint of Ernst Lietze's *Modern Heliographic Processes* (Visual Studies Workshop, 1974), in which there was a full description of Pizzighelli's formulas and workflow. Sullivan tried some of the formulas and found them unforgiving and temperamental.

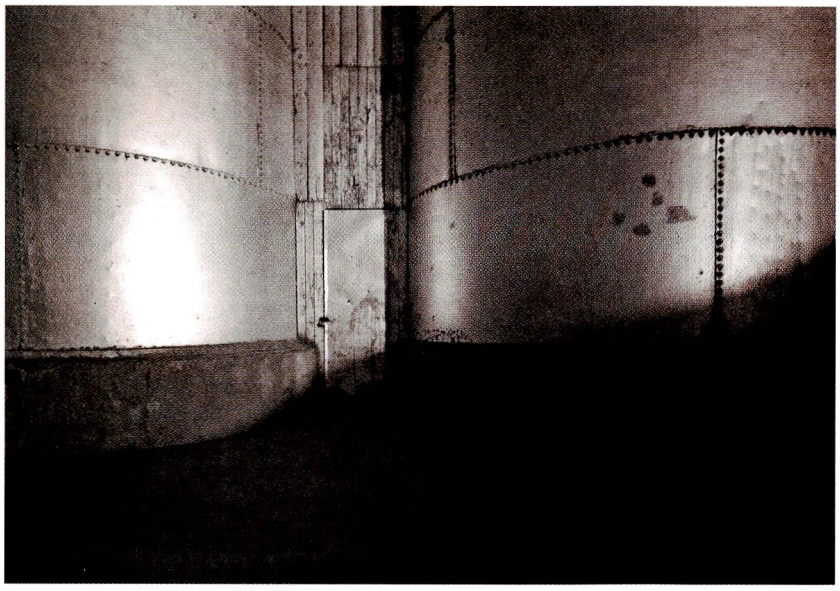


Figure 14–3
Dick Sullivan, *Feed Store*, Las Vegas, NM, 2000 (Ziatype)
Dick Sullivan is the irrepressible co-founder and proprietor, along with his wife Melody Bostick, of Bostick & Sullivan . . . my favorite source for alternative process materials and chemistry. Dick is also the creator of the Ziatype process, and this image is an example of his work. *(Courtesy of the Artist)*

He did, however, confirm that if one were to coat a paper substrate with a solution of palladium salt and afo, and then proceed to humidify and expose the sensitized paper, the image would print out and appear as it might following a standard wet development. This was something that most likely happened during Pizzighelli's own investigations and may help explain how he ended up with an alternative system following his partnership with Hübl.

In 1995, Sullivan re-visited his research by investigating double-palladium salts and accepted the personal challenge of making a commercial process that was user-friendly and fundamentally accessible to anyone interested in exploring the simplicity and advantages of a printing-out method over the traditional Pt/Pd developed-out technique . . . while retaining the same degree of print quality.

Sullivan's "big gestalt" came about when he was trying out various double salts of palladium and happened to see a "brilliant" printed-out image when he ran a test with the lithium palladium chloride salt. He wasn't looking for a POP at that moment and was primarily seeking out variables in coloration . . . and was actually expecting to see a dramatic red or blue. He recognized the POP implications of using lithium, and realizing that lithium was hygroscopic, he proceeded to test with afo, which was also hygroscopic. That led to his big "ah-ha" moment when he remembered that Pizzighelli once had a commercially viable paper with problems that couldn't be remedied at the time. At this point his intention was to distill all of the information that had been learned, from William Willis to Pizzighelli–Hübl to Ware–Malde, and to then create a fluid printing system that was uncomplicated and in which all of the variables except humidity could be controlled through flexible drop count chemical recipes.

In the Pizzighelli and Ware–Malde processes, the color and the contrast of the final print are realized by controlling chemistry and humidity. There is a direct connection between hydration and contrast. Ware and Malde used ammonium salts as opposed to Pizzighelli's sodium salts. In Dick Sullivan's process, the color and contrast are controlled in great part by chemistry . . . specifically the drop count sensitizer mix. Humidity plays a role, but less so than in Ware–Malde processes.

A LITTLE MORE CHEMISTRY

After extensive testing of complex palladium double-salt formulas, using nearly all of the alkali metals that were affordable and safe, Sullivan found that a combination of lithium chloropalladite (LiPd) and afo would make a simple and flexible formula that resulted in prints that were neutral black in color. Sullivan also discovered that by modifying the formula with cesium chloropalladite (see the lower end of Group 1 in the periodic table) either in a mix or by completely replacing the lithium chloropalladite, he could achieve

Figure 14–4
Gwen Walstrand, *Elizabeth at 11, 2007, and 15, 2012* (Ziatype)
This diptych is of Gwen's daughter Elizabeth at 11 and 15. She writes, "*. . . it was a thought I had when initially deciding about which age 15 image to use with the age 11 image. I see her gaze as more complex. I started the project thinking that I would see a lot of attitude and awkwardness but it was a very simplistic and unsympathetic way of working; I ditched* that idea early and opted for more uncertainty and possibility. I think that's here in this pairing." *(Courtesy of the Artist)*

the same tonal range but produce a print with reddish to brown-black coloration.

Note: Potassium, sodium, ammonium, barium, zinc, tin, tungsten, magnesium, lithium, and cesium fit this category. It has been suggested by some that cesium chloropalladite is not truly an ideal option because it is low in solubility. This causes the crystals to precipitate out in the sensitizer. I've been working with Ziatype since Dick Sullivan put it on the market, and personally I don't experience this particular problem as long as I keep the solution hot.

At this stage Dick, as he usually does when he gets a new and robust idea, gathered together fellow researchers and friends. This time he asked for the assistance of Carl Weese, who participated in the testing of the process from his studio in Connecticut. According to Dick, a lot of credit for the Ziatype goes to Carl for his diligent working out of the details and workflow of the process. Together they discovered that some of the technical issues that worked in Dick's Santa Fe, New Mexico, studio (high altitude and very dry environment) did not work the same way in Carl's Connecticut studio (low altitude and humid in three out of four seasons). From teaching workshops in Santa Fe I have learned that what works beautifully in my Dublin, New Hampshire, studio does not work at all the same way in New Mexico, where there is little humidity in the air. Sullivan and Weese continued to sort out the kinks and eventually came up with a system that was simple, rational, and predictable. Dick named this new process *Ziatype* after the circular Anasazi Pueblo icon for the sun.

Differences Between the Ware–Malde and Ziatype Systems

The principal and primary differences between the Ziatype and the Ware–Malde processes are as follows.

- Sullivan's Ziatype utilizes the unique color polarity of lithium and cesium to control color range at a relatively constant humidity, and the color differences are more pronounced than when using the ammonium salts of the Ware–Malde method. Granted, there are also a lot more drop count options and solutions to play with in Ziatype.

Figure 14–5
Jonathan Bakos, *Lowell, MA, Facade*, 2006 (Ziatype)
Jonathan was one of my students at The Art Institute of Boston, and he apparently heard the Ziatype sirens calling his name and quickly became one of the best practitioners of the technique.
(Courtesy of the Artist)

- The Ziatype also differs from Ware–Malde by using palladium alone instead of palladium and/or platinum, and then by using the more unusual lithium and cesium double salts of the palladium. In the early testing stages of the Ziatype, platinum salts were tried, but Sullivan and Weese found that they could not make a pure platinum Ziatype. There was as well, according to Sullivan, a three-fold difference in cost between palladium and platinum, and so they put their focus on the less expensive palladium.
- In the Ziatype, color and contrast are independent of one another and determined by the recipe that the user selects. Humidity is, as it is in the Ware–Malde method, an important element, but not to the same degree. In the Ware–Malde variation, the color of the print and that print's variable contrast are dependent on a balanced ratio of platinum and palladium salts and control of the degree of humidity in the paper prior to exposure.
- Just for the record, both methods are first-rate adaptations and are well worth the time to learn how to do well.

I suspect all of these brilliant gentlemen whom I consider good friends would contend that there is a great deal more to this than I'm relating in this brief summation ... and I would not argue that point. I beg, in advance, their forgiveness and patience with this brief discussion, but it's time to move on to the process.

HOW ZIATYPE WORKS

Similarity to Pt/Pd and Simplicity

The Ziatype is different from the traditional platinum/palladium process in that it is a printing-out process. This means that the values within the image are near fully realized at the conclusion of the UV exposure and that you can define the finished density, and look, of your image by inspection during the printing-out stage of the process. I use the

word *nearly* as there is, as in every alt pro process, a moderate-to-significant dry down to consider when evaluating your POP image prior to washing. Chemical development is not required in Ziatype, and the odds for a successful print are generally quite good within the first attempt or two by a new Ziatype printer.

After you determine that the Ziatype print has met your intentions during the exposure, all you need to do at that point is rinse the print in distilled water, clear the highlights in a simple EDTA bath, and complete a final wash. Beyond this simplicity, the Ziatype is more flexible than the traditional platinum/palladium process, has a greater range of color options, demonstrates less grain in the image, is easier to manage in regard to control of contrast, and equals the quality of platinum/palladium.

Self-Masking

As in some other alternative processes, the Ziatype retains the traditional self-masking characteristic of platinum/palladium. *Self-masking* is the term that describes what happens during lengthy Pt/Pd exposures when UV light will continue to expose highlights after the shadows have reached an optimal degree of exposure. The ferric salts, once reduced, function as a filter, slowing down additional exposure in the thinner shadow sections of the negative. All in all, the Ziatype is a terrific technique to begin learning about alternative process image making, and is the most complex but user-friendly process I have encountered.

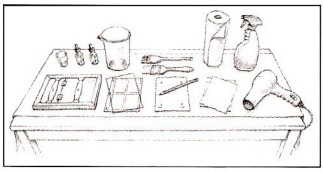
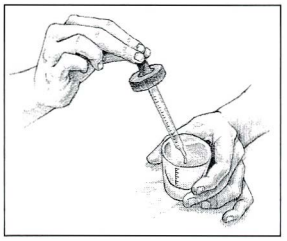


TABLE SETUP FOR ZIATYPE

Note: Make your life very simple by purchasing all of the Ziatype chemistry at once in kit form from Bostick & Sullivan. A standard kit will contain bottles of afo, LiPd, gold, Tn, ad (these non standard abbreviations are defined below), and Tween. All of the prepared Ziatype sensitizer components arrive in 25-ml to 100-ml bottles with dropper caps.

Materials on the Table

- **afo**—ammonium ferric oxalate
- **LiPd**—lithium palladium chloride . . . a.k.a. lithium chloropalladite
- **Gold**—5% gold chloride—boosts contrast and gives cooler tones
- **Tn**—sodium tungstate—reduces contrast and gives warmer tones
- **ad**—ammonium dichromate: 1%, 2%, 5% concentrations. Be careful with this chemical, as it is very aggressive in the sensitizer. A 1% solution is preferred.
- **CsPd**—cesium chloropalladate—palladium
- **sfo**—sodium ferric oxalate
- **Tween 20**—dilute 1:3—a surfactant additive for thorough absorption of the sensitizer into the paper substrate
- **Photoflo**—mix 1 drop to every 10 ml of distilled water for working solution.
- Ziatype drop chart (see text)
- Krystal Klear acetate envelops for printing and print storage
- Clean paper or Lucite for the coating
- Paper for sensitizing: COT 320, Crane's Platinotype, Arches Platine, and gelatin salted paper using salted paper sizing #1
- A heavy-duty shot glass
- A new Richeson synthetic brush (http://www.jerrysartarama.com for best price)
- Clean distilled water in a beaker for brush washing
- Optional: steamer/tea kettle/humidification box for humidifying paper before printing
- Pencil
- Contact printing frame with clean glass
- Negatives for contact printing
- Paper towels
- A paper-safe, drawer, or light-tight paper box for drying (Allow 15–30 minutes of drying time in the box or drawer after coating.)
- A Sharpie for labeling where your chemistry is placed in front of you



ZIATYPE CHEMISTRY

Abbreviation Symbols for Ziatype

afo
ammonium ferric oxalate

sfo
sodium ferric oxalate

lfo
lithium ferric oxalate

LiPd
lithium palladium chloride*

CsPd
cesium chloropalladate-palladium

ad
(1 drop at %)
ammonium dichromate

Tn
(warmer tones, reduces contrast)
sodium tungstate

gold
(cooler tones, boosts contrast)
gold chloride (5%)

*lithium chloropalladite

(Courtesy of Dick Sullivan)

ZIATYPE DROP COUNT CHART & FORMULAS

5% Gold: Color & Contrast Control Swap with LiPd

Gold will give you cooler colors, grays, blues, and purple tones, but printing times will lengthen and contrast will increase. At 15%–25% of the total drop count the color of the mid-tones cools and D-max rises . . . and so does the highlight contrast. Shadows do not gain contrast; they only appear to when compared to highlights. At 50% of the drop count you get more blue tonalities. When gold is at 60%–70% of the drop count you get the lavender colors. You simply substitute the gold chloride for the lithium palladium chloride, drop for drop. Consult the drop-color chart and experiment and you'll see how it works. Keep perfect notes on your prints.

If you want to slowly adjust the color of your print, consider the gold-for-lithium palladium swap. Single drops of gold in exchange for single drops of LiPd will provide a reddish burgundy shift. As you make the drop count exchange greater, say six drops of gold to eight of LiPd, your color will shift radically to blue black, and your contrast will rise.

PART C PALLADIUM(II) CHLORIDE SWAP FOR LIPD FOR CONTRAST

If you find it necessary to boost your contrast in the mid-tones of your print, you may consider up to a 20%–25% swap of the lithium palladium chloride (LiPd) with an equal number of drops of Part C palladium chloride from your platinum/palladium process chemistry. This often produces a richer and warmer tonality depending on paper and humidity. LiPd is more hygroscopic than Part C Palladium(II).

Split Tones, Humidity, and Inkjet Substrates

If you steam your sensitized paper completely prior to exposure, and you have successfully placed your negative in a Krystal Seal envelope, or sandwiched the paper with acetate sheets on the front and back of the paper (to hold in the humidity), you will get a neutral black print using a standard 12 afo + 12 LiPd formula.

Ziatype Drop Count Formulas

afo	lfo	sfo	LiPd	CsPd	gold	ad	Tn	color	contrast
12			12					neutral slate grey black	low
12				12* warm				warm brown	low
12			12			2%		neutral	low/med
12			12			5%		warm	medium
12			12			20%		warmer	high
12			10		2			cool	medium
12			8		4			very cool	high
12			4		8			purple lavender	very high
12			9		3		2	green blue	low medium
12			11		6			blue black	medium high
12			12				2	slightly warm sepia	medium
12			12				3	very warm sepia	low
	12		12					red warm	medium
6	6		12					warm	low

(Courtesy of Dick Sullivan)

- If the sensitized paper is dried before exposure, the print will have a brown tonality and will be less dense in the darker values. If you dry your paper, expose it, and then steam it, the print will develop out completely and will yield a rich sepia color.
- Sodium tungstate warms the print and lowers the contrast. A formula of 50% lithium palladium, 25% gold chloride, and 25% sodium tungstate often produces defined blue/black split tones.
- Consider printing a contrasty and tonally defined inkjet print on a nice Photo Rag stock and then running a Ziatype in registration on top of it. The possibilities here are endless.
- Variations of the process using this knowledge and formula alterations will produce splits. This is especially true when using salted paper as a substrate or cesium chloropalladite (CsPd).

Red Shadow Tones with Cesium Chloropalladite (CsPd)

There is only a single formula in the Bostick & Sullivan drop chart that incorporates cesium chloropalladite (CsPd), but that doesn't mean this formula is the only one that works. Cesium chloropalladite can also generate prints in a non-humid , but be aware of the following.

- Do not use gold and cesium chloropalladite (CsPd) in the same formula.
- Steaming actually produces a cooler image, while a dry print yields warmth.

Figure 14–6
David Stinchcomb, *Food Lion*, 1994 (Ziatype)
Oklahoma artist David Stinchcomb took a workshop with me many years ago and has stayed in touch with new work ever since. David's Ziatype was the example of the technique I had seen with Dick Sullivan's new process and I was immediately impressed with the simplicity, user friendliness, and the quality of the technique. *(Courtesy of the Artist)*

Figure 14–7
Amy Holmes George, *Pumped Out*, 2014 (Ziatype)
Amy, president of the great Texas Photographic Society, writes, *"Awakening to Motherhood contemplates my experiences as a mother of two, with all its wonders and woes. I am continually learning to embrace the beautiful chaos of parenting, pondering the everyday sense of hilarity, absurdity, uncertainty and emotional overwhelm which feeds my work. The composite scenes are autobiographical and simultaneously fictional, with concepts that are introspective. I offer these images as an honest expression of the exhausting yet exhilarating journey through parenthood."*
(Courtesy of the Artist)

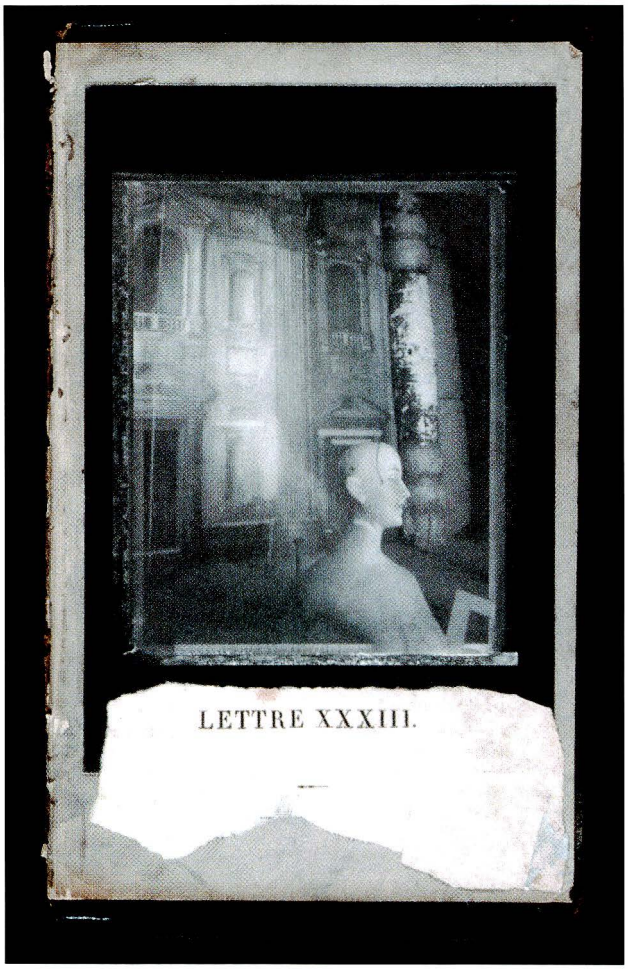


Figure 14–8
Jesseca Ferguson, *Letter XXXIII*, 1998 (pinhole Ziatype)
This is a fine example of Jesseca Ferguson's work incorporating Ziatype and collage.
(Courtesy of the Artist)

- Using CsPd in exchange for LiPd will give you deep red tones in your shadows when the exchange is a total substitution.
- You **must** be sure that the CsPd remains warm, perhaps even hot, throughout the process. It must be heated in a non metallic beaker before use, and it will precipitate out at ambient room temperature if it cools.

Sodium Tungstate: Warmth and Lowering Contrast

- Using sodium tungstate (Tn) in your sensitizer formula will lower the contrast and add warmth to your print. The 40% solution that comes in a Bostick & Sullivan Ziatype kit can be used as an additive directly into a standard afo and LiPd mix.
- The more sodium tungstate in the formula, the warmer and softer the final print.

Ammonium Dichromate: Big Contrast Change, So Be Careful

The Ziatype kit comes with an ad solution that is used principally as a contrast control agent. As it arrives in the Bostick & Sullivan kit, I personally find it really aggressive and not appropriate for my negatives. As a result, I seldom use it in my sensitizer formulas. If I want contrast control, I tend toward a shade–sun UV exposure or gold or Tn in the formula.

When I teach the process I generally have my students prepare percentage dilutions of the ad and urge them to use a drop at a time, if at all. Printing times also slow down with the addition of ad, and since this process is humidity-dependent that fact is important . . . the longer the exposure, the more likely the paper will dry out, especially in the winter or in an arid environment. If you need to control contrast, I recommend beginning with drops of 1% gold chloride and going up to 5%.

- Again, the alternative is to try the palladium Part C swap with LiPd or do the sun–shade exposure technique, in which the bulk of the exposure is done in open shade with a last portion hit with direct sun for the shadows.
- It is really important to remember that the "self-masking" trait of this process will be *lessened* by the inclusion of ad in the formula.

Tween 20 (*polyoxyethylenesorbitan-monolaurate . . .* there will be a spelling test in the morning)

Tween 20 is sold as a 10% solution. It is a non ionic, polysorbate surfactant in your sensitizer formula that promotes the ability of the sensitizer to penetrate deeply into the paper's fibers. Surfactants are used in hospitals for premature infants who need assistance breathing. They reduce the surface tension of fluid in the lungs and help make the small air sacs in the lungs (alveoli) of premature babies (preemies) more stable.

Figure 14–9
Tricia Hoffman, *Figure Study #26*, 2004 (2007) (Ziatype)
Tricia took an alternative process workshop with me in Maine in 2007 and produced this evocative, and dramatic, Ziatype. The unique graphic across the top of the image is the result of a fault in the peel-apart of Polaroid's Type 665 film, which is no longer made. The negative was contact printed with a Ziatype sensitizer on Cot 320 paper. The deep blue tonality comes from a customized drop count in the sensitizing formula. *(Courtesy of the Artist)*

I recommend using it for this process at a 1:3 dilution. You can add 1 drop of Tween per sensitizer mix or combine Tween with a Photoflo wetting agent (diluted to 10%) and use 1 drop of each. The point of this addition to the formula is to assist the sensitizer in finding a secure home in the paper fibers by lowering the surface tension of the sensitizer.

THE WORKING PROCESS

You will need most of the same supplies and the same environment necessary for Pt/Pd, and your coating area and setup will be identical . . . as will your need for a hinged-back contact-printing frame. The Ziatype can handle a greater range of negative densities with ease (negative densities of 0.8 to 2.0 due to the ad and gold contrast control), but a long tonal scale in your contact negative is still preferable to one that is limited. Consider creating a digital negative on Pictorico OHP Ultra Premium digital inkjet film for better control.

Krystal Seal Art Bags

Because the sensitized paper will be slightly humidified when the exposure begins, you may need to worry a little about protecting your negatives. The best way to do this is with a product that I was introduced to by Dick Sullivan for use when making carbon prints. I recommend Krystal Seal Art Bags because they don't "scrunch" up in the contact printing frame under pressure, are perfectly clear, and will protect your negative or sensitized paper easily and inexpensively. You can also use them for storing and transporting your work when you are finished. These are easily purchased through an art supply or Amazon.com

Acetate Sheets and Static Electricity

An alternative to Krystal Seal is a package of clear, thin acetate sheets to place between the negative and the sensitizer to protect the negative. Only use a high-quality acetate sheet without imperfections, as those flaws will degrade your final print. If you don't use Krystal Seal envelopes, or acetate, there is a good possibility of baking your sensitizer to the negative in humid conditions . . . I have done this on several occasions, and although it is a good object lesson for students while teaching, it is heartbreaking when the negative is one of a kind.

You will also want to have your clear sheets of acetate nearby, and if it is winter, or you are at high altitude and the air is dry, it is important not to create a lot of static electricity by dragging them across anything too quickly. If you do, you will notice that the sheets become instant dust magnets. I like to turn on an electric teakettle and separate the acetate near the steam. The best choice is to get a package of Krystal Seal envelopes that you can also use to store finished prints in later on.

Set yourself up in a clean, dry, and low-light work area that is similar to what you would work in for Pt/Pd. Ambient room light is fine as long as it is not too bright and there are no neon lights on. Then arrange the small bottles of Ziatype chemistry in the order that you intend to use them. Each of these bottles will have its personal dropper. I generally mark the butcher's paper that covers my coating area with a labeled location for each of the bottles. This is really necessary with Ziatype, as there are so many bottles on the table, especially when you

have a selection of ad percentages or are working in a group situation such as a workshop.

The Ziatype Negative

The Ziatype process is very flexible, and you can make a very successful print with a negative that has a base plus fog of 0.2 and a D-max of 2.0 or greater. In other words, your negatives can have a very long density range that can exceed the range you would want for platinum and palladium printing. The Ziatype is also 2–3 stops faster than traditional developing out Pt/Pd.

Pyro-processed negatives that would print on a grade II silver gelatin paper work extremely well with the Ziatype process. My friend David Stinchcomb has done a bit of work with the concept of the Pyro tint benefits for a Ziatype and has worked that idea into the production of his digital negatives on Pictorico OHP.

It is a good idea to begin learning how to make specific curves for your specific alternative process adventures. Process-specific curve profiles, to be used with Pictorico Ultra Premium OHP digital film, are readily available on the Internet. To begin, I generally recommend making the best on-screen positive you can, inverting it, printing it out on Pictorico, and doing a test print. Instantly you will get a visual lesson in how you need to begin adjusting your negatives for alternative process printing. This is easier for artists to comprehend than a lengthy technical exercise in computer science and mathematics. That will come later with need.

Moisturizing Your Brush and Table Setup

Before you begin to work, immerse your Ziatype-dedicated Richeson synthetic or hake brush in a glass of distilled water. The reason for this is that your volume of sensitizer solution will be rather spare, and if your brush is bone dry it will simply absorb all of the liquid, leaving you very little to coat and spread on the paper.

Also, have an additional beaker of distilled water for washing your brush between coatings. This wash water should be changed quite often. To one side, have your recently cleaned contact frame and a package of clear Krystal Seal envelopes or acetate sheets for the negative/sensitized paper separation. You will need your negative and a clean piece of as-yet-uncoated paper that you have torn with a straight edge so that it fits within the dimensions of your contact-printing frame.

Figure 14–10
David Stinchcomb, Bandelier, NM (Ziatype)
Here is another Ziatype image from David's excellent portfolio.
(Courtesy of the Artist)

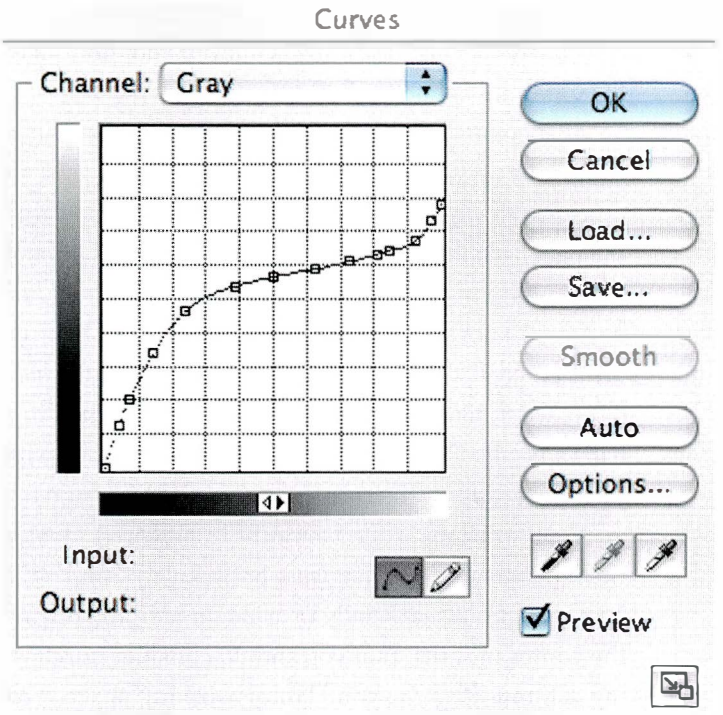
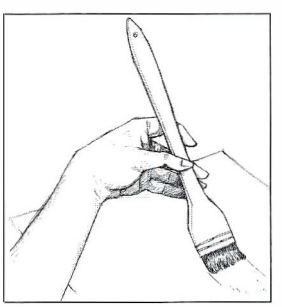


Figure 14–11
Ziatype Curve Profile
This is an example of a Ziatype curve profile that you can load during a curve adjustment sequence in Photoshop.
(Source: Adobe® Photoshop®)

Figure 14–12
Christopher James, *Portrait of Maggie Hall*, Santa Fe, 2007 (Ziatype on salted paper)
This is a portrait I made of former student, and extraordinary artist-book-maker, Maggie Hall at the Santa Fe Photography Workshops in 2007. The original negative was made with a Santa Barbara 4" × 5" pinhole camera with a Polaroid Type 55 film and was then contact printed with a Ziatype sensitizer on Cot 320 paper.
(Courtesy of the Artist/Author)

Making a Ziatype

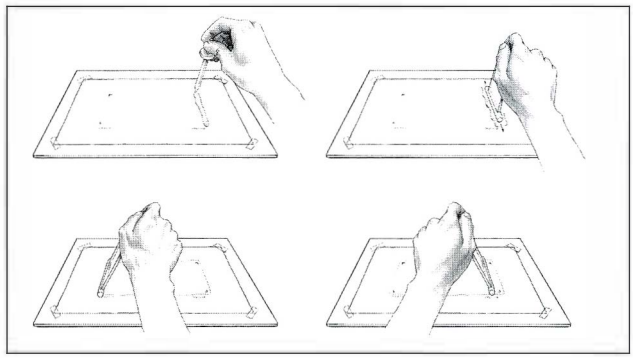
The first part of this process involves determining what kind of print you want and what contrast and color you want the print to be. The next step involves counting the drops of each solution in the sensitizing formula into your shot glass and swirling them together so that the solution is uniform. Consult the drop count chart and do exactly what you did when mixing sensitizer formulas for both the kallitype and Pt/Pd. So far, this is identical to the procedure you use for preparing a sensitizing solution in platinum/palladium printing.



The next step is to place your negative on the paper you are going to sensitize, in the location where you want it to be in the final print, and mark the paper on the outside corners of the negative with an L-shaped pencil line. This tells you where to coat the paper and allows for a little overrun for the brushstrokes. While you have the pencil in

hand, make all of the necessary formula, exposure, and weather notations on the lower margin of the paper to assist in the evaluation of the print during the lab session.

The next step is to pour the mixed sensitizer formula into the center of the marked-out area on the paper where your negative will go for the exposure. Then, with a quick and very gentle touch, brush the solution into that area. As with other brush applications, alternate your vertical and horizontal strokes over the full negative area to guarantee a smooth and complete coverage. As an alternative coating method, see the Platinum/Palladium Process chapter for Puddle Pusher directions . . . it looks like this.



When you are satisfied with the way you have coated the sensitizer on the paper, hold it under the table and whisper nice things to it as it *sets up* and begins to dry down. This will take 1–2 minutes, depending on humidity. You may think I'm kidding, but Ziatypes are fussy creatures and a little kindness will guarantee excellent results . . . you'll see.

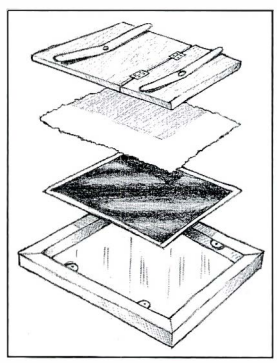
If you are experiencing very high humidity in your working space, you may want to consider using your hairdryer, on a cool setting, and blowing gently on the backside of the paper. Humidity is essential to the print quality of your Ziatype, and it may take you a little while to evaluate the ideal state of humidity in the paper. This is not difficult and simply takes a little practice to figure out. When working during the more humid summer months in New England, this aspect of the process is not a great problem.

However, when I teach in Santa Fe, or at Anderson Ranch in Aspen, there is very little humidity and the process gets a bit trickier. In these situations I am sure to add Tween to my sensitizer and do my best to humidify my working space . . . if only with an electric teakettle boiling water. In these environments I don't use a hairdryer, as the drying is uneven and this makes the tonalities splotchy and inconsistent.

My personal method of evaluating when it is time to expose the negative is to note when I can no longer see a reflective sheen on the paper's surface. I also know that the paper is ready for printing when it appears dry but doesn't have the snap of perfectly dry paper when I flex it. Also, I know the time is right when the back of the print is "cool" to the touch using the pulse-taking side of my wrist, like checking the temperature of milk in a baby's bottle. Try not to touch the paper surface with your fingertips, as they are sources of alkalinity and oil.

Your working space would be considered ideal if the relative humidity in it were between 50% and 65%. This may mean, especially in arid climates and during the winter months, that you should consider purchasing a humidifier for your lab or working space. You can calculate your lab's humidity with an inexpensive hygrometer available from Light Impressions.

Note: For more information see Michael Ware's article, "Platinum Reprinted" (*British Journal of Photography*, October 1996) or Pradip Malde's "New Solutions for Platinum Printers" (*View Camera Magazine*, October 1994).



Making a Ziatype Sandwich

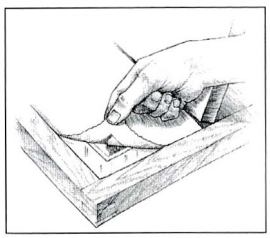
I like to build the Ziatype sandwich on a clean piece of paper before loading the contact printer. If I am smart, and using a Krystal Seal envelope, I simply insert the sensitized paper into the envelope, line up the negative (right-reading) on the outside of the Krystal Seal, and flip it into the contact printer for exposure.

Figure 14–13
Christopher James, *Manikarnika Cremation Grounds*, Benares, India, 1985 (Ziatype)
This Ziatype image is from my Benares Project series documenting death rituals in Benares, India. The original negative was a Tri-X 6" × 7" translated into a Pictorico OHP digital inkjet contact negative for the Ziatype printing.
(Courtesy of the Artist/Author)

If I am using acetate sheets, the layers are arranged on a clean surface in the following order:

- First is a sheet of new acetate that is larger than the negative but smaller than the inside dimensions of the contact printer.
- Next is your newly sensitized and not-quite-dry paper. By the way, the paper recommendations for Ziatype are the same as those for Pt/Pd.
- Next, place a second sheet of acetate on the sensitized paper so that you now have acetate on both the front and back of the sensitized paper. This will be a pseudo-humidifying envelope and will prevent the paper from drying too quickly during the exposure. Also, because your exposure will generate heat, the humidity will actually build during the exposure. This is the part of the experience in which I discovered that I could ruin my favorite negatives if I didn't use acetate between my negative and the sensitized paper.
- Now, lay your negative on the sheet of acetate, within the coating area of sensitizer, so it will be "right-reading" on the paper in the final print.
- Take hold of all of these pieces on the corners, lift them up, and flip them over into the contact printing frame so that when you close up the frame you will be looking through the glass at your right-reading negative > the first acetate > the sensitized paper > the other acetate sheet > the back of the frame. Now it is time to expose the paper to the sun or a mechanical UV light source.

Again, Ziatype is a POP, and you must be able to inspect your print during the exposure sequence in order to determine when the print is ready for washing and clearing. Ziatype exposures happen pretty quickly, so be aware of the outside border's color shift and think of it as your D-max.



Exposure

The average Ziatype exposure will probably not be longer than 6–8 minutes, so it is a good idea to begin checking on your printing-out progress after 3–4 minutes of UV exposure. When you do this, make sure that you are in subdued light. If you aren't, it is possible for you to have a final print that is half-good and half-fogged. Also, remember that the orange color that you are looking at is only the sensitizer and that you are looking for tonal gradations that will make you happy after the exposure, washing, and clearing are complete.

If you find that your exposure is happening too rapidly and that you are blocking up in the shadows and getting very little contrast (meaning that you are not experiencing the self-masking effect due to the inadequate density of your negative), try placing the contact frame in an open shade location. I almost always use a combination of shade and sun for the exposure, as it allows me to control contrast and density simply by paying attention to the time spent in shade or sun.

Incorporating shade exposure will lengthen your exposure time and boost the contrast of the final print. It will also have an effect upon the overall humidity in your paper, especially in a dry climate. If you opt for a shade exposure, it is a good idea to give the print a minute or two of straight sun at the conclusion of the total exposure to intensify your deep shadows. If you don't have deep shadows, this may be a perfect way to expose the entire print. If you have deep shadows, but they are not self-masking and are simply blocking up, chances are very good that your negative is anemic and that you need to make a new digital one with more density.

This sun–shade practice will give you more control over your tonal scale. If you are using a UV mechanical printer, try placing a sheet of Pictorico OHP film over the contact-printing frame during the exposure. Again, don't be alarmed by the orange color of your sensitizer during inspection because it will wash out. It is important that you learn how to read your highlights through this orange filter.

Figure 14–14
Dick Sullivan, Tucumcari, NM, 2000 (Ziatype)
Another Ziatype image from Dick Sullivan, creator of the Ziatype kit, available through Bostick & Sullivan. *(Courtesy of the Artist)*

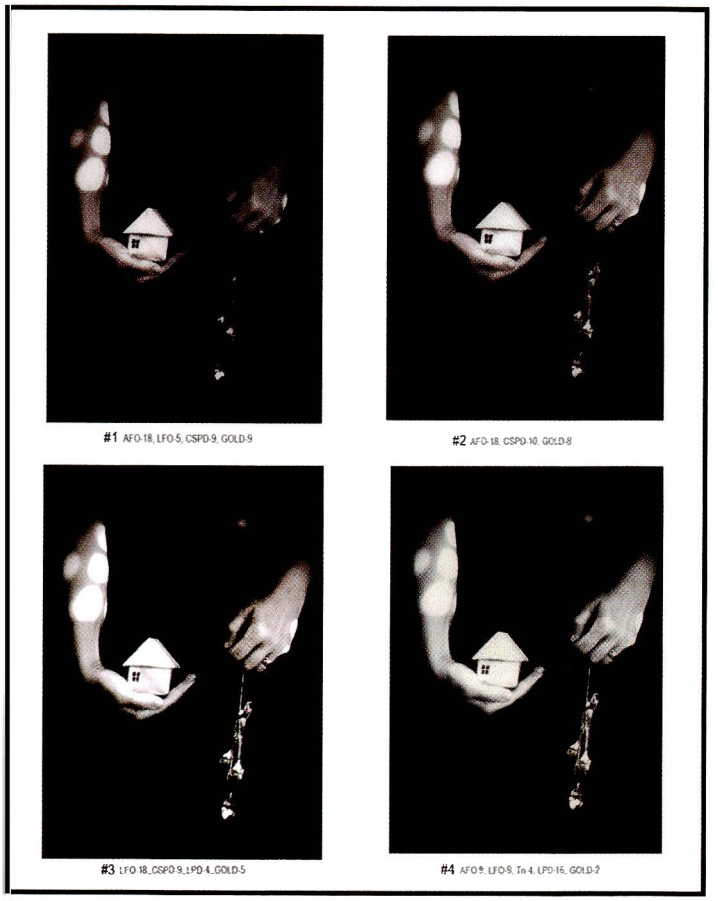


Figure 14–15
Jess Somers, Zia Tests for *Nesting* (Ziatype on salted gelatin)
This image and the following ones (Figs. 14–16 and 14–17) are examples of how amazing Ziatype looks when applied to a salted gelatin prepared paper for salted paper printing. Jess is a graduate of my MFA program and a professor in alternative processes at the College of Art and Design at Lesley University, and these test options are part of her meticulous technical control of the process.
(Courtesy of the Artist)

Increasing Density with a Damp Paper Towel

If you find that your image is simply not responding to exposure as well as you had hoped, there is a fairly good chance that all of the moisture in your paper has vanished. The solution to this problem is to not be stubborn and to stop your exposure and try using a damp paper towel.

Using a hardware-store-quality paper towel, rugged and blue generally, soak it in warm water and wring it out so that it is no longer dripping. Open up your contact-printing frame, and without losing your registration, smooth the damp towel down on the back of the paper being exposed, replace the back of the contact-printing frame, and return to the UV light to continue the exposure. You will, or should, see an immediate increase in density.

ZIATYPE ON SALTED GELATIN PAPER

During an advanced alternative process workshop in Maine a few years ago, I was giving a Ziatype demonstration using the super-tough Japanese Kozo paper but was unhappy with the way it was translating the negative. I decided to extend the demonstration by printing on a piece of Kozo paper that I had gelatin sized and salted for salted paper printing (see Gelatin Salting #1 in the Salted Paper chapter). Still less than thrilled after printing several versions, I decided make a Ziatype on a piece of Arches Platine that had also been salted and gelatin sized.

The first print resulted in beautiful and deeply rich shadows . . . but highlights that were too pink for my taste. I removed the gold chloride from the Ziatype formula and replaced it with a drop of 5% ad in order to keep the contrast in the final print. That strategy was successful at eliminating the pink highlights (because gold was out of the formula), but the delicate highlight details were completely blown out by the vigorous percentage of ad.

At that point I had the choice of using a less aggressive potassium dichromate solution or changing the printing strategy. I decided to make a sensitizer consisting of a simple afo and LiPd (lithium palladium chloride) neutral black mix

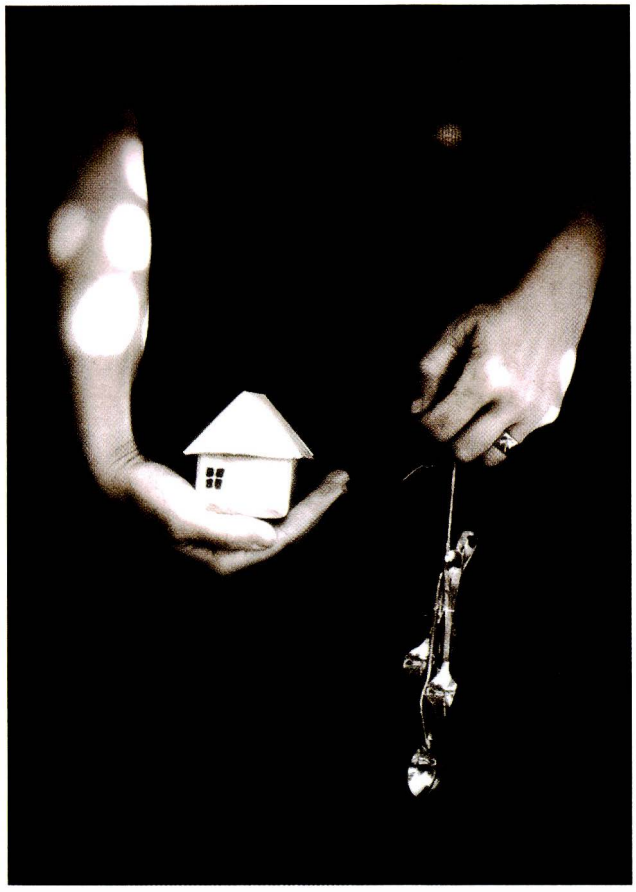
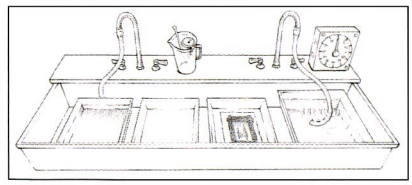


Figure 14–16
Jess Somers, *Nesting* (Ziatype on salted gelatin)
Jessica was in an advanced alternative process workshop of mine in 2007 and worked with me in experimenting with a variety of papers and paper preparations with Ziatype sensitizers. This image is a Ziatype on salted gelatin paper. Jessica wrote, *"My photographs explore the struggle and balance between the choices one makes and the uncontrollable circumstances that intervene with these choices."*
(Courtesy of the Artist)

(about 1:1) and expose the print almost entirely in the shade with 2 minutes of straight sun at the end of the exposure sequence to enhance the integrity of the shadows.

I was really surprised. The values in the final image were simply amazing . . . far richer and more satisfying than any Ziatype I had ever printed. I asked my workshop students to give the Ziatypes on salted gelatin paper a try, and within a few attempts they had all produced beautiful images. If you are looking for a new technique, you may find this variation very satisfying.

Figure 14–17
Jess Somers, *Motherhood*, 2007 (Ziatype on salted gelatin paper)
(Courtesy of the Artist)



SINK SETUP FOR ZIATYPE

Tray 1 A very clean tray filled with running water for 4–5 minutes

Tray 2 1.5% citric acid bath

Mix 1 tablespoon (approximately 15 g) of citric acid to a liter of warm water for 5 minutes. This is a 1.5% solution.

Tray 3 Clean water rinse for 1 minute

Tray 4 1.5% sodium sulphite or EDTA bath

Mix 1 tablespoon (approximately 15 g) of sodium sulphite to a liter of warm water for 5 minutes. This is a 1.5% solution.

Tray 5 Final wash for 20 minutes

Figure 14–18

Cynthia Morgan Batmanis, *Dream*, 2011 (Ziatype)

Cynthia has taken many workshops with me over the years and is quite an amazing artist. Her work has its core in family, ritual, faith, the fragility of the body, and the challenges that these components represent alone or in combination with one another. This Ziatype triptych is an interpretation of a dream.

(Courtesy of the Artist)

Fresh Water First Bath

When you are satisfied with the way your print looks, immerse your paper in fresh running water for 4–5 minutes. Unlike in many of the previous processes, a distilled water first bath doesn't seem necessary. If you can't seem to clear the yellow from your highlights this might be one step you should consider doing with distilled water.

Right away you will notice the orange sensitizer clearing from the paper and also that the print is beginning to lighten a little while exhibiting a bit more contrast than you had planned for. Relax, the density and contrast of the image will return to the way you wanted it after the final washing and dry down of the print.

Citric Acid Second Bath

After 4–5 minutes in clear running water, place your print in a bath of 1.5% citric acid (15 g/1 heaping tbsp to a liter of water) for 5 minutes. Agitate the print gently during this clearing stage.

Sodium Sulphite or EDTA Third Bath

Next, make up a 1.5% tray of either sodium sulphite or EDTA (15 g/1 heaping tbsp to a liter of water) and agitate gently for 5 minutes.

Final Wash

Your final wash should last for at least 20 minutes, and at this stage in the process your print should appear slightly soft and incomplete in the highlights and mid tones. If it looks perfect then you are going to be unhappy after the dry down, as all of the values will likely be about 15% darker.

After washing, do not, under any circumstances, use a screen rack for drying if you are working in a public or workshop darkroom. There is no possible way these screens are uncontaminated. Hang the print on a wire with clothespins and wait until it dries to determine the next step. If you are in a hurry, just blow-dry the print.

Following this dry stage, check your notations against the prints that have come before, and decide if you have made the right choices. If not, begin the process again, knowing that you can alter contrast, color, and temperature of the print with a simple change of the proportional drops in the sensitizer.

LAST THOUGHTS

Renaissance Wax

As with many other alternative processes, consider a final application of Renaissance Wax to enhance the shadows and protect the print. Again, all you need

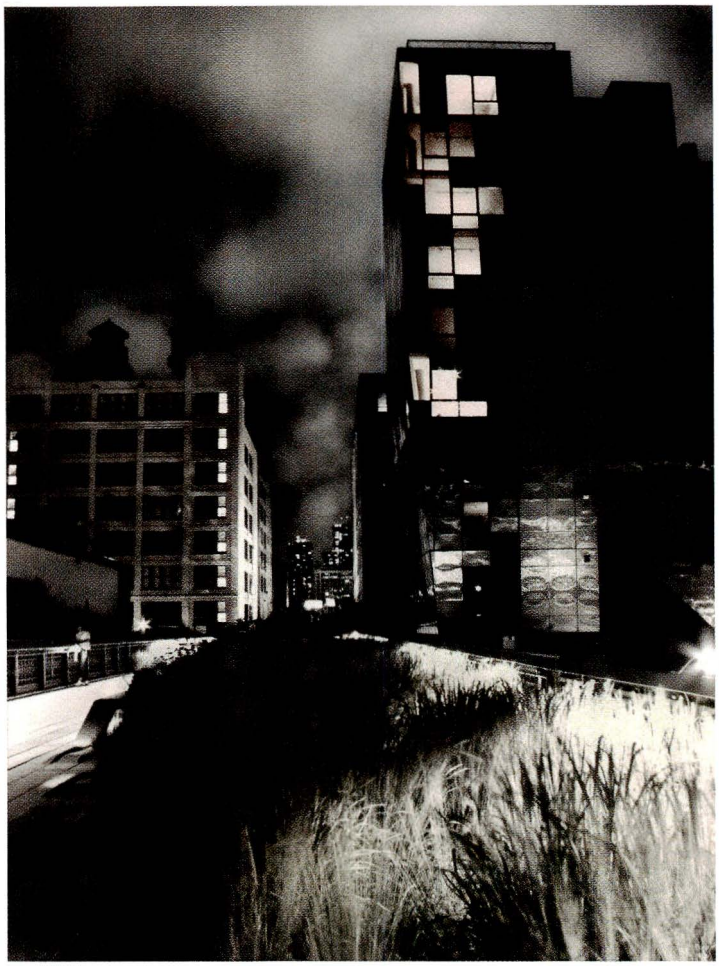


Figure 14–19
Peter M. Lindstrom, *High Line*, No1, 2011 (gum over Ziatype)
Peter has taken several workshops with me over the years and is a patient and ambitious craftsman. This print is a gum bichromate over Ziatype illustrating one of the best ways to get to the Chelsea gallery area and to take a walk in New York City . . . the High Line.
(Courtesy of the Artist)

to do is lay down your dried print on a hard and flat surface and then, with gentle swirling action, finger massage a very even and thin layer of Renaissance Wax over the entire print area. Once that is done, use a hairdryer to gently blow hot air onto the wax-coated area. You will see the wax melt and then dry down to the paper texture. You can also try Dorland's Art Wax, which is far less expensive, but it has, in some cases, turned the highlights of my test prints beige after a few years of storage.

Too New for Rules

Every POP process is a little different and will change depending on heat, time of year and day, relative humidity of both your workspace and printing area, and UV source. Like other POPs, the Ziatype is self-masking and its final resolution is linked to humidity of the substrate, exposure, and sensitizer formula. The variables are infinite, and a creative person can use this chemical flexibility to completely manage the process to suit individual intentions. As its inventor, Dick Sullivan, will readily admit, the work on this process to date may be only the tip of the iceberg. It is, despite its chemical bloodline, a relatively new technique, and there may be some wonderful and quirky adaptations waiting in the wings. Of all the alternative processes I have worked with over the last 30 years, the Ziatype is the most "user-friendly." In fact, this afternoon, after making an underexposed palladium print in a workshop demo in Santa Fe, I took the print and made up a Ziatype sensitizer with a lot of gold chloride in it, sensitized on top of the bad palladium print, blasted it with some direct sunlight, and got something entirely new and different for me . . . and my students. And off we went in a new direction! If you are new to the alternative process genre, looking for a creative kick in the pants, or a teacher of alternative processes, you will want to consider the Ziatype as one of your first process options.

Figure 14–20
Christopher James, *Drivers, Giza*, Egypt, 1992 (Ziatype)
Drivers, Giza was made with my Diana plastic camera that had been adapted with a Kershaw shutter (the single element plastic lens was glued onto the shutter) in order to allow me to shoot in low-light-level situations. The weather was very unusual for Giza: freezing cold and light snow, which resulted in no tourists. *(Courtesy of the Artist/Author)*

The Athenatype Process

OVERVIEW & EXPECTATIONS

In this chapter I will give you a little background information on a process that you probably haven't tried yet, describe to you the best way to learn and modify it to suit your workflow and style, and provide you with some examples of what the process looks like. As always, I will encourage you to have fun and to be patient with the technique, as it does present hurdles along the way, but it will give you some fine-looking images when everything goes well.

Although quite a few people contributed to what is called the Athenatype, my three primary source practitioners for this chapter are its creator, Dick Sullivan, his primary assistant, Maddie Willis, and Jess Somers, who graduated from my MFA in Photography program at the College of Art and Design at Lesley University in 2013 using the Athenatype process as her thesis process of choice. What follows is an amalgamation of what they have learned and related to me over the course of the last 2 years. Thank you to each of them in a big way, since this is a technique that I have precious little experience performing.

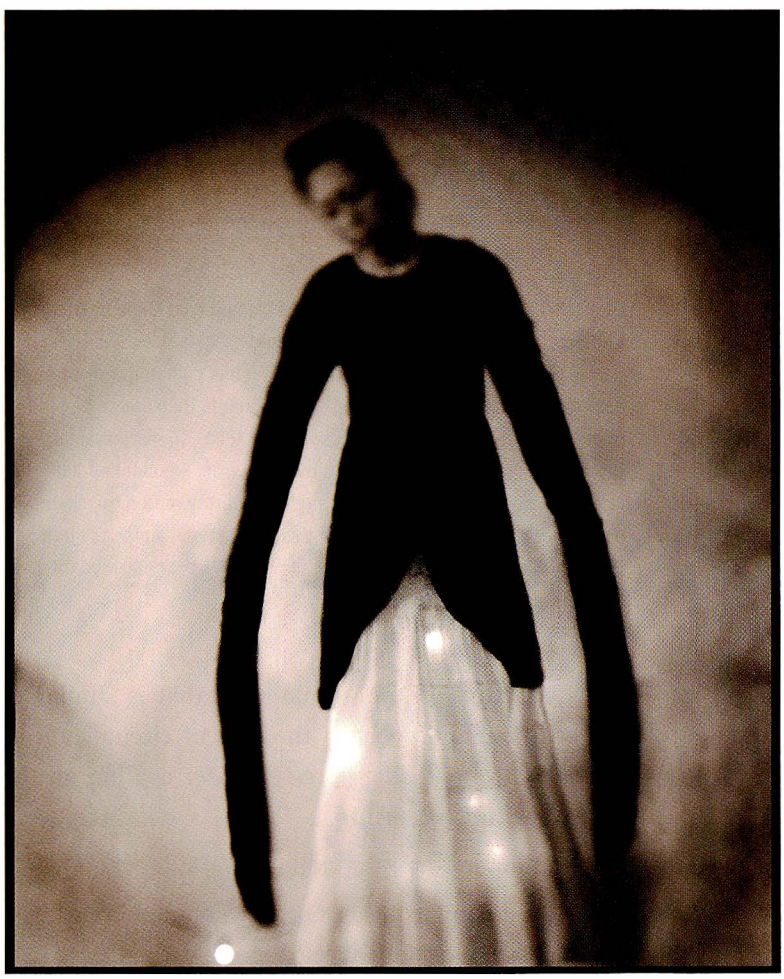
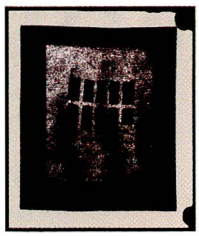


Figure 15–1
Jess Somers, *Meditations on Being a Phoenix #1*, 2013 (Athenatype)
Among the many attributes of the Athenatype process are a generous tonal scale that is similar to kallitype, plain tap water development, a printing-out or developing-out option, low cost, and simplicity to learn. Jess did her MFA thesis using this technique, and this image is one from that portfolio.
(Courtesy of the Artist)



A LITTLE HISTORY

Dick Sullivan's Greek Goddess of Wisdom Process: The Athenatype

In the summer of 2011, my friend Dick Sullivan, of Bostick & Sullivan, ardently showed me a new process concept he and his research team, including his assistant, Maddie Willis, and über-chemist Howard Efner, were tinkering with. Dick named it the Athenatype . . . after the Greek goddess of wisdom, intelligence, skill, battle strategy, and handicrafts, who, without a lot of mortal explanation, emerged from Zeus's head fully formed and decked out in armor. Dick related the pros and cons of the process, provided an outline of where he hoped it would evolve, gave a demonstration, and performed it with such enthusiasm that I felt he should have called the process the Aphroditetype.

Dick explained that there were really only three photographic paths making up the vast majority of processes ever used for image reproduction, and these included the most common, silver halide; the earliest weak-iron compound sensitivity processes (such as cyanotype), and cross-linked colloids such as carbon, albumen, and gelatin.

The Athenatype is in the family of non-colloidal suspended metallic silver prints that include the most common alternative processes of the kallitype and Van Dyke brown. The kallitype uses different developers and toners to achieve its multiple range of tonalities and is known for its platinum-/palladium-like beauty when done well, as well as its unpredictability. The Van Dyke process is well known for its flat tonalities and dense dry-down, where shadows lose their details. The process also does not tone particularly well and has been subject to a lot of misinformation over the years in the area of fixing and washing times, which has resulted in fugitive images even in excellent storage conditions. The Athenatype addresses these issues by achieving

Figure 15–2
Gertrude Käsebier, *Iron White Man*, 1900 (Athenatype made by Dick Sullivan, 2012 Library of Congress negative)
This is another negative from Gertrude Käsebier's photographic project documenting the Sioux who toured with "Buffalo Bill" Cody's Legends of the Wild West in the late 1800s and early 1900s. In this instance, Dick Sullivan has opted to create a negative from Käsebier's 1900 studio session that is available through the Library of Congress. The negative was then used to produce this Athenatype, a process that Dick and his research team have been working on for a few years as of this writing.
(Courtesy of the Artist)

1. a generously broad tonal scale that is similar to kallitype and even, in the best of circumstances, with a fumed silica pre-sensitizer coating on the paper, a Pt/Pd print.
2. a plain tap water development.
3. the option of using a DOP (developing-out process) potassium oxalate developer as a variant.
4. a POP (printing-out process) personality, like the ziatype, where what you see in the print out is what you can more or less expect at the end of the process.
5. low cost and low maintenance.
6. a simple and easy-to-learn process.

There are precious few "cons," and those that are evident pertained to archival issues, questions about the best method for fumed silica pre-coating and appropriate types of paper, and whether a surfactant, like Tween, should be incorporated into the sensitizer, as it seems that too much absorption makes it difficult to spread the sensitizer evenly.

The Athenatype, which features the chemical "light-trigger" guanidine ferric oxalate, seems to be a descendant of the original brownprint process, which preceded the Van Dyke, in that it incorporated ferric ammonium oxalate or similar versions such as sodium or potassium or, as Dick surmised, guanidine or guanidine complex. What Dick and his team concluded after going through the brownprint/Van Dyke patents was that what they were inventing was a re-working of the formula ratios to suit photographic reproduction rather than the industrial application to line drawings such as those found in architectural and engineering drawings utilizing brownprint and cyanotype. In short, the Athenatype was a variant of the brownprint process, but unlike the brownprint or Van Dyke, and more like the kallitype, it achieved its color variations through toning.

The majority of alternative photographic silver processes, used to make fine art images, were developed as one-step processes that did not require a toner to achieve a rich array of values and coloration. The Athenatype requires a toner and can be thought of as a two-step process suitable for toning in formulas traditionally used for albumen or POP gelatin paper printing. A fine example of this type of toner would be Bostick & SullivanB & S POP Gold Ammonium Thiocyanate toner.

In any event, the Athenatype is presently in its infancy as an alternative process, and not many folks have investigated all of the things that can, and will, happen when the Athenatype is integrated with other media and techniques such as cyanotype, platinum/palladium, gum bichromate, and the like. These processes, when combined with Van Dyke and kallitype, have been very successful, and I see no reason that the

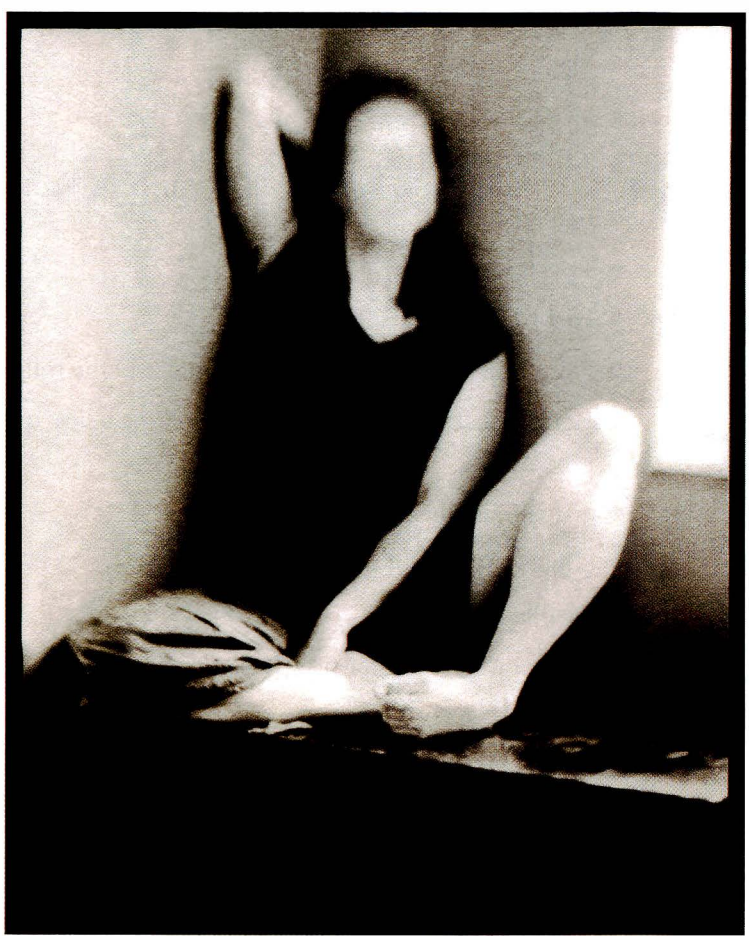


Figure 15–3
Jess Somers, *Meditations on Being a Phoenix #8*, 2012 (gold-toned Athenatype)
Another Athenatype image from Jess Somers and her *Meditations on Being a Phoenix* portfolio from 2012. In this example, Jess has pre-soaked the paper in oxalic acid, pre-coated the paper with fumed silica, and used a standard 1:1 Athenatype sensitizer mix with a drop count of 16 drops guanidine oxalate (BSFO—Bostick & Sullivan ferric oxalate) and 16 drops of 10% silver nitrate.
(Courtesy of the Artist)

Athenatype cannot enjoy the same range of diversity. Again, as in all of the techniques that are new to you, I recommend that you have fun with the unexpected, keep copious notes, be careful of all the chemicals, and share your findings with others.

INTRODUCTORY OVERVIEW OF THE PROCESS

The following represents Jessica Somers' workflow for making an Athenatype print. Although it is a variant of Dick Sullivan's technique, it is important to see how her modifications, knowledge gained, and successes with those modifications point to the flexibility of the process. Hopefully you will see this as an invitation to experiment with this new addition to the Van Dyke, kallitype, and brownprint family.

Print Specs for *Meditations on Being a Phoenix*:

Paper: Cot 320 pre-soaked for 3 minutes in a 5% oxalic acid bath and dried before coating.

Negative: 5" × 7" digital negative, with an applied Athenatype athenatype curve, printed onto Pictorico OHP Ultra Premium inkjet film.

Fumed Silica: Place .5 teaspoon of fumed silica in the middle of an 8" × 10" sheet of paper and roll it out with a high-density "hot-dog" foam roller for 2 minutes. See the instructions, and for more, go to the Fumed Silica chapter.

Sensitizer: A standard Athenatype sensitizer mix is 1:1 and is made up with a drop count of 16 drops guanidine oxalate (BSFO—Bostick & Sullivan Ferric Oxalate) and 16 drops of 10% silver nitrate.

Sensitizer Coating Brush: 8" Liquitex Freestyle Large Scale Brush or generic one-time use 4" foam brush found at all hardware and paint stores.

Exposure: Expose the paper in a UV exposure unit for 2.5 minutes. If you don't have one, try a shade-to-sun combination exposure sequence with more shade leading to a modest increase in contrast.

Processing:

- 2-minute running tap water wash
- 2 minutes in clearing bath 1
- 2-minute soak in distilled water
- 5 minutes in gold POP toner
- 2-minute running water wash
- 10 minutes in 10% fixer with sodium carbonate
- 1 minute in 1% sodium sulphite
- 20-minute running water wash

THE ATHENATYPE CHEMISTRY & MATERIALS

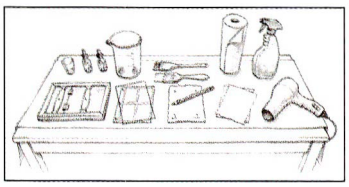
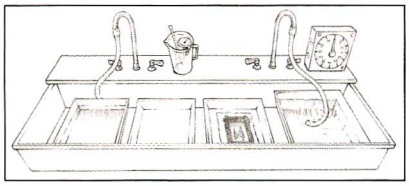


TABLE SETUP FOR ATHENATYPE

- Bostick & Sullivan ferric oxalate/guanidine ferric oxalate
- 10% silver nitrate
- Screw cap eyedroppers for stock solutions
- Paper for sensitizing: best are COT 320, Arches Platine, and Aquarelle
- 5% oxalic acid
- A heavy-duty shot glass
- Fumed silica
- Tween 20
- High-density "hot-dog" roller
- Paint roller tray appropriate for the size of the roller
- Heavy sheet of Lucite or glass for coating silica and sensitizer
- 4" foam brushes for sensitizer coating
- Squeegee or small wiper blade
- Distilled water
- Krystal Klear bags for printing and print storage
- Pencil
- Contact printing frame with clean glass
- Negatives—silver gelatin, wet plate, or Pictorico OHP digital film for contact printing
- Paper towels



SINK SETUP FOR ATHENATYPE

- Potassium oxalate developer for processing option
- Tetrasodium EDTA
- Bostick & Sullivan selenium toner for Athenatype
- 5% gold chloride
- Sodium carbonate
- 1% sodium sulphite
- 10% sodium thiosulphate fixer
- Bostick & Sullivan POP gold ammonium thiocyanate toner
- Moersch MT7 Iron Blue Toning Kit

FUMED SILICA PRE-COATING PAPER PREPARATION

For an illustrated overview of the benefits of preparing your paper with a pre-sensitized coating of fumed silica, or fumed alumina, please refer to the separate and very brief chapter on this technique. A fumed silica application may be used with a variety of alternative processes to varying degrees of success . . . some of them very impressive. Here is a brief description.

Paper

The three best papers, to date, for this process are Cot 320, Aquarelle, and Arches Platine. All three work well and do not exhibit a tendency to stain as do papers such as Revere and Stonehenge.

Paper Preparation: Optional Acidification

Pre-soak your paper for 3–5 minutes in a 5% solution of oxalic acid. The pre-soak acidification of the paper may be important when tap water that is alkaline is used in the washing stages. The addition of oxalic acid also ensures that the ferric oxalate fully reacts with the silver nitrate. As a result contrast and tonality increases.

Silica Sizing Solution, Dry Version

Measure out approximately .5 teaspoon of silica for a 5" × 7" print. Place the silica in the middle of the paper and gently roll to coat the roller. Roll the fumed silica on the paper vertically and horizontally for 2 minutes. There should be no residual silica on the surface of the roller. The surface of the paper is now delicate and almost has the feel of velvet. Be careful not to touch it or you could mar the silica coating. I strongly recommend wearing a dust mask or respirator fitted with a particle filter when working with fumed silica, as the particles do become airborne during this process and are easily inhaled.

Dick Sullivan's Fumed Silica Dry Coating Option

- You will need a high-density foam roller (often called a hot-dog roller) from any decent hardware or paint store. They come in 2", 3", 4", and 6" sizes from various manufacturers.
- A suitable tray for the size of the roller
- A piece of paper to print on

1. Place a small amount (about a heaping teaspoon for an 8" × 10" paper) of silica in the tray, for a 4" roller. You can also opt for placing the teaspoon full of fumed silica directly on the paper and rolling out from that surface.
2. Charge the roller by rolling it with some pressure in the tray, much as you would if you were putting liquid paint on a paint roller.
3. Roll the roller over the paper, covering it completely with the silica in both horizontal and vertical directions . . . being sure to go from edge to edge in each pass for evenness of application. Apply more if the print is large. Surprisingly the silica appears to go on very evenly. It will behave more like a fluid than a powder! And please be aware that this material is so light that there is bound to be dust in the air you are breathing. Please wear a respirator.
4. Use a squeegee with a good rubber blade and squeegee the silica-coated paper with a light swipe across it. Polishing with a cloth will pull silica up

out of the valleys and dimples in the paper texture, while the squeegee appears to even the fumed silica out, leaving a completely filled surface on the substrate.

Josh Partridge's Wet Coating Option

1. Mix the fumed silica by volume, not weight. Mix by adding 3 parts distilled water to 1 part silica. 4:1 to 1:1 works, but 1:2 is too much; the excess falls off the paper after drying.
2. Put the distilled water in a blender and make the speed fast enough to make a funnel of air down to the blades (or almost to the blades). Slowly pour the silica into the funnel (about 1 minute). It needs the high-speed shearing action to not settle out later. Figure about 5 minutes to get it right. If the blender can't make a funnel of air, use the best the blender can do. Try using #5 on the variable speed of the VitaMix with about 1200 ml of water.
3. Put this slurry mix in a tray larger than the paper you will be submerging in it.
4. Put the paper in the tray and push it to the bottom with your fingers. Be sure the submersion is total in its coverage and saturation. Place the saturated paper on a hard non-absorbent surface such as a sheet of glass or ¼" Lucite.
5. Coat with a foam roller for 1.5–2 minutes, rolling slowly back and forth with just normal or light pressure. You are massaging the silica into the paper. A good soak in the silica soup is important to fully saturate the paper with silica.
6. Hang the paper up to dry and then flatten it.

ATHENATYPE SENSITIZER

Athenatype Sensitizer Mix

The standard working sensitizer mix for an Athenatype is 1:1 or equal proportions of Parts A and B. A 5" × 7" sheet of paper uses approximately 16 drops of Part A and 16 drops of Part B. A 10" × 12" print will take 2 ml of Part A and 2 ml of Part B.

Athenatype Sensitizer #1 Formula

Sensitizer #1 Part A: 10% silver nitrate (10 g silver nitrate mixed with 100 ml distilled water)

Sensitizer #1 Part B: Guanidine ferric oxalate (a.k.a. Bostick & Sullivan ferric ammonium oxalate that is prepared and sold by Bostick & Sullivan)

Guanidine Ferric Oxalate Solution: Make or Pre-Mixed: If you decide to try to make your own guanidine ferric oxalate at home, here is a formula from Dick Sullivan that he gave to me in 2011. Prepare it in a glass beaker as follows.

Sensitizer #1 Part B Preparation

1. Guanidine carbonate —18 g
2. Oxalic acid—12.6 g
3. Add 50 ml of water.
4. Add 12.5 g of powdered ferric oxalate.
5. Stir and you'll see an abundance of carbon dioxide bubbles.
6. Cool to room temperature.
7. If you see sediment and crystal in the bottom of the mixing vessel following the cooling, simply decant into a new glass beaker using coffee filters and/or cotton balls in a funnel.

Athenatype Sensitizer #2 Formula: With Gold or Pt/Pd #3

Sensitizer Part A: 10% silver nitrate (10 g silver nitrate mixed with 100 ml distilled water)

Sensitizer Part B: 40% ferric ammonium oxalate

Addition Option: 1 drop of 5% gold chloride or 1 drop Solution # 3, Part C, potassium chloroplatinite/sodium tetrachloroplatinite (II) sensitizer from a standard platinum printing mix

Altering Contrast With Pt/Pd

One drop of palladium #3 standard solution locks the image in and does not bleach back in the fix. It also results in softer contrast.

Three drops of platinum standard solution #3 give a powerful boost to the contrast and locks in the image. This is to a total of 30 drops of silver nitrate 15%, so it is still very cost effective.

Figure 15–4
Madelyn Willis, *Santo Domingo Horse*, 2011 (Athenatype)
One of the primary members of the Athenatype research group at Bostick & Sullivan is Madelyn Willis. This is one of her many test prints with the process.
(Courtesy of the Artist)

Athenatype Sensitizer #3 Formula: Potassium Oxalate Development

This is the same make-it-yourself sensitizer formula as the Athenatype Sensitizer #2 Formula except that in this variation you may wish to consider a DOP technique by using a potassium oxalate Pt/Pd developer in the same mix that you would use for Pt/Pd print development. This results in an image that is visually sharper and clearer. As in the other two examples, the paper is pre-coated with fumed silica to enhance the depth of the image. The following represents the sequence constructed by Maddie Willis using Lana Aquarelle paper and fumed silica pre-coating before sensitizing with guanidine ferric oxalate and silver nitrate.

1. Mix Part A: 18 g guanidine carbonate and 12.6 g oxalic acid.
2. Mix Part B: 14 g ferric oxalate and 50 ml distilled water.
3. Mix Parts A & B together 1:1 to make guanidine ferric oxalate.
4. Mix 1:1 guanidine ferric oxalate and 12% silver nitrate.
5. You now have your Athenatype sensitizer for this print.
6. Apply the sensitizer with a foam brush on Aquarelle paper that has been pre-coated with fumed silica. After sensitizing, allow the paper to dry completely on its own without using a hairdryer.
7. Mate the negative to the sensitized paper and expose to UV light.
8. Develop the print with potassium oxalate developer.

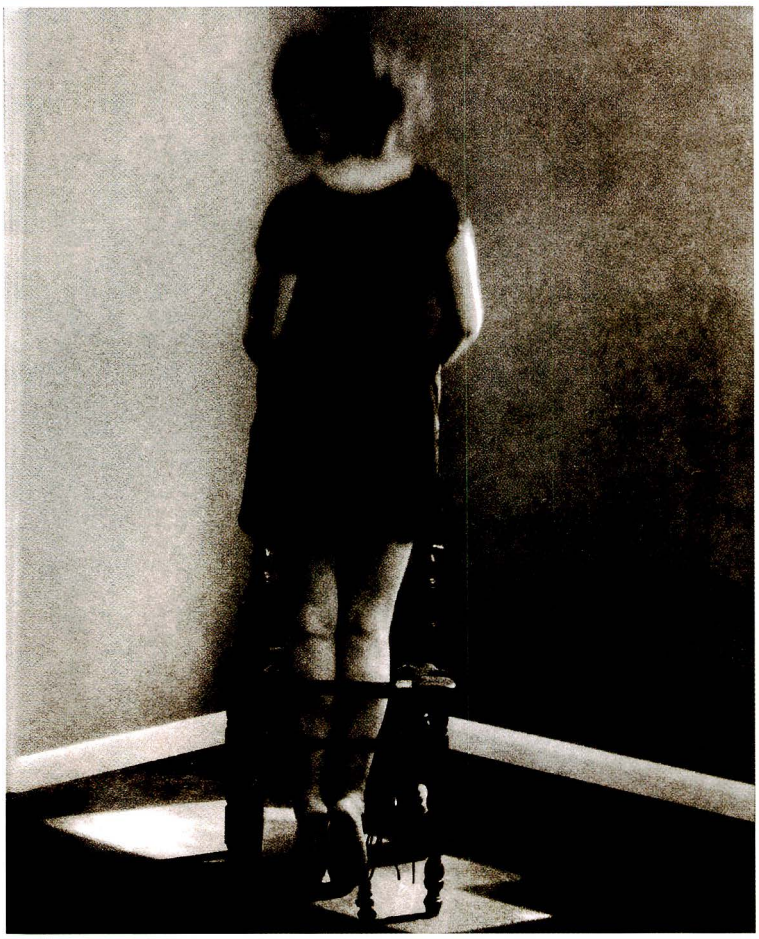


Figure 15–5
Jess Somers, *Meditations on Being a Phoenix #4*, 2012
(Courtesy of the Artist)

9. Rinse in distilled water for 5 minutes.
10. Clear with EDTA baths as in Pt/Pd printing.
11. Wash for 30 minutes.
12. Hang the print to dry or place it on a clean non-metallic screen.

SYNOPSIS OF MAKING AN ATHENATYPE PRINT

Sensitizer and Coating

Coat a piece of paper with fumed silica sizing as described earlier. COT 320, Lana Aquarelle, or Arches Platine will work well as paper options. To be safe, please wear a respirator for this step, as fumed silica has the density of smoke and the silica already on the paper will be disrupted when coating the sensitizer. It can be inhaled, and as with anything other than air, that is unhealthy.

Once the paper is evenly coated with fumed silica, prepare a sensitizer consisting of 16 drops of Part A sensitizer and 16 drops of Part B sensitizer. Do this drop count in a small graduate or short-barreled heavy-duty shot glass. Pour the sensitizer onto your paper in a line at the top edge of the paper. Using a high-quality synthetic brush, such as a Richeson, or a Liquitex Freestyle Large Scale brush (with widths up to 8"), begin your coating sequence. Brush vertically and horizontally, being sure to cover the entire length and width of the print area before changing directions. It is best to use a short-bristled synthetic sable brush, the same width as your print, if possible. You may also consider dense foam one-time-use brushes that are available at any hardware or paint supply.

Brush gently at first and then briskly until the paper goes from looking like a glossy piece of photo paper to a dull luster finish photo paper. During your final brush strokes rapidly and lightly whisk the surface of the paper to burnish out any visible brush strokes left in the fumed silica surface. You should feel some resistance as you continue to brush the sensitizer, and you will hear a soft squeaking sound.

It is important that the brush you use to coat sensitizer is completely dry. Do not soak the brush between prints, but be aware that you are likely picking up fumed silica from the paper surface with each brushing application. If you wash the brush, make sure it is completely dry before using it. A damp brush makes it harder to eliminate visible brush strokes in the final application stages. Immediately dry the paper with warm air until it is bone dry.

Put your film or Pictorico OHP Ultra Premium digital negative in registration with your dry sensitized paper. Expose the image to UV light until you have an image with a small amount of detail in your brightest highlights. If your paper was pre-soaked in oxalic acid, you will have a whisper image upon proper exposure; if the paper was not soaked in oxalic acid, you will have a "stage whisper" as in a kallitype prior to development.

Humidity and Exposure

A low-humidity working environment will yield a higher contrast image that is slightly warmer in tone. A high-humidity environment will show a lower contrast image and produces a cooler-toned print. A UV exposure unit allows for the most consistent contrast and tone. If exposing with sunlight, shade and early morning sun yields a flat purple-gray print. Printing in mid-afternoon sun yields a slightly more dense purple-brown tonality.

PROCESSING THE ATHENATYPE

TRAY 1 **First Wash**—Running tap water bath for 2 minutes. Immerse the print quickly and evenly into this first wash of running cool tap water. Uneven or hesitant immersions into this first wash will often result in a mottled or uneven appearance on the Athenatype surface. Be careful not to touch the print surface during the wet stages, as it is very delicate. The print will instantly darken and will be, as you will see, about a half-stop darker and slightly higher in contrast than the final print. The color tonality will be golden brown, but this will change during the processing.

Remember that you have an option at this stage in the process of using a DOP technique by using platinum/palladium potassium oxalate developer followed by a rinse in distilled water and Tray #2: Clearing Bath #1. See Maddie Willis's sequence (Figure 15-4).

TRAY 2 **Clearing Bath #1**—Mix up a clearing bath solution of 15–20 g of sodium sulphite, 15–20 g of tetrasodium EDTA, and 15 g of sodium thiosulphate with 1 liter (1000 ml) of water. Agitate the print gently in this bath for 2–4 minutes. If your print has a purple cast to it, rather than the normal golden brown color,

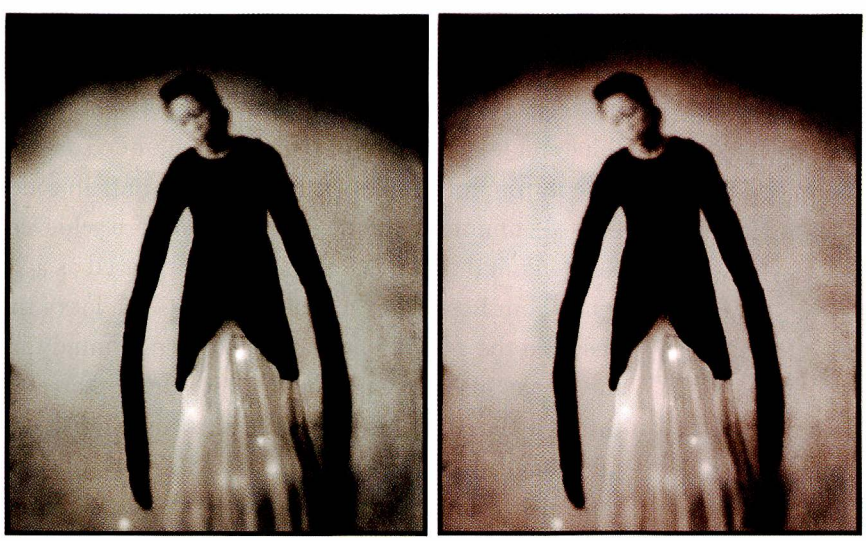


Figure 15–6
Jess Somers, Athenatype Wash, Distilled vs. Tap Water Illustration
Where you are working and the type of water you are using makes a large difference in the outcome of your Athenatypes. Here are two Athenatype prints from Jess Somers. The more monochromatic image on the left is washed using distilled water. The selenium-like colored image on the right, with highlights that are softer, is washed in tap water. This is the more typical reddish brown Athenatype tonality. It will be important to test your personal water supply and to decide if acidifying your paper before printing will make a difference.
(Courtesy of the Artist)

Figure 15–7
Wolfgang Moersch, *Braghphenn*, 2012 (MT7—iron-blue-toned Athenatype)
Any metallic silver print can be toned in a noble metal, such as gold, to enhance the depth of the print as well as to achieve a more archival life after the process. These prints can also be toned in traditional silver toning solutions such as selenium and iron blue toners. Wolfgang Moersch's MT7 Iron Blue Toner is a single bath blue toner that was traditionally developed for fiber-based and RC silver gelatin papers. The toner can be played with to produce tones from bright blue to dark blue and between green blue and magenta blue. Wolfgang Moersch's toning kits (Moersch Photochemie in Germany) are available from Freestyle. *(Courtesy of the Artist)*

you may want to mix your clearing bath with distilled water.

TRAY 3 **Second Rinse**—Place your print in a tray of distilled water for 2–4 minutes. This step is crucial before toning, as excess sensitizer will wash off the print. The look of this is similar to that of kallitype processing when residual sensitizer continues to run off the paper following an inadequate washing time. Place the print face down while washing. Be sure when removing it from the wash tray that there is no longer any sensitizer running off the print. This is easily seen in the outside print margins. Change this water bath for each print.

TRAY 4 **Gold, Selenium, MT7 Iron Toning Prior to Fixing**

Any metallic silver print can be toned in a noble metal, such as gold, to enhance the depth of the print as well as to achieve a more archival life after the process. Prints can also be toned in traditional silver toning solutions such as selenium and iron blue toners. For simplicity, the three that will be discussed here are POP gold ammonium thiocyanate, a standard alternative process toner often used in albumen and salted paper processing; selenium; and an iron blue toner developed by Wolfgang Moersch called MT7.

Gold ammonium thiocyanate toner often results in a bluish cooling of the highlights and overall cooling of the print itself. To use, mix 50 ml of 2% ammonium thiocyanate and 50 ml of 0.2% gold chloride solution with 900 ml of distilled water. Agitate prints in toner for 5–15 minutes until the desired results are achieved. Keep in mind that this toner can be purchased as a kit toner from Bostick & Sullivan, eliminating a lot of the hassle in the gold preparation. Also keep in mind that this toner loses strength with every print that goes through the 1000 ml solution; subsequently it will take longer to achieve your results. After 4–5 prints, replenish your toner by adding 50 ml of 2% ammonium thiocyanate and 50 ml of 0.2% gold chloride solution to the tray of toner.

Another recommended toner is Dick Sullivan's Bostick & Sullivan selenium toner for Athenatype. It produces a brown, to dark brown black, to blue black without staining. As well, it is much more economical than gold or platinum. One of the more irksome problems often associated with traditional selenium toning of silver prints is that the highlights often take on a yellow staining. This particular selenium toner eliminates this fault.

One of the reasons for this may be that this selenium formula has no thiosulphate in it and thus no sulphur, as does the traditional Kodak Selenium Toner that you may be more familiar with for silver gelatin printing.

To make this toner, mix 5 ml Bostick & Sullivan thiosulphate-free selenium toner with 5 g of sodium tungstate and 500 ml of distilled water. Tone until it meets your subjective needs. Be aware that over-toning will often result in the fogging of the image, as the smallest particles of silver in the image take on the selenium and are converted to silver selenite. Be judicious and keep track of your toning times.

An additional selenium solution, made with nominal percentages of sodium sulphite and selenium metal, also works well when there is no simultaneous fixing action going on. Bostick & Sullivan makes and markets this toner, called B&S sulphur-free selenium solution or Fool's Gold Toner due to its gold-like appearance. To make it, mix 6 g of selenium metal, 75 g of sodium sulphite, and 1 liter (1000 ml) of distilled water. Considering the dangerous nature of selenium, I would recommend buying the prepared solution.

Wolfgang Moersch's MT7 Iron Blue Toner is a single bath blue toner that was traditionally developed for fiber-based and RC silver gelatin papers. The kit will make 6–10 liters of working solution, and the resulting image tonality will depend on the paper you use. The toner can be played with to produce tones from bright blue to dark blue and between green blue and magenta blue.

The toning kit, available from Freestyle, contains five solutions for the preparation of the toner. You have to use at least three. By altering the ratios of the three main ingredients and by adding the other two optional solutions, you can tune the colors to suit your needs. Berlin-blue dye is sensitive to alkali. After toning avoid prolonged rinsing. To quickly remove the yellow cast of the ferricyanide, an acidic de-yellowing concentrate is included in delivery (dilute to 1:9 for use). As soon as the image whites are cleared, rinse the print for another 3 minutes. If you want to shift the blue tone toward violet or blue grey, you can immerse the print in a weak 10% alkali solution that is included in the kit. You need between 5 and 10 ml per liter of water for this process. When you are done, you can use this solution to get rid of blue stain residue in your tray.

TRAY 5 **Second Rinse**—Wash the toned print in a running cool water bath for 2 minutes.

TRAY 6 **Fixer**—Fix the toned and washed print in a 10% sodium thiosulphate fixing solution for 10 minutes. I know this seems like a long fix for an alternative process, but this is the recommended time from both Dick Sullivan and Jess Somers. To make a 10% fixing solution, add 100 g of sodium thiosulphate and 3 g of sodium carbonate to 1 liter of water and stir it into solution. The addition of the sodium carbonate has a noticeable effect on reducing the bleach-back that sometimes occurs in the fixing stage. Fix the print for 10 minutes, being sure to change the fixing bath every 2 to 3 prints. Be very cautious of the print surface and try your best not to touch it with fingers or paper.

TRAY 7 **Optional Clearing Bath**—An optional clearing bath solution can be employed here if you wish. To make this bath, mix a 1% sodium sulphite bath using 10 g of sodium sulphite mixed with 1 liter of water and soak the print for 1 minute.

TRAY 8 **Final Washes**—Wash the print in a final wash of running water for 20 minutes. If you notice that your highlights are yellowing after dry-down, consider a final soak in distilled water for 5 minutes before hanging the print up to dry. Print dry down is about 10% darker in the shadow details and marginally darker in the mid-tones and highlights.

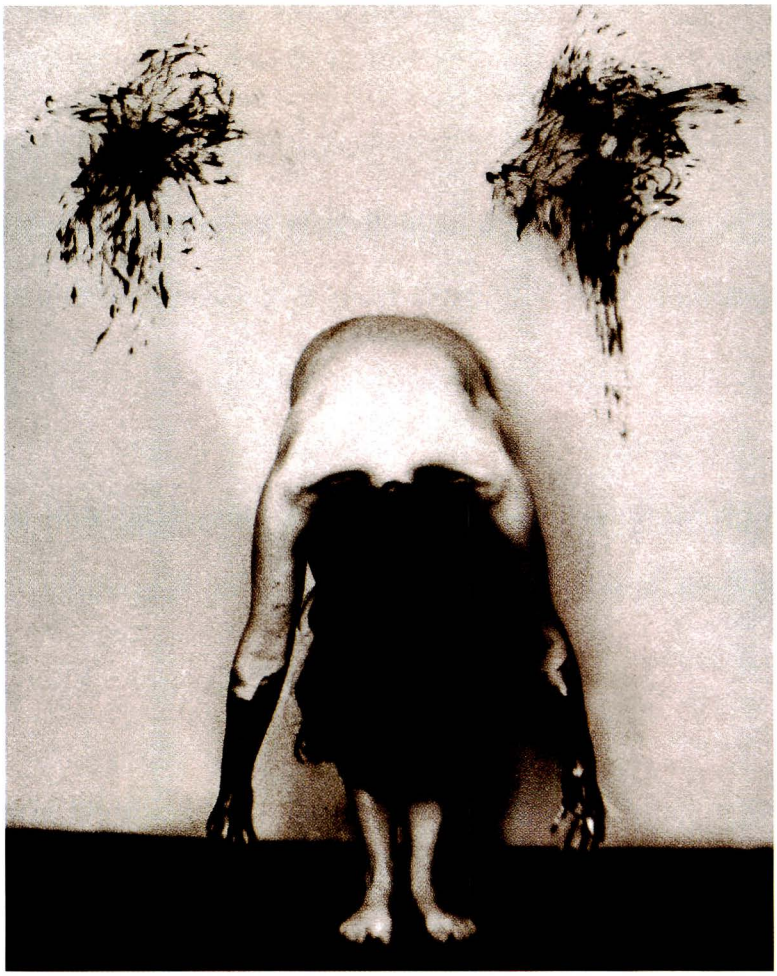


Figure 15–8
Jess Somers, *Meditations on Being a Phoenix #3*, 2013 (Athenatype)
Here's another Athenatype print from Jess Somers's MFA thesis portfolio.
(Courtesy of the Artist)

TROUBLESHOOTING ATHENATYPE

Lines and Brush Marks

If you have lines or visible brush marks on the surface of the print, the sensitizer may need to be brushed more thoroughly. Use a low-watt tungsten bulb, off to the side of your coating area, to visually inspect the surface of the print while coating the sensitizer. This will help in detecting an uneven coating. Keep the coating pressure light, and be sure to work vertically and horizontally for complete coverage.

Mottling

If you have mottling on the surface of the print, or the look of disrupted paper fibers or pilling, this may be a case of over-brushing when the sensitizer was applied to damp paper.

If the print appears light or washes away in the first series of washes, the sensitizer has not been brushed into the paper enough or the fumed silica was not rolled into the surface of the paper. Try rolling the fumed silica for no less than 2 minutes.

When brushing on the sensitizer make sure it has a matte surface before you stop brushing; you should feel resistance on the brush.

Adding a drop or two of Tween 20 will also help the sensitizer absorb into the silica. (See Dick Sullivan's variation of Josh Partridge's wet coating option presented earlier.)

Print Bleaching

If the print yellows and smells of fixer after the final wash and dry down, the fixer may be too acidic. Add 3 g of sodium carbonate to the fixer and use distilled water for your mix and rinses.

Another cause of prints that appear to be bleached out, with a pale yellowish tonality, will often be attributed to selecting the wrong type of paper for this process. As with any technique, some papers

just don't behave well. The best papers for this process are Cot 320, Arches Platine, and Aquarelle.

Reddish Speckling

If there is speckling in the print, specifically a reddish brown speckling in the shadow areas, your paper or print area is overly humid. This will often disappear once the print is fully washed and dried. Dehumidifying your workspace and making sure the print is bone dry before exposure can minimize this potential problem.

Water Spots/Lines/Blotches

If the surface of the print has water spots or uneven lines and blotches it may not have been immersed evenly and smoothly into the first wash bath. These blotches can also occur if the finished print was stored before the paper dried completely or if moisture was introduced after drying. An inkjet fixative spray may help protect the paper once it is completely dry. Another unproven idea here would be the application of Renaissance Wax to the completed dry print . . . a very thin application buffed with a microfiber cloth.

Purple and Blue Prints

Purple-blue prints may indicate that the paper or water source was too alkaline. If it is the paper, the paper can be acidified by soaking it for a couple of minutes in a 5% oxalic acid bath. If it is the water, use distilled water for the first clearing bath and second water wash.

Figure 15–9
Wolfgang Moersch, *Swamp*, 2012 (un-toned Athenatype)
This image by Wolfgang Moersch was made using a Holga 120 camera, processed in Efke IR820 developer, 1 + 1 = 50 at 20° C 11 minutes, print negative on Wephota FO5 Lithografic Film by reversal development. The paper was Arches Platine, pre-coated with fumed silica applied with a foam roller, and then sensitized with Athenatype sensitizer and a foam brush. The clearing bath was a 2% citric acid bath, and the fixer was an ATS alkaline fixer 1:30. *(Courtesy of the Artist)*

The Albumen Process

OVERVIEW & EXPECTATIONS

This chapter is pretty direct in its intentions . . . to take the mystery out of this very beautiful process that was the process of choice of photographic image makers for decades. I will guide you into the process of making albumen prints with as few problems as possible and will begin, as I do in every chapter, with A Little History component about the brief and luminous life of the albumen process . . . a seductive and labor-intensive technique involving egg whites, salt, acetic acid, silver nitrate, and gold chloride.

You will learn how the process works and how to prepare the chemistry with both the traditional, and contemporary, versions of raw egg white/albumen preparation. I'll also be offering you two versions of how to create a unique matte albumen method: one method using a fumed silica paper preparation and the other a variation using tapioca starch. This latter technique is the one I use exclusively to introduce students to the process because it is fun separating thirty-six eggs in a group and then making a great crème brûlée from the egg yolks you aren't using. I've included the recipe!

I'll also describe the "instant gratification" and powdered albumen versions of the technique and will do my best to simplify the coating, printing, processing, toning, and fixing stages. I'll then go over some troubleshooting issues, including the primary problem of yellow highlights, and discuss the importance of not taking too many shortcuts. This technique is truly one of the most enchanting in the alternative process library and is one of my personal favorites.

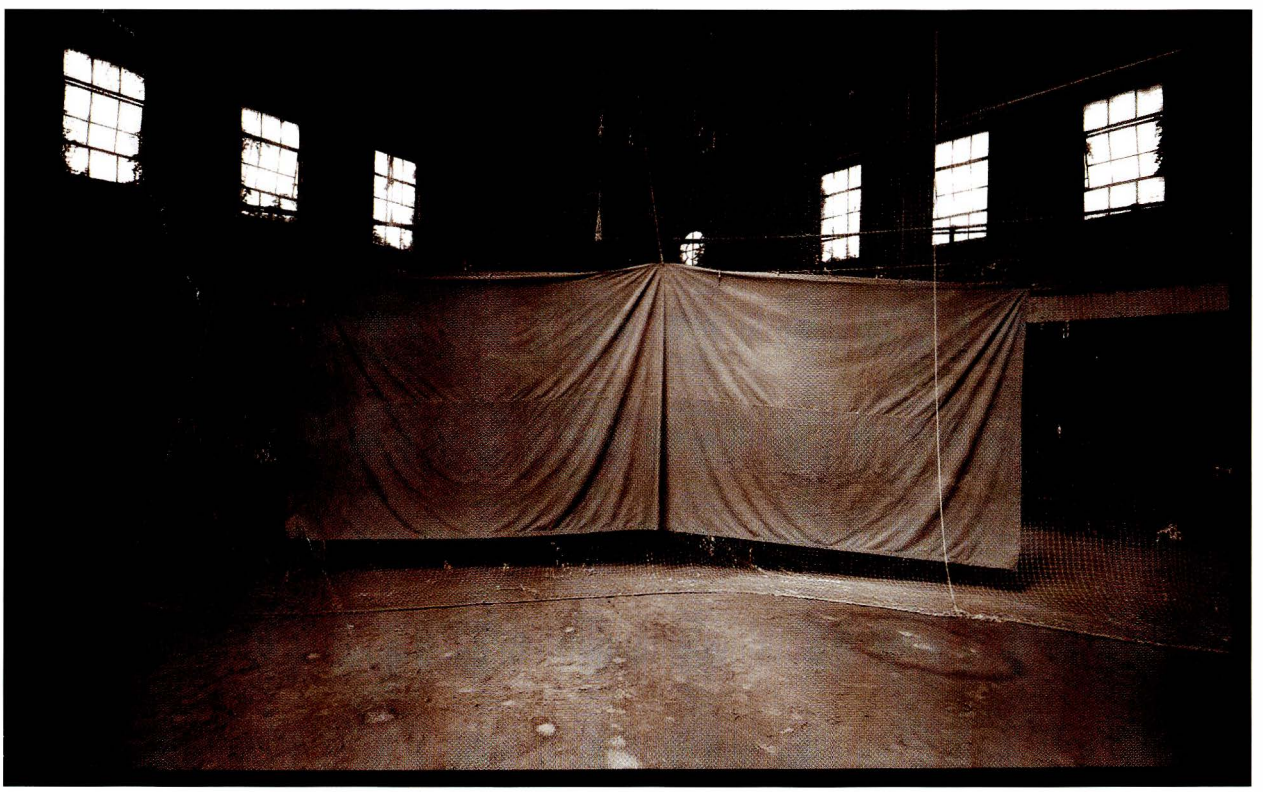
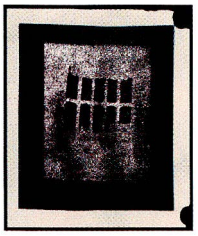


Figure 16–1

Christopher James, *Hanging Tarp,* Harvard, 1979 (albumen)

One of the best things about the 13 years I spent teaching at Harvard University was the abundant number of subject and tableau opportunities that the over-300-year-old campus presented. This is a hanging tarp backstop that could be used for a variety of athletic practice purposes. Above it, surrounding the lower level of the tarp's location, is an aged and angled wooden running track that made the pounding of feet sound like cannon fire. *(Courtesy of the Artist/Author)*



A LITTLE HISTORY

The earliest photographic prints on paper were created using sodium chloride salted papers that had been sensitized in a bath of silver nitrate to create UV-sensitive silver chloride. The principle fault of the salted silver-based processes of this particular technique was that the salted paper print was most often dull and lifeless due to a dilute 1:1 albumen and water surface coating, and to the absorption of the sensitizer by the paper's fibers.

In 1860, in an exchange of letters between Henry James (not the author Henry James) and William Henry Fox Talbot, Talbot related that he had been considering gelatin and gum binders to hold his preparations of silver nitrate sensitizer since 1840. This was when he performed some experiments involving albumen on glass that he subsequently fumed with iodine and then sensitized with silver nitrate . . . creating a light-sensitive silver iodide coating. In conjunction

Figure 16–2

France Scully Osterman, *Embrace*, 2002

There are few who equal France when it comes to solving the complexities of an antique process. More importantly, her visual sense is as refined as her technical ability. This gold-toned albumen print from an 8" × 10" collodion negative from her *Sleep* series is a wonderful example.

(Courtesy of the Artist & The Howard Greenberg Gallery)

Figure 16–3
Nadar, *Self Portrait Carte d' Visite in hot air balloon*, 1863 (albumen)
This is a terrific, and equally silly, carte d'visite by Nadar, who was quite well known for his irrepressible personality; his fascination with flying machines; and, one would think by looking at this image, his extremely short legs. His studio was a gathering place for the artistic and literate, and he made his mark by photographing all of them. He was the first to use artificial light, to make pictures from a balloon, and he invented the illustrated interview. Look up Nadar's portrait series of color theorist Michel-Eugène Chevreul on the eve of his 100th birthday.
(The J. Paul Getty Museum, Los Angeles)

with that work, Talbot also conducted several experiments that focused on combining albumen with potassium iodide. According to Talbot's notebooks, none of his albumen binder techniques met his expectations or were successful enough to merit further development.

In 1844, in Boston (home of the beloved Red Sox for the last 100 years), John Adams Whipple (see Figure 1–8, his daguerreotype of the moon from 1852) and his good friend, William Jones, conducted a series of investigations using Fox Talbot's calotype chemistry on glass plates coated with milk. This effort seemed to be less successful than they had anticipated, so they switched from the milk to albumen as a binder and for the next several years worked on perfecting the new technique. Their work, like Talbot's early albumen experiments, was neither officially recognized by a politically friendly scientific society nor formally presented or published.

In 1847, Claude Felix Abel Niépce de St. Victor (1805–1870), a career cavalry officer and a cousin of Nicéphore Niépce, published a detailed description in the *Compte rendus des Séances de l'Académie des Sciences* (a prestigious French scientific journal that has been in existence since 1835) of his experiments incorporating starch as a photographic binder on glass. In his account, he described how a glass or sheet mica plate was coated with sodium chloride and potassium iodide mixed in a starch binder solution of albumen. Once the solution had dried on the glass plate's surface it was sensitized with a solution of aceto nitrate of silver (silver nitrate with added acetic acid) and exposed to sunlight in contact with a negative of some type. Following the exposure, the exposed and sensitized glass plate was developed with a solution of gallic acid, or pyrogallic acid later in the experimentation (notice the direct relationship to Fox Talbot's initial calotype development technique), resulting in a finely detailed image on the glass plate. He called his variation on the Fox Talbot calotype theme a Niépceotype.

At the conclusion of his article, Niépce de St. Victor recommended replacing the starch with the superior albumen binder and briefly documented the preparation of the albumen and its use. Unfortunately, the process was unacceptable for portraits because an average exposure with his new variation took 15–20 minutes. Not only that, the development of the plate with hot gallic acid required hours of intensive labor, and the rapid oxidizing nature of this acid, I will speculate, likely resulted in far more failures than successes. Even more unfortunately, Niépce de St. Victor's plates, notes, and journals were destroyed during the 1848 public riots of the second French Revolution.

In 1849, Louis-Désirée Blanquart-Evrard (1802–1872) created an albumen paper process with a silver chloride sensitizer with an albumen binder that was remarkably

Figure 16–4
Louis Ducos Du Huron, *Self Portrait made with a distorting camera*, 1888 (albumen)
(Courtesy of George Eastman House, International Museum of Photography and Film)

similar to Niépce de St. Victor's. It also featured the curious option of being exposed in either a wet or dry state. Coincidentally, Blanquart-Evrard's inspiration occurred at the same time when many photographers were adopting the practice of shooting very large glass plate negatives. This demanded a different and far more explicit translation of detail than salted paper could ever provide.

Within a year of his discovery the entrepreneurial Blanquart-Evrard plunged into a very successful business of mass-producing albumen images utilizing his recently announced technique. In his establishment, Blanquart-Evrard worked with the top photographic artists of the day, including such notables as Le Secq and Du Camp, and published the esteemed *Photographic Notes* with his partner, Thomas Sutton of calotype fame. Their enterprise, founded in Lille, France (1851), was the first commercial photographic printing and publishing business in history. There was a rumor that Blanquart-Evrard, who was being referred to as the "Gutenberg of Photography," employed three dozen girls to make prints for the business . . . and not wishing to let an entrepreneurial moment pass him by, to work on his farm when business was slow.

By this time, the albumen as a perfect binder concept was getting a lot of attention. Fox Talbot, as was his habit, quickly placed a patent on the stage involving the iodide fuming sensitization of albumen. Niépce de St. Victor recovered from the 1848 riots and published a declarative manuscript on an improved albumen process that included adding honey to the albumen binder to remedy the problem of surface cracking. John Whipple also finally got around to publishing the work he did with Jones and placed a patent on his version of the albumen process . . . which incidentally also incorporated honey and bromide salts. It turned out that it was Whipple who first incorporated honey into the albumen.

Blanquart-Evrard's albumen technique, when used in combination with Frederick Scott Archer's wet collodion glass plate negative process (1851), was considered the first true and repeatable paper-based imaging system capable of yielding values and details that were commercially viable and commensurate with the daguerreotype image on silver-plated copper. In the technique's early formative stages, the results of the process were often flat and uninspiring. This problem was quickly fixed with the adoption of a gold chloride toning process that resulted in an intensification of print color and a variety of chromatic tonalities ranging from aubergine, purple, red, and brown to black. Aubergine (think eggplant) was the color the early practitioners were aiming for.

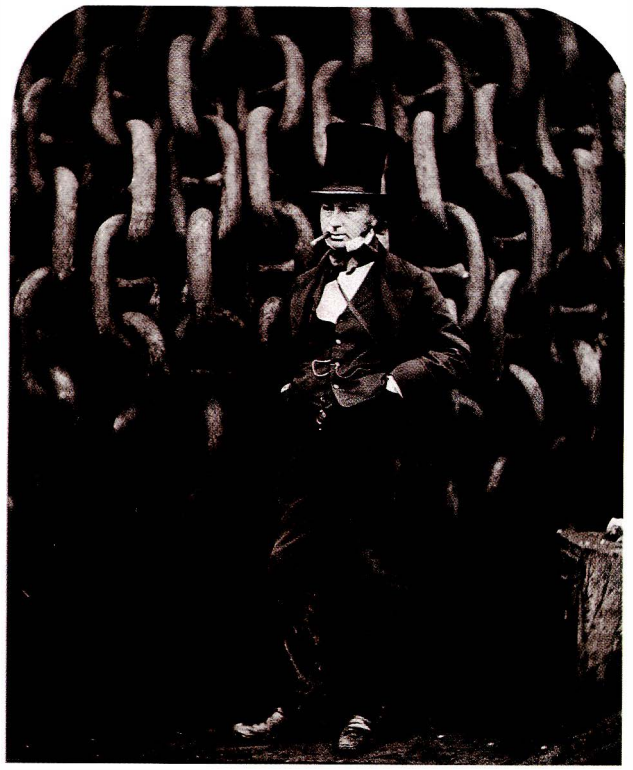


Figure 16–5
Robert Howlett, *Isambard Kingdom Brunel, Builder of the Great Eastern*, 1857 (albumen)
Robert Howlett and his partner, Joseph Cundall, were commissioned to document the construction of the mammoth coal-driven steamship *The Great Eastern*. Howlett's supplement to the medium was his personal interest in exploring the meaning of documentary image making and the subjective view of the person, place, or thing being documented. Howlett manufactured, and sold, a portable darkroom tent but died at the age of 27, according to some speculators, from working with so much chemistry in his tent without adequate ventilation.
(Courtesy of George Eastman House, International Museum of Photography and Film)

Figure 16–6
Lewis Carroll (Charles Dodgson), *Irene MacDonald*, 1863
Lewis Carroll is remembered well for his brilliant fantasies of *Alice's Adventures in Wonderland* and *Through the Looking Glass*. He is also known for his photographs of children, who he enjoyed dressing up and photographing according to his constructed tableaus. This is an albumen print or Irene McDonald, one of five children of Scottish writer George MacDonald. Carroll was a family friend referred to as "uncle" by the children, to whom he read the adventures of Alice and who encouraged him to publish the tales.
(Photography Collection / Harry Ransom Center / The University of Texas at Austin)

For over 30 years, albumen was "the process" in photography, and its consistency, relative to other image-making systems that were practiced and known at the time, rivaled more contemporary silver gelatin papers that were the next big thing. Prepared albumen paper, coated but without the silver sensitizer, was commercially produced for an exploding photographic marketplace, and the insatiable demand for the paper, by both professional and amateur photographers, was unprecedented.

One of the most common anecdotes about the process, repeated in virtually every art-in-the-dark history of photography course, explains the popularity of albumen by citing the successful German-based Dresden Albumizing Company. According to legend, this company used more than 70,000 egg whites per day to meet the albumen paper demands of the public. And then, the Neanderthal professor says, "it is most interesting to note that only women were employed to crack the eggs and to prepare the albumen paper because it was believed that their hands, and touch, were softer than a man's."

In the last few years there has been a resurrection of the albumen process by contemporary artists whose work equals, and in some cases greatly exceeds, the qualities of the original albumen techniques. With the advantages of contemporary image-making systems and concepts, photographic artists are once again being charmed by the absolute beauty of the process.

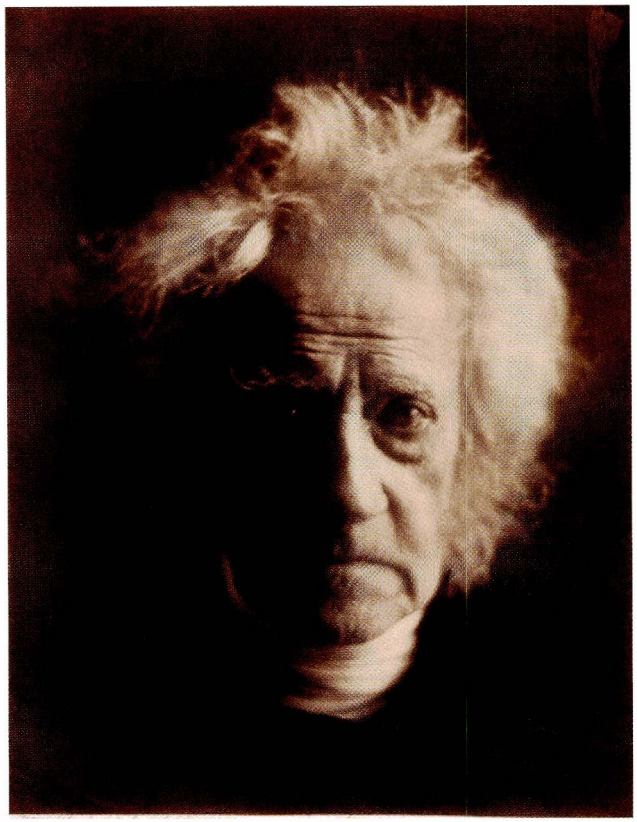


Figure 16–7
Julia Margaret Cameron, *Portrait of Sir John Herschel*, 1867
Cameron's albumen print of her friend of three decades, Sir John Herschel, is not the expected depiction of a revered scientist, author, scholar, and artist, but that of a well-known friend who shared the art of growing old with her. This is a photograph of a man who changed her life by showing her the first photograph that she had ever seen. She wrote that that moment was like water to the parched lips of the starved.
(Copyright © Royal Photographic Society/ Science & Society Picture Library)

HOW THE TRADITIONAL ALBUMEN PROCESS WORKS

First, I am going to make a distinction between what I call the traditional albumen method that produces a glossy surface print and its recently popular variation, the matte albumen technique. The matte surface is not actually a contemporary concept but one created by Baron Arthur von Hübl in the late 1890s and championed by the Photo-Secessionists, who were seeking a photographic expression that was akin to romantic painting. In the traditional method, the preparation time is lengthy, quite fussy, perfect, and often aromatic. The matte albumen version, as practiced and explained in this text, is quite fast and far less complicated. I use the version practiced by Zoe Zimmerman with new students and am usually be able to take a picture of them all holding their first albumen print within a few hours of cracking open the first egg. One other pre-sensitizing method that works quite well is the albumen paper coated with a fumed silica, a technique that is covered in its own small chapter in this book.

In a nutshell, this is how the process works. A piece of fine-quality, lightweight drawing paper, stationery, vellum, or glass (save this surface for when you are really confident in how talented you are) is initially coated with a thin layer of albumen in a solution of either ammonium chloride or sodium chloride in combination with acetic acid and distilled water. Don't simply go to the market and buy some table salt, thinking it's sodium chloride . . . chances are it is adulterated with additives so it won't clump up on a picnic table in the humidity of summer. If you are going to go with sodium chloride, use kosher salt, rather than a conventional table salt, as it is pure sodium chloride.

Later, the prepared albumen paper is sensitized by floating it in a distilled water and silver nitrate solution in a tray for 3 minutes. You can also coat with the traditional brush application technique using a hake or Richeson synthetic brush or go the Home Depot route and apply your silver nitrate with a small "hot dog" paint roller. This is a technique that Dick Sullivan practices, and it yields pretty nice results, especially for large-scale albumen prints.

As soon as the paper is coated with sensitizer and thoroughly dry it may be used. You will load your newly sensitized albumen paper into a contact printing frame with your negative (negative density range is a high 2.0–2.2 with this process) and expose it to UV light until the image prints out and begins to show signs of dark metallic "bronzing" in the darkest shadows. With albumen, I usually do combination sun/shade exposures to bring the most out of my negatives. There will be more on this a bit later.

The now exposed albumen paper is initially given a first rinse bath in distilled water with a good pinch of sodium chloride (kosher salt) to remove a good portion of the excess, or free, silver nitrate by precipitation. If you don't have distilled water, and use municipal tap

Figure 16–8
Henry Peach Robinson, *The Lady of Shallot*, 1861 (multi-negative albumen)
Robinson's *Shallot* was constructed artfully (long before Photoshop) from two separate negatives and illustrated Alfred Tennyson's epic poem of the same name, which was quite influential to the Pre-Raphaelite painters who gave their art and heart to the romance of the Arthurian myth. It's a pretty cool poem, actually, and one of my favorite lines is when the Lady says, at that point in her life when she realizes that things need to change right now, "I am half-sick of shadows."
(Copyright © Royal Photographic Society / Science & Society Picture Library)

water, it is likely to have a chlorinated additive that will create a cloudy precipitate (silver chloride) when the chlorine reacts with the excess silver in the paper. It is vital to remove all of the excess silver before toning, which means that you keep rinsing and dumping water until you don't see the precipitate any more.

At this point in the process, think about either toning for color and permanence or about going directly to a double-tray setup of 15% sodium thiosulphate (plus 2 g sodium carbonate to make the solution neutral). The prints will be immersed in the two consecutive fixing baths for 2.5 minutes each and then washed for 20–30 minutes and hung to dry.

The resulting print is quite often the perfect technique, even for the most discerning alt pro artist, due to its clarity, resolution, and surface elegance. The principal reason for this clarity is the albumen base support, which has a very important function: it fills the pores in the paper, like the gelatin glyoxal sizing in gum bichromate, preventing the sensitizing solution from being swallowed up by the paper, which leads to image clarity.

Another reason for the increased image clarity is that albumen is an organic binder that when combined with silver and salt results in greater printing speed and contrast than can be obtained with plain salted paper. This results in the paper having a thin, and thoroughly saturated, sensitized *skin,* and it is this albumen skin, working as a colloidal binder, that holds the light-sensitive silver salt in suspension above the paper's surface, providing a finely detailed image that is essentially unaffected by the substrate's texture. Albumen is a beautiful thing.

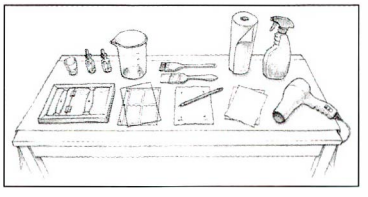


TABLE SETUP FOR TRADITIONAL ALBUMEN PAPER PREPARATION

- Pencil
- Electric hand blender wand (very inexpensive on eBay)
- Refrigerator (not required for the matte albumen method)
- Cheesecloth or fine strainer
- An empty Poland Spring plastic bottle for egg yolk separation (Method #2)
- A large funnel
- 2.5 dozen large eggs or ready-to-use pure egg whites with no additives
- 28% acetic acid (not glacial variety that is 99.5%)
- Distilled water
- Ammonium chloride

Figure 16–9
Christine Elfman, *Storydress II*, 2008 (albumen cabinet card)
Storydress II is a series of photographs of a life-sized paper mache and plaster sculpture. The dress is made of paper mache stories that Christine recorded of her great-grandmother's autobiographical reminiscences. Each photograph contains legible words. The finished sculpture was photographed with the wet-plate collodion negative process, printed on handmade gold-toned Albumen paper, and burnished onto antique cabinet card mounts. For exhibition the cabinet card photographs are displayed using an antique wooden magnifying device called a graphoscope. *(Courtesy of the Artist)*

- A non-metallic mixing bowl
- A new and clean dark glass bottle for storing the albumen
- A marker and tape for your label
- Clothesline and clothespins

THE ALBUMEN

If you are into "process," you will have a lot of fun making the albumen solution from raw eggs . . . and you will end up with more yolks than you can safely consume. In the past I recommended considering the use of ready-to-use albumen that you can easily purchase in any supermarket . . . or developing serious cholesterol passion for the leftover yolks, which can be used in making crème brûlée. Please see the great recipe in the Method #2: Matte Albumen section of this chapter that my friend and colleague, Mike Webb, makes to perfection for the workshop students in Santa Fe!

METHOD #1: TRADITIONAL ALBUMEN PAPER PREPARATION

Note: This method follows a traditional path and process and requires patience. If you are interested in making an albumen print today from breaking the egg to processing the image, then please skip ahead to the Method #2: Matte Albumen section that follows Method #1.

Traditional Method

- 16 jumbo-size eggs
- Good chef hands or a yolk separator
- 2 ml 28% acetic acid (not the 99.5% glacial acetic acid)
- 15 ml distilled water
- 15 g ammonium chloride

Note: If you double coat with this traditional method, you may need to harden the first coating of albumen with a 500 ml bath of 70% isopropyl (rubbing) alcohol combined with whatever amount of ammonium chloride you used in the original coating. I'll explain this in more detail later on in the chapter.

Separate the Yolks from the Albumen

To make 500 ml of albumen, enough to double coat about 75 8" × 10" pieces of paper, you will need 16 extra-large or jumbo-size eggs. I recommended getting 2.5 dozen eggs in case you change your mind and decide to follow the matte albumen method or you get yolk in your whites and must begin separating from

the beginning. Carefully separate the whites from the yolks with a yolk separator, or with the shell halves like a professional chef, and add them into a non-metallic mixing bowl until you have 500 ml of egg white albumen. Avoid any organic shell bits, yolk parts, or blood. The odd opalescent stringy things in the albumen are called ligands, and we will be emulsifying them in the blending stage, so don't stress.

Note: If you make any mistakes at all, like a little bit of yolk in the albumen, start over or become really expert at removing the yolk bits with a bit of cheesecloth or plastic chopsticks. Some albumen printers separate their egg whites in small batches to avoid yolk contamination. When the smaller volumes of albumen look perfect, add them to the larger collection bowl of egg whites. You should now have 500 ml of pure albumen in a non-metallic container.

Adding the Chemicals

To your 500 ml of albumen, add the following:

- 2 ml 28% acetic acid
- 15 ml distilled water
- 15 g ammonium chloride

Whip It Good

Now, whip the egg whites into stiff peaks like the top of a Starbuck's latte. If you really want to replicate the traditional method and go "old-school" you can use a bundle of quills to whip the albumen. If you don't have the time to pluck a goose, use a handheld electric blender wand, one of the best kitchen appliances around. When you are not whipping up albumen you can use it for soups and purees in the kitchen.

Let the solution sit overnight, uncovered and unrefrigerated, just as albumen printers did in the nineteenth century. The foam you created with the quills or blender wand will settle, revealing to a clear yellow liquid with a thin crust of white dried albumen by the next morning. When you wake up, while the coffee is brewing, simply poke a hole in the dried albumen crust and carefully pour out the clear albumen into a pristine and clean glass container . . . like a Pyrex measuring beaker.

Figure 16–10
Mike Robinson, *Flatiron Building, NYC,* 1996
Canadian photographer Mike Robinson made this albumen print of the famous Flatiron (Fuller) Building on 23rd Street in New York City. Designed by David Burnham in 1902, it was one of the first buildings to utilize a steel sub-structure and heralded, at 287' tall, the age of the skyscraper. A curious fact: when the Flatiron building was erected it generated a lot of wind speed at its base. That air turbulence attracted crowds of men hoping to get a peek at women's ankles as their long skirts were lifted by the wind. The crowds led to police patrolmen yelling "23-skidoo" (in a reference to 23rd Street) at the gawkers to make them move along. *(Courtesy of the Artist)*

If you're careful, you won't even need a filter or cheesecloth.

Allow the solution to age another 24 hours at room temperature. Warmth breaks down the proteins in the albumen, but if you can't take the aroma, cover the container and put it in the refrigerator.

Strain and Refrigerate for a Week

On the second day, remove the now-liquid egg whites from the refrigerator and let them warm to room temperature. Remove all of the frothy crust that has settled

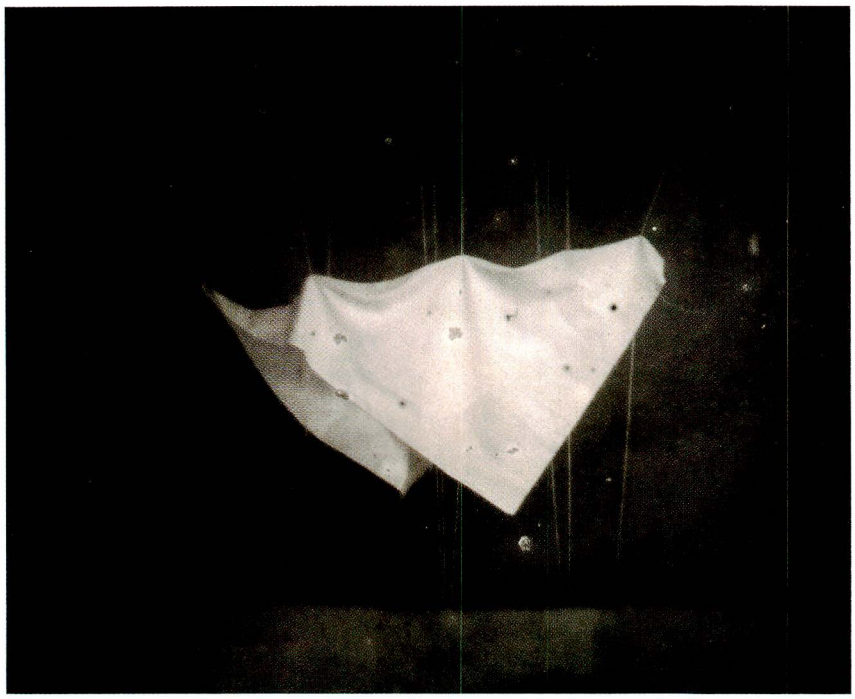


Figure 16–11
Dan Estabrook, *Interior, Floating Cloth,* 1996 (albumen)
(Courtesy of the Artist)

on top of the albumen mixture and strain the solution through cheesecloth. Return the solution to the refrigerator; you will do absolutely nothing with it for the next week.

Once your albumen has been removed from the refrigerator, simply keep it at an ambient temperature out of direct sun. I store mine in a glass KIMAX® chemical bottle with a leak-proof top, wrapped in bubble wrap. I once had a broken seal on a bottle of albumen that was left in my office over the summer, and the experience was truly gag-worthy. Store your albumen safely and in a very good glass container, which should also be well labeled.

If the albumen gets too cold in storage you will get dull images. If it gets too hot you will get a toxic omelet . . . trust me, this is unpleasant. Clearly you can see that this process takes some adjusting to. It is slow and methodical and totally antithetical to a twenty-first-century instant gratification mentality. This is exactly why the people who make albumen images love the process.

When you are ready to coat your paper with albumen, warm the solution to room temperature. Pin the sheet of paper to a clean surface and apply the albumen with a baster and a squeegee or VW windshield wiper blade. You can also use a total immersion technique, which I personally favor. Hang the coated, or immersed, paper to dry in a warm room. Your paper will keep indefinitely.

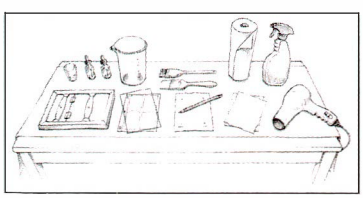


TABLE SETUP FOR PREPARING TRADITIONAL ALBUMEN PAPER

- A thin, high-quality writing or drawing paper (Somerset Satin & Cot 320 are very good for this process.)
- A Pyrex lasagna-size glass dish or tray
- A pencil and notepaper
- Matt knife
- Clothesline and clothespins

Coating the Paper with Albumen

First, get a nice thin paper to work with. I recommend a 100% rag paper, such as Somerset Satin, Buxton, high-quality stationery, vellum, or drawing paper. If you live

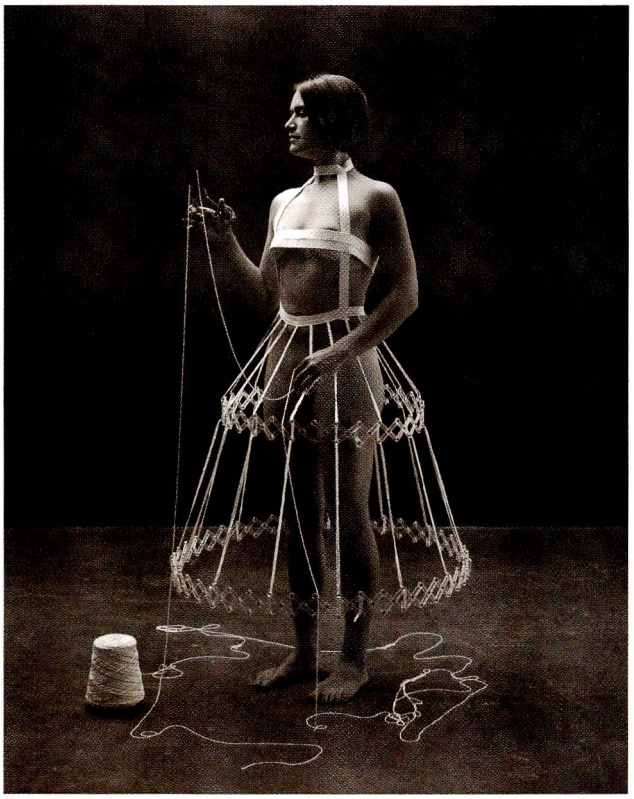


Figure 16–12
Zoe Zimmerman, *Untwined*, 2012 (albumen print)
Another extraordinary albumen print from master albumenist (a new word perhaps?) Zoe Zimmerman.
(Courtesy of the Artist)

in France, look for Canson Crobb 'Art. This is the only paper available that has the same weight and feel of the nineteenth-century papers.

Next fill a lasagna-size Pyrex glass baking dish or a brand-new plastic tray with your prepared albumen solution. Take a piece of your paper and mark it with a pencil to indicate the side that is to be coated with the albumen.

Next, you need to float the paper on the surface of the albumen in the tray. A very good floating technique is to make a pseudo-origami "serving tray" out of your paper by folding up the four sides of the paper a quarter inch so that it looks like a tray. This fold can be trimmed off at a later time, and it gives you something to hold on to during the floating steps while simultaneously preventing the solution from getting onto the backside of the paper, which will result in uneven densities in the finished print. When your tray is formed, set it carefully on the albumen, like putting a toy boat in a bathtub, and move it around a bit without making bubbles.

Float your paper serving tray in the albumen solution for 3 minutes and then remove it by dragging it slowly and smoothly over the side of your tray. If your albumen solution has too many air bubbles in it then you might want to try slowly filtering it into another tray.

Check the paper again for any air bubbles. If you find some, pop them with a pin or toothpick. If it looks hopeless, and the albumen is still fluid on the paper, re-float the paper for an additional minute and then try removing it again, gracefully, by pulling it over the edge of the tray. Hang it on a line to dry and don't fuss with the paper by trying to keep the albumen from collecting at the bottom corner. Just trim that edge off later along with the folded edges of the serving tray.

Glossy or Matte Surface Option

You have the choice in traditional albumen preparation of having a glossy or semi-matte surface. If you double coat or steam the paper, it will take on a semi-matte appearance.

To make a true matte surface albumen coating you simply have to make an arrowroot starch and salt solution and mix it into your prepared albumen in a 1:1 ratio before coating. If a matte surface is what you are really after, and you want to make prints the same day that you prepare the albumen, I will recommend that you go to the Method #2: Matte Albumen section, as it will save you a lot of time and trouble. If you're already underway with the traditional method, here's the formula for a matte appearance.

Arrowroot Starch for Matte Surface Traditional Albumen

12 g	arrowroot starch
12 g	kosher salt (sodium chloride)
300 ml	distilled water

To prepare a matte surface albumen coating; mix 12 g of arrowroot starch into a paste with a little of your distilled water. Add 12 g of sodium chloride and the rest of the distilled water to the arrowroot paste and, in a clean pot, boil it for 1 minute. Once the solution has cooled off, remove the skin from the surface and mix the solution 1:1 with your prepared albumen coating solution.

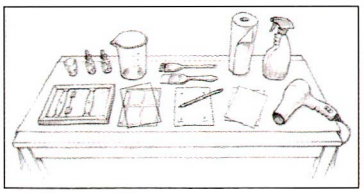


TABLE SETUP FOR SENSITIZING TRADITIONAL ALBUMEN PAPER

- Flattened and sensitized albumen paper
- Pencil and paper for taking notes
- Scissors or matt knife for trimming paper
- Maybe a pair of white cotton gloves if you're nervous
- Clean paper for the table surface coating area
- Contact printing frame
- Negative or photogram materials for contact printing
- 15% silver nitrate sensitizer (30 g silver nitrate and 200 ml distilled water)
- Silver nitrate crystal for alternate strength solutions
- Distilled water for mixing and brush cleaning
- Citric acid
- Isopropyl (rubbing) alcohol for hardening

15% SILVER NITRATE SENSITIZER

Sensitizing Traditional Albumen Paper: 15% Silver Nitrate

30 g silver nitrate
200 ml distilled water

Under low tungsten or ambient room light, mix a 15% solution of silver nitrate, being extremely careful not to get it on your skin or in your eyes. Silver nitrate is not light sensitive until it is combined, or comes into contact, with an organic material such as albumen, gelatin, dust, or human skin. Be cautious and avoid getting it on your skin. Keep your hands away from your face and eyes at all times when working with silver nitrate. Be wary of fluorescent light, as it emits low levels of UV light and may fog your paper.

Your albumen-coated paper can be sensitized with the silver nitrate solution by using the floating "serving-tray," coating rod/Puddle Pusher/VW windshield wiper, or hake/Richeson/or foam brush application methods. Brush coating is less expensive but not as effective in my experience. Your newly sensitized paper will generally be acceptable for printing for up to a day after this step . . . but that is pushing it unless you make a formula with an acidic preservative in it . . . see later in the chapter.

The density of your print can be controlled, to a point, at this stage by adding or reducing the amount of distilled water used in making the silver nitrate solution. I have used 20% concentrations successfully. A more dilute solution, say 10%, results in a softer image and is generally much less than satisfying. The best results are generally in the 12%–15% concentrations and double coated.

Whatever concentration you make, be sure to stir the solution well, and when the silver nitrate is totally dissolved, pour it into a dark glass bottle and label it with a date and a warning. Silver nitrate solution is clear and can be mistaken for water, so please don't be casual with it or with how you store it. Do not store it in the refrigerator where it can be opened by mistake or played with by curious children.

TRADITIONAL ALBUMEN HARDENING OPTIONS: DOUBLE COATING

Single coating traditionally prepared albumen paper with silver nitrate will generally *not* require a hardening step. However, if you double coat, there are a few albumen-hardening methods available before you sensitize the paper for printing. These methods will result in a glossier albumen print.

Hardening Option #1: The Hay Loft

According to James Reilly, nineteenth-century albumenists simply stored their freshly albumenized paper in a warm hayloft for half a year. This was the amount of time it took to slow cure and harden the albumen.

Hardening Option #2: Steam

In the nineteenth century, it was thought that steam would be an adequate vehicle for hardening albumen. The problem was that the level of steam it's possible

to generate at home isn't strong enough to do this task nearly as well as letting the albumen age in the hayloft for half a year. However, if you don't have a hayloft and wish to try the steam method, feel free. The worst that can happen is that the albumen will be removed.

Steam is used, however, to make the paper more pliable prior to floating on the silver solution. To do so, steam the original albumen coated surface for one minute before the second albumen coating; obviously, this is like cooking an egg. A handheld clothes steamer, or a piece of heavy-duty window screen laid over a soup pot of boiling water, will work as well. Another option is to use a steam iron and iron the albumen-coated paper through a clean piece of thin paper. Set the clothes iron on a silk setting. After steaming, hang the paper up to dry.

Hardening Option #3: Alcohol & Ammonium Chloride

Still another method, and really the most practical of the three, is to harden the first coating of albumen with a 500 ml bath of 70% isopropyl (rubbing) alcohol combined with whatever amount of ammonium chloride you used in the original coating (e.g., 15 g in our original formula) and immerse for 15–20 seconds. Be careful that you don't treat the paper in too strong an isopropyl alcohol concentration, as it will dissolve the albumen. If you immerse for too long in the alcohol, it may lead to cracking patterns in the albumen surface.

Why are you adding the ammonium chloride again? Because it is possible that the isopropyl alcohol will cause the original ammonium chloride in the formula to leach out and abandon the albumen coating. Replacing this ammonium chloride with what you've included in your alcohol solution makes up for the loss. At least that's the general idea.

These techniques will prevent the first albumen coat from breaking down during the application of the second coating. Be careful of blistering, which is not an uncommon second coat experience. After hardening the coating, hang the paper using film clips on the top and bottom of the paper on a line in a dust-free place.

Figure 16–13
Jesseca Ferguson, *Two Birds/Negative Island*, 1999 (pinhole/albumen)
This is a nice example of an albumen-based collage from the brilliant, and eclectic, Boston artist and teacher Jesseca Ferguson.
(Courtesy of the Artist)

Silver Nitrate as a Hardening Agent

Just a quick bit of information that you are already accommodating in this process: a strong solution of silver nitrate will harden albumen, whereas a less strong concentration will dissolve it. I am recommending a 15% silver nitrate concentration in this chapter, but you can easily, and effectively, increase that percentage up to 20% without a problem. Be aware that a weak solution of silver nitrate will yield weak shadow details.

MORE INFO REGARDING SILVER NITRATE

15% Silver Nitrate Sensitizer with Citric Acid

There is a semi-popular theory that the addition of citric acid to the silver nitrate sensitizer will lengthen the time the silver nitrate solution will be suitable for

printing. The citric acid works as an acidic restrainer. This is the same formula that I use for salted paper. Add 5 g of citric acid to every 100 ml of sensitizer.

Acid Restrainers in Silver Sensitizer for Humid Conditions

In exceptionally warm and humid conditions it is a good idea, some say imperative, to add a little citric or acetic acid to the silver nitrate sensitizer. This slows down the exposure time, as the acidity acts as a restrainer, slowing down the interface between the silver and the halide salt. It will also cause the print to become redder in color. This is a good formula, and I advise using it for anyone printing in the summer at sea level or in relative humidity that is uncomfortable.

30 g	silver nitrate
200 ml	distilled water
4 g	citric acid . . . this will result in light-sensitive silver citrate

Silver Nitrate Replenishment During Sensitizing

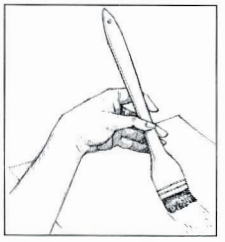
If you are sensitizing your albumenized paper by floating it in the 15% silver nitrate solution it will be necessary to replenish the silver nitrate as you progress. Make up a 25% solution of silver nitrate by mixing 25 g of silver nitrate with 100 ml of distilled water. After every 8" × 10" sheet of paper, add 15 drops of your 25% silver nitrate. There is a caveat here. When silver nitrate comes into contact with organic matter such as paper and albumen, which it will do in a big way using the floating method of sensitizing, the silver will eventually begin to show signs of contamination. This is often in the form of spots and dots and uneven and unclear highlight detail. The best method of coating is to fill a shot glass with your silver nitrate and pour it into the center of your prepared paper and brush coat.

Precipitating Contaminates from a Discolored Silver Nitrate Solution with Kaolin

You can maintain a silver nitrate solution for years if you add 15 g of kaolin to every 1,000 ml of your silver nitrate solution. Kaolin, also known as "china clay," is a clay mineral more correctly known as kaolinite. It is a soft, white mineral that is used as one of the primary ingredients in porcelain and is made up of individual crystals in its pure form. Kaolin's whiteness, opaqueness, large internal surface area, and non-abrasive quality make it an ideal filler material for chemical and paper production. Kaolin precipitates the organic matter that has combined with the silver nitrate and allows it to fall to the bottom of the container. This is good if you sensitize by floating and want to keep your silver healthy.

Be sure that when pouring the silver nitrate into a tray or beaker for coating you don't disturb the kaolin. The best technique is to use a small siphon to move the solution from the bottle to another location. An inexpensive siphon can generally be found at an auto supply store. After using the silver solution you must replenish it with your 25% silver replenisher or you'll soon have a weak solution that will give your prints the dreaded "measles." It looks like what it sounds like.

The other nineteenth-century method is to "sun the bath" by placing the silver solution in a large clear glass cookie jar. Stir in enough sodium bicarbonate to get the solution to reach neutral pH and set the jar on a sunny windowsill. The sunlight will cause the dark organic contaminates to precipitate and fall to the bottom of the jar. This technique was also used in the wet-plate process. For complete instructions on this sunning technique, consult the Wet Plate Collodion chapter.



COATING SILVER NITRATE SENSITIZER

Set yourself up in a room with very low light. Put on a pair of fresh Nitrile gloves and remind yourself to be careful not to touch your face or eyes while you are doing this part of the process. As mentioned, you have coating options . . . float coating, rod coating, or brush coating.

Using the same technique that you employed in the albumen float coating, make your origami "serving tray" out of a sheet of albumenized paper, pour your

silver nitrate solution into a Pyrex casserole dish or super clean tray, and float the paper on the silver nitrate surface for 3 minutes. Gracefully peel the paper from the silver nitrate solution, and be careful not to get any silver nitrate on the back of the paper. Hang it up to dry in a dust-free and dark environment, and be sure to lay down a lot of newsprint underneath the drying line to catch the dripping silver nitrate.

If you elect to brush coat, you will be able to work more quickly and you'll have those romantic brush coating marks on the outside of your image area that show nothing existed on that paper until you put it there. The first thing to do is mark out where the coating will take place with four faint pencil "L" marks. I will recommend, as I have done for the last several years, using a synthetic Richeson brush, the same one that I use for salted paper. Foam brushes are inexpensive, but the silver nitrate you leave behind in the foam brush is more precious. After coating your paper, thoroughly clean the brush in distilled water and dry it before going to the next piece of paper.

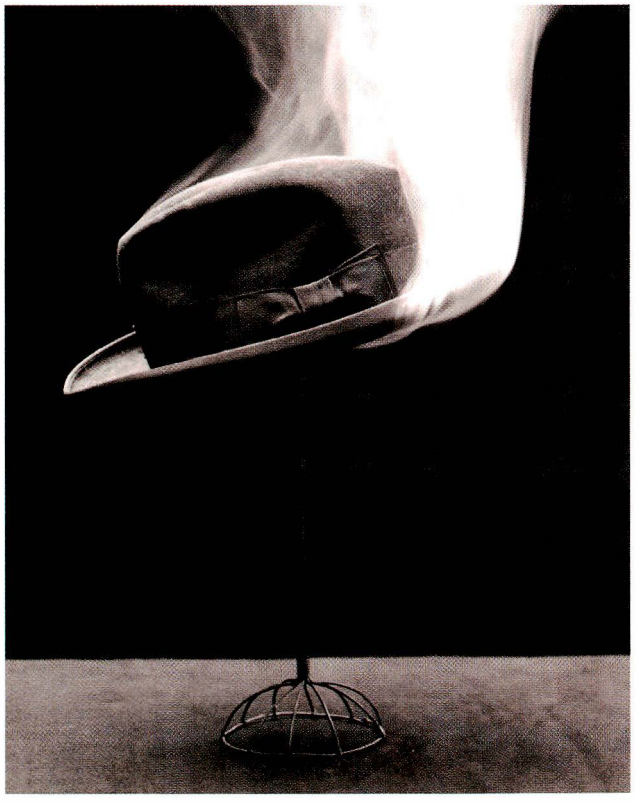


Figure 16–14
Zoe Zimmerman, *Under Your Hat*, 2006 (gold-toned matte albumen)
This is an image of Zoe's that illustrates her sense of humor and imagination, as well as her preferred matte albumen technique . . . one that requires no refrigeration and tedious skimming of foam. Her method is, hands-down, my favorite way to make and teach albumen printing. *(Courtesy of the Artist)*

Tack down your paper on a very clean, flat surface. Next, measure out your silver nitrate solution into a shot glass with an eyedropper. A 4" × 5" negative area can easily be covered with 25–35 drops of sensitizer solution if the air is not too arid. When you're ready, pour the contents of the shot glass into the center of your coating area and brush the silver nitrate quickly, lightly, and evenly over the marked-out dimensions of your coating area.

You can also pour a small amount of the silver nitrate into a plastic or glass beaker, or hot-liquid paper cup, and dip your brush into the solution. Brush-coat it in the same manner you have been using: light, even strokes covering the full image area vertically and then horizontally. After the coating, allow the paper to air dry in the dark, or very low light, until it is almost dry. In environments where high altitude and lack of humidity are normal, you will find that the paper will dry very quickly. Again, a little humidity is a good thing.

METHOD #2: THE MATTE ALBUMEN PROCESS

The Single-Session Matte Albumen Process

This is my favorite albumen method and one that I use in all of my class or workshop teaching situations when I am limited to a single session demonstration or a curriculum that needs to cover a lot of ground in a short time. I really appreciate the simplicity of the technique and love the color and quality of the perfect matte image on a paper substrate. Zoe Zimmerman, who is, in my humble opinion, one of the best albumen printers working today, gave me this albumen recipe.

The matte albumen technique simply indicates that the albumen was created with a mixture of albumen, salt, and a starch. The technique has its roots in the inventive mind of Baron Arthur von Hübl, who also did extensive research with Pizzighelli on the platinum process. Hübl was an active advocate of photographic matters and technique and wrote a landmark book on matte salted papers in 1896 entitled *Der Silberdruck auf Salzpapier* (*Silver Printing on Salted Paper*).

Hübl's original formula for his matte albumen paper was initially published in the photographic journal *Photographische Rundschau* in February 1895, and the information described his method of paper preparation as employing a mixture of albumen and 2% arrowroot starch in equal volumes. This formula, based on the romantic look of the image's surface, much like gum bichromate in its painterly effect, was adopted by several commercial albumen manufacturers, among them Trapp and Munch and E. Just in Vienna, because Hübl's formula was free for the taking and because it was wildly popular among photographic practitioners.

Hübl's Matte Albumen Formula (1896)

Hübl described the following method of preparing matte albumen paper in his book, *Der Silderdruck auf Salzpapier* (1896).

1. Gather some fresh eggs (presumably this means you will be going to the supermarket). Carefully separate the eggs and beat the whites to a froth just as in the usual glossy traditional method of albumen paper preparation. This albumen that you are making is not aged, and Hübl recommended that you use it within 24 hours after it has settled back to a liquid state. As in the traditional method, you will skim off the albumen frothy crust and filter the liquid through cheesecloth. The solution should be kept refrigerated during settling and filtered through muslin immediately before use.
2. To prepare the salting solution, combine 100 ml of fresh albumen with 100 ml of 2% arrowroot solution. This is a 1:1 relationship, making it very simple to remember. Your 100 ml of arrowroot and albumen solution should also contain 4 g of sodium chloride or kosher salt. As you can see, everything you need may be purchased at the supermarket where you bought the eggs.
3. Pin the sheet of paper to a clean surface and apply the albumen by squeegee or VW windshield wiper blade. You can also use a total immersion technique, which I personally favor. Hang the coated, or immersed, paper to dry in a warm room. Your paper will keep indefinitely.
4. When the paper is almost dry, because a little humidity is always welcomed when printing with this technique, it will be time to sensitize and expose the paper. It is very important to success with matte albumen paper to insure that the paper is not too dry at the time of printing. Excessive dryness of the paper will result in flat and weak prints.

Hübl's Sensitizer Solution

120 g silver nitrate
15 g citric acid
Distilled water to make 1 liter

Apply the sensitizer with a brush, either a traditional hake or synthetic Richeson, dry, and reapply with a second coat. You will know if the level of sensitization is adequate because the shadows will be resolved. Weak shadows indicate weak sensitizing.

The matte albumen printing method varies from the traditional technique, both technically and visually, in several ways. You can print within an hour or two of your albumen preparation or as soon as your paper is ready for sensitizing. It opens up the option of making prints on a greater variety of papers, including thick printmaking papers, as no floating is required or necessary. As well, the highlights tend to be whiter than those in the traditional albumen print (likely due to the citric acid in the formula), and when toned with a thiocyanate toner, the prints mimic the tonality, surface, and color, depending on length and strength of the toner, of a Pt/Pd print. Here's the process that Zoe Zimmerman passed on to me and that I've been playing around with for years.

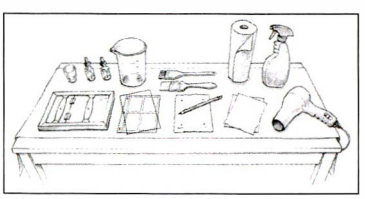


TABLE SETUP FOR MATTE ALBUMEN PAPER PREPARATION

- A large 2-liter plastic beaker or mixing bowl
- Pencil
- Paper towels

- An electric plastic kettle—dedicated solely to heating salts and citric acid
- A large beaker of wash water . . . as albumen gets sticky as it dries
- Electric hand blender wand
- Cheesecloth for straining albumen foam and removing organic errors
- A large funnel
- Distilled water
- 2.5 dozen large or jumbo-size eggs
- Citric acid
- Sodium chloride (notice that this is not ammonium chloride)
- Tapioca starch (found in Asian cooking emporiums and online)
- A new dark glass bottle for storing the prepared albumen
- A marker and tape for your label
- A selection of fine paper for albumen coating (see later in the chapter)
- A thick piece of Lucite or glass for squeegee wiping
- A good squeegee
- Clothesline and clothespins

Matte Albumen Starch Solution: Ingredients

40 g	sodium chloride
3 g	citric acid
40 g	tapioca starch
1 liter	distilled water
2.5 dozen	eggs

Step 1 Mix the sodium chloride and citric acid into 950 ml of distilled water in a non-corrosive plug-in kettle. Stir until the chemistry is dissolved and then bring it to a gentle boil. I like using an electric kettle with a hidden heating element. Look at Chef's Choice models.

Step 2 Meanwhile, mix the tapioca starch with the remaining water until it looks like paste or a New Orleans *roux*. Make sure there are no lumps in it. Add this roux mixture to the boiling citric acid and sodium chloride salt solution from Step 1 while stirring constantly. Continue to stir until the mixture appears translucent as opposed to white and starchy. This will take about 3 minutes.

Remove the mixture from the heat and allow it to cool to about 110°F. When the solution is sufficiently cool remove the foam/skin from the liquid surface and strain the remaining solution through a cheesecloth-lined strainer. You may have to do this a few times, but don't get compulsive about it.

Step 3 Next, separate the egg white from the yolks. Can you do this like a professional chef? Crack the egg cleanly and then shift the egg contents back and forth between eggshell halves as the white albumen slurps (I can't think of a better way to describe what the albumen is doing) into the holding container and the yolk stays in the shell. If you cannot do this well, use an egg separator or an empty Poland Spring water bottle. My MFA graduate and present alt pro professor, Jess Somers, showed me this trick, and it's really cool. Break the egg in a shallow bowl and then put the end of the Poland Spring bottle, which you have squeezed the air out of, up against the side of the egg yolk and let it go. The sides jump back, creating a slurping suction, and the yolk jumps inside the bottle. Students love this technique!

Whip up the egg whites in batches of 500 ml with a handheld blender wand for one or two minutes. Allow the froth to settle, and strain the solution through a funnel lined with dampened muslin or cheesecloth. This solution is mixed with an equal portion (500 ml) of the tapioca starch, sodium chloride, and citric acid solution (1:1) and used as soon as it is ready.

You can see that there is a similarity to Hübl's method. You will also notice that this method doesn't require a refrigerator, which is bound to ruffle a few feathers in the alt pro hen house, but I will ask all who doubt to remain

calm and look at the quality of the prints for affirmation that the method works very well.

Step 4 The freshly mixed 1:1 albumen solution is now gently poured it into a very clean tray that sits inside a larger tray filled with hot-to-warm water. This method keeps the solution warm and helps with absorption. Submerge the sheets of paper completely in the solution, doing your best to be sure there are no air bubbles trapped on the paper's underside. Soak the paper for 2–5 minutes and then pull it from the tray, toward yourself, along the tray edge, when removing it from the solution. This takes the majority of the excess albumen from the printing side of the paper.

Step 5 Place the paper on a flat, smooth surface (e.g., glass, Lucite, or thick Plexiglas) and with a single gentle but firm stroke, beginning at a corner and sweeping in an arc until the squeegee leaves the paper at the end of the stroke, squeegee off the excess albumen solution from one side of the paper. A soft and flexible squeegee, larger than the paper, is necessary, but you can also get away with a VW windshield wiper blade. They meet the requirements, are inexpensive, and come in a variety of sizes.

Hang the squeegeed paper on a line with clothespins to dry. After a minute, flip the paper 180 degrees. This will help prevent one side of the paper from being thicker with albumen than another. Try to be sure that there is no excess albumen dripping down the paper's surface. This mistake will frustrate you if you overlook it. Also be on the lookout for air bubbles, as they do not pop on their own and will ruin the surface of your paper. If you see air bubbles either return your paper to the albumen bath and begin again or try popping the bubbles with a wooden coffee stirrer . . . or something like that.

When the paper is bone dry, it is ready to be sensitized. It can also be stored indefinitely for later use. Be sure to mark your paper as "albumen," along with the type of paper you are using, on the side that has been squeegeed. It is actually a good idea to mark your paper with paper type and process before you begin all of these steps.

A Very Quick Word Regarding Paper

Hot press printmaking paper and quality stationery work well for this process, as do traditional printmaking papers such as Cot 320, Buxton, Weston Parchment, and Fabriano Artistico. Arches Platine has a tendency to yellow badly during the dry down unless it receives a final lengthy rinse in distilled water, and Arches 88 is often riddled with little black spots. The albumen–starch solution can be applied to the paper with a hake or Richeson brush, but a 2–5 minute immersion method works best. Weston tends to yield a more reddish color without toning, while Cot 320 provides the richest shadows. Be very careful handling the albumenized Weston . . . it's quite fragile when wet.

Flattening Albumen Paper

You will find that double-coated albumen paper is very difficult to keep flat. I like to use my old dry mount press (it's still good for something) for this purpose. When the albumen paper is dry, heat your press, and when it gets to about 200°F turn it off, put your stack of coated paper in the press, and then let it cool down. In a few hours you'll have a stack of flat albumen sheets. Be careful not to burn the albumen. This should not happen with a 200°F setting and a protective first sheet.

Silver Nitrate Sensitizing Solution for Matte Albumen

30 g	silver nitrate
3.5 g	citric acid
250 ml	distilled water

Step 6 In low ambient light, mix the silver nitrate and citric acid in the distilled water until fully dissolved. Pin the paper to a smooth, very clean surface. Apply the sensitizer with a brush, either a traditional hake or synthetic Richeson. You may also employ the float method here,

but I've found the economical and foolproof method is to do a silver nitrate drop count in a shot glass, pour to the center of the prepared paper, and brush out the sensitizer as you do in every process. Quickly dry with a blow dryer until the paper is no longer glistening wet and then re-apply a second coating of the silver nitrate. Blow dry again until the paper is cool but dry. You are now ready to expose your print. You can coat for a third time, but this may be overkill depending on the paper you are using. A thicker paper looks beautiful with a third coating.

Step 7 Exposing, washing, toning, fixing, etc., can be done according to the instructions for traditional albumen printing in this chapter. I've found that a full-range negative requires a 2-minute exposure in the low-humidity environments of Santa Fe and Aspen. You can control contrast with sun and shade combination exposures using the shade exposure to determine the contrast and the sun to determine shadow densities.

ALTERNATIVE METHOD: POWDERED AND LIQUID READY-TO-USE ALBUMEN

A few years ago, I became less enamored with the traditionally prepared albumen due to its "dead mouse" odorous factor. I tried the powdered albumen method for a while before switching to Zoe's matte albumen method and saw no distinctive difference between the real egg and powdered egg. I also tried the ready-to-use albumen from the supermarket that became very cool when people stopped eating yolks with their eggs. The "dead mouse" factor was actually a bit worse with the powdered albumen version, but it could have simply been the brand that I was using. In case you don't like crème brûlée here's the formula for the powdered albumen.

72 g	powdered albumen
475 ml	distilled water
2 ml	28% acetic acid
15 g	ammonium chloride

Dissolve 72 g of the powdered albumen in 473 ml of distilled water. Add 2 ml of 28% acetic acid* and 15 g of ammonium chloride to the powdered albumen and distilled water solution and whip it into froth. Label the container really well and refrigerate the solution for 24 hours.

Note: Be sure that you are using a 28% acetic acid and not a 99.5% anhydrous glacial version that is three times as concentrated as the 28%.

On day 2, remove the now-liquid egg whites from the refrigerator and let them warm to room temperature. Remove the froth that has settled on top of the albumen mixture and strain the solution through cheesecloth. Return this solution to the refrigerator for the next week. If this still takes too long for you, there is a modified instant gratification (sort of) version, and that would be Method #4.

Note: I am assuming that you may easily use liquid and ready-to-pour albumen straight from the dairy and cheese case in your local market. You can treat it as you would the albumen that you hand separate, but you will miss out on the fun of cracking eggs or being able to use the yolks for crème brûlée.

OLD ALBUMEN IS GOOD ALBUMEN

It should be noted at this point that old albumen is good albumen. Mike Robinson typically uses albumen that is over a year old because as it ages the proteins break down, resulting in a drop in the pH level to around 6. This means that there will be less yellowing of the highlights in the final print. I once had a bottle of albumen that was over 5 years old and seriously offensive . . . but it worked beautifully. The problem is that it stunk so badly I could only demo it outdoors in the summer, and I noticed, with each passing year, that my students stood farther and farther away from me while I showed them how to prepare the paper. A few summers ago I gave up and threw it out and have used the matte albumen ever since.

THE CHLORIDE & NEGATIVE RELATIONSHIP

In the first stage of albumen coating, the amount of the ammonium or sodium chloride in the solution can be used to counterbalance the density of your working negative. Here's how ....

Any normal density negative is considered "thin" for an albumen print. However, if that is the type of negative that you have to work with, you can still make a pretty decent print by cutting back on the amount of ammonium or sodium chloride, to about half strength, and using a more diluted (less than 15%) silver nitrate sensitizing solution.

Fox Talbot figured out that there *must be an excess of silver to salt* to make this work. Typically, a 4 or 5 to 1 ratio is used with long-scale negatives with a density range of 2.0–2.25. If you increase this ratio you will be able to print *flatter* negatives, but too much of an excess of silver to salt will cause problems such as bronzing and highlight yellowing.

AMMONIA FUMING FOR CONTRAST

If the silver-to-salt ratio is reduced, you run the risk of uneven or under-sensitizing and you will see a malady referred to as "measles" (the word says it all) as well as flat and weak prints. One more thing to think about is that fuming the sensitized paper with ammonia will give you a significant increase in tonality and contrast when using flatter negatives. It also gives the silver halide a higher pH, which makes it more sensitive.

The ammonia fuming technique is far easier than trying to fine-tune the silver to salt balance. Fuming is essentially subjecting the paper, or plate, to the fumes of a particular chemical in an enclosed environment. If you intend to try this method with any chemical that is particularly aggressive, like ammonia, please consider doing so in a space with decent ventilation. When France Scully Osterman and Mark Osterman fume (that's not the same as having a marital spat) they use a large plastic storage box for the task. The bottom of the box is covered with an even layer of wadded cotton, and ammonia is drizzled evenly over this material. The paper is taped, albumen side down, to the inside of the box lid and placed inside the box for about 4 minutes. Be sure to let the paper outgas for a few minutes before placing it in the printing frame.

WHAT TO DO WITH THE EGG YOLKS: CRÈME BRÛLEÉ!

A Great Recipe for Crème Brûlée

- 2,000 ml heavy cream
- 20 large egg yolks
- 30 ml vanilla extract (Mexican *Xanath* is best)
- 400 g granulated sugar
- Serves a large class of 16–20

Step 1 Vigorously beat the egg yolks and granulated sugar in a large bowl until the mixture becomes light in color and the sugar has dissolved.

Step 2 In a large saucepan, combine the heavy cream with the vanilla extract and bring the mixture to a simmer; when small bubbles have formed around the edges of the cream, turn off the heat.

Step 3 Slowly pour the cream mixture into the egg and sugar mix, and with a wire whisk blend the two together gently. Then strain the combined mix through a fine mesh strainer and cover the mixture with a sheet of plastic wrap, pierced several times to release any steam. Place the mix in the refrigerator overnight.

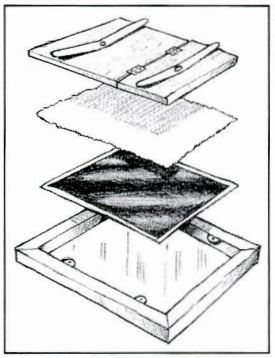
Step 4 Preheat the oven to 350°F (180°C). Place 16 to 20 six-ounce ramekins (individual soufflé dishes) in a large baking pan that is deep enough that water can reach at least halfway up the sides of the dishes so that it can work as a double boiler (bain-marie).

Step 5 Fill the ramekins 3/4 full. Place the pan in the preheated oven and pour hot water into the baking pan so the water level reaches halfway up the sides of the ramekins. Cover the pan with a sheet of heavy-duty aluminum foil, sealing the edges to retain steam. Cook 40–50 minutes or until the custard sets.

Note: To test for doneness, gently shake the individual ramekins; if the custard is a little wobbly return it to the oven and check again in 5 minutes. Look for a circular shape, about an inch wide, in the center of the custard that remains loose while the outside edges are firm.

Step 6 Remove the ramekins from the baking pan and chill the custard in the refrigerator for several hours.

Step 7 To serve put a thin layer of granulated sugar atop each custard. Then, using a handheld propane blowtorch, char and blowtorch the tops of the custards until the sugar caramelizes.



EXPOSING TRADITIONAL AND MATTE ALBUMEN

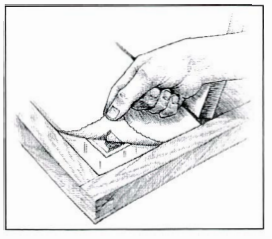
Exposure Control

Although you have about 24 hours to use the sensitized paper, it is a good idea to expose the print as soon as the paper is dry. If you wait too long before exposing the paper, the contrast in the final image will decrease and you'll eventually get yellowing highlights due to *silver albumenate,* which begins to be created quite rapidly. (More on this in a few paragraphs.) If you know that you will not be printing the sensitized paper right away consider using the silver nitrate with preservative citric acid formula. You can also use drops of acetic acid. With pH strips, monitor the bath as you gradually bring the pH down to about 3.

Place the paper and your negative into a hinged-back contact-printing frame in a *right-reading* position, and go sit in the sun or shade with it. If you don't have sunlight, use a mechanical UV-printing unit. As with POP and salted paper techniques, exposing in direct or indirect sunlight is a personal choice. Personally, I prefer to begin my albumen exposure in open shade and will take it practically to the end of the exposure in that indirect light environment. At the end of the exposure sequence I will give the exposure a 1- to 2-minute shot of direct sun to intensify the shadows. In the summer, an average negative will require 4–6 minutes in the open shade and 1–2 minutes in the sunlight or UV box. Negatives with a lot of density will require longer exposure times, while thinner negatives may demand that almost all of your printing is done in shade.

Albumen is a printing-out process, so you will be periodically examining your print during the exposure in order to determine when it is perfect. Exposure time is dependent on the density of your negative, time of day, heat and humidity, etc., so it is important to write all of this information down when you're printing.

Note: If the negative is an unvarnished gelatin emulsion film or plate, you should place it in a Krystal Seal envelope that will lie against the silver sensitized paper in the right-reading position. This will prevent any excess silver from migrating to the film emulsion and causing irreparable damage to your negative.



What to Look For During Exposure

When you think it's time to check on the exposure, go into low light, release one side of your contact printer, and check the image. Keep the other side locked to prevent the registration from shifting. Look for a purplish print with *bronzed* to solarized tonalities in the deepest shadows. *Bronzing* is a term used to describe having a metallic look to the darkest values. This will be the visual sign that tells you when the print is exposed well. Overexpose the image by about 1.5 to 2 stops darker than you would like the finished print to be because it will lose a little density during the upcoming

Figure 16–15
Christopher James, *Dying Man*, Benares, India, 2012 (matte albumen demonstration print)
This is a matte albumen demonstration print that I produced from a Pictorico OHP.
(Courtesy of the Artist/Author)

stages. This is similar to the recommendations I gave you for a salted paper print.

You may recall that in the salt process I recommended facing the contact frame away from the sun and printing in open shade to achieve a modest contrast gain and a bit more control of your exposure. The albumen process, like all silver chloride printing-out processes, reacts in the same way. You may also place a sheet or two of tissue paper or Pictorico OHP film over the printing frame and print in direct sunlight to increase contrast.

Silver Albumenate/Highlight Yellowing

The best strategy with albumen paper is to process the print immediately. This action will reduce the amount of silver albumenate that is being formed during the albumen's extended contact with the excess silver nitrate in your sensitizer formula. The longer the silver nitrate excess in the sensitizer solution remains in contact with the albumen, the more likely it is that the highlights in that print will turn yellow over time. Silver albumenate does not "fix-out." This results in white highlights turning yellow, as in many historical albumen prints.

James Reilly, in his *The Salted Paper Book*, indicates that yellowing is produced by the chemical reaction of residual, undeveloped silver with sulphur-containing groups on albumen proteins and can be found on 85% of prints developed after 1860 and 95% of prints from the 1850s. Photographers were aware of the yellowing problem as early as 1855 when the Photographic Society of London's "Fading Committee" blamed it on inadequate processing. This belief persisted until Reilly discovered that high humidity is largely responsible for the yellowing. The yellowing cannot be remedied during processing because

it is nearly impossible to remove all of the excess or free silver during washing. One other issue that has become far more evident as a problem in recent years is the proximity of curated early photography to alkaline storage systems that simply compound the yellowing problem.

Yet another version of this yellowing issue is called the Maillard Reaction, which describes a reaction of glucose with the albumen proteins. This yellowing effect in historical albumen prints may be related to poor washing techniques and not adequately removing the soluble glucose remaining in the print. It could also be the result of not fermenting the eggs, as other techniques had been developed to break the molecular ligand strands, such as the high-speed whipping that we perform when using the handheld blender wand.

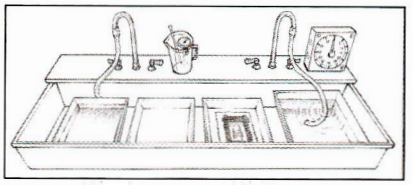
Final Distilled Water Rinse as a Yellowing Preventive

In the last few years I have found that I can often get rid of the dry-down yellowing in albumen highlights by simply washing well and following the final wash with a 5-minute soak in clean distilled water before hanging the print to dry. This also works with a variety of other alt processes.

One more thing . . . yellowing of a finished albumen print is often the result of the wrong paper for the process. You may need to test papers to find out what works well for you with the albumen preparation and water that you are using. I would recommend beginning with Somerset Satin or Cot 320, as they are proven papers.

Color & Exposure: Using the Right Negative

From a purely classical perspective, it is pointless to work with a thin negative. It will be near impossible to get that lovely aubergine coloration in an albumen print if your negative can't hold up to sufficient exposure while creating an environment for clean highlights and deep shadow details. The tone of the albumen print is dictated by how deeply you can print. If you stop exposing too soon, you'll never get the d-max (maximum density) strong enough to get rich tones.



SINK SETUP FOR ALBUMEN PROCESSING

Tray 1 Kosher salted tap water with a pinch of citric acid

Tray 2 Fresh running water

Tray 3 Toner trays

Tray 4 Rinse trays

Tray 5A 15% sodium thiosulphate fixing bath

Tray 5B Optional: Sel d'or toner/fixer monobath

Tray 6 1% sodium sulphite hypo clearing bath

Tray 7 Final wash in clear running water

PROCESSING ALBUMEN

Salt/Citric Wash First Bath

This first tray holds a slightly acidic salt bath whose purpose is to precipitate the free or excess silver by producing silver chloride. You will often see a milky residue coming from the print's surface as the excess silver nitrate starts bonding with the chloride. This is more evident in a municipal water supply where a chlorine additive is present. You will see less of a milky cloud with a distilled or rainwater first bath. If you omit salt from this bath, you will not be removing the free silver, and this will create problems with your toning, as the gold will not adhere to the silver unless the free silver is eliminated. Here's your first bath mix:

10 g citric acid
30 g kosher salt
1,000 ml distilled water

Following your exposure, immerse your print in this bath of salted water that is slightly acidic due to the addition of citric acid, lowering its pH. Under low to moderate light, agitate the print slowly for about 5 minutes or until no more milky precipitate is visible. Change the water frequently during this wash out.

Figure 16–16
Christopher James, *Mary's Chair*, Santa Fe, 2007 (albumen)
This print was made outside of our lab building during one of my 2007 Advanced Alternative Process Workshops in Santa Fe. I used a matte albumen process, and my demonstration, from separating three dozen eggs, making the paper, making the pinhole, and completing the finished print, took two hours. *(Courtesy of the Artist/Author)*

Following this step, move your print to a tray filled with fresh water and gently agitate. Repeat the fresh water exchange for 5–10 minutes. Using a black plastic tray will help you to see when the water is completely clear.

ALBUMEN TONING

Optional Toning Prior to Fixing

Un-toned, an albumen print will be reddish plum to warm brown in color. Toning the print *prior to the fixing stage* will provide you with options for the color of your finished work. It will also greatly assist in making the print archival and less susceptible to fading and yellowing as time goes on. Gold-toned prints will render a variety of colors depending on the length of the immersion, with tones ranging from purple brown to aubergine to slate gray to and blue gray. As an aside, the slate-blue and grey tones are considered the least archival.

Albumen Gold Toner

2 liters	warm distilled water
1 g	gold chloride
8 g	sodium borate

In a clean non-metallic beaker, carefully add 1 g of gold chloride to the distilled water and stir it into solution with a glass or plastic rod. Next, add 8 g of sodium borate and stir until it is completely in solution. Filter the sediment that did not go into solution through a fine stocking or piece of cheesecloth and store it in a dark glass bottle. To tone the print, simply immerse the print in the toning solution and remove it when you are happy with the color. The print is then fixed and washed.

Salted Paper Toners for Albumen

Seeing as there are so many other similarities between the albumen and the salted paper processes, an option you might wish to consider is using salted paper toning formulas with your albumen.

Note: Please refer to the Salted Paper Process chapter's toning section for recipes and instructions for the following toners.

- Gold/borax toner (warm/reddish color)
- POP Gold–ammonium thiocyanate toner (cooler whites and darks)
- Gold–sodium acetate toner
- Palladium toner
- POP platinum toners

FIXING THE ALBUMEN PRINT AFTER TONING

15% Standard Sodium Thiosulphate Fixing Bath: Two-Tray Setup

150 g	sodium thiosulphate
2 g	sodium carbonate (to make the fix slightly alkaline)
1,000 ml	distilled water

Your fixing bath will be a familiar one. Dissolve 150 g of sodium thiosulphate and 2 g of sodium carbonate into 1 liter (1,000 ml) of distilled water to make a 15% fix solution.

Make up two trays of this fixer. Immerse the print in the first fixing tray for 2 minutes. Remove the print and immerse it in the second fixing tray for an additional 2 minutes. On average, using a double-tray fixing setup, you should be able to adequately fix up to 16 prints before having to re-mix the fixer.

SEL d'OR TONER/FIXER MONOBATH FOR ALBUMEN

Sel d'or Toner/Fixer Monobath

Several years after the daguerreotype process was announced, a French physicist by the name of Hippolyte Fizeau introduced an important process addition called sel d'or (salt of gold) that gave daguerreotypists a way to intensify and tone their work. Sometime between 1847 and 1855 the process was incorporated into additional photographic processes.

For many years in the mid-nineteenth century, sel d'or gold toning was commonly incorporated into the albumen and salted paper processes, although it was impossible to predict whether the technique would improve, or fade, the print. When an albumen or salted paper print was immersed in the sel d'or toner/fixer monobath the image color would lighten to an orange brown and then reconstitute itself to a cool sienna, a purple, or a blue black. The final image color would be based upon the depth of the printing, the toning formula, and the length of time the print is in the toning solution. Print deeply if you intend to use this technique.

The sel d'or toner is actually a toning-fixing monobath and is constituted by mixing a solution of gold chloride into a solution of sodium thiosulphate and a little bicarbonate of soda to make the solution lean a bit to alkaline. Using it allows the photographer to both tone and fix his or her print in a single action. Again, it is unpredictable, and the following formula is more "kitchen-sink" than lab proven. The toning/fixing time is approximately 4 minutes following the wash stage.

Sel d'or Toner/Fixer Formula

500 ml	water
75 g	sodium thiosulphate
1	teaspoon bicarbonate of soda
3	grains of gold chloride (use a 30 ml stock solution)

Stock Gold Solution for Sel d'or Toner/Fixer

154 ml	distilled water
1 g	gold chloride in a glass ampule (1 g = 15.43 grains)

Drop your 1-g ampule (a sealed glass or plastic capsule) of gold chloride into a bottle containing 154 ml distilled water. Break the ampule with a clean, hard object like a glass rod and leave it there. Because 1 g equals 15.4 grains, and you mixed this amount with 154 ml distilled water, every time you need 1 grain of gold for a formula all you need do is add 10 ml of the gold stock solution.

1% SODIUM SULPHITE HYPO CLEARING BATH

If you want to be sort of sure that all of the residual fixer is gone from your print you may mix up a solution of 1% sodium sulphite hypo clearing agent. Simply dissolve 10 g of sodium sulphite into 1,000 ml of water and agitate your print for several minutes before going to the final wash.

FINAL WASH

Wash the toned and fixed image for 30 minutes and hang to dry.

FUMED SILICA

I'll be getting into this pre-sensitizer technique in another chapter, but I wanted to reference it here so that it was on your alt pro radar. In a nutshell, applying fumed silica with a hot dog paint roller to an albumenized paper, prior to sensitizing with silver nitrate, will often yield a greatly increased image quality of cleaner highlights and deep blacks with greater detail. Dick Sullivan is the creative force behind this idea and, along with his team, has developed a pretty standardized way of applying the fumed silica to create very beautiful imagery.

I will add, as a caveat, that not everyone gets the same perfect results, but when it works it is outstanding

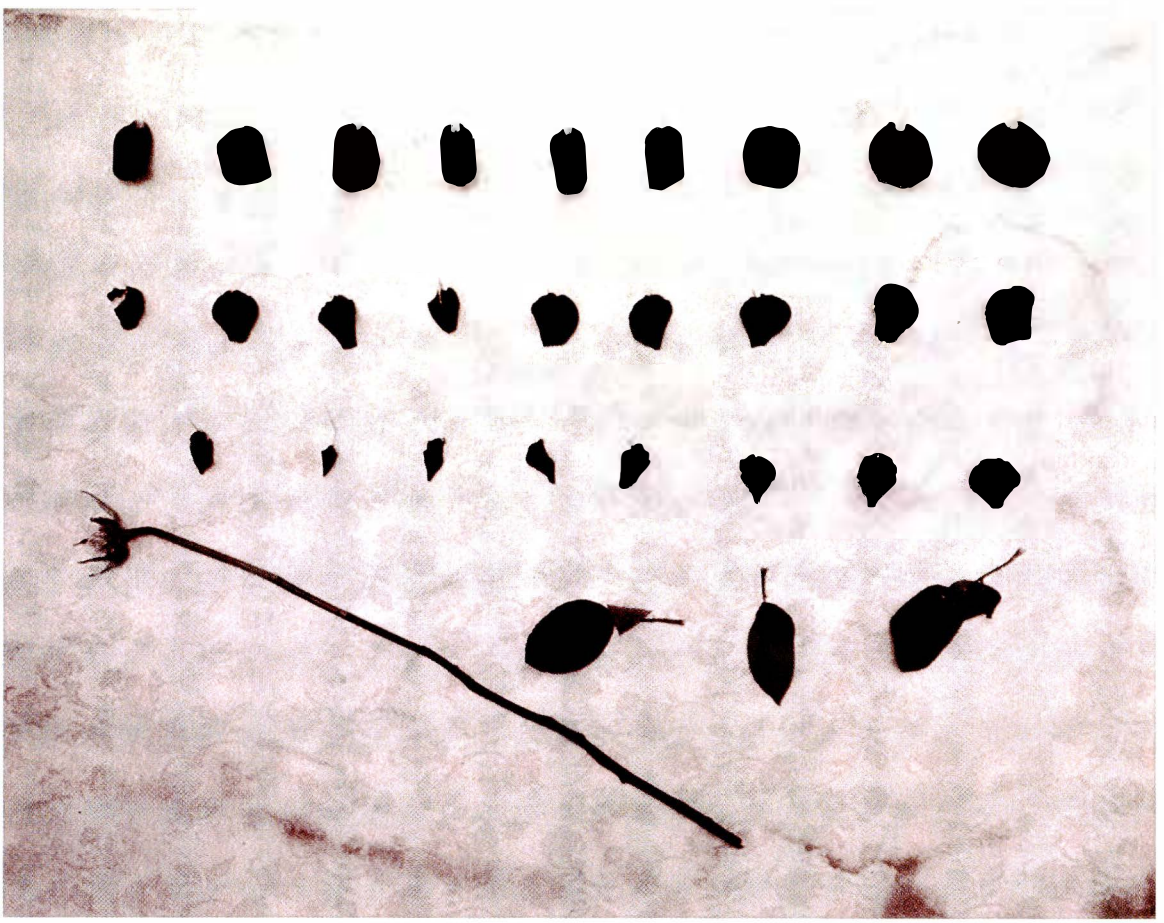


Figure 16–17
Dan Estabrook, *Rose*, 1995 (albumen with gold/borax toner)
Dan, who was a student of mine at Harvard many years ago, caught the alternative process bug early in life and hasn't looked back since. He is one of the most innovative and influential alternative process artists working today and has managed to marry the processes of the nineteenth century with the critical theory and concerns of the twenty-first.
(Courtesy of the Artist)

as a technique. It also works differently for different processes but seems ideally suited to albumen.

The process involves a quick dry rolling of fumed silica powder over the paper before applying the silver nitrate. Here's a brief overview (I will get into it more deeply in another part of the book). In essence, a small quantity of fumed silica is rolled onto a piece of paper with a dry high-density foam hot dog paint roller. The silica goes down quickly and evenly . . . or so one supposes, but the proof will be in the final print when any errors in application of the silica will be evident. The paper, following the silica application, is velvet-like to the touch. The paper is then coated with a standard sensitizing solution, such as ferric oxalate Pt/Pd or silver nitrate. The coated paper is dried, exposed, and developed as one would ordinarily do for an alternative process print. The coating seems to behave as a sizing enhancer with the contrast of the final image appearing to be greatly enhanced by the association of the richer blacks against the paper whites. Of all the processes that I've seen with the fumed silica application, albumen seems to be most compatible. More on this elsewhere if you are motivated to work with the material.

Wet Plate Collodion Process: Tintypes, Ambrotypes, & Glass Plate Negatives

OVERVIEW & EXPECTATIONS

Let me begin this chapter with something to think about. Sometimes you eat the fish, and sometimes the fish eats you. If you think, for a single moment, that your talent is bigger than the wet plate collodion process, it will humble you. There is a reason that the tribe of wet collodion practitioners is a small society with a madly passionate membership. It takes time, and you need to see everything that can go wrong at least a few times before you can identify the problem and the solution. It takes time to get your techniques, and workflow, in harmony and to make the process personal and appropriate for where you are working and how the weather is influencing your results.

The process requires old and carefully tended equipment . . . often made by hand, or patiently restored and given new life and purpose . . . as in those lovely Kodak 3As. It requires a tenacious belief in the beautiful and the mysterious. It rewards analytical thinking, process, and patience. At the same moment, it demands a love for the accidental and unexplained and the peace of mind to fully know that the process means more than the final product . . . every single time you make a plate. Wet plate, like every other alternative photographic process (and I am beginning to include film and silver gelatin printing in this genre), is not about what the equipment and the software determine but what the artist and the handmade printmaking process can conjure up together. As T.S. Elliot wrote, "Anyone can carve a goose if the bones are missing."

This is not digital image making without penalty or sacrifice . . . this is photography.

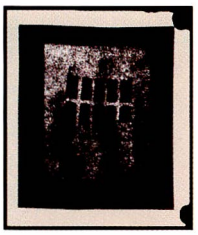
I'll begin by providing A Little History about the discovery of collodion and its evolution into the wet plate collodion process that revolutionized photography. The process was realized, adopted, and married to albumen and in that partnership ruled photography for decades, providing the opportunity for the detail prized in a daguerreotype as well as the ability to reproduce multiple prints from a single wet collodion glass plate negative.

Figure 17–1

Christopher James, *Rebecca & Wisteria*, Dublin, NH, 2010

I remember this day pretty clearly. My wife Rebecca had just returned from her daily swim in Dublin Lake and I was messing around with an old Darlot lens that had just been fitted to an old plate camera restored by my friend Takeshi Shibata. I asked her to pose with the wisteria in front of the studio and in that simple 6-second exposure made an image of her that remains my favorite of them all. There is a mystery to the light that is revealed in wet plate collodion that escapes comparison or explanation. It seems to see what is felt.
(Courtesy of the Artist/Author)

I will describe the materials and chemistry, as well as the care and maintenance of that chemistry. I'll also provide a great many recipes for everything you'll need to know (at the moment) about collodion, iodized silver sensitizer, developers, fixer options, chemical safety, and setting up your working space. I'll then take you through a basic overview of a recommended workflow using tintypes production as the example. I'll include sections dealing with mounting, presentation, and troubleshooting, including specific recommendations for hot, and arid, weather conditions and working on the road in an ice-fishing tent or the back of your car. You will then have a nice foundation to create your own workflow and personal way of doing this very provocative, seductive, and beautiful process.



A LITTLE HISTORY

Prior to 1851, if you wanted to march in the fledgling photographic parade, your options, provided you didn't want your images to be botanical studies rendered in blue or romantically fuzzy dichromate gum or salted paper prints, were limited to the complicated daguerreotype, Talbot's calotype, and a few odd techniques that were lightly practiced by those whose role in life was to be an interesting conversationalist at dinner parties.

The daguerreotype was known for its crystalline detail, its preciousness of presentation, the time consumed for its exposures, the intricacies of the process, and the fact that it was a one-of-a-kind image. Fox Talbot's calotype was, as Michelangelo once said when describing beauty, "a purgation of superfluities". . . . simplicity itself. A gelatin-sized stationery, impregnated with salt, and sensitized with silver nitrate, would result in a paper negative that was suitable for making an unlimited number of salted paper prints.

Just a side note clarification: Talbot did make some developed-out positive prints from his developed-out paper negatives, and these can also be called calotypes. The calotype's resolution potential was vastly inferior when compared to daguerreotype, due to the texture of the paper substrate, and it was also much less sensitive to light, making studio portraiture very difficult. Paper negatives

Figure 17–2
Unidentified Photographer, *Portrait of Blind Man Holding a Cat*, ca. 1850 (daguerreotype, 6.7" × 5.2" cm, 1/6 plate)
I love this daguerreotype and thought, when I first saw it, that it could so easily be used for a contemporary album illustration for a metal band called Headless Cat.
(Courtesy of George Eastman House, International Museum of Photography and Film)

Figure 17–3
John Adams Whipple, *Cornelius Conway Felton w/His Hat & Coat*, c. 1850 (daguerreotype)
John Adams Whipple, who, as director of the Harvard College Observatory, also made extraordinary daguerreotypes of the moon, had a little post-modernism in him as well . . . which, fortunately, he was unaware of. This whimsical diptych of Cornelius Felton with his hat and coat is one of my favorite historical photographic illustrations.
(Image copyright© The Metropolitan Museum of Art. Image source: Art Resource, NY)

were occasionally waxed or oiled in order to make them translucent enough for contact print printing.

The much-sought-after solution would be a single process that could be both reproducible, like the calotype, and finely detailed, like the daguerreotype. Once the problem was solved, and the technique discovered, glass would be the obvious substrate, because it was both clear and flat. The remaining big question, however, would be how to keep the light-sensitive halides on the glass throughout the entire process. A clear, and flexible, binder was needed.

Wet Plate Irony

In 1845–1846, Christian Frederick Schönbein (1799–1868) discovered nitrated cotton, popularly known as *guncotton,* by soaking cotton fibers in a solution of sulphuric and nitric acids. The cotton was placed in the acidic mixture for an extended period of time (I am being nonspecific here for obvious reasons) and was subsequently washed well until free of the sulphuric and nitric acids. This initial process yielded a very unstable flammable material that was employed very successfully as an explosive.

Ironically, in 1847, a young medical student by the name of John Parker Maynard formulated an ingenious medical dressing that could be used to treat the wounds from Schönbein's guncotton-based explosives. This medical dressing was called *collodion*, a name taken from the Greek word *kollodes* meaning, "to adhere." Maynard made his medical collodion by dissolving Schönbein's explosive nitrated cotton in a mixture of equal parts ether and alcohol.

The end result of Maynard's action was a clear and viscous fluid, similar to a diluted, warmed honey that dried to a durable and flexible skin. Maynard's adaptation was used extensively by field doctors during the Crimean War (1853–1856) in a battlefield environment, and the benefits related to its use were immediate.

Figure 17–4
Frederick Scott Archer, *Kennilworth Castle*, 1851 (sel d'or toned albumen from collodion negative)
In March 1851, Frederick Scott Archer published the technique and formula for the application of iodized collodion on sheets of glass for the purpose of making glass plate negatives.
(Courtesy of Scully & Osterman Studio)

Collodion dried quickly, due to the evaporation of its ether and alcohol, and it could be applied directly upon, and around, the surface of bandages as an adhesive skin to keep the injury clean and dry and as protection from infection. In some accounts it is reported that the collodion was applied directly to the wound. This collodion application technique was neither pleasant nor particularly effective.

As an aside, this emergency treatment has a reflection in contemporary battlefield first aid, as super glue (cyanoacrylate) can be used to close wounds quickly. Super glue was first used in Vietnam and the technique is now practiced using a medical-grade version of the adhesive that results in less skin damage due to the methyl alcohol in the original formula.

In January 1850, Robert Bingham proposed the idea that Maynard's collodion solution could be applied to photographic use because it appeared to be the perfect vehicle for holding light-sensitive compounds on glass. Gustave le Gray followed soon after by publishing a theoretical formula echoing the same intentions.

In March 1851, Frederick Scott Archer published the technique and formula for the application of iodized collodion on sheets of glass for the purpose of making glass plate negatives. Archer described a process in which a light-sensitive salt, potassium iodide, was combined with a solution of dilute collodion. This viscous solution was applied to a glass plate and allowed to set up quickly via evaporation, thus preparing it for sensitizing in a bath of iodized silver nitrate.

The collodion-coated plate was then immersed in the silver nitrate for several minutes, resulting in a light-sensitive layer of silver iodide on, and in, the collodion. At this point, the plate went from having a transparent collodion coating to having a translucent and creamy appearance. You will see this same transition when you remove your plate from the silver bath. The sensitized plate was then set into a plate holder, and camera, before it dried (which would have made it less sensitive to light) and exposed and developed quickly . . . thus the reason for the term *wet plate*.

Following the exposure, the latent image on the plate was developed, under safe conditions, in a solution of ferrous (iron) sulphate, flushed with clean water, and fixed in a mild solution of potassium cyanide or sodium thiosulphate. Intensification of the glass plate negative was common, and under-exposed plates, which appeared positive against a dark background, or on dark glass, could be seen as positives and were referred to as ambrotypes. The advantages were immediately evident. The process provided a detailed negative rendering on a glass substrate that was most sensitive in the wet state, permitting exposures that were dramatically faster than the calotype. Prints from wet-plate negatives were also democratically priced, being a fraction of the cost of the daguerreotype. This democratization of the family album portrait became even more pronounced with the advent of the tintype/ferrotype process.

Soon after Archer published his technique, he realized that an under-exposed wet collodion negative, when laid on a dark background and viewed in reflective light, would appear as a soft tonality positive.

Figure 17–5

Unidentified Photographer, *Group Portrait: A Visit to a Tintype Studio*, c.1850s

As soon as Archer published his method of producing collodion glass positives, the entire medium of photography instantly became democratized. Now, for the first time, people of all social identifications and backgrounds could easily and affordably have a photographic record of themselves and their family.

(Courtesy of the Artist/Author)

This phenomenon was enhanced when he bleached the brown silver deposit to white with mercuric chloride. Archer called these positive collodion images *Alabastrines*, playing on the white of alabaster. Eventually, image makers adopted the now practiced use of ferrous sulphate developer and potassium cyanide fixer, a chemical combination that eliminated the need for a bleaching step. The following is a short aside dealing with the Alabastrine positive technique from John Towler's amazing text, *The Silver Sunbeam*, from 1864.

Alabastrine Positive Process from *The Silver Sunbeam* (1864)

I think this is a really interesting description of Archer's Alabastrine positive process from John Towler's 1824 book, *The Silver Sunbeam*. In the first paragraph of the text, Towler writes a sentence that truly gives a sense of how the public's democratic perception of photography was already beginning to take shape: "*Naturally the operation must be very simple, and but a very small quantity of color must be used, otherwise the operation will become a work of art, and none but an artist could perform it*." This is very much in tune with the philosophical path that Steve Jobs took with Apple . . . make it beautifully complex on the inside but perfectly simple and intuitive on the outside.

I'm going to keep the text as written by Towler, as I think the archaic tone of the writing is rather charming and will set the right note for your experimenting with the process. However, I will make a variant to the original formula so that you can more easily attempt it in your own lab.

"*The coloring of collodion positives, as already remarked, may be effected on the whites of the picture, either before the varnish is flowed on, or upon*

the varnish itself: When well performed, it communicates life and roundness to a picture which before was flat and lifeless. The colors in use are in fine powder, and are laid on with a dry and very fine pencil of camel's, etc., hair. Naturally the operation must be very simple, and but a very small quantity of color must be used, otherwise the operation will become a work of art, and none but an artist could perform it. In all ordinary cases the color lies on the surface, and does not penetrate into the material of the film. In the Alabastrine process, however, the film is so treated as to become permeable to varnish, and thus to exhibit the color, as it were, in the collodion; besides this the whites are still retained white, notwithstanding the impregnation of the film with the penetrating varnish. Positives treated in this manner are regarded through the glass and the collodion film; the pictures, therefore, are direct, as they ought to be. The mode by which the tones are preserved soft and white, and rendered at the same time permeable, is the following."

Alabastrine Formula Solution

2.6 g	sulphate of protoxide of iron (iron(II) oxide/ ferrous oxide)
5.2 g	bichloride of mercury (mercuric chloride)
2 g	chloride of sodium (kosher salt)
120 ml	rain or distilled water

Note: Mercuric chloride–mercury(II) chloride (also known as mercuric chloride) was used as a photographic intensifier to produce positive pictures in the collodion process of the 1800s. When applied to a negative, the mercury(II) chloride whitens and thickens the image, thereby increasing the opacity of the shadows and creating the illusion of a positive image (Towler, 1864). Mercuric chloride is toxic, white, and a soluble salt of mercury (at 6%). It has been used in disinfectant, as a fungicide, and in photographic fixers. It's also odorless, colorless, and really dangerous, which is why I'm letting you know about it here. Take all safety precautions when working with this chemical.

Note: Regarding sulphate of protoxide of iron (iron(II) oxide/ferrous oxide) . . . this is a black powder, is very unstable, and can easily corrode into iron(III) oxide. This means that it may take a few tries before your Alabastrine process works. Ferrous oxide is often used in cosmetics and in tattoo inks.

"Select for this operation a vigorous good positive; a faint and thin film does not answer well. One that has been rather under-exposed is most suitable. Then, whilst the collodion film is still moist from fixing, pour upon it a quantity of the above solution, and keep it in motion. At first the picture assumes a dead and gray appearance; but this soon chases, and becomes continually more and more brilliant.

"It is sometimes necessary to add a little more of the fresh solution, and to retain this solution on the surface until the whites are perfectly clear. The time required for this operation varies according to the temperature and the thickness of the film. Heat promotes the effect; the plate is therefore frequently supported on the ring of a retort-stand, with the fluid on its surface, whilst a small flame is kept in motion beneath it. Unless this precaution be observed, there will be a liability to break the plate. It happens sometimes that a few minutes are sufficient; but generally more time is required. If no heat is applied, the operation may require in some cases as much as an hour. As soon as the whites have attained their utmost purity, the operation is complete. It is better to be quite certain that the whites have attained the purity required, than to shorten the time, and have the effect underdone. There is no danger in giving too much time; but it is a disadvantage to remove the fluid from the plate too soon; because in drying, the whites in such a case are apt to grow darker again, and the picture assumes then the cold blue tone, which arises from treatment with corrosive sublimate alone.

"As soon as the effect has been reached, the plate is thoroughly washed in several waters, and then dried over the spirit lamp. The plate is now ready for the first coating of varnish, which communicates transparency to the shadows, without at all impairing the whites.

"The next operation is to lay on the colors carefully and artistically on those parts that require them. It is unnecessary to apply any to the Shades. Where much color is desired on a given surface, it is better to apply it by repetition, and not in one thick blotch. Colors thus tastefully laid on produce a very brilliant effect, by reason of the purity of the whites; and this effect is again increased by the softness communicated to the whole picture by the application of the penetrative varnish, which causes the color to permeate into the pores of the film, or to be seen at least in full beauty from the opposite side. This varnish is nothing more than a very pure strong-bodied protective varnish. The picture so far finished is backed up with a piece of black velvet, but never with black Japan, which would injure the film."

The positive image was then placed in a decorative case that was often the same type that housed daguerreotypes. This ornate presentation method was also occasionally applied to ferrotype/tintype metal plates. The ambrotype, due to its relatively speedy exposure and clarity, quickly displaced the daguerreotype as the vehicle used for studio portraiture. With a collodion negative you could make unlimited paper prints, particularly Carte de Visite (card of the visit) prints, from a single negative, and these prints could be given away or put into albums. The collodion positive process had its market . . . but it was only from the mid-1850s to the mid-1860s, and the people making such prints were not called photographers, but ambrotypists. The term *photographer* referred to those who made prints from negatives.

A LITTLE HISTORY CONTINUED

The early positive collodion plates were occasionally referred to by the French as *daguerreotypes-on-glass* and were common throughout the 1850s and 1860s. However, most people called the plates, ambrotypes, a name introduced by Boston photographer Joseph Ambrose Cutting after Marcus A. Root suggested the name. The term *ambrotype* could be assumed to have been taken from Joseph Ambrose Cutting's name, but in truth it was actually derived from the Greek word *ambrotos*, meaning "immortal" . . . referring to Cutting's method of covering a completed image with a second sheet of glass in the fashion of preparing a slide for a microscope. Interestingly, Cutting gave himself the middle name of Ambrose to match the process.

Wet plate collodion hit its stride in the early 1850s when Blanquart-Evrard's albumen technique was used in combination with Frederick Scott Archer's wet

Figure 17–6

Sally Mann, *Triptych*, 2004

Left to right, an impressive 40" × 50" gelatin silver prints made from collodion negatives of Virginia, Emmett, and Jessie Mann . . . the same family line-up that graced the cover of Sally's book, *Immediate Family*. In some ways the expressions haven't changed; they're just 15 years apart.

(Courtesy of the Artist and Gagosian Gallery)

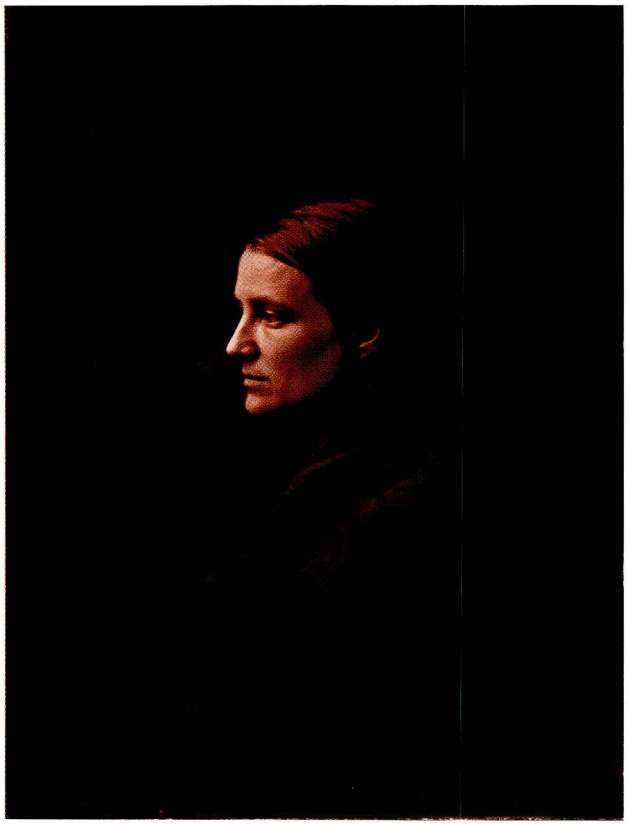


Figure 17–7
Malin Sjoberg, *Self-Portrait*, 2009 (ambrotype on ruby glass)
A wet collodion self-portrait on ruby red glass by my former student, Malin Sjoberg, who is rapidly becoming a leader in the genre of alternative process image making.
(Courtesy of the Artist)

collodion glass plate negative process. This was the first true and repeatable negative-to-paper imaging system capable of yielding values and details that were commercially viable and equal to the daguerreotype image on silver-plated copper.

Today there is an ever-growing community of photographic artists using the wet collodion process as their primary means of image translation and expression. Their work is particularly meaningful because it incorporates the traditions and characteristics of the process while addressing the contextual and conceptual trends of contemporary visual expression. Several of the prominent practitioners and innovators in this select group are John Coffer, S. Gayle Stevens, Joni Sternback, France Scully Osterman, Mark Osterman, Sally Mann, Will Dunniway, Jody Ake, David Emitt Adams, and Ian Ruther.

As an aside, it is quite common to see ambrotypes and daguerreotypes side-by-side and identically labeled in flea markets and antique shops. The daguerreotype appears as a metallic mirror with a ghostly image residing in its interior. Due to its predominant reflective quality, observing the image is a bit like looking at a "little secret" because only one person can see it well at one time. The ambrotype, on the other hand, is only as reflective as the glass itself, and when made on clear glass it is often possible to see

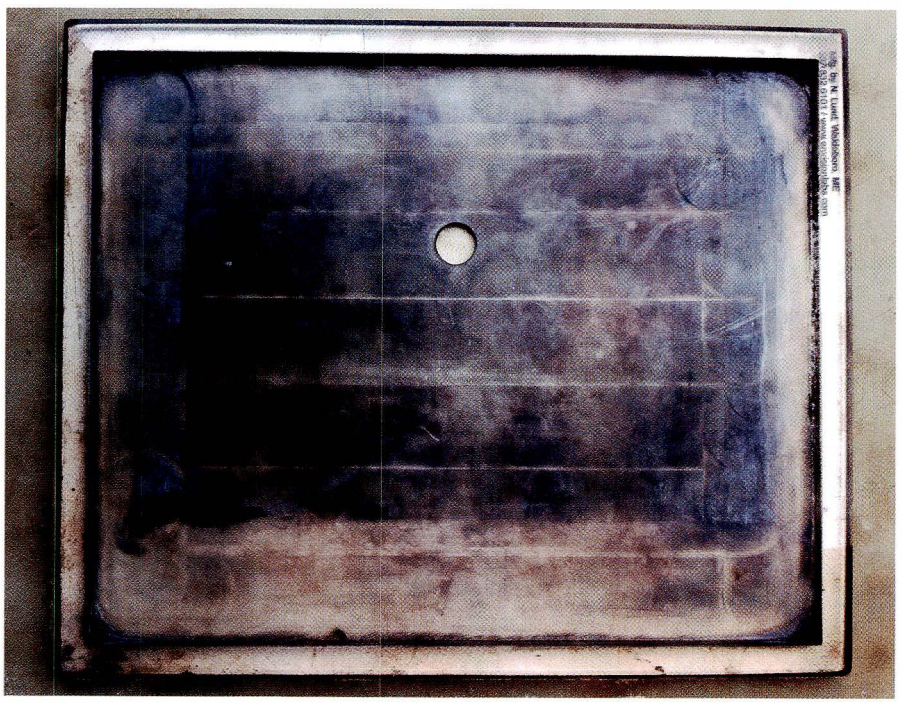


Figure 17–8
Christopher James, Wet Plate Developer Tray, 2011
Often, in the workshops I run in my studio, I will have a student who prefers the control of the handheld plate developing tray that keeps the developer evenly upon the surface of the plate. In this case, I offer him or her this tray, which simply gets more interesting as a piece of art and artifact as time goes by.
(Courtesy of the Artist/Author)

a slight separation between the image on the glass and the black backing behind it. This is especially evident if dark paper or fabric was used. This separation adds to a 3D effect and is an instant clue as to the process. Beautiful variations of the ambrotype are often made using a tintype workflow on a substrate of dark glass, such as deep red, cobalt blue, green, and black.

There are many workable, published, and practiced formulas, and the following recipes and technical descriptions represent a useful starting point for you to begin experimenting with wet collodion. The initial technique described herein is for the wet plate collodion ambrotype/tintype. To make a wet plate collodion *negative*, as in Archer's work, you would need to consider using a slightly different salted collodion formula (increasing the iodide-to-bromide proportions at a rate of up to 4:1 in the formulas to follow), longer exposures, longer development, and a weaker and more acidic ferrous sulphate, or pyro, developer. More on this later on in the chapter.

THE WET PLATE COLLODION PROCESS: MATERIALS

Although wet plate collodion work shares many of the same characteristics and sequences with traditional silver-gelatin processes, it does require more than a few equipment adaptations. For a beginner, one of the easiest wet plate camera solutions is to buy an antique Kodak 3A or 3B film camera and use pre-coated and prepared black aluminum plates, with a removable film membrane, that fit the size of the original negative dimensions. Affordable plate cutters can be purchased from Main Trophy Co., an Illinois firm that specializes in trophy plaques. Plate stock can be ordered in bulk or cut to size by a number of businesses, such as Main Trophy, Lund Photographics, and Bostick & Sullivan. No camera adaptation is required, and the sensitized plate is held securely on the shelf that is used to support the film transport. The only pre-exposure preparation I have used is to use the sandarac varnish used to coat the finished collodion plates, or lacquer, to paint all metallic surfaces that will come in contact with the sensitized wet plate when it is placed in the camera.

If you are going to use a traditional-view camera, you will need to adapt your film holders to accommodate the sensitized wet collodion plate. This is not a terribly difficult task, as all you need is a conventional view camera sheet film holder so that you may modify it to accept a glass or metal plate. This process doesn't take long at all and requires only a few simple items: a power drill with a small bit, a mini hacksaw blade, silver jewelry wire, varnish, a ruler, and part of a yogurt container.

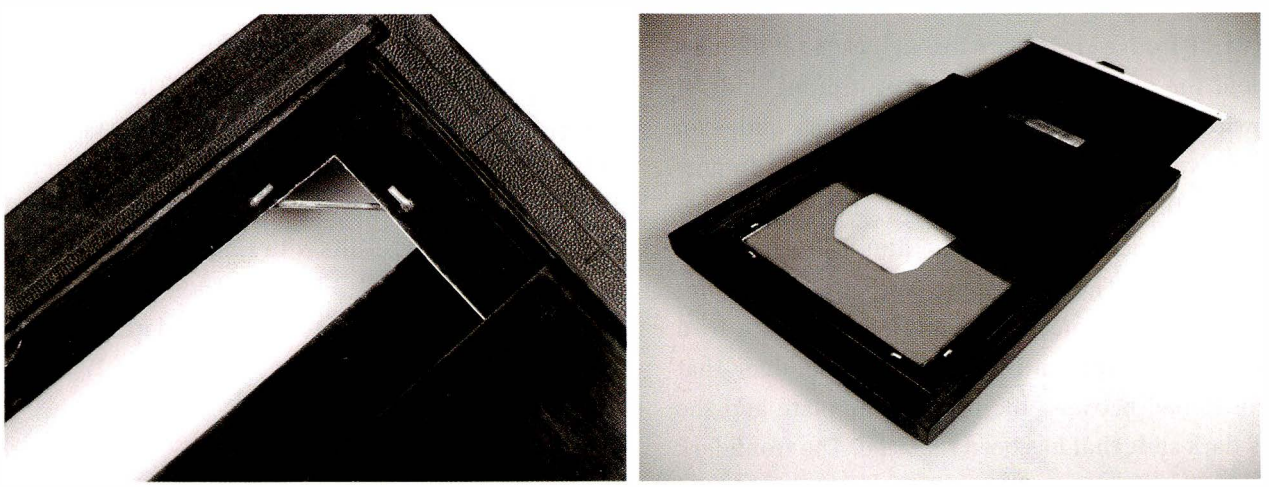


Figure 17–9
S & D Film Holder to Plate Holder Conversion
A detail example of a film holder to plate holder conversion design pioneered by Mark Osterman and France Scully.
(Courtesy of Scully & Osterman Studio)

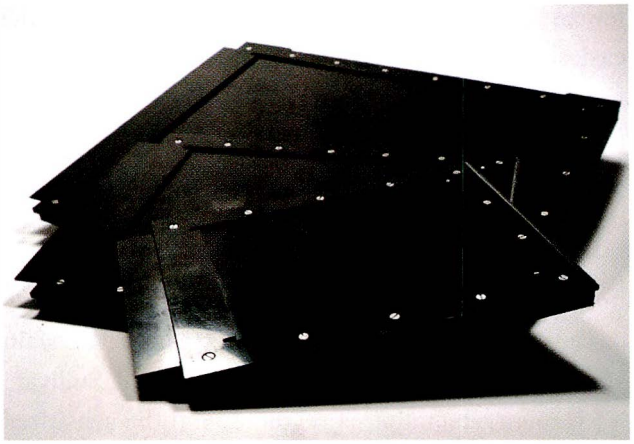


Figure 17–10
Niles Lund, Lund Acetal Resin Plate Holders
In wet plate collodion workflow, it is necessary to load the silver sensitized collodion coated plate into a plate holder and transport it to the camera. This design by Niles Lund is specifically made to accommodate the wet plate process. I have several of these that I use in various format cameras and they are perfect for the task.
(Courtesy of the Artist)

Scully & Osterman Conventional Film Holder Conversion

The easiest way to create a wet plate holder is to adapt a conventional film holder by removing the dark slides and cutting a hole in the rigid septum that separates the two sides. This opening will be slightly smaller than the size of the glass, or metal, plates that you will be using. Drill two small holes on either side of the four inside corners of the opening and insert a clip made from a silver wire through each set of holes to hold the plate. Bend over the protruding ends of the wire and flatten them so that the dark slide can be removed without scraping the wire. It is important that the collodion side of the glass plate is on the same plane as would be the film if it were being used for film. The sensitized plate is loaded collodion side down from behind and held in place by a "spring" made from a plastic yogurt container that is positioned between the back of the plate and the back dark slide that has been replaced. The front dark slide is used as usual. This is pretty easy to do, and I converted my first one in about 30 minutes. If you don't feel handy, you can order them from Niles Lund (http://www.lundphotographics.com).

Dry Plate Holder for Wet Plate Process

Another simple method of adapting a conventional large-format camera to a wet plate camera is to go antique hunting for dry plate film holders. These are often found on web sites such as eBay by looking under the headings of "vintage photographic equipment" and "large-format cameras and accessories." In the last year or two I've purchased six full and half-plate holders that I've been able to use in common dry plate cameras that accommodate that size holder. The only additional adaptation that I've done to make the plate holder suitable for wet plate is to varnish the inside of the plate holder in all areas where the sensitized plate will come in contact with the holder. I do this to preserve the plate holder, make clean up easier, and prevent any metallic areas of the holder from coming in contact with the sensitized plate. A simple varnish is the gum sandarac and lavender oil one I use for varnishing the finished plate.

Antique Camera, or Holga, with No Plate Holder

Another very simple solution to the plate holder requirement is to go hunting on eBay or at your local antique store/flea market for the previously mentioned Kodak 2A or 3A camera. When you look inside, you will see that there is an obvious place where the film stopped so that a frame could be exposed. Measure that area and then go and order some prepared black plates that are slightly larger than the measurement you just made. The sensitized plate will lie on top of that opening very easily and will stay in place when you close the camera up in the darkroom prior to going and making your exposure. I have also had great results with Holga plastic cameras and have only needed to build out a simple lip with gaffer's tape on one side to hold the plate steady in the camera.

Lund Acetal Resin Plate Holder

The ideal solution, other than having a mint condition original wet plate holder is to make a brand new one out of an opaque Lexan (a polycarbonate resin material) that will last until the end of time. A few summers ago,

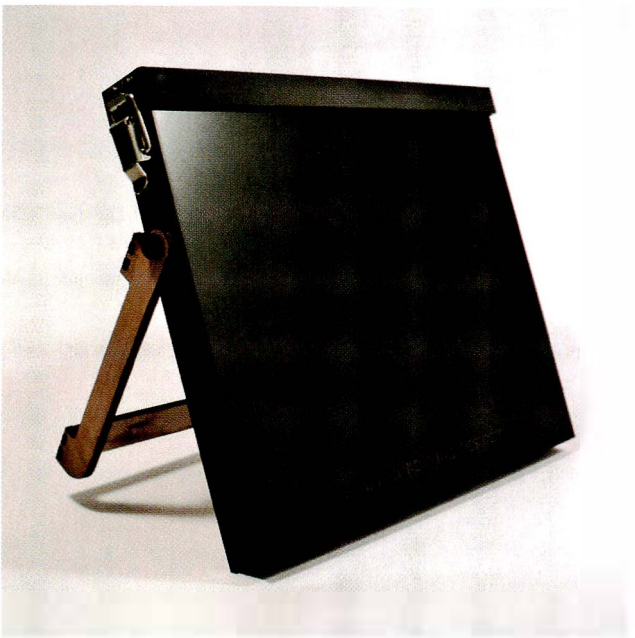


Figure 17–11
Niles Lund, Lund Traveling Wet Plate Silver Tank with Dipper Top
This is another terrific product from Niles Lund's wet plate collodion products web site, a liquid tight traveling tank for the silver and fixing baths.
(Courtesy of the Artist)

during a wet plate workshop, I let students use my camera and plate holders and noticed that their casual clean up after every plate was beginning to have a negative impact on the wood in both holder and camera.

Niles Lund, a wet plate practitioner and engineer who had just begun his wet plate products web site, was visiting the workshop, and we started to talk about making a plate holder that could withstand any kind of chemical or physical abuse. I asked Niles to make a modern version for one of my wooden, handmade, Japanese full-plate cameras, and a few months later he had solved the problem of having the plate holder and camera disintegrate over time.

The only precautions that you need to take if you order one of these holders from Niles is to hold a paper towel under the corner of your plate holder as you go to your camera. Also, be sure to wipe down the back of your freshly sensitized plate after loading it into your plate holder. The reason is that the polycarbonate resin holder doesn't absorb any of the silver excess run-off and you will likely drip on the floor, and your shoes, on your way to the camera.

Plate Dipper for Sensitizing and Fixing

While both sensitizing and fixing can be done in conventional trays, it is far easier, and much safer, to use upright Lexan dip tanks for these operations. The silver nitrate tank should have an outer light-tight box, or it can be constructed using a Lexan material made of an opaque ruby red, or black, polycarbonate resin. The light-safe silver tank is essential, while the fixing tank should be clear so that you can see what is happening to your plate during the fixing stage. Each tank should be equipped with a "dipper" or some mechanism for lowering and raising the plate in the solutions without touching the delicate and sensitized surface of the plate, or the chemistry.

In the nineteenth century these plate dippers were made from glass, rubber, ceramic, or thick silver wire. One solution that works quite well is a 2" wide strip of Plexiglass® softened on one side over a stove burner and bent to have a 1/4" lip. The cheapest version is cut from a gallon milk container. The best place to get these tanks is through Niles Lund's site (http://www.lundphotographics.com). Niles has incorporated the dippers into his tank lids so that everything is in one comprehensive unit.

A COMPREHENSIVE WET COLLODION PACKING LIST

In other chapters I have provided dry and wet, table and sink, set ups. Since this process is really a simultaneous combination of the two states I will give you a basic list of materials that are important to have on the road. With those materials in hand it will be quite simple to add a few additional items to your stay-at-home lab to make life easier for you.

On The Road & Lab Wet Plate Collodion Needs

- A plate camera with a relatively fast lens and a way to accommodate a wet plate. This can be a traditional view camera, an old wet or dry plate camera with companion plate holder, half or full size, a vintage Kodak camera such as the 3A, or even something as basic as a Holga.

Figure 17–12

Scott Hilton, *CYCL*, 2012 (wet plate neg to inkjet print)

Scott, a self-taught wet plate artist, shared some thoughts regarding this work. The words *text* and *texture* share a common Latin root, *TEXO* ("to weave; to braid together; to construct with elaborate care"). Language and sensation, the textual and the textural, are processes of pattern perception. Meanings are woven from words just as lived experience is interlaced with bodily feeling. To me, the handmade, physical photographic image is the ideal way to express how concepts have a tactile presence because they are woven . . . because they are stitched together from what Barthes calls a "tissue of signs." In wet collodion, these elements speak of the deep connection between ideas and their physical manifestation *(Courtesy of the Artist)*

- A tripod or some device to hold your camera still during a lengthy exposure
- QuickFish ice-fishing tent for on-the-road wet plate work (http://www.geteskimo.com) or a clever portable wet plate set up for the trunk of your car or truck. The QuickFish tents are lightweight, are easy to set up, come in various sizes, and can hold tables. They can get hot in the summer, but you can always cover the roof with a reflective space blanket or paint it white. These are great for multiple people in a workshop situation, and you can make one of them work easily if you keep your collodion pour, sensitized plate loading, and development in the tent and your fixing station and wash outside on a separate table.
- Portable safelight conditions. You will only need to be in safe conditions for the sensitized plate insertion into your plate holder and development. On the road, if you use an ice-fishing tent, the purest solution to your lighting situation is to get a red LED caver's headband with white and red LED lights. You can adjust the angle of the light and make it fall directly on your plate for both pouring and development. A more refined solution to lighting would be to get some strong magnets to put on the outside of the tent to hold magnetic LED road alert lights on the inside of your tent. Try http://www.flarealert.com. One other solution if you have electricity nearby: festive red chili pepper lights!
- Prepared black plates, with a removable film laminate on the black side, for tintypes or—if you want to make your life complicated—asphaltum, balsam fir, and mineral spirits to make your own blackened plates

- Glass, and glass cutting tools, for negatives and ambrotypes. Clear glass for negatives, and black, blue, and red glass for ambrotypes.
- Glass cleaning vise, or a nonskid rubber pad, for cleaning glass with a whiting or rottenstone liquid formula
- Funnels that are specific to the fixer, developer, and silver
- Absorbent paper towels
- Latex or nitrile gloves, a plastic or canvas apron, and eye safety wear
- Enough distilled water for development and for cleaning. Usually, a day of shooting and rinsing will not require more than 5 gallons of fresh water if you are using a potassium cyanide fixer. Rubbermaid sells a fine insulated water container that is excellent. If you need it for keeping water chilled, to cool off silver tanks or developer, you might want to consider two of these . . . one for general use and cleaning up and the other for drinking.
- Gallon-size milk containers for bringing home your used developer, developer rinse water, and post-fixing wash water
- Collodion chemistry to mix or prepared salted collodion (see resources)
- A catch tray for pouring collodion on your plate and for keeping your collodion pour bottle. It is essential that you protect your plumbing in case of accidental spill. I line my catch tray with multiple layers of newspaper or paper towels. You can also sacrifice a tray for all of your collodion pouring and use it only for that purpose. **Never allow collodion to go down the drain of a sink.**
- A 7% to 9% salted silver nitrate solution for sensitizing and a tray to prevent any spill. I always keep my silver tank in a plastic catch tray.
- A liter-size, silver dip tank, with a dipper or a silver-only glass tray (Pyrex)
- Ferrous sulphate developer
- Distilled water for your developer dilutions
- *A low-volume glass measure for mixing your developer*
- A catch tray for catching your developer during development
- A freshwater tray for the critical initial rinse following development before fixing
- Potassium cyanide (*read the fixing section thoroughly*) or sodium thiosulphate fixer
- A 1- or 2-liter dip tank for fixing plates. I strongly recommend a dip tank for fixer, especially if you are using potassium cyanide.
- A Tank Caddy for the silver and fixer tanks (http://www.lundphotographics.com)
- A tank or tray for the fixer, lined with layers of newspaper to catch any spillage
- A tray for the final water bath following the fix
- At least a gallon of hydrogen peroxide for neutralization of your post-fixing wash water if you are fixing with potassium cyanide. Be sure to read the section on types and methods of fixing.
- Cotton balls (for gentle plate cleaning in the washing stage)
- Coffee filters for filtering if necessary
- Krystal Seal envelopes for transporting your plates back to the lab
- Trash bags for hauling away your trash

Additional In-the-Lab Wet Plate Needs

- Glass lab wear for mixing collodion and other solutions (1000 ml to 50 ml)
- pH strips or digital pH wand and a hydrometer to test your silver bath
- A graduated cylinder for the hydrometer test
- Glass stirring rods
- Running water or water supply
- A developer helper tray a size larger than the plate so the developer doesn't have to be poured directly on the plate in the event that you prefer that method to hand-held development (http://www.lundphotographics.com)
- A 100–200 ml shot glass for prepared developer and your developer pour
- Safelight or a window with a foam core over it and a cutout for a red filter

- Mina Gloss Polyurethane for nontraditional varnishing
- Sandarac varnish and spirit lamp for traditional varnishing
- Glass storage jars for collodion and varnish. Add marbles to the collodion as you use it up to keep the air space small. This keeps the collodion fluid if you aren't using it up quickly.
- Nalgene, lab-quality storage bottles for both fixer and developer. It would be a good idea to get a lab-quality Nalgene bottle for your silver nitrate as well. If you can get an opaque or dark red bottle, it would be ideal.
- A wet plate collodion kit with all the chemistry, spirit lamp, pre-mixed salted collodion A & B, pre-mixed developer, fixer, pre-mixed varnish, hydrometer, funnel, etc. (http://www.bostick-sullivan.com).

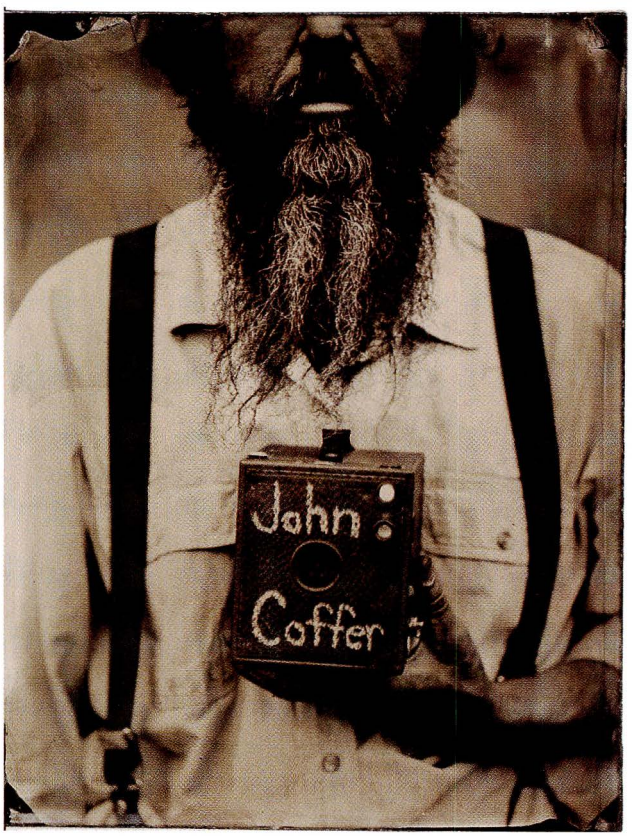


Figure 17–13
John Coffer, *John Coffer Camera*
John Coffer is a legend in the tintype universe, and this is a portrait of his camera and himself.
(Courtesy of the Artist)

GLASS AND METAL PLATE PREPARATION

If you intend to make a collodion negative or an ambrotype on glass, you need to take a different approach to your plate preparation than you would if you were working on blackened metal. The glass plate is prepared by thoroughly cleaning a piece of clear or dark glass with a liquid slurry solution of whiting or rottenstone and grain alcohol.

Once your glass is cut to size so that it fits into your plate holder, file the edges with a handheld sharpening stone or medium mill file to prevent any inadvertent cutting of your fingers on the sharp edges. Put on a pair of gardening gloves. To take the sharpness away, place the file at a 45° angle on the edge of the glass and draw the file away from you several times. Repeat this step on all 8 of the sharp edges. Then, if you have a dishwasher, wash all of the plates using Bon Ami instead of detergent. If not, wash by hand in hot soapy water and rinse in very hot water.

The glass must be totally free of any solvent, grease, and debris or the collodion solution will not adhere to the glass effectively. A traditional glass cleaner is rottenstone, a fine grit-like material that can be purchased at stores, or web sites, that sell furniture-finishing supplies. It is a fine gray powder, and mixing it with equal parts of powder, water, and alcohol produces a good glass-cleaning solution. You can also make up a bottle of calcium carbonate, or "whiting," to accomplish the same purpose. Personally, I prefer the whiting to the rottenstone. Here's the formula. . . .

Whiting Formula for Glass Cleaning

Here's a very good calcium carbonate/whiting formula for cleaning glass. Mix it and store it in a small bottle like the culinary arts drizzle bottles that sous chefs use to make their sauces look exotic on your plate.

80 g	whiting
100 ml	water
20 ml	grain alcohol

Place your sheet of glass in a glass-cleaning vise (see illustration). Apply the whiting solution to the glass liberally, and with one piece of cloth,

or a cotton pad, vigorously cover the entire plate in a swirling motion until you hear a squeaking sound. Take a fresh piece of cloth or cotton pad and continue to buff the surface, removing any and all whiting residue and lint from the glass. To verify that your plate is cleaned properly, breathe on the glass and check to see if there are streaks showing in the mist condensation from your breath. If there are, continue cleaning. A 4" × 5" sheet shouldn't take more than a minute or two.

Super-Clean Last Step with Bon Ami

Once your glass plates have been cleaned with whiting or rottenstone, you may want to make them perfect. The best way to accomplish this is to put your cleaned plates in a dishwasher and to add some Bon Ami to the detergent holder instead of dishwasher detergent. Run a short cycle and you'll be in perfect shape to pour without problems. If, by chance, you still are having issues with your collodion adhering to the glass, read up on the albumen edge sizing discussed later in this chapter.

Prepared Black Metal Sheets, Cut to Size, with a Film Laminate

If you are going to be making tintypes, by far the easiest way to begin working in wet plate collodion, then I would recommend calling up Bostick & Sullivan, Lund Photographics, or Main Trophy Supply and telling them exactly what size plates you want—you'll get them in the mail in short order. These plates are ready to go, and all you'll have to do is peel back the protective film on the blackened plate and proceed to coat with collodion. Plates come in black or chocolate brown and assorted thicknesses. If you opt to prepare your own metal plates with asphaltum, balsam fir, and mineral spirits, then you are a strict traditionalist and I would recommend taking a workshop with John Coffer at his Camp Tintype in Dundee, New York. Everything at John's camp is done from scratch!

If you are going to make a lot of plates, or are working with an assortment of cameras and plate sizes, you should invest in a plate cutter (about $300) and a large box of 20" × 24" blanks. Main Trophy is the best source for the plate cutter.

Figure 17–14

Christopher James, *Nelske Elzer*, Maine 2010

In every work session you will make a plate that encourages you to say the words "what if. . . ." In this case, I made a plate of Nelske Elzer and decided to find out what it might look like if I fixed it with brush applied fixer in intense sunlight and simply let the fix crystalize on the surface of the plate.

(Courtesy of the Artist/Author)

WET PLATE COLLODION CHEMISTRY

Collodion: Preparing Your Salted Collodion

You can go about salted collodion preparation by purchasing the collodion, ether, alcohol, and salts and preparing them in sequence, or by purchasing the salted collodion parts A & B from a chemical supply like Bostick & Sullivan and mixing them together a few hours before use, depending upon the type of collodion you make up. Making it from the separate ingredients is not complicated, and if you're going to do this process seriously then you should do it from the beginning at least once.

Note: I strongly advise against attempting to nitrate your own guncotton in order to make your own collodion from scratch. Nitrating cotton is very dangerous, and it is simply not worth the risk without the right safety equipment, facilities, or training. It is much safer to purchase prepared "plain" and uniodized collodion USP from a chemical supplier and salt it at home in your well-ventilated lab or outdoors. To make life easier, you can purchase the collodion in an A & B kit and simply mix the two parts together and be on your way to making plates in minutes. There is not a single good reason to make collodion on your own, as plain USP is readily available.

Safety Issue: Flammable Fumes

The fumes from the ether are very flammable, and a spark could ignite and cause a problem. I'm not suggesting a Hollywood type of explosion, but it's important to err on the side of caution and handle ether, alcohol, and collodion as dangerous and flammable materials. Always mix the collodion solution in a well-ventilated lab, or outdoors, when possible, and do not smoke during the process. (Insert your own non-smoking lecture here.) If you are using a lab, be sure that the ventilation is excellent and that the fan motor is flameproof (i.e., no sparks). If you use an in-line fan in your darkroom, be aware that it is likely to have an armature that generates a spark. *Do not use that type of fan during this process.*

Basic Collodion Ingredients

Plain collodion USP
Ether
190-proof grain alcohol
Cadmium and/or ammonium bromide
Potassium iodide, cadmium iodide, or ammonium iodide

Note: Generally speaking, the bromides are responsible for the half tones, while the iodides are responsible for the contrast and resulting densities.

Collodion Ingredients

Collodion comes in two types, "flexible" and "plain USP." Plain collodion USP is readily available from a variety of sources, and gathering the other materials needed is not very complicated.

If you buy the prepared and salted collodion you will be given two separate solutions that must be put together to make an almost ready-to-use collodion.

- **Part A** is a mix consisting of a combination of salts such as cadmium bromide and ammonium iodide (the types of bromides and iodides change in each recipe) in a solution of 95% grain alcohol.
- **Part B** will be a mix of 60% collodion USP and 40% ether. Again, this formula will change depending upon which recipe you are using.

Note: Plain ether will boil at around 94°F. Keep this in mind if you are ever in the mood to warm up that particular ingredient on a cold day while the top is still on the bottle. What will happen is that pressure will build up in the stoppered bottle and you will have the potential of a pressurized reaction when the bottle is opened.

Different formulas will have different proportions and combinations of ingredients and are often referred to as being a "double-salt" or "triple-salt" collodion depending upon how many salts are used in the formula (for example, "Ol' Workhorse," which you will see shortly in this chapter, is a triple-salt formula.

To make a working solution you will need to combine the A & B solutions in a glass bottle and allow it to "age" for a short time. Salted collodion solutions using ammonium iodide are usually ready to use within 24 hours. Solutions with potassium iodide generally take longer to age.*

*ALWAYS USE GLASS TO MIX AND STORE YOUR COLLODION—never use plastic when mixing or storing ether and collodion, as the ether will destroy the plastic.

Collodion will begin its useful life with a pleasant amber color and will progressively become darker and redder in tonality as it ages. This color change is the result of free iodine that is gradually released into the solution. As a general rule, a freshly mixed salted collodion working solution will have a shelf life of six months, but different formulas will have different life spans. To increase the life of your collodion, it isn't a bad idea to replace the empty space in your storage bottle with glass marbles.

Using Aged Collodion

As it ages, collodion begins to break down and has less resilience and tenacity in adhesion to the glass and aluminum plates. It will also become less effective. This diminished effectiveness does not mean that you should throw out the old collodion. Instead, mix up a fresh solution of salted collodion and combine it with the older collodion, up to 50%, to give you a very workable hybrid collodion that is perfect for dealing with both mid-tones (the older formula) and highlights and contrast (the newer mix). Better still, the collodion is already salted and ready to go as soon as you mix it up and let it settle.

Older collodion tends to yield a wonderful range of tonalities and subtle highlights, but there is a point of diminishing returns when the age of the collodion will begin to give you an assortment of problems. These include poor adhesion to the plate and less resiliency in the collodion. This is an issue if you use a cotton ball to clean the edges of your plates in the final wash. Another related issue that may rise up and make you a little upset is seeing your image dissolve before your eyes when you varnish your finished plate using the traditional sandarac varnish.

Note: Before we get to the recipes, here are some important things to remember. NEVER, EVER, POUR COLLODION DOWN A DRAIN or you will experience a plumbing disaster of unrivaled proportions. The scope of the problem will be so vast that you won't even be able to tell a good story about how bad it was. When I pour plates in my lab sink, I always do so over a large tray lined with several layers of paper towels or newspaper so that if I get clumsy I'll only spill into the tray and not down the drain. This 30" × 40" tray is also where I put my silver and fixing tanks. If there is ever a spill, everything will stay in the tray and out of the drain and septic system.

Figure 17–15
S. Gayle Stevens & Judy Sherrod, *Nocturnes 3*, 2012
This is one of my favorite wet plate pieces ever . . . a collaboration with camera builder Judy Sherrod and photographer S. Gayle Stevens. S. Gayle writes, "Nocturnes *1–4 are 20" × 20" wet plate collodion pinhole tintypes of the gulf shot in Pass Christian. Judy and I decided to go where no one has gone before and shoot mammoth plate pinhole tintypes. I constantly hear how you can't (or shouldn't) shoot pinhole wet plate images; I love both so I am glad we did. Nocturnes, whether musical or paintings, are of the night and we have created images that represent that drama of evening light on the water.*"
(Courtesy of the Artist)

Disposing of Old or Contaminated Collodion

Another thing to remember is that if it is truly time to get rid of old, or contaminated, collodion, set out a cookie sheet, or large tray, outside (away from children and pets) and line it with newspaper. Pour your old collodion onto the newspaper and let it evaporate into a skin-like yellow film. This collodion film is very flammable, so don't be casual with it around open flame. It might be exciting to set a match to old dried

collodion on newspaper as a way of disposing it, and it is an exciting way to "take out the trash." However, burning old salted collodion is not really a great idea. Not because of tiny explosions and flames, but because the collodion contains heavy metals in the form of cadmium that become airborne when set afire. These fumes can be harmful to your health. The safest method of disposing is to take the newspaper and paper towels to your local recycling center for disposal.

COLLODION RECIPES

There are literally dozens of working collodion recipes, and I'll give you a few of them to get you started. The ingredients are pretty consistent , and you can change proportions depending upon how the collodion will be used, the time of year, the type of contrast required, metal or glass plates, and a few other personal and professional considerations that are relevant to the artist using the formulas. The basic ingredients are prepared plain collodion USP, ether, 190-proof grain alcohol or denatured alcohol, and bromide and/or iodide salts. The iodides are responsible for the contrast and image density. The bromides are necessary for sensitivity to light and for the mid-tones on the plate.

Bostick & Sullivan Prepared Salted Collodion

This recipe is a simple, effective, and fast-clearing formula to use and is perfect for a workshop or class environment in which you are likely to go through a lot of collodion in a short time and need a simple way to salt your collodion and replenish your stock easily. The collodion comes in two containers. Part A consists of the cadmium bromide and ammonium iodide salts in a solution of alcohol. Part A is approximately 42% of your solution. Part B consists of 60% collodion and 40% ether. Part B equals 58% of your total volume. Parts A & B are combined to create a working salted collodion that is clear and ready to use in a few hours.

Combine salted collodion A & B into a single solution in the following manner. Make sure you have adequate ventilation and are wearing a pair of latex or nitrile gloves, eye protection, apron, and a dual respirator if you are overly sensitive to harsh fumes. **Always mix your solutions in glass**. Take a clean glass beaker and have some isopropyl alcohol, or grain alcohol, on hand for cleanup. Be sure that your mixing beaker and collodion storage bottle are the appropriate volume for the amount of collodion you are making up.

Bostick & Sullivan Working Mixed Collodion Ratios

- 15 ml Part A to 35 ml Part B . . . or
- 60 ml Part A to 140 ml Part B . . . or
- 150 ml Part A to 350 ml Part B

Step 1 Over a large tray lined with newspaper or paper towels, pour salted collodion solution Part A (cadmium bromide and ammonium iodide salts and alcohol mix) into a clean, glass graduated beaker. Then slowly pour it into the clean amber glass bottle that will become your pouring and storage bottle.

Step 2 Slowly pour your salted collodion Part B (the collodion and ether mix) into a glass graduated beaker that is in measured proportion to the Part A that you selected.

Step 3 Slowly pour Part B into the storage bottle containing Part A until it stops flowing. You will see stringy white ligand-like pieces in the solution, and this is totally normal. Cap the bottle and shake vigorously for 10 seconds. Wait until the solution clears, in minutes to hours, and you're ready to coat a plate and sacrifice it to the silver nitrate solution in order to introduce salt to the silver sensitizing bath . . . stay tuned . . . that part is coming. If your silver has already been iodized, you are good to go and can begin coating as soon as the new collodion becomes clear and cloudless.

I've been using this formula in workshops for a few years, and it is quick, is predictable, and has a good shelf life of 6–7 months. It also has decent mid-range values and contrast and is user friendly. It is not a

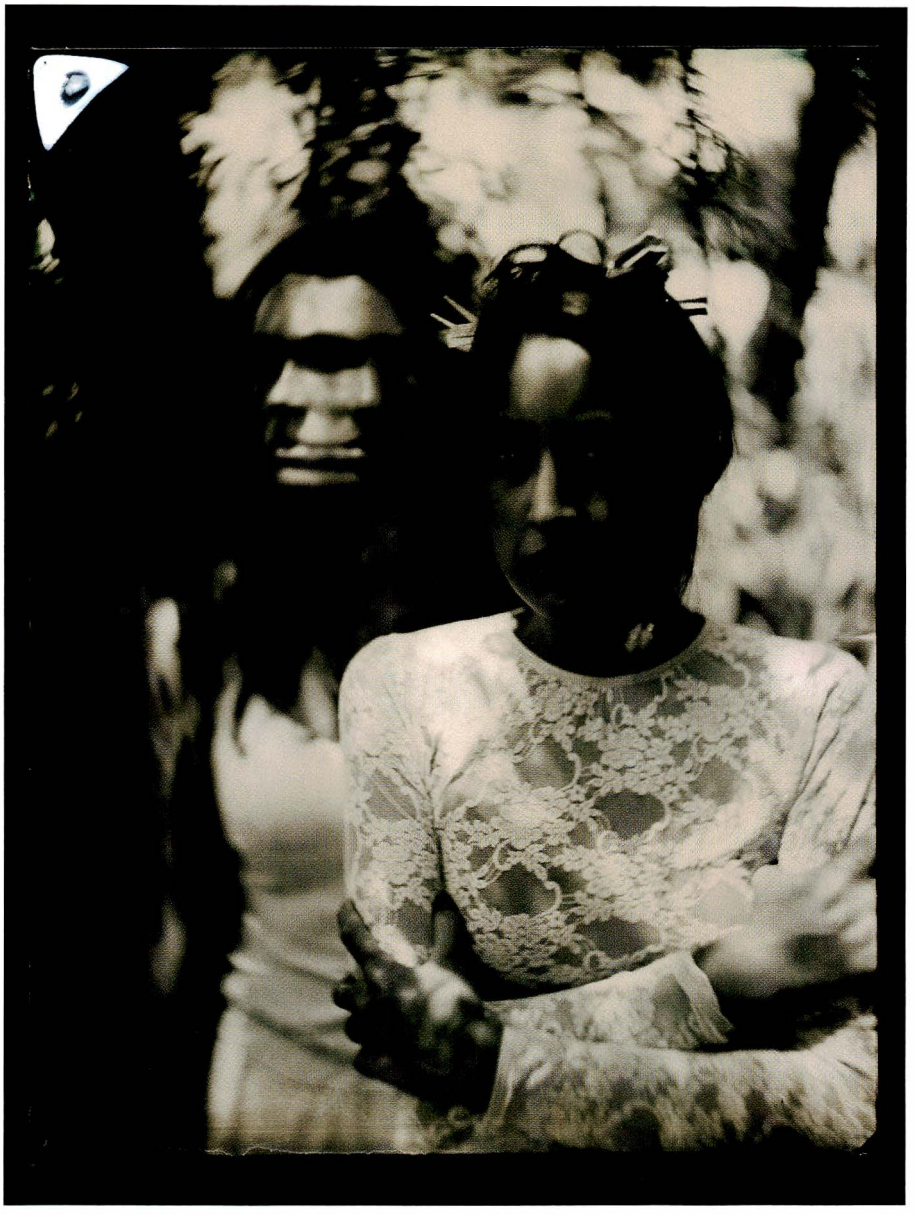


Figure 17–16
Christopher James, *Alison Nguyen & RubyRose*, New Mexico, 7-13-2012
An uncomplicated action-timed wet plate portrait of my friend Alison Nguyen and workshop course assistant Ruby Rose Kelly made in New Mexico.
(Courtesy of the Artist/Author)

collodion with attitude, and for the beginning wet plate artist it is a good way to fall in love with the process.

Old Reliable Collodion

This is a historical salted collodion that has been around for a long time. As its name implies, it is reliable, has a long shelf life of up to a year, has great adhesion and sensitivity, is easy on newcomers to the process, and is ideally suited to positive images (ferrotypes and ambrotypes). It is also quite suitable for making glass plate contact negatives. However, be warned: without significant plate intensification, it is considered a bit too weak for contact printing in UV light with processes such as albumen and salted paper. Like the Bostick & Sullivan salted collodion it is made in two parts. Here are the ingredients.

Part A

3 g	cadmium bromide
6 ml	distilled water
4 g	potassium iodide
200 ml	grain alcohol

Part B

240 ml	plain collodion USP
100 ml	ether

Part A: Old Reliable Bromo-Iodized Solution

Step 1 In a small glass measuring beaker, dissolve 3 g of cadmium bromide in 6 ml of distilled water. Use a glass rod to break it up if possible.

Step 2 Dissolve 4 g of potassium iodide in the cadmium bromide solution.

Step 3 Add 200 ml of 190-proof grain alcohol.

Part B: Old Reliable Collodion Ether Solution

Step 1 In a glass beaker, dilute 240 ml of plain collodion USP with 100 ml of ether.

NOTE: Always add ether to collodion and not the other way around.

Step 2 Gently add, and stir, the Part A bromo-iodozed solution into Part B.

Speeding Up the Ripening Stage of Old Reliable

You have a choice here. Because you used potassium iodine in Part A, the "ripening" time for the Old Reliable is generally a few days to a week. However, you can greatly speed up the ripening by adding 2–3 drops of tincture of iodide. You can also add some of your old Old Reliable to your fresh Old Reliable and cut your ripening time down to a day or so. Notice that there is a significant difference in the ripening time between the Bostick & Sullivan formula, using ammonium iodide, and Old Reliable's potassium iodide.

Pour your 540 ml of prepared salted collodion solution into a suitable glass bottle and let it sit undisturbed for a day or two. Do not treat it roughly or shake it up. If you do, you may end up with bubbles and sediment on your plate after pouring. Also, make a practice to routinely clean off the lip and seal area of your pouring bottle to avoid the collodion chunks that inevitably fall onto your freshly coated plate if you ignore this advice. You'll notice the problem because it usually looks like a large pimple surrounded by a halo of dark.

Figure 17–17
David Puntel, *Mathilda*, Berlin, 2011
David writes, "*The ambrotype of Mathilda was taken on October 2, 2011, at our Kleingarten here in Berlin. Kleingartens, or Little Gardens, are like British allotments, places individuals living in cities can use to grow fruit and vegetables. This is the first ambrotype Mathilda permitted me to take. She agreed to sit, 'one time,' after I promised her the exposure would last only 5 seconds. Since that day it's been my favorite. I'm still trying to get her to sit for more photographs, to no avail, since I'm not expecting her stubbornness to diminish as she approaches her teenage years.*"
(Courtesy of the Artist)

Ol' Workhorse Collodion Formula

This is my favorite collodion recipe. Ol' Workhorse is a triple-salt, instant-clear collodion formula that has been around for a while and was given to me by John Coffer, who got it from Bob Szabo. The formula is a close cousin to Old Reliable and differs with the addition of a second bromide salt. This is a great field collodion and has a nice sensitivity to salted collodion's available spectrum (a great proportion of which is, by the way, in the UV end of the scale).

Ol' Workhorse has a shelf life of about 6–8 months but, like other mixes, the out-of-date collodion can

be utilized to iodize fresh collodion by mixing them together at no more than 50% to 50%. Ol' Workhorse is similar to Old Reliable in that it produces fine soft negatives that are often too soft, without intensification, for decent contact printing in UV. This is especially true when you are producing negatives for albumen or salted paper. It does, however, excel with positives on glass and metal. This is a truly great collodion for tintypes and produces a creamy coloration with deep blacks and beautiful mid-tones, especially with potassium cyanide as a fixer. I really appreciate how great this formula is for beginning students in challenging working conditions and on the road. It is a forgiving collodion, ready to use almost as soon as it is mixed (it clears quickly), and it has an extended shelf life. It can be combined with fresh collodion easily when it gets too old to use and gives you the added benefit of nice mid-tones with the contrast from the fresh collodion added to your out-of-date mix.

It is also quite flexible if you need to change it due to the weather (for example, you can add extra alcohol to the formula in hot weather, which will help reduce the possibility of collodion peeling from your glass or metal substrate, which is sometimes caused by the collodion drying too quickly). If you add ether, it tends to toughen the film, causing the collodion to shrink and contract when drying, which results in an increase in the possibility of the collodion peeling from the glass or metal substrate. This formula will also work well for collodion negatives on glass when coupled with the negative intensification instructions in this chapter. One last thing . . . if you do a bit of research on this formula you will find several different recipes all claiming to be Ol' Workhorse. Every practitioner has his or her personal additions and alterations, and if you make wet plates long enough, you will make changes as well. This is the core triple-salt Ol' Workhorse formula, and it is a winner.

Ol' Workhorse Ingredients: A & B

Part A: Collodion

240 ml	plain collodion USP (cellulose nitrate in ether-methanol solution)
100 ml	ethyl ether

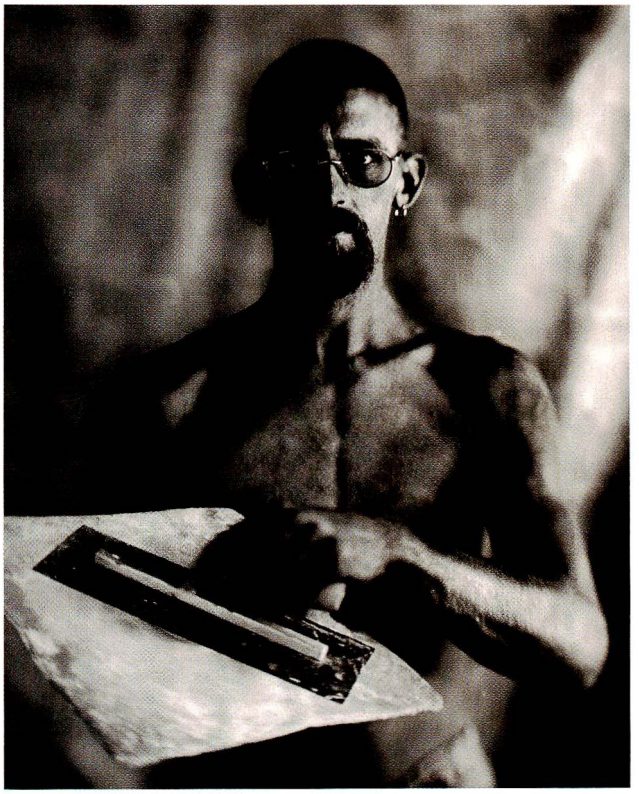


Figure 17–18
Quinn Jacobson, *Tim, Portraits from Madison Ave*, 2004
Quinn Jacobson is an extraordinary influence upon the wet collodion community, and this is his portrait of Tim, a day laborer he photographed in Utah. Tim was working that day to raise money for his rent. He, his wife, and his child were about to be evicted, and he needed to earn $300 that day putting stucco on houses. This is a full plate clear glass ambrotype. *(Courtesy of the Artist)*

Part B: Bromo-Iodizer

1.6 g	cadmium bromide
1.4 g	ammonium bromide
6 ml	distilled water
5 g	potassium iodide
200 ml	190-proof grain alcohol (Everclear)

Part A: Mixing Ol' Workhorse Collodion Ether Solution

Step 1 In a glass beaker, dilute 240 ml of plain collodion USP with 100 ml of ether.

NOTE: Always add ether to collodion and not the other way around.

Step 2 Gently add, and stir, the Part A bromo-iodozed solution into Part B.

Part B: Mixing Ol' Workhorse Bromo-Iodized Solution

Step 1 Dissolve 1.6 g of cadmium bromide and 1.4 g of ammonium bromide into 6 ml of distilled water.

Step 2 To this mixture, add 5 g of potassium iodide.

Step 3 Add 200 ml of 190-proof grain alcohol.

All of the seasoning and storing information from Old Reliable is identical to Ol' Workhorse, so just refer to the information just given. For your information, as of this writing, Bostick & Sullivan is producing a Part A & B Ol' Workhorse for commercial sale, and it works very well. Here's the working solution for A & B and the order of mixing.

Ol' Workhorse Working Solution: Parts A & B

Collodion: Part A	Bromo Iodizer: Part B
25 ml	40 ml
50 ml	80 ml
125 ml	200 ml
250 ml	400 ml

If you are intending to produce ambrotypes or glass plate negatives you can increase the adhesion qualities of the salted collodion by adding 3–5 ml of amino silane to each 100 ml of collodion.

To increase moderate contrast in your salted collodion, add 4 drops of 1% tincture of iodine to each 100 ml of salted collodion. Speed is not greatly affected.

To Mix: Measure the desired amount of Part A collodion USP into a graduated glass beaker or cylinder. Do not use plastic! Pour this measured amount into a clean and dry pouring bottle. I like to use the 250 ml or 500 ml Kimax blue top wide-mouth bottles. Mark the bottle with the date of mixing. Then, using the same graduate or beaker, measure out the corresponding amount of Part B bromo iodizer. Next, pour the Part B into the dated pouring bottle holding the Part A collodion. Cap the bottle and shake vigorously. Let the solution relax, and it will be ready to use almost immediately.

Clean up the graduated cylinder with very hot water that will loosen the milky skin of the collodion from the glass, and flush and wipe with paper towels. Do not pour your rinse water or collodion skin down the drain. Collect it with a paper towel, bag it with a plastic freezer bag, and put it in the regular trash. I like to finish off the cleanup with Everclear alcohol.

Freshly mixed collodion will change color and speed as it ages. It will start off as a straw color, and as it ages, the contrast will increase and the color will change to a burgundy red.

Quinn Jacobson's Quick-Clear Collodion Formula

This is a formula that is a modification of one published in an 1856 book by M.H. Ellis entitled *The Ambrotype and Photographic Instructor*. The formula provided here makes a bit more than half a liter, and because of its ability to clear quickly, it is almost ready to use as soon as it is made.

Part A: Collodion & Ether

240 ml plain collodion USP
160 ml ether

Part B: Cadmium Bromide

3 g cadmium bromide
5 ml warm distilled water

Part C: Mix Part B into Part A

Part D: Iodide, Alcohol, and Water

4 g ammonium iodide
5 ml distilled water
160 ml grain alcohol

To Mix: Slowly add Part D into Part C and shake the solutions together during the mixing sequence.

Scully & Osterman Collodion for Positives

The formula from France Scully Osterman and Mark Osterman is very close to Old Reliable except that it has a little less alcohol in the bromo-iodide and more ether in the collodion-ether mix. This leads to a revelation of the effects of solvents in collodion.

Scully and Osterman use an ether-rich collodion formula for making ambrotypes where density is not only unimportant but detrimental. This helps establish a more delicate range of tones. A higher ratio of

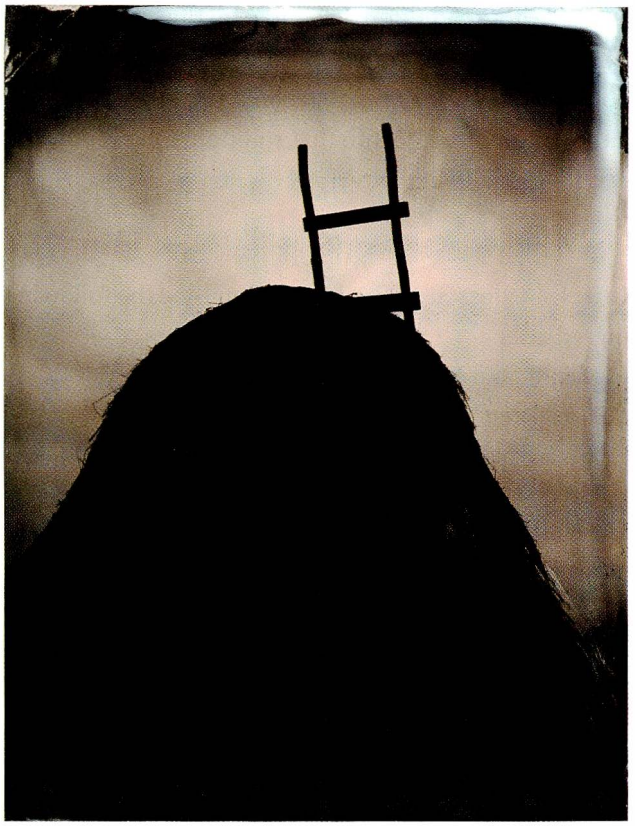


Figure 17–19
John Coffer, *Haystack*, Scan #10138
A mysterious and simple wet plate from John Coffer . . . presumably made at his Camp Tintype.
(Courtesy of the Artist)

alcohol, though never more than 50% to 50%, provides stronger deposits of silver when making negatives where density is desirable. Be warned, however, that alcohol also introduces water into the collodion, a primary cause of ripple-like "crepe" lines.

Part A

236 ml	plain collodion USP
155 ml	ether
3 g	cadmium bromide
4 ml	warm distilled water

Part B

155 ml	190-proof alcohol
4 g	ammonium iodide

Step 1 Add 236 ml plain collodion USP to a 550 ml amber glass bottle and then slowly add the 155 ml of ether. Cap the bottle, shake the solution, and place the bottle aside for a short time.

Step 2 Pour 4 ml of warm distilled water into a small glass beaker. Then add 3 g of cadmium bromide to the beaker and proceed to break it down by crushing it with a glass rod. If you have trouble getting the bromide to dissolve, hold the beaker over a flame and move it around until the cadmium bromide dissolves completely. Once it is dissolved, slowly add it to the bottle containing the collodion and ether mix and shake the bottle. Call this bottle **Part A**.

Step 3 Place the ammonium iodide in a glass beaker containing 155 ml of 190-proof alcohol and stir this with a glass rod until it dissolves. Call this **Part B**.

Step 4 To make the working solution, slowly combine Part B and Part A, and shake the solution to mix it up.

Note: This will be the last time you will shake the bottle.

Step 5 This formula has a relatively short shelf life of several weeks, though it will keep longer if refrigerated. If you wish to make a collodion that does last longer, substitute the potassium iodide for the ammonium iodide. This solution might be cloudy at first, but it will clear given enough time.

Note: Some water is beneficial in collodion; however, too much promotes the formation of crepe lines (like the parallel lines one sees on the beach after the tide goes out) in the surface of the plate. If lines are a problem, the ammonium iodide and cadmium bromide may be dissolved in alcohol instead of water, but do not use an alcohol lamp when mixing.

Ether-Less Collodion: Substituting Grain Alcohol for Ether

Every so often, due to storage, safety, or availability concerns, it may be prudent to substitute grain or denatured alcohol for the ether in your collodion formula. This is increasingly true if you are traveling to

a country with sensitive political concerns and where bringing ether, grain alcohol, and collodion into that country may cause some difficulties for you in customs. The issue at hand is the increase in water content in the collodion formula due to the presence of 5% water in the grain alcohol.

In some cases, you may find yourself in a position of simply having to substitute grain alcohol for ether, a situation that my friend and former student, Travis Hocutt, encountered when teaching wet plate collodion in Argentina, where ether was simply unavailable to him. If you are in this quandary, you will find that the alcohol and collodion mix will flow normally at first but will take on a thicker, honey-like consistency as the solution is used up. For this reason, Travis increased his proportion of alcohol to keep the solution fluid and useable.

The act of evaporation (which ether is very good at instigating) becomes especially important following the collodion pour, and the setup of the collodion, preceding immersion into the silver-sensitizing bath. The extra water in the collodion may result in a reduction of the adhesion quality of the collodion to the plate and the need to extend the wait time between the pour of collodion and the immersion into the silver-sensitizing bath. Though it's always prudent to ensure that the collodion is properly "set" before immersing it in the silver bath to avoid the film from lifting from the glass, generally formulas strong in alcohol adhere better to glass than those strong in ether. This is due to the amount of shrinkage the film experiences when high percentages of ether are used. Here is an "ether-less" collodion formula that is an alcohol bromo-iodizing collodion called Lea's Landscape #7 Alternate Formula. It features two bromide salts and two iodide salts in an ether-less alcohol and collodion solution.

Lea's Landscape #7: Non-Ether Collodion Formula

In a 125 ml glass bottle or larger beaker, combine the following ingredients:

100 ml	Everclear grain alcohol
1.5 g	cadmium bromide
1.3 g	ammonium bromide
3.4 g	cadmium iodide
2.6 g	ammonium iodide

Dissolve the cadmium bromide in the alcohol (this will take a little while, as the cadmium bromide doesn't dissolve easily in alcohol). Then, dissolve the ammonium bromide into that solution, followed by the two iodide salts in the recipe.

To Make a Working Strength Solution

In a clean glass liter-sized bottle combine the following ingredients:

100 ml	of the 4-salt formula given previously
200 ml	grain alcohol
300 ml	plain collodion USP

Let it sit and ripen for 2–3 days. When it is clear and straw colored it is ready.

Timmermans Ether-less Collodion

My friend, Alex Timmermans, became allergic to ether and constructed a collodion formula that keeps him healthy and produces successful plates. It is a double-salt formula, effective for a few months before turning a deep red, and it yields plates with a nice long tonal range.

Part A

200 ml	grain alcohol

Part B

4 ml	demineralized water
2 g	cadmium bromide
3.5 g	ammonium iodide

This very simple formula clears quickly and can be used right away. To keep it useable longer, store it in a cold location and add a few drops of acetone.

Cleaning Plates with Old Timmerman's Collodion

When it loses its effectiveness, Alex suggests that it can be used to clean your glass plates. He pours the old collodion on the plate, lets it dry, and then immerses the plate in hot water. The collodion comes off the glass easily and leaves you with a very clean plate that can be used again.

Coffer's Poe Boy Collodion: No, No Grain Alcohol Formula

This is a formula from John Coffer and one that you can use when you do not have 190-proof grain alcohol or ether available to you.

Figure 17–20
Aspen Hochhalter, *Untitled#24*, 2011
Aspen writes, *"I am most interested in the fragility of these plates, specifically in the thin, tenuous delicate skin of silver that sits on top of the glass, ready to tear at the slightest misplaced touch. The tears in the silver skin create unsettling cuts into the portrait. For me, these moments of unexpected violence within the images brings to the surface my sense of anxiety, frustration, and ambivalence—they are small poetic moments that make me reflect on how and why I photograph and how and why I cultivate these fragmented self-portraits."*
(Courtesy of the Artist)

Part A

240 ml plain collodion USP
300 ml denatured alcohol (hardware store type)

Part B

6 ml warm distilled water
3 g potassium bromide
5 g potassium iodide

Part C

Tincture of iodine (a few drops)

Add 300 ml of denatured alcohol to 240 ml of plain collodion USP and stir it until it is clear. Mix up 5 g of potassium iodide in 6 ml of warm distilled water in a glass beaker and stir with a glass rod. Next, in the same glass beaker, add 3 g of potassium bromide and stir into solution. If it doesn't go into solution easily, try warming the mix over a very low heat, stirring as you go. Try this before adding more distilled water, as you want to keep the water content to a minimum since you aren't getting the benefits of the rapid evaporation caused by the ether in a traditional formula. Also, denatured alcohol has water in it, and too much water in a collodion formula causes what I refer to as "crinkles" in the collodion. In my experience, and observation, a little water is necessary because the collodion needs water to allow the silver and iodine to mate.

Add Part B to the collodion and denatured alcohol solution and stir until it is uniform. Now, add 2–3 drops of tincture of iodine to help speed up the ripening process. Then let it ripen for a few days before using it. The shelf life is about 6 months.

THE SILVER NITRATE SENSITIZING BATH

The Silver Nitrate Bath

A silver nitrate sensitizing bath, following the collodion pour on your glass or metal plate, is necessary in order to sensitize the collodion . . . so that it will record reflected light in the camera, resulting in a latent image ready for development. I know this seems entirely obvious to most of you, but for those completely trained in the mushy democracy of digital photography, it's important to know how film works. You are essentially making film, except your substrate is a rigid glass or metal plate coated with collodion rather than a substrate of flexible plastic film. Here's how you prepare your silver nitrate sensitizing bath.

Note: Remember, silver will stain and discolor your skin very easily, due to the silver nitrate reacting to the proteins in your skin. Always wear nitrile or latex gloves to protect your hands, an apron to protect your clothes, and eyewear to protect your eyes in case you splash or inadvertently touch your face or eyes while working. It's difficult not to get a stain on yourself somewhere if you are working with silver nitrate, so please rest assured that you will survive the henna-like stain and that it will go away on its own after a few days. While you have it, think of it as evidence that you are very cool for making handmade photographs.

Figure 17–21

Sally Mann, *Face Grid 1*, 2012

Here's a piece of work you probably haven't seen. A while ago, Sally had an equestrian-related riding accident and her back was badly injured. This traumatic event led to this body of work made during her rehabilitation when it was impossible for her to physically haul her camera around. Instead, Sally simply stood in front of it and recorded this painful, and uncertain, period in her life. As a follow up, Sally's better and in training for equestrian endurance races.

(Courtesy of the Artist and Gagosian Gallery)

The recommended working strength of a silver-sensitizing bath is between 7% and 10%, depending upon who you're speaking with. I personally prefer a 7% solution and will give you the instructions for that dilution. Most of my wet plate friends prefer the more traditional 9%. As you can see, however, changing the concentration of the solution is really easy to do. If you want a softer silver bath, say a 7%, just mix 70 g of silver nitrate with 1000 ml of distilled water. If you want a 9% strength, mix 90 g of silver nitrate with 1000 ml of distilled water.

A Standard 7% Solution

70 g	silver nitrate
1000 ml	distilled water

To make this 7% silver solution, thoroughly dissolve 70 g of silver nitrate crystal into 1000 ml of distilled

water. Pour this solution into your vertical silver nitrate tank. Again, I strongly recommend that you sensitize your collodion-coated plates in a tank, rather than a tray, as it is safer, cleaner, and more process-efficient. This silver-sensitizing tank is lightproof and made of polycarbonate resin. It and the clear window-fixing tank are sturdy, made for travel, and come with secure clasps and a moisture proof O-ring foam seal. If you work on the road, you can also get the tank caddy, which will hold both the silver and the fixer securely.

Iodizing the Silver Nitrate Bath

Once you have your silver nitrate sensitizing bath ready to go, you still need to iodize it before immersing your first collodion plate for in-camera exposure. This is necessary because newly formed iodides are soluble in concentrated silver nitrate. If the silver bath is not saturated with iodides first, the first plate or two will have a grainy appearance due to the excess silver nitrate on the plate, effectively cannibalizing the iodides (which are responsible for image formation) as the plate begins to dry while in the camera. Iodizing the silver is really a simple task. Simply coat a plate with your prepared salted collodion and put it in the silver tank for a few hours. That's all.

If you're in a really big hurry, you can squeeze a few drops of tincture of iodine into the silver, and that will do pretty much the same thing . . . iodize the silver nitrate. One final technique for quickly iodizing your silver is to add 15 drops of your prepared salted collodion to the silver bath. A yellow precipitate will form but will disappear as you work the solution. Personally, I like the romance of leaving a collodion plate in overnight, but this does the job very nicely. One quick reminder: if you use a plastic pipette to put your collodion drops in the silver, that pipette is pretty much toasted. If you plan to make this a regular thing, I would invest in a glass pipette for this sole purpose.

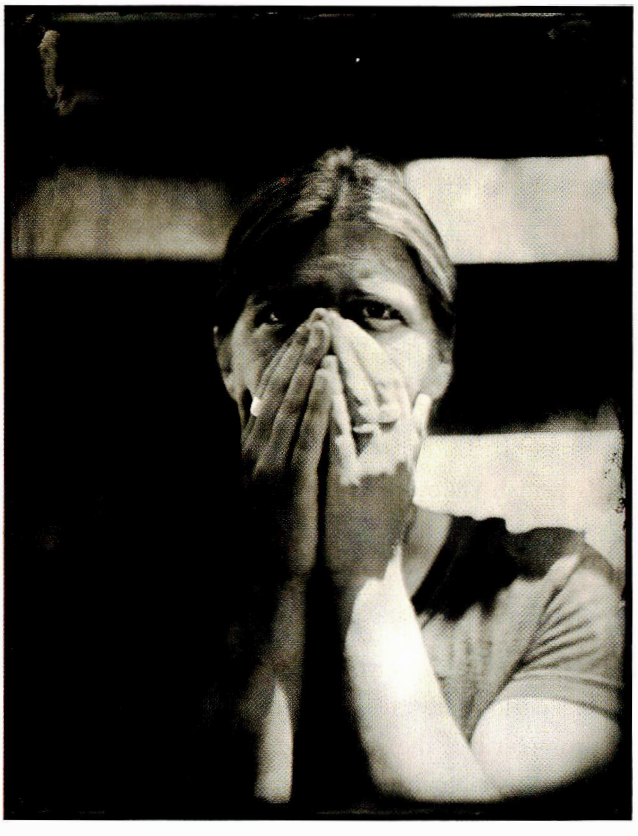


Figure 17–22
Christopher James, *Amanda King*, New Mexico, 2011
I made this portrait of Amanda King, a graduate of my MFA program at the College of Art and Design at Lesley University, in the midst of her telling a story about an important event that took place in her life.
(Courtesy of the Artist/Author)

CARE & MAINTENANCE OF A SILVER SENSITIZING BATH

Testing the Silver Sensitizing Bath for pH

Taking care of your silver bath is a sound idea because it will last a very long time with the right amount of attention. A fresh silver nitrate bath will have a pH in the ideal range of pH 4 to pH 5. The pH scale measures how acidic or basic a substance is. The pH scale ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic. A pH greater than 7 is basic, or alkaline. Battery acid is pH 1; vinegar has a pH of around 3; acid rain has a pH of 4 to 5; your pee, saliva, and blood are in the 6 to 7 range if you're healthy; hard water from the tap is around 8; baking soda has a pH of 9; ammonia pH is around 11; and Clorox bleach has a pH around 11.5.

Like everything else, your silver sensitizing solution has a pH as well, and when it's in the slightly acidic pH 4–5 range, many of the problems encountered chemically in wet plate collodion are eliminated. Over time, the silver bath may begin to lose some of

its necessary acidity, and this will be evident to you because your images will show evidence of "fog" or "veiling" after you've corrected everything else that you can think of (e.g., correct exposure, development time, development technique, safelight environment, etc.).

At this point, test the pH of your silver nitrate bath, and if it needs acidifying, because the pH has risen above your ideal pH range of 4 to 5, then add a drop of glacial acetic acid for each 250 ml of silver solution. You can also use nitric acid. With either acid, you should be back within the normal pH range of 4–5. Be aware that your film speed will slow down as the solution becomes more acidic. Another quick bit of information: if you're making glass plate collodion negatives, it is better to have a slightly higher pH than when making a wet collodion positive.

To test the pH level of acidity, you may use a piece of litmus paper or a digital pH tester wand. If you are testing your pH with a state-of-the-art digital pH-testing device (I use a Jenco Model 619), you will need to calibrate it with a buffer solution. Call up a chemist for assistance and go to a chemical supply, like Fischer Scientific, to get a pre-made buffer, as pure buffers are too fussy to make at home. Once you have your buffer, everything else is quite simple; just follow the directions that come with the pH tester.

The Red Cabbage pH Tester Solution

This is a very cool red cabbage pH indicator test for those wishing to go low-tech. It was created by Anne Marie Helmenstine, Ph.D. (I had an urge to type *pH.D.* here). These are the basics of it.

Red cabbage juice has a natural pH indicator in its juice that will change color based on the pH of the solution tested with it. The juice contains a water-soluble pigment molecule called "flavin" (an anthocyanin) that is found in an assortment of fruits and vegetables. Acid solutions will turn anthocyanins red. Neutral pH solutions will turn purple, and base/alkaline solutions will turn green and yellow. This makes it possible to determine the approximate pH of any solution based on its color from the red cabbage juice test strips. How does this work you may ask . . . simple, according to Dr. Helmenstine: "*The color of the juice changes in response to changes in its hydrogen ion concentration. pH is the -log[H +]. Acids will donate hydrogen ions in an aqueous solution and have a low pH (pH < 7). Bases accept hydrogen ions and have a high pH (pH > 7).*" Is that clear?

To make the pH test solution, chop up 2 cups of red cabbage into small pieces and put them in a glass container. Boil up some distilled water, and then cover the cabbage with it and let it steep for about 10–15 minutes. Filter out the veggie bits and keep the liquid. This will have a red to purple cast to it and will be about pH 7, or neutral pH. To test a liquid, pour about 100 ml of the red cabbage juice into a glass beaker, and then add the liquid you are testing until it changes color . . . if it is an acid or a base.

You can also make red cabbage pH test strips. Soak filter paper (or a coffee filter) it in a **concentrated** red cabbage juice solution. After a few hours in the concentrated juice, remove the paper strips and allow them to dry by hanging them on a line. Cut the filter into strips and use them to test the pH of various solutions like your silver nitrate bath, which should have a purple cast with a slight lean to violet.

Red Cabbage pH Indicator Colors

- Red = pH of 2
- Purple = pH of 4
- Violet = pH of 6
- Blue = pH of 8
- Blue Green = pH of 10
- Greenish Yellow = pH of 12

Testing the Silver Sensitizing Bath for Specif c Gravity

Another indicator of your silver bath's general health is to periodically test its specific gravity using a hydrometer . . . the same piece of kitchen equipment that you use when making home-brewed beer. Simply put, get a hydrometer and a graduated cylinder. It's important not to get a hydrometer that is too large for the graduated cylinder because it has to be able to float for you to get a reading. If you buy a starter wet collodion kit, such as the one that Bostick & Sullivan sells, it will come with a hydrometer and graduated cylinder.

To test the specific gravity (essentially meaning the amount of healthy silver in your solution) pour 50 ml of your fresh and unused iodized silver solution into a graduated cylinder and then slowly lower the hydrometer into the solution. Read the scale on the side of the hydrometer and record the number. That is your bath's unused specific gravity. I put this number on my tank and silver storage bottle, along with the pH, and date it. A fresh silver bath of 7%–8% will have a specific gravity of 1.08 and can produce fine results even at 1.04.

After I've worked the silver for a while and find that it is giving me contrasty images and taking longer than normal to expose, I will filter the silver solution and once again test the specific gravity. If the number has dropped below 1.04 then I will add silver to the solution. There are a few ways to do this. One is to have a backup silver nitrate solution in the 30% dilution range and add a little of that to the used silver until the specific gravity is back to looking good again. Another technique, one that John Coffer uses, is to have a solution of 12% silver nitrate (120 g of silver to a liter of distilled water) on hand and to pour off half of the old silver solution and replace it with the fresh 12%. That usually takes care of the problem.

Filter Your Silver Nitrate Sensitizer Solution Often

Not much to add to that headline. Over time, your silver solution will get crapped up with little dry collodion bits from all of the plates you've been running through it, dust, debris, and general dirt from around the lab or in the field.

Put on a pair of latex gloves and an apron. Fold a coffee filter in half, fold it in half again, take one edge and pull it into a cone shape, and put it in a plastic or glass funnel used for nothing else but filtering your silver. I like to place a cotton ball in the bottom of the cone and then gently pour my silver through it into a clean "silver-only" glass container. You'll be surprised how much crap is in the solution. Then, pour it back into your rinsed-out tank and let it sit in the tank for a few hours so that any little silver bits can settle. If you don't, you may get little white things on your plates that we call "comets." You'll see why if you get some, as they look like small shooting stars and comets off in deep space.

Sunning Your Silver Nitrate Sensitizing Solution

This is a very easy task to perform when your silver nitrate bath is getting tired, but it is necessary to the overall health of your silver bath. Sunning your silver solution is a way to give it a good visual inspection and cleaning.

1. First, get a large glass jar, or easily handled glass container, with a total volume that will allow you to pour all of your silver solution into it. Go outside (yes, the sun is OK for the silver sunning treatment) and pour the silver solution into the glass dish, or glass jar, in direct sunlight. You can get a nice 2-gallon glass jar, used for putting up homegrown sauces and vegetables, at your local farm supply.
2. Put a plastic screen over the dish, or jar, to prevent pets, and living things, from checking it out, and make sure that there are **no children anywhere** around . . . or that none will be as long as the silver is out in the sun. The silver solution will begin to turn a muddy grey . . . don't worry about it.
3. Wait a few hours and notice that the contaminants have settled on the bottom of your container. Cover the bottom of a tray with newspapers in case you spill anything, and then filter the sunned solution, through a filter and cotton ball funnel setup, into your washed out silver bath container.
4. Get out your hydrometer and graduated cylinder and check your specific gravity. Compare it to the original specific gravity reading you made with the fresh silver solution and add new silver as needed. If you're feeling really compulsive, you can check the pH level as well and add acid as needed . . . chances are that after fixing the specific gravity you'll be good to go.
5. One quick hint for those of you who live and work where winter means blizzards and freezing temperatures: sunning your silver with a simple drugstore-grade tanning light works well and you can stay indoors.

Figure 17–23
David Emitt Adams, *Chikara*, 2011
David has been taking wet plate into conceptual territory, a welcome change to the salon philosophy that if the image looks good, it must be good. He writes, *"In the piece* 36 Exposures, *I used 35mm film canisters discarded by my students as the metal base to hold their collodion tintype portraits. I employed this 19th-century photographic process to make the students' portraits on the very film canisters that played a crucial role in their initial understanding of photography. The canisters and the process I used in this piece speak of my fascination with the evolving nature of photography, representation, and culture."* *(Courtesy of the Artist, David Emitt Adams)*

You are almost ready to silver sensitize your collodion plates and make images. But before you do this, you need to make your developer, a simple fixing solution, and set up your working space. Before that step . . . here's a bit more information about the silver for those of you who work in the hot and arid sections of the world.

HOT & DRY WEATHER CONSIDERATIONS FOR SILVER

Recently, while teaching a wet plate collodion road show workshop at the Santa Fe Photographic Workshops, my class and I experienced a morning of frustration. I have found that when working in hot weather a 7% solution works a lot better than a traditional 9%. Working out of an ice-fishing tent setup in New Mexico, where the temperature was in the upper 90s outside and about 130°F in the tent, and very, very dry, the higher concentration of silver had a tendency to create a fogged impression similar to a plate that has been slightly, but fatally, over-developed.

Part of the problem had to do with the temperature of the silver bath that had risen considerably in the ice-fishing tent we were using for sensitizing and development. After reducing the silver bath concentration from 9% to 7%, we placed the sensitizing tanks in an ice chest of cold water. Be sure not to put too much water in the ice chest, as it will make the silver tank buoyant and cause it to tip over.

After cooling off the 7% solution, the fogging effect completely disappeared, and all subsequent plates, for the rest of the day, and subsequent days, were perfect with no veiling or fogging present. Be aware, however, that too cool a silver solution also has its issues. Simply put, find a nice ambient balance between hot and cold and keep it there.

One other way to deal with this problem is to bring along a thermos of cold distilled water. Before development, mix your developer 1:1, or 1:3 if it's developing too quickly, with cold water from the thermos. Or, make your dilution at home and put it in a cooler, surrounded by ice, and simply pour a shot glass of the cold developer and process.

The 1:3 developer option, kept in labeled plastic water bottles, on ice, will extend your developing times up to 90 seconds. This will give you more time to evaluate the details in the bright areas of your plate that will become your detailed shadows after development. Consider adding a few drops of your silver nitrate to the shot of developer for a little highlight boost.

Figure 17–24
Joni Sternbach, *Ahearn Twins #3*, 11.08.05
Joni Sternbach has been making wet plate images of surfers on the beach for some time now and has created a beautiful document of an equally beautiful sport and its practitioners. This is a plate of the Ahearn twins, made at Ditch Plains, Montauk, New York, in August 2011. *(Courtesy of the Artist)*

Double Silver Bath for Long Exposures in Hot and Dry Weather

Here's another thing we learned on the same very hot day at the Santa Fe Photographic Workshops. One of the wet plate collodion workshop participants was experimenting with pinhole and zone plate wet collodion exposures. Some of her exposure times were over 5 minutes long, and there was a distinct possibility that her collodion was going to dry out too much during the exposure, thus reducing the chances of a successful plate.

Following her long exposure, in near zero humidity and very hot air, she returned to the safety tent and noticed that half of her plate had dried out. The solution to the problem was to re-immerse the exposed plate in the silver bath for 20–30 seconds, letting the solution re-wet the collodion. Doing this allowed for a much smoother development, as it created a situation in which the developer could easily flow onto the wet plate, ensuring a smooth and even development pour.

Wet Paper Towel in the Bellows Trick for Dry Conditions

Another way to deal with arid and hot conditions and long exposures is to utilize the wet paper towel trick. This was suggested by Niles Lund, who was visiting the workshops during this particularly brutal heat wave. He suggested placing a damp paper towel, on a sheet of plastic, inside the bellows. In the hot weather, the bellows heated up, creating a humid environment due to the wet towel, providing some additional moisture to the sensitized plate in camera. It actually worked really well and could be used in the winter months when humidity is low.

FERROUS SULPHATE DEVELOPER FORMULAS

A Simple Ferrous (Iron) Sulphate Developer for Positives and Negatives

There are essentially two traditional directions to go chemically with your developer: the iron sulphate direction that almost all modern wet plate collodion artists use or the pyrogallic acid developer, which is, to me, less pleasant, not as adaptable to your positive and negative needs, and requiring of longer exposure times. I'm going to go with the simple ferrous sulphate formula and then give you a few optional ferrous sulphate developers that are popular with a number of my wet collodion friends.

- Ferrous sulphate developer for positives
- Ferrous sulphate developer for negatives

- Weather-sensitive ferrous sulphate & sugar developer
- SOS iron negative developer
- Bostick & Sullivan ferrous sulphate developer for positives and negatives
- Vinegar–sugar developer

Ferrous Sulphate Developer for Positives on Metal (Tintypes) and Glass (Ambrotypes)

In this first recipe, you will be able to make the developer in two different ways: #1 with more ferrous sulphate and less acid for positives (tintypes and ambrotypes) and #2 with less ferrous sulphate and more acid for negatives.

16 g	ferrous sulphate
400 ml	distilled water
24 ml	glacial acetic acid
24 ml	190-proof grain alcohol

In a clean 500 ml glass beaker or measuring cup, mix the ingredients in order . . . ferrous sulphate into the distilled water and then add the acetic acid and the grain alcohol.

Increasing Image Brightness on the Plate by Adding Potassium Nitrate or Silver Nitrate to the Developer

If you find that your highlights are a little flat and need some brightening, and you are not using potassium cyanide as your fixer, which would brighten them considerably, you may goose your developer a bit by adding small amounts of either potassium nitrate (saltpeter) or silver nitrate (from the iodized sensitizing bath) to the working developer. Using a pipette, add a few drops and notice the difference.

Ferrous Sulphate Developer for Negatives on Glass

12 g	ferrous sulphate
400 ml	distilled water
32 ml	glacial acetic acid
32 ml	190-proof grain alcohol *

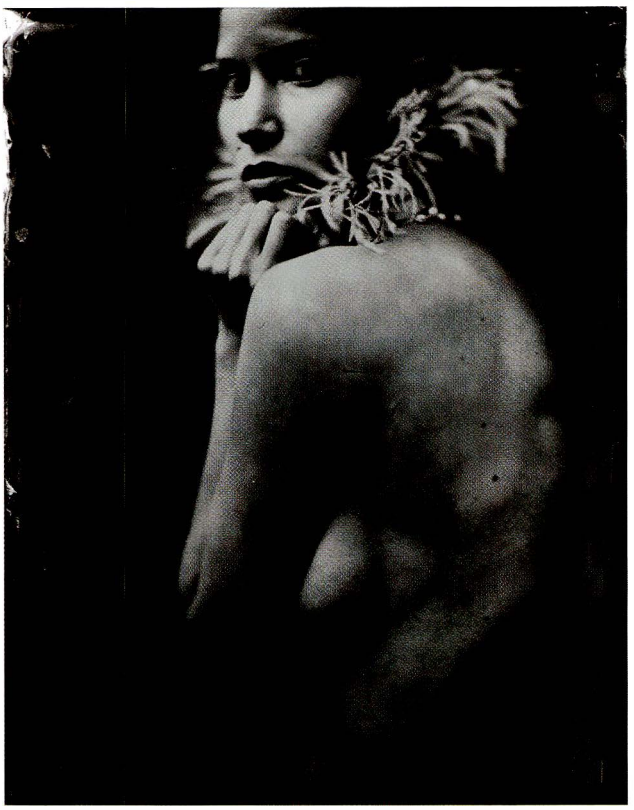


Figure 17–25
Kristin Hatgi Sink & Mark Sink, *Shelby with Feather #234*, 2008
Former student Kristin Hatgi and her husband, Mark Sink, work collaboratively in both their commercial and artistic life. Their subjects are often themselves and include longtime friends such as Shelby, who is seen in this wet plate.
(Courtesy of Kristen and Mark Sink)

In a clean, 500 ml glass beaker or measuring cup, mix the ingredients in order . . . ferrous sulphate into the distilled water and then add acetic acid and the grain alcohol.

Hot and Cold Weather Ferrous Sulphate Developer: Sugar Recipe

Here's another ferrous sulphate developer from Will Dunniway. It's one that is referred to as a sugar developer and is unique in that grain alcohol is not needed when the silver bath is new. It can also be modified depending upon the temperature of the environment you are working in. Sugar is added to this formula, as an organic restrainer, in situations in which hot

**Note: The reason for the increase in the amount of grain alcohol in the formula for negatives is to help the solution flow more easily. You may wish to avoid the possibility of dissolving the collodion by staying with the 24 ml in the positive formula recipe. If you have trouble with a smooth pour, add a little more alcohol to the more acidic negative-on-glass recipe.*

weather conditions may be the cause of ineffective development or chemical fogging. Other actions that may help, given the same problems, include diluting the stock developer with a bit more water, reducing the amount of ferrous sulphate in the formula, or slightly increasing the amount of acetic acid.

16 g	ferrous sulphate
18 ml	glacial acetic acid
15–20	g of sugar in warm weather/5 g in cold weather
20 ml	grain alcohol (not necessary if the silver bath is new)
1000 ml	distilled water (There is a similar formula that calls for 1/3 the amount of distilled water in this formula, indicating that this is a flexible number depending upon the weather and behavior of the developer.)

To mix, dissolve the ferrous sulphate in the distilled water and then add the remaining ingredients. Filter the solution through coffee filters (Chemex brand is best according to Will). Shelf life of this developer is quite short, about 4 months, and you'll know when it's aging because the color will become deep red amber . . . like a hearty ale. Be sure to label this well so no one makes a mistake and takes a sip.

Bostick & Sullivan Stock Developer for Positives and Negatives

Here's a nice, and very reliable, ferrous sulphate developer that I've used for several years now. It's a very comfortable recipe for those new to the process. Here's the easy-to-use developer from a stock solution for both positives (tintypes) and glass plate negatives. This developer is dilution specific. If you don't wish to make your own developer, you can buy it pre-made as a stock solution, and ready to use, from Bostick & Sullivan.

64 g	ferrous sulphate
8 g	potassium nitrate
100 ml	glacial acetic acid
100 ml	Everclear grain alcohol

To Use

- **For Positives:** Dilute 1:1 (1 part stock formula to 1 part distilled water)
- **For Negatives:** Dilute 1:3 (1 part stock to 3 parts distilled water)

Figure 17–26
Robert Szabo, *Tattoo*, 2010
Bob Szabo has been making photographic images for over 40 years, and his work has centered upon the concept of recording a living history of our time using antiquarian processes. Robert writes, "*The image titled* Tattoo *is based on Norman Rockwell's "The Tattoo Artist." It was a collaboration with my friend and protégé Nicole Py. I have to give her credit for the concept. It was taken in New Hope, PA at Living Arts Tattoo and features Nicole and Tattoo Artist Brian Ulrich.*"
(Courtesy of the Artist)

Fresh developer works perfectly well as soon as it is mixed in a proper dilution for your positive or negative collodion development. I recommend 40–60 ml for development of a handheld full plate. One other thing to consider with this formula . . . in hot conditions it is a good idea to slow down the speed of the developer and if you dilute your stock 1:2 or 1:3 instead of 1:1. It helps you get a more even and resolved image on the plate and allows you to extend your development time, if you chill your developer to 45°F, to 60–90 seconds . . . a much more relaxing way to process your plate.

Hot Weather Developer: Sugar-Free Recipe

Here's another very effective hot weather developer, formulated by Dana Sullivan and one of my MFA graduate students, Dave Hyams, that I used in the epic heat wave

of 2012. This is especially effective when working on the road in ice-fishing tents or dark boxes, and it appears to solve the hot weather problem of fog. It is a sugar-free recipe that relies upon the addition of potassium nitrate and an increase of the acetic acid concentration from 2.5% to 5%. Vinegar is a 5% acetic acid. This is a working solution that you can dilute to 1:3 and process at a temperature of 40°F to 45°F for 90 seconds.

- Add 50 ml of acetic acid to 900 ml of distilled water (*always add acid to water*)

Then dissolve

16 g	ferrous sulphate
2 g	potassium nitrate
50 ml	alcohol

Hot Weather Developer: Using Bostick & Sullivan Stock Developer

If you are working with a stock Bostick & Sullivan ferrous sulphate developer and want to adapt it to a hot weather formula, try this recipe to make a standard working solution:

250 ml	B&S stock developer
375 ml	vinegar
375 ml	distilled water

SOS Iron Negative Developer in Hot Weather

This formula is particularly useful for use in hot weather when fogging can be a problem. I've found that it's a tricky developer to get right, and I would first recommend cooling off your regular developer before embarking on the long learning curve with this one.

355 ml	distilled water
9 g	ferrous sulphate
18 g	white sugar
10 ml	acetic acid

A properly exposed ambrotype will become visible within 5 seconds. You will see the exposed areas turn darker as they are reduced to metallic silver. Continue for 10 additional seconds. If the entire image is formed before 15 seconds, the plate was over-exposed. If you push the development longer than 20 seconds, the exposure was probably too short. *Development must be stopped before the details in the shadows are evident or the image will be fogged.* Extended development will result in grey images.

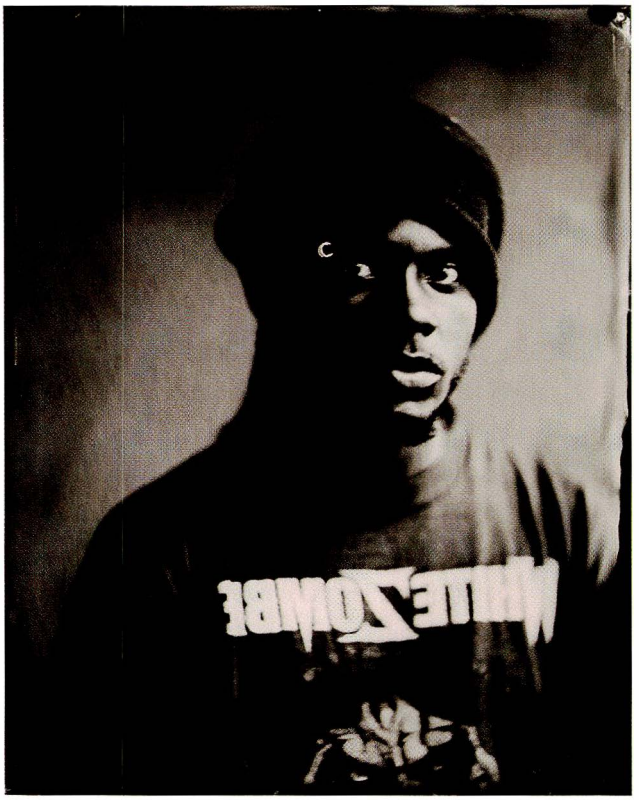


Figure 17–27
Michael Mazzeo, *9, Andre*
A powerful ambrotype by New York photographer/gallery director, Michael Mazzeo.
(Courtesy of the Artist)

Sweet & Sour Developer (Vinegar–Sugar Developer)

Here's another version of a developer that can be customized for hot weather working conditions. It is unique in that it substitutes vinegar for acetic acid. Jody Ake worked out this developer formula when he couldn't come to a reasonable solution for safely shipping glacial acetic acid. Instead, he substituted supermarket-grade vinegar and sugar. When combined with ferrous sulphate and Everclear grain alcohol he ended up with a flexible formula that he could travel with. This developer yields a warmish-neutral image tonality. The formula is altered depending upon the shooting situation. If the ambient temperature is hot, add a bit more sugar to the formula. If additional contrast is needed, reduce the amount of sugar in the formula.

Figure 17–28
France Scully Osterman, *Embrace*, (wet collodion negative)
Here's the collodion negative that France made for her albumen print, Figure 16–2.
(Courtesy of the Artist & The Howard Greenberg Gallery)

2 tbsp ferrous sulphate
2 tbsp sugar
2 capfuls of Everclear 190-proof grain alcohol
1 liter white vinegar

GLASS PLATE NEGATIVES AND INTENSIFICATION

While a sizeable portion of this dialogue is dedicated to making wet collodion tintypes and ambrotypes, there will be times when you will want to produce a wet plate collodion negative in-camera that is suitable for contact printing with UV-sensitive processes such as albumen and salted paper. This means that you will need to shoot the negative on glass and then intensify it to a degree at which the densities are sufficient to stand up to a contact-printing procedure in the sun or UV-exposure unit.

Subbing Your Glass Plate

The first step you will need to attend to is to cut and clean a sheet of glass that will fit perfectly into your plate holder or modified camera. Please refer to the glass-cleaning instructions in this chapter. Once the glass is squeaky clean it is time to move to the albumen subbing stage of the process.

In order to create a nice adhesive-like environment for your collodion, you will want to coat your entire glass plate with an albumen subbing. Unlike an ambrotype subbing, in which you may only be subbing the very edges and sides of your glass plate, the glass plate negative works best with a full albumen sub-coating. Make up a subbing solution with the following formula and then flow your plate in exactly the same manner that you do when pouring collodion. Allow the subbing to dry thoroughly and then proceed to pour your collodion onto the surface of the dried albumen subbing and subsequent sensitization in the silver nitrate.

White of a single large egg
2 drops of ammonia (not totally necessary)
100 ml distilled water

Iodizing the Plate for a Contact Negative

Coat your subbed albumen plate with your prepared collodion and sensitize it in your silver nitrate bath . . . but for 3 to 5 minutes instead of the 3 minutes that is normally recommend for tintypes and ambrotypes.

Triple Your Exposure

In order to ensure that you are giving yourself the best chance of an adequately dense glass plate negative, you will want to give your image about three times the exposure that you would for an ambrotype or tintype. Following exposure, you can use the same developer that you have been using for tintypes and ambrotypes with a similar dilution. In some cases, as with the Bostick & Sullivan prepared ferrous sulphate

developer, your dilution will change from 1:1 to 1:3. Then . . . it's time to intensify the negative.

A Simple Intensification with the Sun

A very simple intensification that involves very little effort on your part is to develop the plate following exposure, rinse it properly until the rinse water flows in a sheet off the plate (same as in the first wash with tintypes and ambrotypes), and re-expose the plate to the sun.

This action causes the silver in the highlight areas of the plate to exhibit a slight increase in density. Mind you, this is only a very modest intensification, and it's better to graduate from this simple solution for a thin negative to a chemically enhanced intensification of that negative.

A Chemical Intensification When the Plate is Wet

The most straightforward method of negative intensification, and one that is practiced widely because of its chemical simplicity, is a two-stage bleaching and enhancement process that takes place ***while the plate is still wet*** but fixed and adequately washed. Remember, washing times will change quite a lot between fixing with sodium thiosulphate or potassium cyanide. Be sure to read the information to follow.

Step #1: Bleaching Stage

Stock Solution A: (to make 100 ml of 18% copper sulphate solution)

- Mix 18 g of copper sulphate with 100 ml of distilled water.

Stock Solution B: (to make 100 ml of 9% potassium bromide solution)

- Mix 9 g of potassium bromide with 100 ml of distilled water.

Intensification and Workflow

To make a working solution of bleach, take 7 ml of stock solution A and add it to 7 ml of stock solution B. Add your 14 ml of A & B to 300 ml of distilled water. Put this solution in a tray and immerse your fixed and washed plate in it for 20 seconds. If you choose, you can forget the tray and simply pour and flow the solution on the plate as you would a developer. Watch the bleaching action and determine if pulling the plate from the bleach earlier than 20 seconds is warranted. Colder chemistry, or a wish for greater intensification, may require a longer bleaching time.

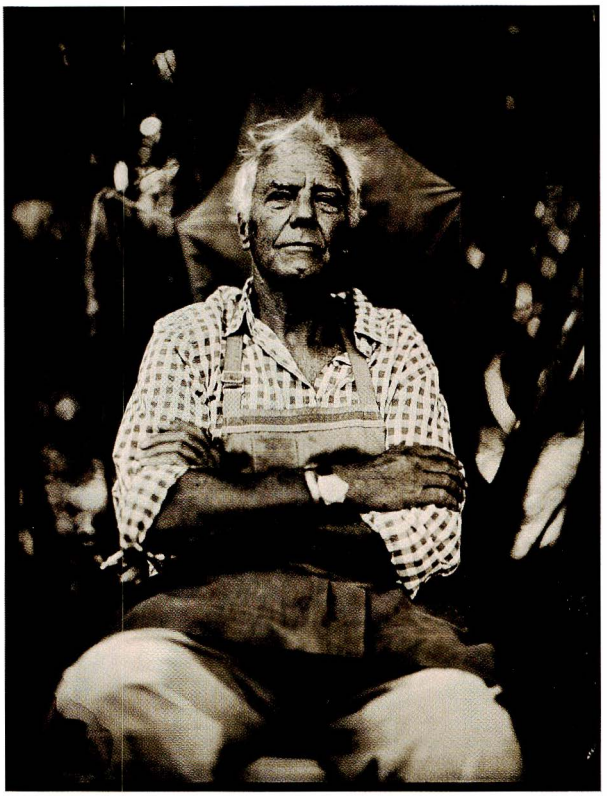


Figure 17–29
Christopher James, *Joe Swayze*, July, 2010, Maine
In the summer of 2010, my old friend Joe Swayze was working in Maine teaching a Young Photographer's Workshop and I offered to do a wet plate collodion demo for his students using him as a model. This is a portrait of a strong man, a fine artist, and a consummate teacher.
(Courtesy of the Artist/Author)

After bleaching, rinse the plate for a minute or two in softly flowing water. Then rinse with distilled water and smoothly immerse the plate in the silver intensification bath that is made in the following manner. Again, you may elect to flow the solution instead of using a tray.

Step #2: Silver Intensification Stage

- Mix together 12 g of silver nitrate, 200 ml of distilled water, and 6 drops of nitric acid.

Pour your silver solution into a Pyrex glass dish or plastic tray. Slowly and gently, wearing gloves, immerse your plate in the intensification solution. The intensification will take place almost instantly. Then, remove the plate and wash it thoroughly before setting it aside to dry.

IODINE/PYRO REDEVELOPMENT FOR GLASS PLATE NEGATVES

If you wish to increase the negative density on your plate in stages, providing you with a bit more control, you may decide to try a redevelopment technique that incorporates tincture of iodine and pyrogallic acid (a favorite of the "pyro-maniacs" who live and die for the perfect tonal scale and negative).

This is a two-stage process that requires a reduction of the visible image with the iodine and then a re-intensification with pyrogallic acid and silver nitrate. The process takes place in ambient light.

Part A: Tincture of Iodine Solution

400 ml tap water
A few drops of tincture of iodine

Take 400 ml, more or less, water from the tap and add a few drops of tincture of iodine (the type used on cuts and that is available from a pharmacy) to the water until it takes on the color of a nice anejo tequila, or freshly made collodion. You can use it immediately or store it for use later on.

Part B: Pyro Redeveloper with Silver Nitrate

Mix together the following:

355 ml	tap water
6 g	citric acid
1 g	pyrogallic acid

Store this solution in a 500 ml bottle.

Part C: Silver Nitrate

- Iodized silver nitrate from your silver bath to be used in droplet amounts stored in its own bottle or taken directly from the silver bath with a pipette/eyedropper.

Step 1 **Reduction:** You can perform the next steps in normal ambient room light. After the plate has been processed completely, and you have put on a pair of nitrile or latex gloves, hold your exposed and processed glass plate in your hand as if you were going to develop the plate, (i.e., flat and face up like a tray). Gently pour the tincture of iodine solution over the plate and agitate until the image turns pale. Wash the plate in tap water until the water tension stops beading. This is the same smoothness that you look for when rinsing your plate following ferrous sulphate development.

Step 2 **Re-exposure to UV light for several seconds:** If you are performing this task in the daytime, simply continue the procedure with the ambient room light providing the re-exposure needed. At night, you can give the plate a brief experience with a UV-exposure unit.

Step 3 **Re-development using pyro and silver nitrate:** After re-exposure, put a modest amount of your prepared pyrogallic developer in a shot glass to which you have added several drops of iodized silver nitrate from your silver-sensitizing bath. Repeatedly pour the solution

Figure 17–30
Jody Ake, *Self-Portrait*, 2007
Jody writes, *"The shot was made the last day before I moved out of my old studio. It seemed only right to do a self-portrait before I left as it was a very special place for me and I was sad to leave. I only had enough collodion to do 2 plates and it was the middle of the night. It was one of those moments where things just worked. The image is a perfect representation of how I was feeling that* night."
(Courtesy of the Artist)

on the plate, agitate, and pour it off . . . back into the shot glass. Repeat this sequence for several minutes until you attain the desired density. You will notice that the glass negative's densities will get progressively darker with each flow of the developer. This will be followed by a good washing sequence involving several changes of freshwater.

Step 4 **Drying the plate:** Dry the plate in a drying rack, and once it is ready you can use it as a contact negative with any process you desire.

WET PLATE COLLODION FIXERS

Sodium Thiosulphate Fixer

This is a simple fixer and one that is very familiar to all who work in alternative processes. After the wet plate is coated, sensitized with the silver, exposed in the camera, developed in a ferrous sulphate developer, and rinsed thoroughly, it needs fixing to remove the unexposed silver and bring out the beauty in the plate. This is the stage in the process where you get to open your present.

There are two ways to go about this task. The first is to make up a safe, and familiar, sodium thiosulphate fixer—the same one you have probably been using in most of your alternative process techniques—in a dilution between 15% and 20%.

To make a 15% solution, mix 150 g of sodium thiosulphate into 1000 ml of distilled water. To make a 20% solution, mix 200 g of sodium thiosulphate into 1000 ml of distilled water. Personally, when I use sodium thiosulphate to clear tintypes in a workshop situation with new students, I use a 20% dilution as in the following recipe.

Sodium Thiosulphate Fixer for Positives: 20% Solution

200 g sodium thiosulphate
1000 ml distilled water

The sodium thiosulphate fixer should be mixed fresh for each session and will require a 5-minute fixing time and a solid 20- to 30-minute wash following the fix. The shelf life is pretty decent, but the 20% dilution will necessitate making up fresh fixer at least a few times during a multi-hour working session. You'll know when you need fresh fixer because the plate will not clear as quickly.

You can use a commercially manufactured Rapid Fixer, such as Ilford's, in place of sodium thiosulphate, and a typical dilution will be a 20% concentration of the film recommendation for Rapid Fixer. There is so little difference between the Rapid Fix and sodium thiosulphate that I, personally, would just stick with the sodium thiosulphate and save money.

Sodium Thiosulphate Fixer for Negatives: 15% Solution

150 g sodium thiosulphate
1000 ml distilled water

When making a collodion glass plate negative, sodium thiosulphate is sometimes the preferred fixer because it

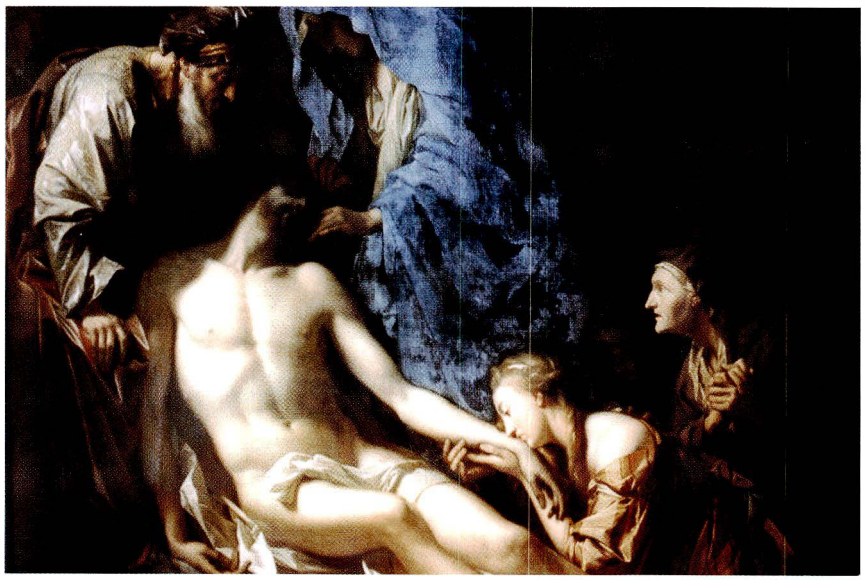


Figure 17–31
Pieter van der Werff, *Entombment of Christ*, 1709
When ferric ammonium citrate and potassium ferricyanide are exposed to UV light, they are reduced to ferrous ammonium citrate and potassium ferricyanide, which then forms ferric ferrocyanide . . . the well-known and insoluble prussian blue. This vibrant and deep blue-colored pigment was synthesized by Johann Jacob Diesbach in Berlin, in 1706, and was first used by the Dutch painter Pieter van der Werff in 1709, in his painting *The Entombment of Christ*.
(Stiftung Preußische Schlösser und Gärten Berlin-Brandenburg/ Photographer: Daniel Lindner)

leaves the collodion slightly darker when seen by reflected light. It also eliminates the chance that the shadows will be dissolved in the fixing stage, which may happen with a more aggressive fixer such as potassium cyanide.

When using sodium thiosulphate, fix the plate until it shows clearing and then extend the time by at least twice that time . . . usually about 5–6 minutes. Following the fixing bath, gently wash the plate in clean water for 20–30 minutes, being very careful not to disturb the fragile collodion surface.

POTASSIUM CYANIDE FIXER

This is the simplest explanation of how the word *cyanide* came into being. The iron-containing dye prussian blue had been first accidentally made, around 1706, from substances containing iron and carbon and nitrogen. Unknown at the time, cyanide was formed during the manufacture of this dye.

Figure 17–32
Christopher James, *Angelina Kidd*, New Mexico, July 2011
This is a plate that I made of my friend and former MFA candidate/graduate Angelina Kidd in the series where the subject of the plate graphically denied access to the viewer through body language or direct gaze. *(Courtesy of the Artist/Author)*

Prussian blue, as colored pigment paint, was first used by the artist Pieter van der Werff in his painting *The Entombment of Christ*, in 1709. It was one of the first synthetic, chemically made pigments and was cherished for its lightfast qualities and deep blue coloration. The pigment derived its name from the use of prussic acid and ferrocyanide. The name *ferrocyanide*, means "blue substance with iron," from the Latin *ferrum* ("iron") and the Greek *kyanos* ("[dark] blue"). When ferrocyanide was analyzed, the iron was removed from the compound and from its name, leaving *cyanide*.

Potassium cyanide (KCN) is the not-so-simple fixer. If you are always careful with all phases of your chemistry, pay attention to lab details, and don't object to a little risk, you can make up a batch of 1.2% potassium cyanide fixer. Personally speaking, potassium cyanide is my choice of fixer and is far superior, in many ways, to sodium thiosulphate for wet plate collodion positives (tintypes and ambrotypes) and negatives for the following reasons.

The Good Things About Potassium Cyanide

- It produces a brighter and more detailed image. If I make an identical exposure with two separate plates, and fix one plate with potassium cyanide and the other with sodium thiosulphate, the potassium cyanide fix shows a distinctly more luminous and more resolved interpretation of all available values. Recent comparative tests, on clear glass, resulted in a cooler black with the potassium cyanide, which was a bit different than the "coffee and cream" appearance seen on blackened metal plates. Visually, to me, there is no contest. However, I have friends who have shown me plates on which the difference between fixers appears to be marginal, so if you prefer to use a less aggressive fixer than potassium cyanide, and it eases your mind, your plates will not suffer by comparison.
- Using fresh potassium cyanide, the plate fixes and clears in 30 to 40 seconds. Sodium thiosulphate, or Rapid Fix, takes 5 to 6 minutes.
- The final wash time with KCN is 5 minutes. Sodium thiosulphate is 20–30 minutes, and if you are on location, this is a very big difference. Water weighs

8 pounds per gallon, and in the field you will need to bring it in and bring it back out.

- Unlike sodium thiosulphate, an extended fixing time in potassium cyanide can be used to reduce density. For this reason, it is a better idea to use sodium thiosulphate for glass negatives, as you will need all of the density you can get on the glass plate.
- It lasts a lot longer than sodium thiosulphate but will slow down and show signs of yellowing in the plate image when it begins to lose strength due to the volume of plates being fixed. This yellow-toned contamination indicates the formation of silver cyanide. At this point it will be necessary to make up a new batch of fixer and dispose of the old. Please see my instructions for neutralizing this dangerous potassium cyanide chemical with a simple drugstore-grade 3% hydrogen peroxide.

A Few Not So Good Things About Potassium Cyanide

- Potassium cyanide (KCN) is a deadly poison. **Never, ever, handle this chemical with bare hands, and be sure that your nitrile gloves have no tears or holes in them.** Check before you touch anything related to the KCN.
- Always wear an apron and work either in a well-ventilated space with a fan and hood or outdoors.
- Always wear eye protection and a respirator when working with dry potassium cyanide.
- Never leave the container open where children or pets have access to it.
- Never inhale dust from this chemical. Wear a respirator when mixing.
- Always store it in plastic rather than glass, before or after mixing, so that the container won't break if dropped or bumped.
- **Keep potassium cyanide far away from all acids at all times.** The developer has acetic acid in the formula. This means that you must be very sure that your first rinse, following development, is done in fresh water and is totally complete before going to the fix. You will know when it is OK to go to the fixer because your post-development rinse water will flow off of the plate in a smooth sheet of moisture. Potassium cyanide is a deadly poison . . . period. Respect it and you won't have any trouble. I recommend softly rinsing the plate with a slow flow from the tap just prior to immersion in the fixer. This precaution will help you avoid an irregular prussian blue cast on the plate when the washing time is inadequate.
- Be prepared to neutralize the used potassium cyanide with 3% hydrogen peroxide before you dispose of it anywhere. Also be prepared for any splash or spill. Always have several liters of hydrogen peroxide on hand next to the KCN tank in case there is any question of splash or spill.
- Be VERY careful with the potassium cyanide. Again, before you immerse the plate in the fixer, following the developer and subsequent wash, make sure that the water is flowing off the plate in a flat sheet and not exhibiting the "oily-like" resist surface texture it had when you first put it into the wash. I will repeat: **There is acetic acid in the ferrous sulphate developer and it must be removed in that first wash. The water must run off the plate in a smooth and continuous sheet and not be textured or oily-looking in any way. If acid comes into contact with the potassium cyanide it may release hydrogen cyanide gas, which has a greater toxicity than the potassium cyanide.**
- There is a rumor that ordering this chemical as an individual buyer versus ordering it through an institution will put you on the Homeland Security Watch List. To me, the results are worth getting a few questions and a friendly pat down at the airport.
- If you are anxious about using this chemical for fixing . . . don't use it. There are perfectly fine alternatives. Potassium cyanide is best for working in the field due to its speed and the fact that it doesn't require nearly as much water as an alternative fixer.

Recipe for a 1.2% Potassium Cyanide Fixer

Be sure to label your plastic container with the large words:

POTASSIUM CYANIDE: POISONOUS

12 g	potassium cyanide
1000 ml	distilled water

DANGER: WEAR NITRILE GLOVES, AN APRON, EYE PROTECTION, AND RESPIRATOR MASK WHEN MIXING. KEEP THIS CHEMICAL AWAY FROM ANY ACID. FOR NEUTRALIZATION AND DISPOSAL INSTRUCTIONS SEE THE SAFE DISPOSAL SECTION.

Using Potassium Cyanide Fixer

It is important to remember that in traditional black-and-white silver gelatin printing the black parts of the image represent the developed silver. In the ambrotype and tintype process it is the light-colored areas that are the developed silver. The blackness of the plate provides the shadows, which are not reflecting light.

The purpose of these fixing baths is to remove the unexposed silver halides. The potassium cyanide version of the fixer is the preferred solution for collodion positives because it works quickly, producing a lighter and more reflective silver particle and leaving perfectly clean shadows in the final image. When using potassium cyanide, fix the plate until the unexposed silver halides are completely removed. This is usually accomplished in less than a minute, usually in 40 seconds. It is essential that the plate be removed from the potassium cyanide fixer before the chemistry removes too much of the image silver. If you have fogged the shadows of your image, it is possible to clear these areas by extending the fixing time, but you run the risk of image degradation. Wash the plate for at least a minute in clean water, though extended washing doesn't hurt the image.

SAFE DISPOSAL OF POTASSIUM CYANIDE

Neutralizing Potassium Cyanide to a Non-Hazardous Potassium Cyanate

READ THIS FIRST: Never execute the neutralization of potassium cyanide without adequate safety protection. This means you should wear industrial grade nitrile gloves instead of medical grade, as they are thicker. Potassium cyanide is readily absorbed through breaks in the skin in the form of cuts and scratches. After use, rinse the gloves with hydrogen peroxide and discard. Always work in well-ventilated spaces. Wear an apron, dual respirators, and eyewear.

Before you begin, read these directions twice. Have a back-up person present in the event that something goes wrong. I know this sounds scary, but if you pay attention to detail, and exercise proper safety techniques, this is an uncomplicated process.

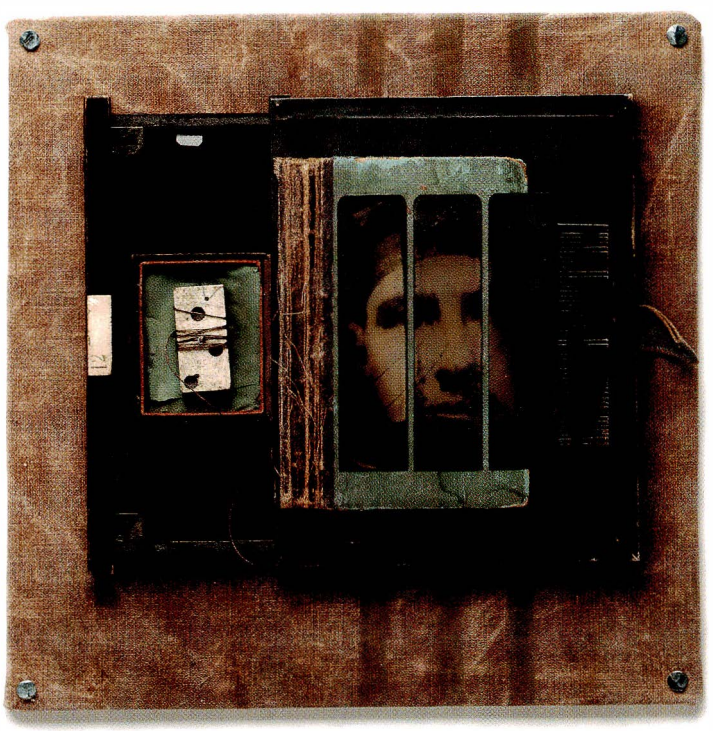


Figure 17–33
K. K. DePaul, *Three*, 2010
This is another fine example of the artistry and craft of former MFA student K,K. DePaul, who I had the pleasure of mentoring for her graduate thesis. In this work she is integrating a wet plate collodion image into a montage of physical remnants that place the subject of the piece into a metaphorical context. In other words, a captive of the things he was attracted to. *(Courtesy of the Artist)*

- Potassium cyanide (KCN) has an MSDS Health Level Hazard of 3 and a dangerously high pH of 11, depending upon concentration. It is a heavily regulated chemical. It can be detoxified most efficiently with hydrogen peroxide and will be converted to potassium cyanate (KOCN), with an MSDS Health Level Hazard of 1 and a water-like pH of 8 that is unregulated and safe.

  $KCN + H_2O_2 \rightarrow KOCN + H_2O$

- You need a 3% hydrogen peroxide (H2O2) (the type found in the drugstore and supermarket and that is the same strength as that used for cuts and minor wounds).
- 50 ml of 3% hydrogen peroxide will neutralize 1 g of dry potassium cyanide.
- **To Neutralize Dry Potassium Cyanide:** Put on eye protection, a respirator, and industrial nitrile gloves. Know exactly how many grams of dry potassium cyanide you are going to neutralize. Place the dry potassium cyanide in a non-breakable beaker. Dissolve the potassium cyanide in cool water first in a proportion of 1 g to 100 ml water. After it is dissolved in the water, oxidize with 3% hydrogen peroxide (drugstore grade is 3%), using at least 50 ml of hydrogen peroxide to every gram of potassium cyanide that you dissolved.

  Place the open beaker in a well-ventilated and VERY SAFE place and let it stand overnight. **DO NOT** cap the container, as the peroxide may create a gas and that will result in pressure within the closed container. The following morning, dilute this now safe potassium cyanate solution with water at a proportion of 3–4 times the liquid volume you are neutralizing. Rinse everything with hydrogen peroxide. An interesting side note . . . when you neutralize the potassium cyanide, it will turn a milky white. If you leave the neutralized KCN outside in the light, it will turn chocolate brown because of the silver in the fixer.
- **To Neutralize a Liter of 1.2% Potassium Cyanide Fixer:** To neutralize a 1.2% potassium cyanide fixer solution (a standard dilution for wet plate collodion), put on eye protection, a respirator, and industrial nitrile gloves and place the old potassium cyanide fixer in an indestructible plastic bucket (a drywall compound bucket will work well). Be sure the total volume of the bucket will accommodate twice the volume of the fixer you are neutralizing. If you have an industrial chemical hood you are in luck . . . use it. If not, I recommend going outside for this next step.

  Slowly add 600 ml of 3% hydrogen peroxide to each liter (1000 ml) of used 1.2% potassium cyanide fixer. You have now converted a heavily regulated chemical to a non-hazardous, unregulated, potassium cyanate. You will notice that there is a visible reaction between the potassium cyanide and the hydrogen peroxide. This will subside in a relatively short time. Allow the solution to stand overnight in a very safe place out of reach of anyone who may be curious about it. Do **NOT** cap the container, as the peroxide may create a gas and that will result in pressure within a closed container. The next morning, saturate this now safe potassium cyanate solution with water at a rate of three to four times the liquid volume you are neutralizing.

  Once again: for every 100 ml of 1.2% potassium cyanide (12 g to a liter of distilled water [1,000 ml] is the standard wet plate fixer concentration) you will use 60 ml of 3% hydrogen peroxide. This is the minimum dilution, but it is acceptable to use more hydrogen peroxide if you wish. It is always better to err on the side of excess hydrogen peroxide when performing this task.

Note: Even though the cyanide has been oxidized to potassium cyanate, the wet plate fixer still contains silver that may require special disposal depending on state and local regulations. It would have to be treated the same as spent sodium thiosulphate fixer.

- **Potassium Cyanide & Sodium Thiosulphate Fixer Warning:** There is a published formula that mixes sodium thiosulphate with a small amount of potassium cyanide. This fixer works well but cannot be neutralized in the same manner as described in this section. A mixed thiosulphate/potassium cyanide

fixer is a different bag of worms when it comes to disposal! Hydrogen peroxide will not only oxidize the potassium cyanide, it also will react with the thiosulphate to oxidize it to sulphate. Therefore, the 600 ml of 3% hydrogen peroxide per liter of fixer does not apply and this ceases to be a simple disposal problem. Instead it becomes a complex analytical problem of (a) How much cyanide is present? (b) How much thiosulphate is present? (c) How do I detect the end point of the oxidation reaction so the cyanide and thiosulphate are consumed? Bottom line . . . don't be complacent about using these instructions for neutralizing a hybrid fixer.

Neutralizing Waste Water After Using Potassium Cyanide Fixer

- You will have wash water from fixed plates (the first two rinses) whether you are working on the road or in the lab. The potassium cyanide concentration will be very low in these rinse baths. Collect your wastewater and then add about 300–400 ml of 3% hydrogen peroxide per liter of water and let stand overnight before discarding. After the first two or three rinses, the cyanide concentration should be so low that further treatment is not needed. Make sure you clean everything that is touched by the potassium cyanide with hydrogen peroxide.

Silver Recovery from Neutralized Potassium Cyanide

- Once you have successfully neutralized the potassium cyanide by converting it into an unregulated potassium cyanate, it is a simple matter to run it through a silver recovery system as you would any other fixer used in photography. Please adhere to any, and all, federal and state regulations regarding silver removal.

WET PLATE COLLODION WORKFLOW

Note: The following workflow will be specific to the tintype because that is the most forgiving of the options in wet plate and the best way to learn the process. The same sequence, and working process, will be totally compatible between tintypes, ambrotypes on glass, and glass plate negatives. Although the chemistry, and list of tasks and options, will change when making wet collodion negatives on glass, the workflow will be compatible. These additional parts of the workflow are detailed in other sections of this chapter.

Coating the Plate with Salted Collodion

If you're a scuba diver you no doubt remember the first time you went into the ocean for your Open Water certification dives. Once you relaxed, you may recall looking over at your divemaster and marveling at how totally at peace she looked in her neutral buoyancy . . . seemingly able to move in the water without ever moving her body . . . simply breathing. When you saw that ease, it was then that you knew just how good you needed to be. Watching someone who knows how to pour a beautiful collodion plate is just like that feeling . . . it's really the art of the process.

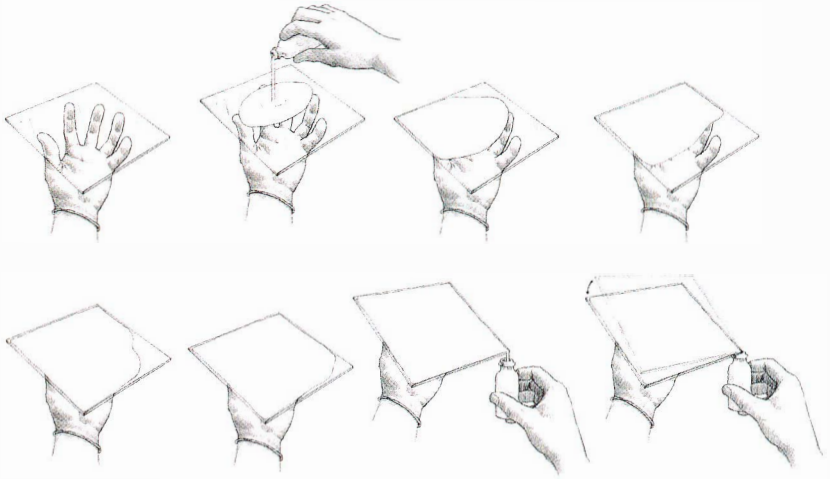


Figure 17–34
Joe Boyle, Pouring Wet Collodion
A wonderful illustration by my friend, and illustrator, Joe Boyle of the wet collodion pouring sequence using the "waiter" method of holding the plate.
(Courtesy of Joe Boyle)

Figure 17–35
S. Gayle Stevens, *Through My Looking Glass*, 2011
S. Gayle writes, *"I had been working on the idea of creating a narrative piece from my collection of things I collect. Likening my darkroom to a Lewis Carol story, I started creating the piece bit my bit. Charles, my cat, brought me the remains of a baby bunny that cemented the looking glass content. It didn't completely come together until he brought me the mouse." (Courtesy of the Artist)*

However, in the interest of covering the wet plate aesthetic spectrum, I will add that there is an entirely different school of thought about pouring one's plates, and it is the organic opposite of the perfectly poured one. Examples of this type of pour abound, especially among brand new wet collodion folks, and can be illustrated by the plates of, say, S. Gayle Stevens or Sally Mann, who utilize the ebb and graphic flow of the collodion as an intended aesthetic. Personally, I love this effect and equate the freedom in it with that of a child's drawing . . . something every well-trained artist would like to get back to.

In order to be a great wet collodion artist, you'll need to practice. I would recommend getting a few metal or glass plates and practicing with lightweight vegetable oil or thinned syrup. The point of this practice is to judge the amount of liquid it will take to cover the plate easily, not so much as to have a heavy build up or so little as to prevent full plate coverage. It won't take you long to figure it out, and since you can pour and put your plate in the silver tank in ambient light conditions, you will find the learning curve to be fast and gratifying.

Put on your apron, nitrile or latex gloves, and eyewear. In daylight, or ambient room light, decide how you're going to hold your plate. Some like the "claw" method, in which you grasp the lower left plate corner between thumb and forefinger. This will generally leave a very small uncoated spot in the corner of the plate. Others prefer the "waiter" method, in which you hold the plate like a waiter holding a tray of plates. This requires a bit more skill, and the first time I used the technique I poured collodion into the cuff of my latex glove. If you do this to yourself, you will understand why it was such an effective battlefield bandage. Some 190-proof grain alcohol, or denatured alcohol, will clean your skin pretty well.

Make a plate-holding decision and then begin slowly pouring your salted collodion into the center of your plate. I personally look for the collodion to form an ellipse in the center of the plate, reaching edge to edge in one direction, and stop pouring just as the collodion reaches the shortest width dimension of the plate. Hold on to the collodion bottle because you're going to use it again in a few seconds.

Gracefully, tilt the plate toward the lower-left corner (where you may be holding the plate if you are doing the "claw" holding technique), letting the collodion flow up to your fingers in the corner, but not at so much of a tilt as to let the collodion flow off the plate and into the cuff of your latex glove. Then, with gentle haste, tilt the plate so that the collodion runs to the upper-left corner, but stop before it runs off of the edge. Now, change

Figure 17–36
Amanda King, *Maggie*, 2012
An evocative piece from former MFA student and friend Amanda King that takes advantage of the elongated span of time needed to expose a sensitized wet plate. In this example, the baby is doing exactly what babies do . . . wiggle.
(Courtesy of the Artist)

the plate's tilt so the collodion freely flows to the upper-right corner. Finally, tilt the angle of the plate a bit to allow the collodion to fill in the lower-right corner.

Now, tilt the entire plate at a slight angle (collodion side up, of course) making the lower right the lowest corner of the angle. Put that corner of the plate tip into the collodion bottle so that the excess collodion flows back into the bottle and gently rock the plate, using the corner tip in the bottle as a fulcrum, back and forth at a slow and moderate speed and angle . . . like the ticking of an antique clock. This smoothes out any uneven densities that may be setting up on the plate. Keep in mind that you are working with speed and efficiency now because your collodion is beginning to evaporate and it will begin to set pretty quickly, signaling that it's time to immerse it in the silver-sensitizing tank.

Bring the plate back to level when the collodion stops dripping into the bottle . . . this usually takes about 10 seconds after you start rocking the plate after the pour. Bringing it to level will help prevent collodion flow lines on the plate. I generally keep the plate moving at this point. Where you are making the plate will determine what you do next.

If you are in a very arid and low-humidity environment you will not be waiting very long before putting your coated plate into the silver nitrate sensitizing bath. Usually, as soon as you complete the pour-off into the collodion bottle you can immerse the plate in the silver nitrate. The reason for this is that the ether in the collodion is drying very rapidly and you will end up with a host of little problems on the final plate if you linger too long after the pour. If you are in a humid environment, you need to wait a bit longer, usually 30–45 seconds (although I seldom wait more than 30) so that the ether has a chance to evaporate a bit before I immerse the plate in the silver bath.

I recommend a small squeeze test on the corner of the plate to determine when it's time to go into the silver. Once I think that the sheen of the collodion has turned from liquid to satin, I will do a tiny squeeze test to a corner of the plate. When I release the squeeze, I should see a small patch that looks like the texture of my fingerprint or latex glove. At that point, I am sure that it's ready for the silver.

One more thing about rocking the plate . . . if you rock too quickly, or at too great an incline, in low humidity conditions, you will often end up with "crepe" lines that look like sand on the beach after the tide has gone out. This is because the collodion is drying rapidly and you are creating a lot of centrifugal and kinetic force with your rocking motion.

Sensitizing the Coated Plate in the Salted Silver Bath

Turn off the room lights (safelight is fine) and immerse your collodion coated plate into the silver nitrate sensitizing tank, or tray . . . you now require safelight conditions until you get through the development stage and into the first rinse tray. Some people prefer to do their collodion under safelight conditions and simply go through the entire process in that red light.

Figure 17–37
Keith Carter, *Galina's Gift*, 2012
This is an ambrotype from my friend, and colleague, Keith Carter . . . author of 11 monographs, professor, entertainer, and known for the most undisciplined collodion pouring techniques on the planet.
(Courtesy of the Artist)

If that makes you comfortable, feel free, but it really isn't critical to pour your plate under safelight. However, when it is time to immerse the plate into the silver bath, it is a good idea to be in those total safelight conditions. If you are using a tray for your silver sensitizing (not recommended), that is another story.

After the plate is immersed in a solution of silver nitrate for 3 to 4 minutes (this is the time for tintypes and ambrotypes . . . glass plate negatives require a longer sensitizing time), it is time to remove it from the bath and load up your plate holder. Again, the environment for this stage is a darkroom with a red filtered safelight, a room with deep red Plexiglas on the windows, or my preference, a caver's LED headlamp with a red filter. If you are working on the road, the red LED caver's headlamp is perfect but can be replaced with several red LED, non-blinking, emergency road flare lights or a string of red chili pepper lights. Both of the LED solutions and chili lights work great in the ice-fishing tent.

What Is Happening in the Silver Tank

During the 3- to 4-minute immersion period, the silver nitrate bonds with the iodides and bromides in the salted collodion and creates a light-sensitive silver halide deposit on, and just under, the surface of the collodion.

After the immersion time, the plate is sensitized. As you remove it from the tank you will see that it is milky white. Sometimes, depending on the skill of your pour, you may notice swirls or changes in the overall milky coloration of the sensitized collodion on the plates. Don't worry about this yet. Just keep going, as most of the flaws will often disappear during the process . . . or be replaced with other ones.

Watch Out for Legs

One thing I would recommend looking for as you remove the plate from the silver bath are what I refer to as "legs." These have the same description, look, and meaning as the legs on the inside of a glass of deep red wine after you take a sip and put the glass down. If you see the legs when removing the plate from the silver bath, gently lower it back into the silver for another 20 seconds or so, and the legs will usually go away, leaving you with a perfectly smooth and sensitized plate surface.

Loading the Plate Holder or Camera

While still wet, gently blot the edges of the plate on a paper towel and be sure not to rub or touch the sensitized collodion itself. Insert the plate into your plate holder. I know this seems too obvious, but be sure the sensitized side of the plate is facing the direction of the lens and subject. It is a good idea to mark the plate holder with a piece of tape so you don't forget which side is front facing in the excitement.

The sensitized plate is then placed directly into the camera for the exposure. Be very careful during this

stage, because the plate holder may still be dripping silver nitrate. A technique that helps make less of a mess is to drain the silver nitrate sensitized plate over the immersion tank, or a blotter, and to wipe off the rear of the plate once you have placed it in the plate holder. This technique prevents any excess silver nitrate from migrating to the front of the plate, a problem that often results in streaks called "oyster stains."

Again, take all necessary safety precautions, and under no circumstances touch anywhere near your eyes during the process because silver nitrate contact causes serious eye damage. Almost everyone who works in wet plate, no matter how careful they are, occasionally gets silver nitrate on their skin. Nine times out of ten it is on their fingers and is generally because they have removed their safety gloves and are wiping down their plate holder for the next plate. Don't be alarmed by the stains. The silver reacts with the proteins in the first epidermal layer of your skin and turns it a nice henna color for a few days. Don't worry about it . . . BUT . . . don't be casual either. And never touch your face when you are working with silver nitrate.

If you are using an antique camera, a pinhole or zone plate lensless camera, or a Holga, the procedure is the same except that instead of loading a plate holder to put into your camera, you are loading the camera itself. Essentially, in this case, your plate holder and camera are the same thing.

EXPOSURE

Presumably you have set up your shot before coating your plate. Remember, you don't have a lot of time, and that is why it is called wet plate. Once the plate holder is in the camera, remove the dark slide to expose the plate. When this step has been done you may then remove the lens cap from the lens and expose the plate. You are the shutter, and counting off seconds using the words "one ansel-adams . . . two ansel-adams . . . etc." usually results in an accurate time. Average exposure times can be as brief as a second or two when working outdoors, in open light, and using period-portrait-type lenses. I recommend shooting primarily in open shade, as that light will yield the best values with this process. Your personal working style will have to be worked out over time and will depend on a multitude of factors in chemistry, gear, subject matter, and where you work. I will tell you that I've rarely had a good exposure using bright sun and prefer open shade in almost all circumstances.

iPhone App Exposure Meter: Pocket Light Meter

This could be fun. There is a free iPhone app that is pretty efficient as a light meter for wet plate exposure. It's called, appropriately, Pocket Light Meter. It's pretty cool, very easy to use, and surprisingly accurate. Download the app and open it up. First, set the ISO to 1, the app's lowest setting. Next, click the "gear icon"

Figure 17–38
Michele Rogers, *Pritzl*, 2012
Another example of how wet plate collodion's syntax can be used as a tool to enhance the mystery of the subject.
(Courtesy of the Artist)

and click on Exposure Settings. Last, set the "Exposure Correction" for −2 2/3 EV. Everything else is pretty normal. Pick a spot in the shot to meter, tap the screen to set the area you are calculating, set the aperture, and it will give you the required time of exposure for wet plate tintype or ambrotype. I was impressed that it was so accurate, even with direct sunlight or indoors.

If you don't have an iPhone . . . my personal technique, using my Hermagis portrait lens, is to expose the plate for the number of seconds equal to the aperture I am using. I realize this isn't science, but it is simple and it works for me almost all of the time.

In-Camera Exposure Test Strip

My friend, Niles Lund, showed this simple technique to me. Just like exposing a test strip in the darkroom (for all of you old-school folks who still practice the wet craft under romantic safelight), it is a simple matter to make an in-camera test-strip to determine the perfect amount of time to give to a given subject. Begin by exposing the entire plate for a period of time that is your best experienced guess. We'll call this the "base" exposure. After the base exposure, close the dark slide 1/4 of the way and expose again for one base exposure. Push the dark slide in ½ of the way closed and expose again for two base exposures. Finally, slide the dark slide in 3/4 of the way and expose again for four base exposures. This will give you total exposures on the collodion of 1x, 2x, 4x, and 8x the base exposure. In other words, four exposures separated by one-stop intervals.

Develop and fix the plate as you would normally and inspect the image for the appropriate exposure range. This is a great technique if you're just starting out, using a camera you're unfamiliar with, trying out a new lens, or working in unfamiliar lighting conditions.

Another very simple variation of this exposure test is to pull the dark slide, make a single base exposure, and then close the slide in equal intervals, adding a specific and equal amount of time to each band. After developing the plate you will see a series of bands at a single aperture, with a range of exposures built on a base of the initial exposure plus equal increases in exposure. This is especially valuable as a working tool if you are heart-set on a particular depth of field or are limited by the amount of time you can expose.

This process is most sensitive to blue, violet, and UV light but less so to shades of red, brown, amber, green, and yellow light. Remember, the success of an ambrotype, or a tintype, is often dependent upon keeping the deepest shadows from being exposed.

To make a negative, on the other hand, you would give the same scene twice the exposure and develop much longer with a weaker and more acidic developer to build up density. Refer to the formulas for negatives.

Note: A proper ambrotype (or tintype) needs the correct amount of exposure, as does a negative. It's just that a positive doesn't require as much exposure as a negative because you will be using a stronger developer and a shorter developer time. If you underexpose an ambrotype and push the development, you get an ambrotype with high contrast and no shadow detail.

Figure 17–39
Sally Mann, *Omphalos Grid 3*, 2012
During the time that my friend Sally Mann was rehabilitating from a serious equestrian accident, she entered into one of the most productive periods of her career. This series features her torso and equals the abstractions of her faces produced during this same period as seen in Fig 17-22. The plates are heavily manipulated and the title, *Omphalos*, refers to the symbolic interpretations of Sally's long-term work exploring the themes of family, time, and fertility.
(Courtesy of the Artist and Gagosian Gallery)

Once the exposure has been made, replace the lens cap on the camera and then return the dark slide to the plate holder. Immediately return to the darkroom, or your antique wet collodion darkroom wagon or red ice-fishing tent, and proceed with development. Development must be done before the collodion dries.

When Exposure is Delayed, or Long, in Camera in Hot Weather

Occasionally, while working in hot and arid conditions, your exposure, following sensitization of the plate, can be delayed. This may happen due to a need to re-focus, a change in weather conditions, or having to go a distance between your sensitizing area and your camera. In situations like these, you will want to keep the sensitized collodion from drying out on your plate.

A good solution to this dilemma is to lay a piece of plastic, like one side of a zip-lock bag, on the lower bellows in your camera. Then double- or triple-fold a section of paper towel and dampen it so that it is wet but not dripping with moisture. Lay it on the plastic inside your camera and take care to keep the height of the plastic and paper towel to a minimum. When you close the back of the camera, the interior will become humid due to the heat on the outside of the camera. When you place your plate holder, and sensitized plate, in the humid environment of the camera it will buy you some additional time and help prevent the sensitized collodion on your plate from drying out.

PLATE DEVELOPMENT

Flooding the Plate with Ferrous Sulphate Developer

In a darkroom, or red-LED-lit environment (lit by your caver's light headband, chili pepper lights, or road flare red LED lights), it is time to process your freshly exposed plate. Begin by removing it from the plate holder, being very careful not to scratch or touch the delicate collodion. Place the exposed plate in a "helper tray" or in your hand, like a waiter holding a tray, over a catch tray. Then very gently flood the developer across the surface of the collodion, commencing from the edge of the plate. Do not pour the developer directly onto the plate, as this will wash away some of the silver on the surface that is needed for full development.

My preference is hand development. I begin by holding the plate in my hand using the "waiter" grip. Then I gently flood the plate with the developer, being careful to walk that fine line between almost touching the plate's surface while pouring on the developer and trying to balance all of the liquid on the surface of the plate. Immediately, look for the developer on the

Figure 17–40
Tom DeLooza, *Icarus*, 2012
This ambitious 60" × 24" wet plate collodion work is a terrific example of the sculptural and structural possibilities available when metal and glass are used as substrates for the image.
(Courtesy of the Artist)

surface of your plate and be sure that the developer has covered the entire surface. Then begin to move the plate rapidly, keeping it flat, and focus on the image that will begin to come up.

Hand holding the plate for development is often the best technique to use when you need to stop development in a split second. Using a helper tray often causes a delay in flushing the plate with water to end the development, as it takes a bit of skill to get the plate out of the helper tray. Helper trays are best for beginning students of the art, as it is easier to flow the developer across the plate with a small mini-wave, making development more uniform. For the more experienced wet collodion artist, hand development is more efficient and controllable.

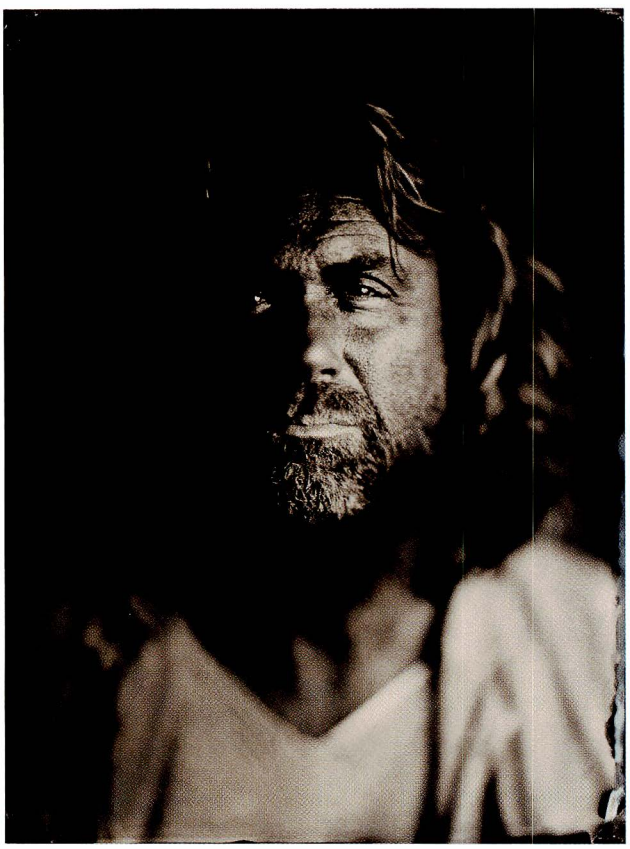


Figure 17–41
Alex Timmermans, *Mario*, 2011 (black glass ambrotype)
Alex Timmermans is a well-known and highly regarded photographic artist living in the Netherlands. This piece is an example of a black glass ambrotype, made with a Dallmeyer 3b Petzval lens, on a Narita studio camera, exposed for 7 seconds and fixed with potassium cyanide. Alex wrote, *"There is no real story behind this plate. He's my brother in law. A huge guy but extremely kind and sensitive."*
(Courtesy of the Artist)

When to Stop: Re-thinking Development Time

A properly exposed ambrotype, or tintype, will become visible within under 10 seconds. As you flood the exposed plate with your developer, you will see the exposed bright areas emerge on the plate as they are reduced to metallic silver. You are not looking for the quality of the finished image—that will come later in the fixer. For now, you are seeking detail, and it is essential to flush your plate with freshwater almost immediately after seeing your image emerge.

If the entire image is formed before 10–12 seconds, the plate was over-exposed. If you push the development longer than 20 seconds the exposure was probably too short. ***Development must be stopped before the details in the shadows are evident or the image will be fogged***. Extended development will result in flat, grey images and is usually the most common fault of new wet plate artists. To give you a little more control during development, dilute your developer to extend the time of development.

Cold Developer Option at 1:3

However . . . for a more relaxed development experience, keep you developer in a 1:3 dilution and pack it in ice. Fill a shot glass with the cold developer and flood your plate. Now, instead of looking for a finished development in 10 to 15 seconds, your development time will be extended up to 60 seconds. Keep the developer rapidly moving on the plate until you see the details in the brightest areas of your plate, and then flush the plate with freshwater.

First Wash: Stopping Development

Just as you see the highlights with density begin to appear, immediately flood the plate with freshwater over a catch tray. Repeat this flooding with freshwater two more times and then immerse your plate in a tray of clear water. This stops the development, and it is now OK to turn on the lights, or open the tent flap. The plate is then washed with freshwater until the oily look, where developer and water make a texture, is totally gone and the rinse water flows freely off the plate.

Wash until the water ceases to bead up on the collodion surface, and be positive that it flows off in a continuous smooth sheet. It is critically important to wash the

plate well before proceeding to the fixing stage, which can also continue to be done in daylight. You will know that you have done this part incorrectly if you have prussian blue stains on your plate. If you are making a portrait you may see your subject look like an extra from the movie *Avatar*. Again, continue washing until the water no longer beads on the surface of the plate.

One more bit of advice . . . change your rinse water often and make sure that your very last final rinse is in clean water that is void of developer residue. This is a perfect way to avoid the blue staining of an image that sometimes occurs in potassium cyanide fixer when you neglect to keep this final wash, before fixing, clean.

Fixing the Plate

There are several fixing options, so please go back to the fixer section of this chapter and review thoroughly. Fixing the plate is the point at which you get to open the "present," but it is serious business and you want to be sure that you know what you're doing before starting.

It is important to remember that in traditional black-and-white silver printing the black parts of the image represent the developed silver. In the ambrotype and tintype process it is the light-colored area that is the developed silver.

The purpose of the fixing bath is to remove the unexposed silver halides. The potassium cyanide version of the fixer is the preferred solution for collodion positives because it works quickly, producing a lighter and more reflective silver particle and leaving perfectly clean shadows in the final image.

When using potassium cyanide, fix the plate until the unexposed (light-colored) silver halides are completely removed. Let the fixer continue its action for about 40 seconds before moving the plate to a water wash bath. *It is essential that the plate be removed from the potassium cyanide fixer before the chemistry removes too much of the image silver.* On the other hand, if you have fogged the shadows of your image it is possible to clear these areas a little by extending the fixing stage.

Note: It is important to remind you that the wash water for the plates coming out of the potassium cyanide fixer will need to be neutralized before it is disposed of. Please refer to the safety and disposal instructions for potassium cyanide in this chapter.

Washing the Plate

When using potassium cyanide, your fixing should be pretty much complete in 40–60 seconds, although you may want to stay a bit longer if you want to open up the highlights a little or dissolve a thick collodion line on the edge of the plate. Once you transfer to the final wash, it will be important to wash your completed plate for at least 2–3 minutes in clean water, though extended washing doesn't hurt the image or the plate.

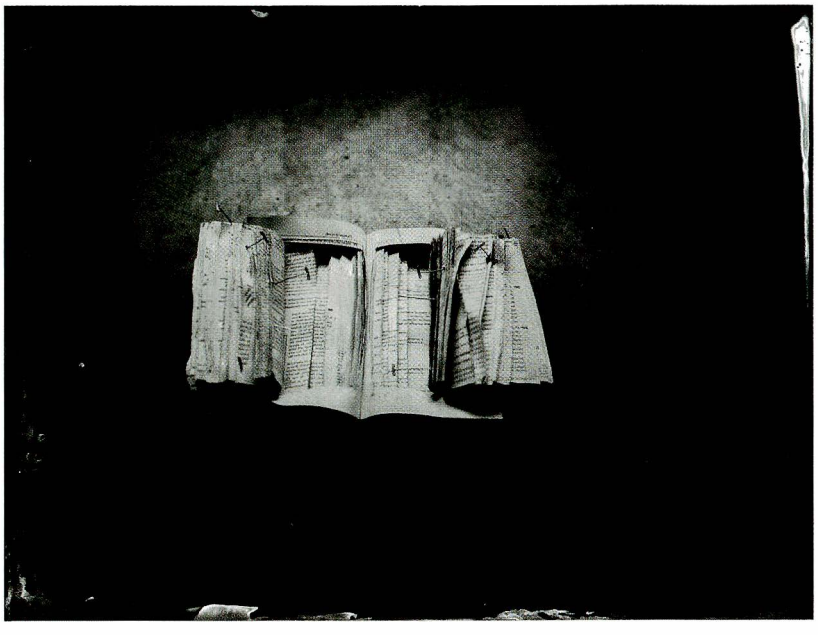


Figure 17–42
Sarah Nesbitt, *Working Harder to Reclaim That Context*, 2011
This was a visual metaphor of what happens when research is examined to a point at where it transforms the original intention of analyzed work. This practice raises ethical issues—citations are required for published work that borrow content from another, but the context of this newer, published work can reinterpret the original intention of the content. The original book in this image is now in possession of the Pennsylvania State University Library, where they now have legal rights in providing their own context for the physical object.
(Courtesy of the Artist)

When using sodium thiosulphate, fix the plate until it shows clearing and then extend the time by at least twice that time . . . usually around 5 minutes. Following the fixing bath, gently wash the plate in clean water for 10–20 minutes, being very careful not to disturb the fragile collodion surface.

You can see from this comparison the significant differences between the length of fixing time and the subsequent length of time needed to complete the wash cycle. In the field, this difference in water usage is significant. Whatever water you bring in, if not neutralized in the field, you must bring out.

Drying the Plate

As soon as your plate begins to dry, you will notice that it becomes brighter and greatly improved. Drying is a pretty simple matter of leaning the plate against the wall and letting it dry. You can also use a plate drying rack, a dish drainer rack for plates, or the low heat from a burner on the stove (at a distance, please) or spirit lamp. Don't use a hairdryer . . . dust is not your friend. In the summer, all you have to do is take your plate outdoors in the sun, turn around a few times, sing the first verse of "Home on the Range," and your plate will be dry. If you wait overnight, you can gently buff the surface with a cotton ball, and the highlights (exposed silver) will begin to shine like a mirror. Watch out: if you're overly enthusiastic you will scratch the delicate surface.

Figure 17–43
Keliy Anderson-Staley, *Beekeeper*, 2010
Keliy is an influential and well-respected artist and educator in the alternative process movement. This piece is an example of a wet plate collodion glass negative (essentially grainless) that has been printed out on silver gelatin paper.
(Courtesy of the Artist)

If you elect to use an open flame for drying, it is imperative that you move the plate continuously to ensure even drying and to prevent cracking the plate. This is especially important when dealing with glass. Be aware that the water dries first and then the collodion. During this stage, the image is extremely fragile, and all precautions must be taken to avoid harming the collodion surface. If you did not clean your plate well the collodion may begin to peel at this stage. Pyro-developed images are also prone to peeling if the glass plate's edges are not previously subbed with albumen.

Because the image on your plate is made of silver, it will behave like silver and begin to tarnish if you don't tend to it properly with a delicate coating of sandarac varnish, organic wax, or a high-quality gloss polyurethane.

VARNISHING/WAXING THE PLATE

Once the ambrotype, or tintype, has completed its process, it is essentially a silver image on glass or black lacquered plate. This silver, when exposed to air and the environmental tribulations of air, heat, humidity, abrasion, and adoring touching, will begin to show signs of being unhappy. The air especially will cause the silver to tarnish and turn grey. Since these are your highlights, it is generally an unwelcomed color shift. One simple way to prevent this problem is to seal the image behind a layer of varnish. I'll discuss the traditional method first and then give you two more contemporary options that are gaining a lot of favor among wet collodion artists.

When varnishing is employed, a protective coating of gum sandarac, alcohol, and oil of lavender is flowed over the plate in an identical manner to the way you

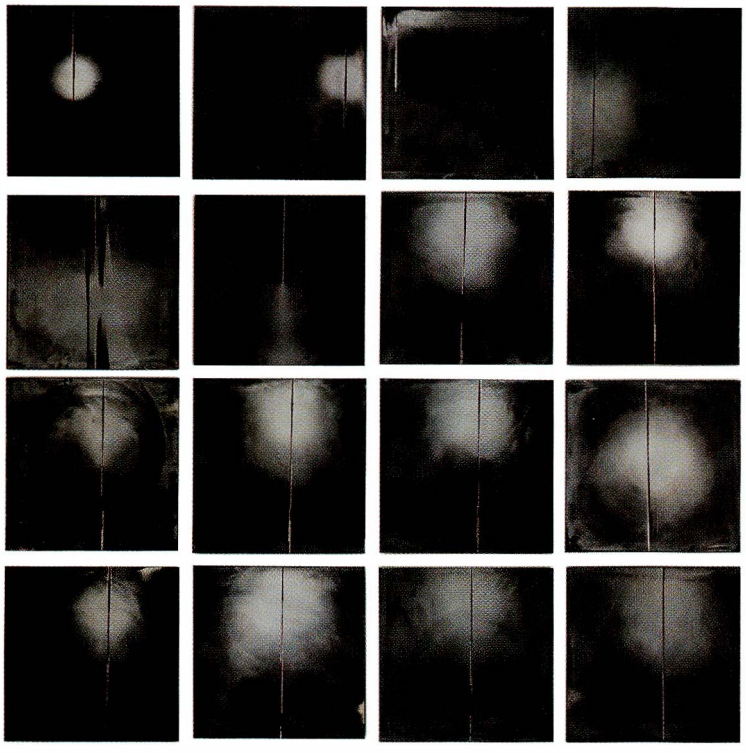


Figure 17–44
Travis Hocutt, *16 Suns*, 2011
A conceptual wet plate modular construction from my former student, Travis Hocutt.
(Courtesy of the Artist)

flow on collodion at the beginning of the process. This varnishing step is, for many artists, quite complicated due to the difficulty of pouring a perfectly smooth coating. Personally, I am always a little anxious during the varnishing stage and especially when working with a plate that I am happy with. I like the lovely oil of lavender smell in the lab . . . an improvement over the ether and alcohol odor of the collodion . . . however, a lot can go wrong at this point after a lot has gone right. Unvarnished collodion plates are prone to abrasions, peeling, and severe tarnishing over time. The varnishing step will impart a warmer tone to the image and slightly darken it. A note: because the plates tarnish, it is possible to take a cotton ball and gently buff areas of the plate to "polish" the highlights. Here is the traditional varnish formula and application.

Ambrotype and Tintype Varnishing Formula and Technique

414 ml	190-proof grain alcohol
57 g	gum sandarac
44 ml	oil of lavender

Mix the ingredients together until the gum sandarac has completely dissolved. Then strain and filter the mix until you have a perfectly clear yellow varnish. You may have to filter the varnish several times before it is perfect. Before the varnish is poured on the dry plate it is necessary to warm the plate. This is neatly done with a small spirit lamp that burns alcohol with a controllable flame. These can be easily found on the Internet. You can also use a small Coleman Catalytic Propane heater, which is usually used for camping and keeping the interiors of tents warm. This is a non-flame heat source. One other source of heating the plate, both for drying and prior to varnishing, is a single-burner hot plate set on its lowest heat setting. On a hot summer day, you can also use the sun to heat your plate, but if it's too hot, the varnish will turn an opaque white when it comes into contact with the plate.

To begin, pour a small amount of your varnish into a varnish-pouring bottle. Heat the bottle up with a water bath or a catalytic heater. Then, warm the plate over the spirit lamp, hot plate, or catalytic heater, by holding it over the heat source while smoothly moving it around. When the plate is just warm enough to the touch, pour a small amount of the warmed varnish in the center of the plate and move the plate around quickly until you have a complete and smooth coating. The warmed varnish will be like water. Hold the plate in a vertical position and pour off the excess back into the varnish storage bottle. This should feel very similar to the technique you use when pouring collodion, but faster.

When the varnish appears to have set, hold the plate in a flat horizontal position over your heat source, moving it continuously, until the varnish is completely dry. Be careful not to proceed to this step until the alcohol from the varnish has evaporated or else the varnish may catch on fire and you'll drop your glass plate. This step is not difficult, so please don't be too worried. You may, if the weather is nice, the wind isn't blowing, and the pollen is low, take your plate outside in the sun where it will dry quite quickly. Place the plates in a drying plate rack for a day so that they dry completely in a quiet environment. One more thing: if the collodion that you were using was too old, the alcohol solvent in the varnish may destroy the image instantly.

You can order the varnish pre-mixed and ready to use from Bostick & Sullivan if you are looking to save time and trouble.

Renaissance Wax Option

An option for protecting the surface of tintypes is an excellent product called Renaissance wax, a microcrystalline wax polish that is used extensively in antique restoration and as a protective sealant by museum curators. Used primarily for furniture restoration, it also has wide acceptance for use on metals and any protection for important objects that are subject to the alkaline oils in human fingertips. It creates a barrier against moisture and contaminants in the air.

To use it on a plate, heat the underside of the plate with a hairdryer. Apply a very thin coating of the wax to the entire plate, in a swirling motion, with your fingertip. Re-heat the plate and then begin to gently buff the surface of the plate with a soft micro-fiber cloth or cotton ball. I like using eyeglass-cleaning micro-cloth squares for final polishing but the cotton balls for everything up to that point. You'll see the wax begin to smooth out, and as you buff, the surface will begin to shine and take on a brilliant sheen. Re-heat the underside of the plate as needed and continue buffing gently until the entire surface is perfect. Unlike Sandarac varnish, the plate is instantly ready for travel.

Gloss Polyurethane Option

Recently, when working with a lot of students in a workshop, it became clear that their work was getting better as the week went on. On the face of it, this is really positive, but there was one problem that had to be addressed . . . how to get the last plates home safely when there wasn't enough time to varnish them. At that point I opted for a simple solution and showed them how to avoid the heartbreak of a bad varnish experience on a favorite plate. This involves protecting the plate in a manner similar to using the traditional sandarac, with a varnishing stage that looks nearly identical to sandarac, and prepares the plate for travel in an hour or two.

I have taken to recommending spraying several very thin layers of high-quality gloss polyurethane. My preference is Minwax Gloss Polyurethane. It looks like the traditional varnish when dry, protects the plate for travel (best for students), and is a simple process, guaranteeing that the plate they like will last and not be messed up with a less-than-perfect varnishing technique.

The technique is simple. Go outside on a non-windy day and place the plate on a clean and dry surface, like butcher's paper or the wall of a cardboard box. Spray very light coats, from one side to the other, bottom to top. Then, move the plate 90 degrees clockwise and spray it again. Move another 90 degrees and spray again and finish the cycle off by one more turn and spray. If you look across the surface of the plate it will have a very low orange-peel-like texture at this point. If it's summer, hold the plate in the sun for a few minutes and the texture will flatten out and the surface will dry like a varnished mirror. Or, use a heat source on the bottom of the plate to warm the polyurethane and allow it to flatten out. In an hour or two it should be perfect and ready for bagging.

Note: This solution to protecting your plate is down the list of my first options, but in a pinch, when you need to travel, it works pretty well. Be careful of letting the plate get too hot, and don't use the technique if there is any wind that will blow dust on your freshly coated polyurethane. If quick mobility with a new plate is called for, I would recommend the Renaissance wax option first.

Figure 17–45
Todd Vinson, *1 Tree Against Storm*, 2008
Todd writes, "Once upon a time I was in Missouri on a trek, when the photo session was cut short by darkening skies and a tornado warning. I made a single 35mm color slide image of a tree against the darkening sky before running for cover. A few years later I projected the 35mm slide onto a piece of glass coated with collodion. The exposure time of my slides-to-collodion ranged about 45–60 seconds if I remember correctly. Then I used the collodion image as the contact negative on fiber-based paper. The final print is not what I saw that day, but it's exactly what I felt as I photographed while tornado warning sirens sounded in the background."
(Courtesy of the Artist)

WET COLLOOION PROJECTION WITH AN ENLARGER

If you are ever in the mood to make a wet plate collodion tintype, ambrotype, or glass plate negative, it is a relatively simple matter to use your enlarger to project to your silver sensitized wet plate. Almost everything that you do outside, you will do in the darkroom except that rather than using a camera to capture a subject on your sensitized plate, you will project your existing subject, in the form of a film positive, to the plate. It is still a positive-to-positive/negative-to-negative event. Best yet, you can get into the wet plate collodion process without the need of a wet plate camera or very pricey Petzval lens. All you need is the darkroom and everything else. I'll detail this technique using the creation of an ambrotype as the example.

The first step for an enlarger projection is to create a nice film positive to be used for projection in the enlarger. This can be in the form of a colored transparency, but be aware of wet collodion's sensitivity, or lack thereof, to some of the colors within the visible spectrum. You may also make a very serviceable film positive from any digital source using Pictorico Ultra Premium OHP inkjet film. Simply make the most perfect positive image on your monitor, size it to your negative carrier (a glass carrier will be best), and print out several variations of density to discover what works best for you and your individual chemistry and process.

Then, take the film positive into the darkroom, load up the negative carrier, and project your positive to a flat surface, with a white piece of paper so you can focus properly, that is absolutely identical to the height of your sensitized plate that will be projected upon. Mark the area in which the plate will sit during the exposure with pieces of masking tape in the corners. Place the tape so that each corner is clearly marked with an "L" shape, and compound the tape in height so you can simply drop the plate into the location and have it rest solidly up against the corners of the tape. This will prevent movement by accident. Also, place a thin black piece of paper down on the enlarger deck surface to prevent a bounce reflection from the deck to and through the sensitized glass of the ambrotype in waiting. Set up your timer for the exposure, and go on to the next step, which is the preparation of your glass plate.

This information is a short duplication of that for plate preparation found earlier in this chapter. The first step is to thoroughly clean your glass with a solution of whiting (calcium carbonate) or rottenstone. Then, when you are positive that the glass is perfect, clean it some more with cotton balls soaked with Everclear grain alcohol.

Next, prepare an albumen subbing solution (see the recipe in the chapter), and with a cotton swab paint the edges of the glass plate, all 8 of them plus about

Figure 17–46
Craig Barber, *Jared's Sugarbush*, 2009
From Craig's *Working With the Land* series, he writes, "*As our society turns increasingly towards industrial agriculture there are still those who continue a close relationship with the land and all it has to offer, be they hunters, farmers, woodsmen, gardeners, or foragers. My work recognizes and acknowledges this commitment in a series of portraits that honors these individuals and their environments.*"
(Courtesy of the Artist)

1/8" to 1/4" on the surface of the glass. You can also dunk the plate edge into a very shallow tray of albumen, one edge at a time. Or, you can coat the entire plate by pouring on a layer of albumen and coating your plate with it as you do when coating with wet collodion. All three of these techniques, on the cleaned glass, work exceedingly well.

The rest of your experience is just like with a traditional darkroom except that you are going to pour a plate with your salted collodion and move directly to the enlarger. A decent place to begin exposures, with an average value laden positive, is F.8 for 20–22 seconds. Make a test strip, but do not abuse the wet collodion on the plate as you perform the strip test. At the end of the exposure, go through the development, fixing, and washing stages for wet collodion, and after the plate has dried (where it brightens considerably), determine you optimum exposure.

Contact Positive Film Printing on Fresh Wet Collodion

Believe it or not, you can make contact print exposures on a freshly prepared collodion plate. I know it sounds impossible and like your negative will surely stick to the collodion, but it works and the detail is excellent.

I've never had the courage to use a one-of-a-kind film negative, say from the now-departed Polaroid Type 55, but I have no qualms at all about scanning that film and making excellent duplicate positives (which are required) on Pictorico Ultra Premium OHP Inkjet Film. It is a very simple matter to scan and invert your best negative to a positive and reproduce it on OHP using a glossy or Photo Rag printing profile. When producing your film positive for this technique, remember that high-contrast positives do not work very well, unless that is the effect you are seeking. Better to go for a delicate and restrained positive. This is the same mindset you use when shooting outdoors with a camera; open shade and dappled light is almost always more successful than direct sunlight and high chiaroscuro.

You may expose your plate with a traditional enlarger or simply get a 15-watt bulb in a light fixture shop and position it 24" from the plate. Do a test strip and you will be in business in no time. This is a nice way to incorporate the ease of Pictorico Ultra Premium OHP negatives with almost anything you can think of scanning.

TROUBLESHOOTING WET PLATE COLLODION

Here is a partial and interesting list of some of the things that can go astray when making wet collodion imagery. A few things on this list come from the Household Cyclopedia (1881), but most of it comes from making mistakes and watching my students make them . . . and then playing around until the answer comes. Ask any bear in the woods: playing is the best way to learn anything.

Please keep in mind that I am not referring to the following as imperfections and failures. To me they are "issues" that you may be having with the process. And, I keep telling myself, there is always the possibility that a flaw now will become a signature technique later on if you can repeat it.

Veiling

Veiling is a malady that presents itself to you primarily in hot weather, and it has the look of sediment lying upon the surface of the plate. This is different than the look of an under-exposed plate that is weak and pasty, an over-developed one that is flat and lacking contrast, or a fogged one that looks like it has a dull layer of fog over it. Usually it is caused by hot weather, and it's easy to fix.

While the plate is in the rinse tray, simply immerse a cotton ball and ever so gently clean the plate, being careful not to scratch the delicate collodion surface on the plate. That should take care of the veiling. The cotton ball is also a way to get rid of collodion bits and pieces that are sitting on the plate's surface. It will not, however, be able to free small bits and pieces from underneath the collodion skin that became part of your plate during the initial pour. Be delicate.

A veiling look can also be present if the silver bath is too depleted of actual silver. *See the information on maintenance of the silver bath in this chapter.*

Hot Weather Fogging

When the cotton ball is ineffective in dealing with the veiling effect, and the weather is hot, the silver bath will occasionally be responsible for giving you a fogged plate that is similar in appearance to an over-developed tintype or ambrotype. One of the solutions to this problem, for me, is to reduce the 9% silver nitrate concentration to a 7% sensitizing bath.

The other thing I do is cool off the silver bath, especially if I am working outside and the bath's temperature gets too hot. My method for cooling off the silver is to put water and ice in a picnic cooler, just enough to cool the inside of the cooler with the lid closed but not enough to cause the silver tank to become buoyant . . . this is very important. The other solution is to mix your developer per plate using cold water with the overly warm developer.

One additional solution to overly warm developer is to dedicate your developer to a nonmetallic thermos and to keep it in the refrigerator the night before using it.

Figure 17–47

Edie Fogel, *Triptych/Yarn*, 2011

Edie Fogel's work is, for her, a bridge between the old and the new . . . a marriage of tintype and color negative film with Photoshop as the connecting technology. Edie's working in a dry tintype process, but she could just as easily employ wet collodion as a first stage. Her workflow: (1) Scan the tintype, (2) Scan the color negative, (3) Flip the color negative to match the tintype, (4) Make the color negative as a separate layer, (5) Use a masking tool and paintbrush on the color negative, and (6) Print out with pigment ink on archival paper.

(Courtesy of the Artist)

This will guarantee that your developer will be in the 40°F range prior to diluting it with distilled water for your plate development.

Hot Weather Development Technique

If you are used to processing your plates with a helper tray, you may find it more efficient to employ a hand-held plate development technique in which you hold the plate and flood it with a coolish developer until you see the first hints of detail in the highlights. This seems to be effective in hot weather because of the increased speed in plate development.

In hot weather, the length of time to moving the plate from the helper tray to the water bath is often too long and the plate suffers from over-development and a generally flat and uninspiring appearance. Holding the plate by hand allows you to immediately flood the plate with freshwater precisely at the perfect moment of development . . . once, twice, and three times in rapid succession. Then drop the plate into a clean water bath until the water flows off in a perfectly even sheet of water. Then move to a second clean water bath prior to fixing.

The temperature of your developer is quite important when the weather is steamy and hot. I have tried keeping the developer cool when using a tent for processing outside in hot weather, and there is no decent way to accomplish this other than to use a cooler. It is important that the developer is neither too cool before processing nor too warm. It is a "mama bear" middle temperature that is best.

The least problematic way to handle this is to keep your distilled water in a thermos, and when you dilute your overly warm developer stock with it, 1:1, the temperature will settle in at a nice 70° to 75°. If you don't have to endure the heat, simply mix your developer to working strength at the beginning of the work session and don't worry about temperature.

For a Slower Development, Make It Colder

If you want a more leisurely development time, dilute your developer 1:3 and keep it in a cooler so the working temperature is somewhere in the vicinity of 30 to 60 seconds.

Adding a Few Drops of Silver Nitrate for Contrast Boost

When using a cold ferrous sulphate developer, especially a sugar developer, you can add 3 or 4 drops of your silver nitrate sensitizer to approximately a shot glass of ferrous sulphate developer. I find that the development time is accelerated, the highlights pop and appear to result in more silver on the plate, and the shadow areas are not appreciably affected.

Double Silver Bath for Delayed Development

In hot and arid conditions you may find that your plate dries too quickly. This could be a situation that occurs due to any factor that delays your workflow. When you return to your workspace, you may see that the plate has begun to dry unevenly, which may have an effect upon the smoothness of your development pour. Visually, this is made evident by a collection of softly detailed drip-like lines that remain following the fixer. This appears to be the result of the plate drying out unevenly prior to development, which causes the developer to naturally gravitate more quickly to the moist parts of the exposed plate. The fact that you must stop your development so quickly is the cause of the unevenness. The solution to this problem is to re-immerse your plate in the silver bath for 20 seconds or so, in order to re-saturate the plate's surface. This technique will allow you to have a smoother flow of the developer across the entire wet surface of your exposed plate.

Clouding

Full plate clouding comes from over-exposure, or diffused light leakage prior to development of the plate, or alkalinity of the silver bath, or too much (or too little) acid in the bath (nitric or acetic . . . more often than not it is too little), or organic matter in the bath, or the use of colorless collodion indicating something is way off.

Other things that it could be: vapors of ammonia or sulphuretted hydrogen (a poisonous and noxious gas with a smell of rotten eggs made by the action of acids on sulphides). Start by changing one thing at a time. The clouding may sometimes be eliminated by the application of a weak solution of tincture of iodine, followed by immersion into a solution of sodium thiosulphate fixer.

Random Spots upon the Plate

Every so often, you will see random spots from excess of potassium bromide in the collodion, a contaminated silver nitrate sensitizing bath, a super-saturation of the bath with iodide of silver, dust on the glass or coating (silver nitrate and organic matter are incompatible), or a situation in which there is a concentration of silver nitrate drying before exposure. Again, begin trying to remedy one thing at a time until you figure it out.

Curtain-like Marks on the Plate Edge

This visual malady comes from the plate being too dry (you may have rocked too long) before dipping into the silver bath in low humidity situations, or not long enough in the first water bath to remove the greasy appearance prior to fixing. Be really careful of this last point if you are using potassium cyanide for a fixer. Acid in the developer that is left on the plate could be really dangerous to you when it goes into the fixer. A gas may result from contact between the developer and the acetic acid in the developer. Be sure that you rinse the developed plate until the water flows off the plate in a single, non-textured, perfectly smooth sheet of water. Visualize this and take your time.

Oily Lines

See above . . . from the removal from the first water bath too soon.

Silver Comets

Comets, or tiny star-like images in the universe of your plate, are the result of random bits of debris within or upon the collodion skin. There is often a perception that comets originate in the silver. My sense of the situation is that they begin in the collodion stage and become obvious following the silver sensitizing and subsequent processing of the plate.

As an example, as you unscrew the top of your collodion pour bottle, one that you have been using for a while, small little bits of collodion that have dried on the lip of the bottle have a habit of falling onto the perfect surface of collodion that you have just poured. It sets

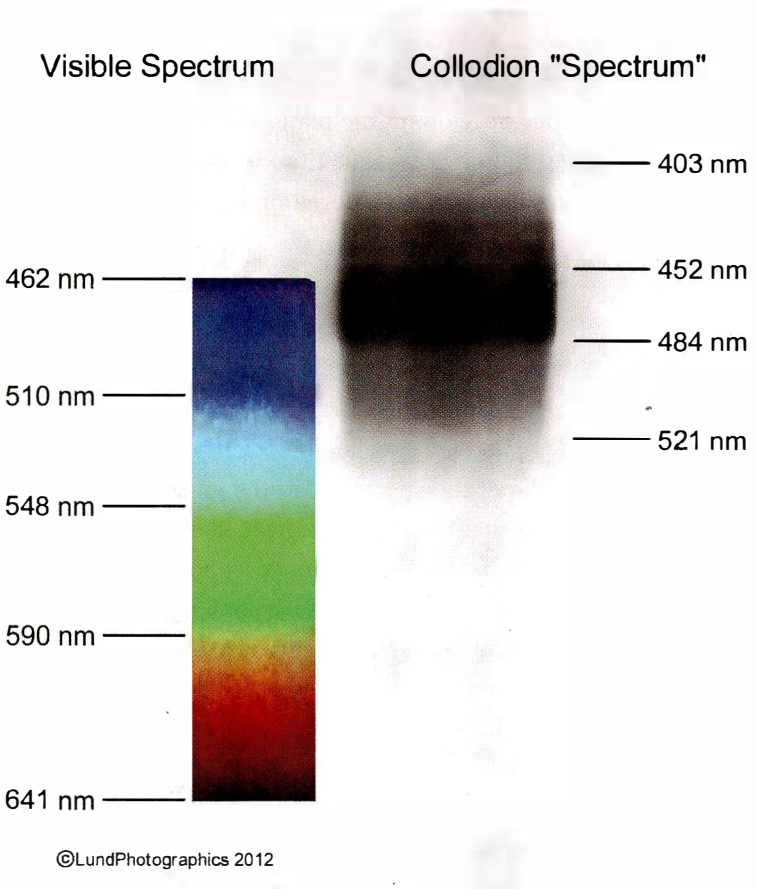


Figure 17–48
Niles Lund, Collodion Spectrum
Spectral sensitivity of silver iodized collodion extends beyond the visible blue and into the ultraviolet region of the spectrum. The sensitivity of collodion begins to fall off around the middle of the spectrum, in the green region. This means that the colors below it, such as yellow, orange, and red, will not contribute to a photochemical (actinic) response and will be recorded as black. The colors above the green, into the blues, violets, and beyond, will be rendered as white. A sky with clouds is difficult to render, as the white clouds have almost as much blue as the sky itself. Lemons and tomatoes appear shiny black, while a blue-and-white-checked tablecloth might emerge as a plain white fabric.
(Courtesy of the Artist)

rather quickly, and on occasion it will set up with that little bit of dried collodion embedded in the recently poured surface. When you immerse the plate into the silver bath, the point of contamination becomes like a rock in a stream, causing the silver to flow quickly past the point of origin and forming a shape much like a comet. Unless the bit of dust or collodion is large, you generally don't see it until it's too late. If you do see it, it's too late anyway. The issue is physical and chemical.

Comets can also be created after the plate is removed from the silver-sensitizing bath, after removing your sensitized plate from the silver and loading it into the film holder. If you handle the loaded holder roughly you are likely to scatter a little dust debris on your collodion, resulting in comets.

Try your best to keep your silver bath, and collodion, really clean. Filter the silver bath often, and if you have recently moved it, give it a chance to settle before immersing a plate. Handle your collodion gently. Always immerse, and remove, the plate slowly into, and from, the silver bath. Try not to check on your plate while it's in the silver bath. Once you are in the silver bath, be patient and don't move the plate until the time is up.

Wavy Lines

These result for a host of reasons including the use of a glutinous, thick collodion; want of rocking when pouring off the collodion; or not getting the plate into the silver bath fast enough in a very low-humidity environment. One quick solution will be to try and keep your plate flatter and moving as you pour off the excess collodion.

Curved Lines and Odd Abstract Shapes

Sometimes, the odd shapes of images are simply the result of pouring your collodion in a free-will manner. If you like the look, feel free to pour creatively whenever you wish. Other types of odd shapes and marks occur because of uneven development. You can tell the difference because the odd-shape collodion pours still have a nice image quality about them. Badly flowed developer has a more liquid appearance, and the values in the image are uneven and partially realized and partially not.

Often, this comes from the developer not covering the whole plate immediately or thoroughly. A solution would be to change your developing style. If you have been using a helper tray, try hand-holding the plate and gently sweeping the developer over the surface and flushing the plate with clean water at the first sign of highlight detail. This will generally clear up the problem because holding the plate by hand, and balancing a flood of developer on the surface for that brief time, takes more focus and concentration . . . which generally leads to better development.

Yellow-Brown Patches

This is often the result of imperfect removal of the silver iodide in the fixing bath and is a good indication that your fix is getting really tired. You are going to want to filter it and repair it with fresh fixer. If you are using Rapid Fixer, simply replace it as soon as you notice the uneven coloration of the cleared plate.

Gray and Flat Image Character

This is most often the result of over-development. I usually begin to seriously consider ending the development when I see highlight details arrive in the shadows. A good rule to follow when doing ambrotypes and tintypes is to over-expose in the camera and under-develop on the plate. When developing a negative, the development time is not as critical and you can survive an over-development easily.

Black and White

This can be explained by the spectral sensitivity of the silver iodized collodion that extends beyond the visible blue and into the ultraviolet region of the spectrum. The sensitivity of collodion begins to fall off around the middle of the spectrum, in the green region, and that means that the colors below it, such as yellow, orange, and red, will not contribute to a photochemical (actinic) response, meaning those colors will be recorded as black. The colors above the green, into the blues, violets, and beyond, will be rendered as white. A sky with clouds is very difficult to capture, as the spectrum of the white clouds has about as much blue as the sky itself. Lemons and tomatoes appear a shiny black, almost like tinfoil sometimes, and a blue and white checked tablecloth may be realized as a plain white fabric.

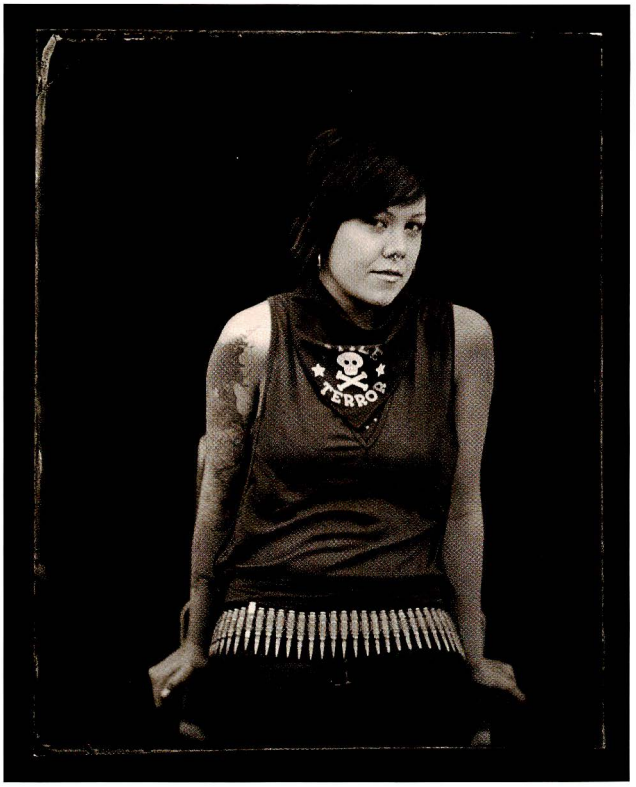


Figure 17–49
Bev Conway, *Ambrotype of Sarazah*, 2005
Bev Conway took a one-day ambrotype workshop with France Scully Osterman and her husband Mark Osterman and produced this portrait of her friend Sarazah.
(Courtesy of the Artist)

Collodion Curls & Albumen Subbing

This is a problem with ambrotypes and glass negatives. When using glass, the collodion sometimes lifts away from substrate. This is generally the result of not cleaning the glass well enough, insufficient alcohol in the collodion, or want of roughness of the edges of the glass. Try putting an albumen subbing solution on the edges of the glass plate with a cotton swab. You might also try a product called amino silane, which is used to create a micro-porous surface on different substrates when carbon printing.

One technique to help with holding the fragile collodion on the glass plate is to whip up some albumen (egg whites) subbing, and with a cotton swab, apply a thin coating around the front lip edge of your glass plate. You can also make up a batch of albumen subbing and apply it to a perfectly cleaned plate in much the same manner as you would pour fresh collodion.

Albumen Subbing Formula to Prevent Collodion from Lifting Off Glass

White of a single large egg
2 drops ammonia (not totally necessary)
100 ml distilled water

Whip the ingredients together in much the same way as you do when making albumenized paper. Using a handheld blender, whip the albumen until there are no stringy "ligands" in the egg whites. If you don't have a hand blender, just put the ingredients in a small container and shake briskly. To use, simply paint a 1/8" to ¼" wide line of albumen on the top and around the edge of the glass plate with a cotton swab.

Collodion Curl and Separation Due to Ether and Alcohol Problems

I'm going to quote my friend, Niles Lund, on the issue of collodion lifting off the glass plate due to the proportions of alcohol and ether in the collodion. This is, of course, a different issue than is the usual problem of peeling collodion due to inadequate cleaning of the glass plate. Niles wrote, "*Generally, collodion* (5% USP, as obtained commercially) *is thinned for use in photography with equal parts of ether and alcohol. If the relative amounts of each solvent* (ether and alcohol) *are varied along a continuum from primarily ether* (and very little alcohol) *to primarily alcohol* (and very little ether)*, one will find the collodion film to vary in physical character from tough and leathery to spongy and fragile.*" Niles also wrote, "*. . .these problems are intertwined as are so many in collodion work. Improper cleaning of the glass doesn't allow the collodion to stick as well, which allows the collodion shrinkage to exacerbate the problem by causing the film to peel up around the edges.*"

If too much ether is used, not only will the film be tough, but it will also be prone to shrinking on the order of 2.5% when it dries. This may not sound like much, but on a 10" plate, this is equivalent to 1/4". It's this combination of shrinkage and the leathery nature of the film that's responsible for the film peeling and sliding off the plate. To prevent this, it is necessary to increase the percentage of alcohol in the mixture. Begin by adding a volume of alcohol equivalent to 5% of the total collodion volume being used. Swirl the

alcohol into the collodion mixture, and then pour and process a new plate. If peeling still occurs, add an additional 5% alcohol to the collodion and repeat.

Blue Tint in Parts of the Tintype

This blue malady is often attributed to a weakness of the iodizer in the collodion, and that could indeed be an explanation. I have an alternative theory. After three or four freshwater flushes to stop development, I usually put the plate in a tray of freshwater, and holding both edges, move it out of, and back into, the water, an action much like a plunger going through water. This causes the physical flow of the water to be faster on the edges of the plate than in the center where the force of the water is slower and flows with less force.

If the rinse cycle is too short, when you can still see an oily resistance to water on the plate or when your last wash rinse is contaminated by too many washes without being changed, a bit of ferrous sulphate developer will be left on the center of the plate. When that leftover iron developer meets the potassium cyanide fixer, it turns a random portion of the plate's surface area blue. Blue is the color that indicates that iron is in excess when meeting a cyanide (i.e., prussian blue ... or blue substance from iron).

Another solution to the blue tint, which many people actually look forward to in their work, is to extend the plate development time by diluting the developer with some distilled water. Adding a little additional acetic acid to the stock developer, in hot weather, also seems to help.

Crystals on the Plate

After the plate dries, following the fixer and wash cycle, you will notice a curtain of cool looking crystals covering the plate. This is usually crystallized fixer (sodium thiosulphate more than potassium cyanide) that has not been thoroughly removed from the plate through washing. I have seen this with sodium thiosulphate when working in the field and when the final wash has not sufficiently removed the residual fixer.

Developer Flows Greasily

This happens because there is insufficient alcohol in the developer. Imagine pouring water on a baking sheet with vegetable oil on it . . . that's greasily.

A Mottled and Irregular Collection of Spots and Patches

This malady is often an indicator that you used developer that is too cold or too hot, that you stopped your development too quickly, or that your technique was less than stellar.

Islands and Lines on the Developed Plate

One very good explanation is an uneven pouring of developer on the exposed plate. As with pouring developer on a freshly exposed platinum/palladium print, any hesitation in the flow of the solution will be illustrated forever by these flaws.

Circular Pale Spots

A circular, and pale, area on one section of the plate is generally caused by pouring the developer on the plate with too much speed and from too great a height. These transparent/translucent areas cannot be fixed after the fact and are usually seen in one spot where the developer first hits the plate. This also shows up as a lack of density in an area of a negative or over-brightness in a positive. One solution to the problem is to use a helper tray that is too large for the plate, pour the developer to the side of the plate in the helper tray, and in one motion sweep a wave of the developer over the plate.

Crepe Lines/Curtain Lines

Crepe, or curtain, lines (sometimes referred to as "crinkles") look like the rippled beach sand in a tide line after the tide has gone out. In my experience, this seems to be a bigger problem for wet plate artists working in a hot and arid environment than for those in one where there is more humidity. Crepe lines can be the result of several factors. There may be an excess of water in your collodion formula, and a solution to this is to add a little more ether to your collodion mix.

Crepe lines can also become evident when there is too steep an angle on the handheld plate after full collodion coverage in a dry environment. The solution to this is to add an excess of collodion to the initial pour on the plate. This excess breaks the surface tension and allows the collodion to not set up as quickly, causing the crepe lines to form while pouring back into the

holding bottle. This situation occurs when people pour too little collodion on the plate in an effort to be thrifty with their collodion stock.

One more solution that works especially well for me is to rock the plate more slowly than is the normal practice, while simultaneously reducing the angle of the plate as you pour off excess into the holding bottle. Rocking the plate too rapidly after the collodion pour, combined with the steep angle as you drain the excess collodion back to the collodion storage bottle, is a simple problem to fix. Flatten the angle of the plate to a slight tilt to the pour-off corner and rock very slowly side to side without changing the angle. Again, this seems to be a problem associated with dry and arid air more than cool and humid air and when the collodion sets up more quickly than you might have expected it to.

Giving New Life to Old Red Collodion with Acetone

Acetone, $(CH_3)_2CO$, is a clear, flammable liquid that is used primarily as a solvent (it's the key ingredient in nail polish remover and paint thinner). It can be added to an out-of-date, not very light-sensitive red collodion to bring that collodion back to life for another opportunity to make you happy. Simply add 2 ml of acetone (hardware-store variety will probably be fine) to each 100 ml of old, red collodion. Within a few days, the red color will change to a pale yellow and it will be useful again.

This information comes from a variety of sources and seems to have originated with a fellow named Alexander Murray in the early 1930s. Alex Timmermans ran a test in 2011 and got great results. However, he also discovered that using a sandarac varnish on the plate with the re-stored collodion was not very successful, probably due to the acetone itself. You might want to try Renaissance wax if you are using the collodion with acetone formula.

An Overwhelming Darkness

The two most likely explanations of a wet plate without any highlight detail, or image presence, are the result of insufficient exposure or collodion that has seen better days. Try the exposure test first (see the section in the workflow part of this chapter), as that is the easiest solution to the problem. If increasing the exposure fails

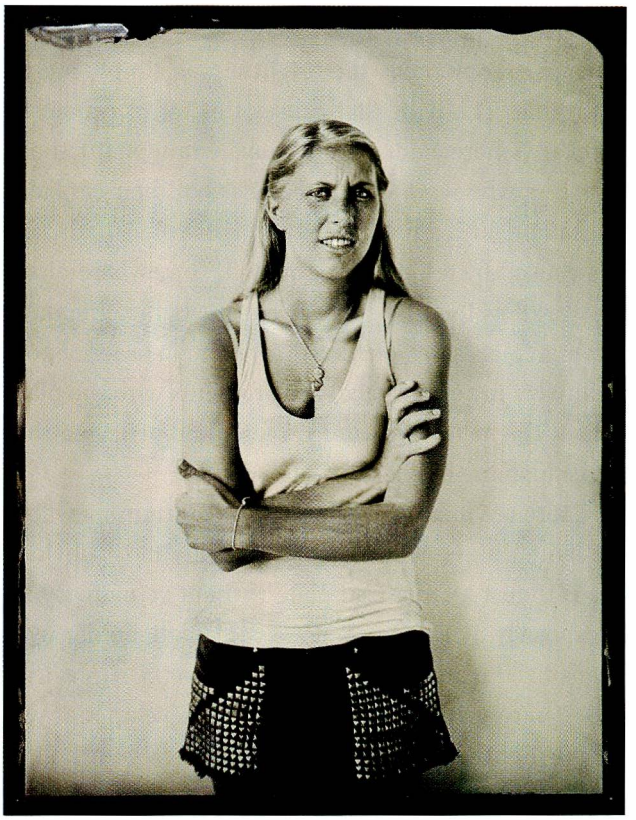


Figure 17–50
Christopher James, *Brannen Vick*, Santa Fe, 2010
A wet plate portrait of workshop student Brannen Vick taken during one of my workshops in New Mexico.
(Courtesy of the Artist/Author)

to fix the problem, take a look at your collodion and see if it appears dark red like an aged sherry. Check the date it was made. Is it over 6 months old? If so, try making up, or ordering, a new batch of collodion.

As mentioned in the collodion description in this chapter, collodion breaks down after a while and loses its effectiveness. Don't throw your old, red collodion away. You can mix it 50% to 50% with your fresh salted collodion and reap the benefits of nice mid-tones with the old and punchy highlights with the new. You can fool around with this proportion in many ways, but try to allow the newer collodion to dominate the refreshed mix.

An Overwhelming Brightness

If your tintype/ambrotype plate is very bright, almost like a mirror with a ghost image, you have exposed far too much silver and have negated the lovely optical effect of the under-exposed image upon a dark background. The simple solution is to re-work your exposure calculations.

Sometimes It's Just Fog

Of course, sometimes the brightness is simply a case of fogging. The light that causes this effect can come from anywhere and is somewhat common to those explorers who work out of the backs of their cars and trucks and in ice-fishing tents. More often than not, it is caused by a light flare, or leak, somewhere along the workflow following the silver sensitizing. The most common places to look for the problem in order of possibility (in my experience) are problems with the plate holder, the bellows of your camera, and believing that red cellophane is a perfect safelight.

There are many logical tests for determining where the light leak is coming from, and the most obvious one is to test a sensitized plate without actually trying to expose it. For instance, load your plate holder with a sensitized plate and walk outside into the sun with it and then return to the safe space and develop it. If you see any lightness after development, then your holder is the problem and requires attention.

A bellows test is pretty simple as well. Load the plate holder with a sensitized plate, once you have determined that it is not the cause of the problem, and put it in your camera. Leave the lens cap on the lens. Pull the dark slide up a quarter of the way for 15 seconds. Then repeat this step three more times. Return the dark slide to the plate holder and go process the plate. If you see any brightness, then the bellows, or some other critical part of the camera nearby, is letting in light. The reason for the strip testing is to see how bad the leak is and what you can get away with before having to go to the expense of replacing your bellows.

Remedy for a Foggy Silver Bath

This is an entry from Thomas Warwick in *Photographic News for Amateurs* (August 1859) dealing with silver bath problems he was having at the time.

Sir, I constantly see in the "News," and other journals of the kind, inquiries how to recover a silver bath that has acquired fogging properties. I have just recovered a bath from the worst state I have ever seen one in, to give one of the brightest positive pictures that has ever come under my notice. I had been trying experiments, and had used it for gelatine, honey, gum, raspberry syrup, paper, and I hardly know what did not go into it. When I had done, I thought, well, now I will try a collodion plate in it; the result was as might be expected. Scarcely, (after a prolonged exposure), after being held up to the light after developing, was any picture visible, and to look upon it's surface it looked like a piece of whity-brown paper laid on the glass rather than collodion; now was the time to try the effect of "sunning." I put it out in full sunlight for an hour, carried it back to my dark room till the morrow, when I tried it again, and I got a plate not a whit improved; on filtering, I found a large quantity of black precipitate on the paper; I had about 3 pints of (silver) bath and of course did not want to lose it.

I then put into it about a small teaspoonful of carbonate of soda, let it stand till the next day, when I filtered it, and added acetic acid for a positive bath, and the result is, as I have before stated, the cleanest and brightest blacks in the shadows I have ever seen.

Increasing Image Brightness Nitrates

If you find that your highlights are a little flat and need some brightening, and you are not using potassium cyanide as your fixer, which would brighten them considerably, you may "goose" your developer a bit by adding small amounts of either potassium nitrate (saltpeter) or silver nitrate (from the iodized sensitizing bath) to your working developer concentration. Using a pipette, add a few drops and see if you notice a difference.

Wet Plate Karma

I will repeat from the intro . . . sometimes you eat and sometimes you are eaten. Learn to love your accidents and be patient. There are days when even the most meticulous wet plate artists can't get out of the "weeds." When this happens, don't get angry or frustrated. Stay positive; only make one correction at a time. Keep good notes, and the problems will work out.

PRESENTATION OF COLLODION POSITIVES

Museum Mount Tintype Presentation

Tintypes are elegantly simple to present. Go to the hardware store and get a tube of GE Clear Silicone II. Cut a museum-mount-style window mat

Figure 17–51
France Scully Osterman, *The Assumption*, 1999
This is an example, by France Scully, of a relievo variant triptych, double-plate ambrotype, tinted with gold leaf. The relievo variant provides the illusion of 3D. In the most common example, the positive collodion image is made of a subject seated in front of a dark-colored background. This is made on clear glass. When the plate is processed, a black varnish is painted on the reverse of the plate but only in those areas where the subject of the image appeared on the plate.
(Courtesy of the Artist & The Howard Greenberg Gallery)

(hinged double board mat with the front mat cut to create a window) with the window opening slightly larger than the plate dimensions. Make a hinge with linen bookbinding tape between the two parts of the mat. Position the tintype so that it sits perfectly in the window opening, and make small pencil marks to show you where your plate will be positioned. Apply a drop (about the size of a dime) of Silicone II to each corner of the plate and one drop to the center. Carefully position the plate, according to your light pencil markings, on the back baseboard and let it sit flat for a few hours while the silicone sets up. That's all there is to it.

Single Glass Mount

The collodion image was made on a single glass plate and placed in a case with the collodion side down to prevent abrasion of the image. The back of the plate was blackened to allow the shadows (the more transparent areas of the exposure) to appear black, with a black asphalt varnish, dark fabric, paper, or japanned ferrotype plate. This allowed the viewer to see the image in a "right-reading" positive form.

Note: Applying black paint, black varnish, or asphaltum directly onto the collodion surface is not recommended. Historic examples are often found in very poor condition.

Double Glass Mount

This double glass method was more expensive and was used when a collodion plate could not be turned over as in the case of ferrotypes, ruby glass ambrotypes, or clear glass ambrotypes with delicate tinting on the collodion surface. Images were presented collodion side up, and because of this they were laterally reversed. This allowed the subject to view the image as he or she saw him- or herself in the mirror . . . a very natural way of seeing one's portrait.

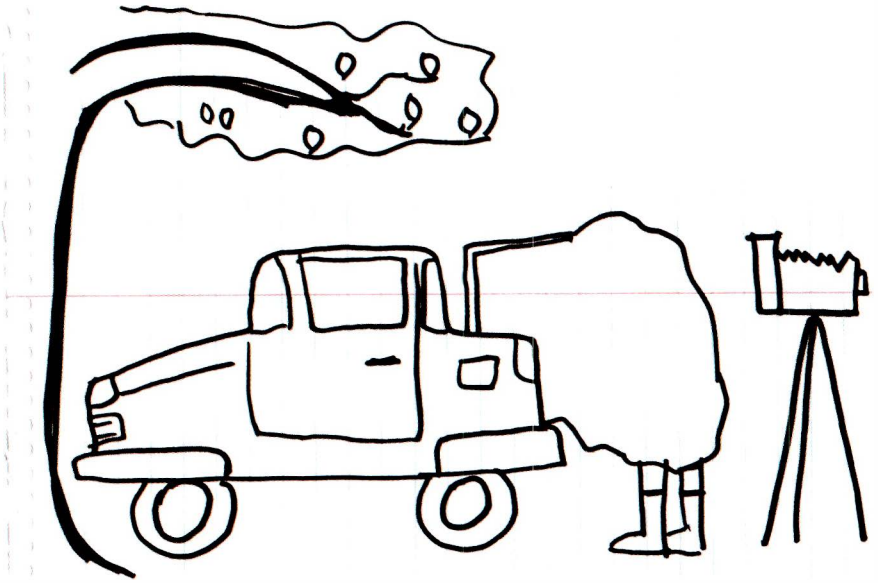


Figure 17–52
Lisa Elmaleh, *Lisa's Everglades Car Trunk Darkbox*, 2010
This is the Lisa's rendering of herself using the trunk of her car as a portable wet collodion darkroom in the middle of the everglades. What is unseen is the very large reptile to the right of the camera and the serpent in the tree above.
(Courtesy of the Artist)

The Cutting Patent Method

A variant of the positive collodion on glass was invented by James Ambrose Cutting of Boston in 1854. A positive image on clear glass was sealed with a separate piece of glass applied to the collodion side of the plate. The cover glass was permanently cemented in place with small amounts of Canadian balsam in the fashion of microscope slide preparation. Cutting used the term *ambrotype* in his English patent, and although it refers specifically to collodion positives mounted in this fashion, all positive, in-camera collodion images on glass were eventually called ambrotypes and the term became generic.

Relievo Variant

Another presentation method provided the viewer with a 3D effect. The positive collodion image of a subject seated in front of a dark-colored background was made on clear glass. When the plate was processed, a black varnish was painted on the reverse of the plate, but only in those areas where the subject of the image appeared on the plate. An optional method of the relievo variant is to expose a fully exposed and processed second plate and then lay the two plates of glass together, providing the impression that the subject was in relief against a light background. The most amazing nineteenth-century relievos feature a complete second collodion image under the first with a scenic background (either real or painted) behind the subject.

Recycled Cases on eBay

One of the easiest solutions for tintype or ambrotype presentation is to go to eBay, or a similar auction site, and go hunting for old daguerreotype and ambrotype ornate cases. Simply bid and win, and when you get the case, clean up the wood, cushion, and bright-work; cut your plate to size; and install. Simple as can be.

SETTING UP YOUR WORKING SPACE

For those of you who are considering going out into the field and romantically making wet plates out of the back of a horse-drawn darkroom on wheels, have fun. If you want to hit the road with your wet plate process, there are a number of nice resources for you.

- Make your working space as bright as possible. You can illuminate with red safelights and decorative string lights, and since you only have to really keep it UV-free for the plate holding and development moments, you should do what you can to make sure that you have plenty of light for every other stage in the process.

- In John Coffer's *The Doer's Guide to Wet-Plate Collodion Photography, which is great to use in the field,* you can find models of his traveling darkroom and perhaps be inspired to attend his Camp Tintype in Dundee, New York.
- Will Dunniway also has a nice layout for a traveling wet plate lab in his manual, *The Wet Collodion Plate.*
- My former student Lisa Elmaleh makes her plates in the Everglades out of a lab in the trunk of her car, and I have other students who prefer used Toyota trucks with caps on them for their wet plate labs.
- Workshop situations require a larger lab, and for this you could rent a truck and outfit it with blackout curtains and an exhaust fan. However, there is a very nice solution for being on the road and that is a red ice-fishing tent. Eskimo QuickFish 3 is the name of the product, and it will fill all of your outdoor lab needs for only $179.00. You will have to purchase a plastic, or canvas, tarp for the floor to keep out dust.
- Black Art Woodcraft (http://www.blackartwoodcraft.com) makes a very nice traveling dark box that can be easily adapted to the road. It's expensive but wonderful, and you only live once.

The less adventurous can make a space at home that isn't too complicated and doesn't involve a lot of waste. If you have an unused home darkroom, and still have an exhaust fan and a safelight, you are good to go.

Figure 17–53
Lisa Elmelah, Mangroves, 2010
This is a beautiful example of Lisa's wet plate portfolio that she produced using the trunk of her car as a darkroom.
(Courtesy of the Artist)

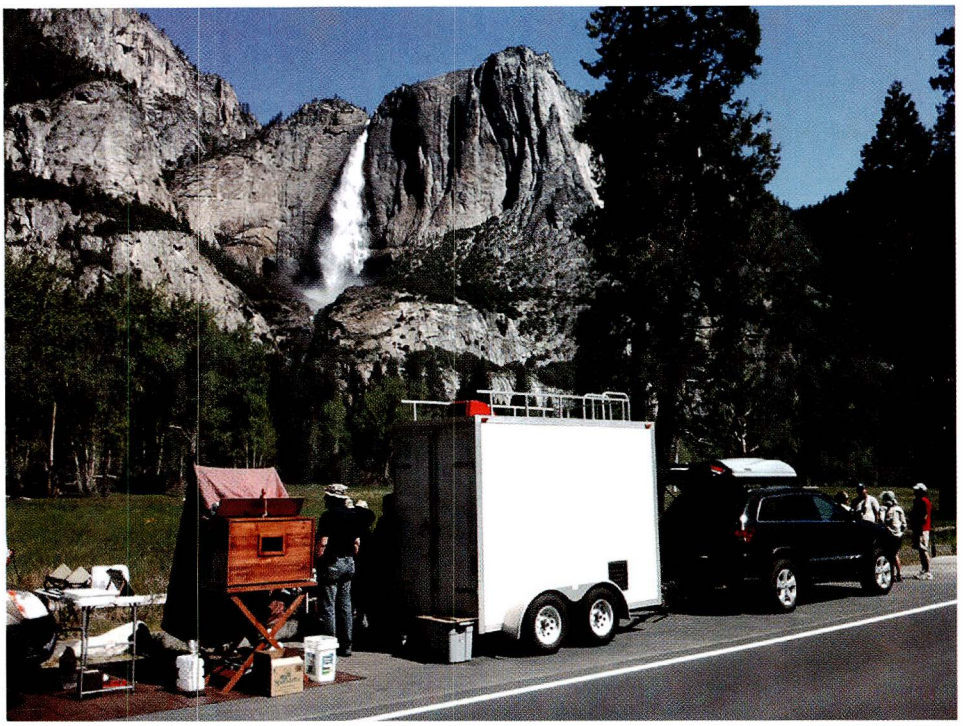


Figure 17–54
Bob Szabo, Black Art Woodcraft Traveling Dark Box at a Will Dunniway Yosemite Workshop
As is the case with those of us who conduct wet plate collodion workshops on the road every summer, this image gives you an idea of how much you have to haul around and instills an appreciation of how the old wet plate artists got around in their horse-drawn wagons. This image is from a Will Dunniway workshop, and that beautiful wooden sculpture is a Black Art Woodcraft Traveling Dark Box.
(Courtesy of the Artist)

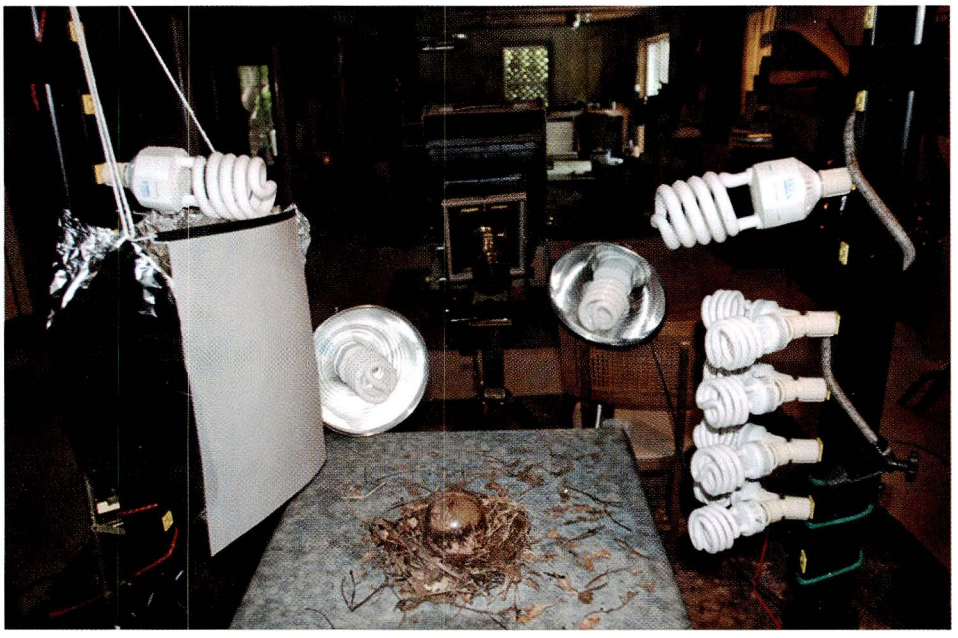


Figure 17–55
Michelle Cole, Michelle's CFL Studio Setup
This is an image of Michelle Cole's studio setup using CFL lights as her source of illumination.
(Courtesy of the Artist)

In fact, I installed a window in my lab after the enlarger left and blocked the light with a removable piece of thick foam core. I'll let you figure out your own setup, but here are the basic lab needs. Go to http://www.lundphotographics.com for developer helper trays, dip tanks, and dipper paddles.

HOMEMADE CFL LIGHTING SETUP

My friend, and former student in an assortment of alt process workshops, Michelle Cole was generous enough to send along her solution to creating a consistent wet plate CFL (compact florescent light) lighting set up for a reasonable investment. Her idea is an excellent one for those of us in parts of the world where winter happens or for those who want to work on their plates at night at home. In a proverbial nutshell, here is her setup.

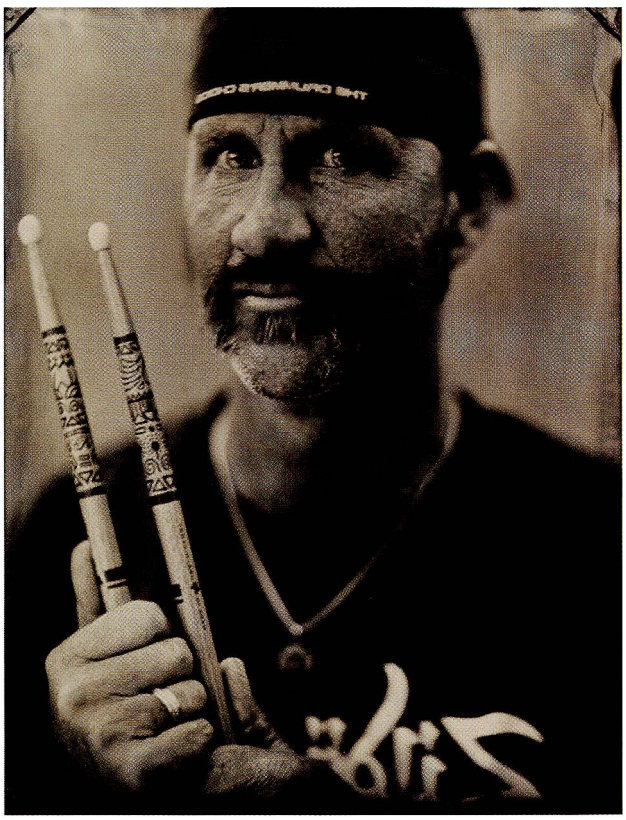


Figure 17–56
Michele Cole, *Sticks* (tintype)
This image is a family portrait with Michelle's husband as the subject. He's is holding a pair of drumsticks decorated with an original design handdrawn by his daughter. The image is part of a series that Michelle has been working on that documents local New Jersey musicians. *(Courtesy of the Artist)*

What you are seeing in the illustration are two homemade soft-boxes constructed with wire hangers, aluminum foil, and vellum. The CFLs are inside, of course.

Michelle writes, "*My 'strip' lights consist of a 10-outlet power strip bungeed to a light stand. I then used socket-to-outlet converters to attach single to double bulb sockets. The nice thing about the power strip is that I can position the lights anywhere I want on it—high or low.*" She added that she has an idea of improving on the soft-boxes by constructing them out of foam core and lining the inside with foil.

Since collodion is most sensitive to blue light, Michelle opted to use the highest temperature CFLs she could find.

- All bulbs were purchased from http://www.1000bulbs.com.
- The 16 smaller bulbs are 30 watt (120 watt equivalent) and 6400 K (https://www.1000bulbs.com/product/1598/FC30-FEIIS30W65.html).
- The 4 larger bulbs are 65 watt (300 watt equivalent) and 6500 K (http://www.1000bulbs.com/product/6052/FC65-S65.html).

With a fresh batch of collodion, her exposures are between 20 and 30 seconds with the lights configured as pictured.

STUDIO LIGHTING OPTIONS FOR WET COLLODION

Falcon Eyes Daylight Kit for Wet Collodion Exposure

My friend, Alex Timmermans, in the Netherlands, uses a Falcon Eyes Daylight Kit LHD-B928FS for his wet collodion studio exposures. This very powerful daylight kit features two lamps with nine 28-watt daylight bulbs each. The light output of a 28-watt spiral lamp is comparable to 140 watts of normal light. An added benefit is that you can switch the lamps on and off in pairs of two to adjust the right amount of light. The kit includes 2 x Lampholder LHD-B928FS, 2 x Light Stand W805, 2 x Octabox 80 cm, and 18 x 28W spiral lamp. This is an excellent system for studio wet plate, but it is difficult to find the units in the United States. The Westcott Spiderlite is a good alternative . . . fewer heads but a similar output.

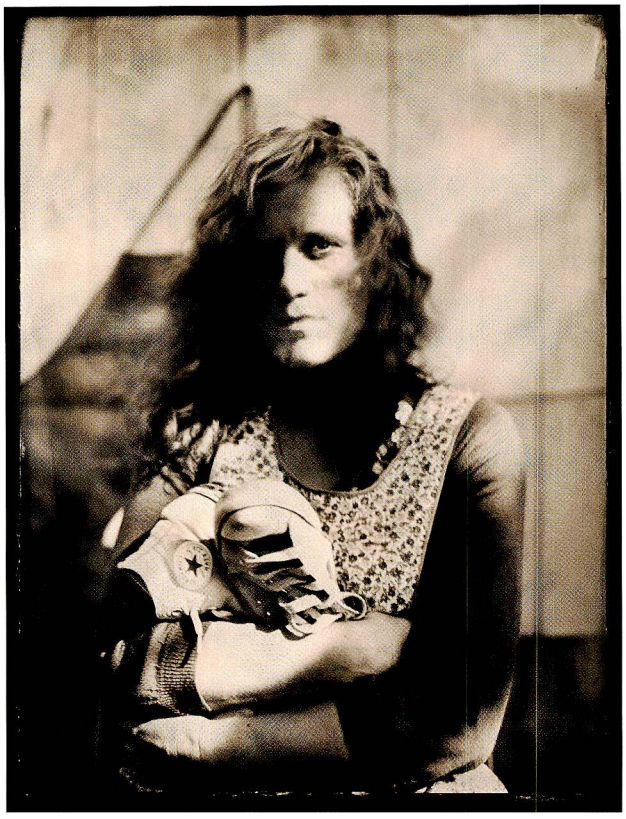


Figure 17–57
Christopher James, *Portrait of Nelske*, Maine, 2010
This wet plate of my friend Nelske was made during the same shooting session as was Figure 17-15. The difference is that in this one I had the right exposure and had asked her to take off her "chucks" and hold them, providing another way to continue my series where the subject resists, through body posture or gaze, the observational privileges of the viewer.
(Courtesy of the Artist/Author)

Westcott Spiderlite TD6

B & H sells the Westcott 1200W Spiderlite TD6 7' Parabolic Umbrella Kit, and this is what the company says about it: "*This is a powerful daylight source with added punch thanks to its silver interior. Imagine welding several beauty dishes together, then add the wrap-around light quality of a really large light source and you have the Parabolic Umbrella. It features a solid metal shaft that tapers to 7 mm to fit European type heads like Elinchrom, as well as standard 8 mm models. The included bonus front diffuser offers even softer results.*"

The Spiderlite TD6 kit includes the TD6 lamp head and six digital-friendly, daylight-balanced, 50W full-spectrum fluorescent lamps with a CRI of 90+. Three switches on the light head allow you to use two, four, or six lamps to control power output. It features all-metal construction, 180° rotation, and a built-in adapter ring. Retail in 2013 was around $500.

CLOSING THOUGHTS

The wet collodion negative was used as the primary camera image for all of the major printing processes of the nineteenth century, including salted paper, cyanotype, albumen, carbon, Woodburytype, lantern slides, orotones, milk glass positives, ivorytypes, ceramic photographs, gum, platinum, gelatin, and collodion printing-out papers. Dye-sensitized collodion negatives were used for the first color processes. The wet-plate collodion process was also used for in-camera positive images such as ambrotypes and tintypes. Collodion emulsions

Figure 17–58
Will Dunniway, *Floyd Oydegaard, Bear Coat*
This is an outstanding example of the craft that Will Dunniway brings to his portraits of those who do look like the average next door neighbor . . . in this case, the commanding presence and energy of Mr. Floyd Oydegaard.
(Courtesy of the Artist)

were also used for dry plate negatives, lanternslides, and collodio-chloride POP printing-out papers.

Learning the basics of wet collodion is generally more difficult than learning other historic alternative printing processes simply because so many different things can go haywire so quickly. Today, a graduate student of mine called to ask why her perfectly good silver nitrate bath had turned nasty on her and become coffee-and-cream brown between one plate and the next. In this case, we simply began with checking the pH of the silver and going from there. Make no mistake about this: mastering a collodion variant requires a serious commitment in both equipment and time. While you can teach yourself from reading this chapter, or other historic literature, the best way to shorten the learning curve is to attend a collodion-specific workshop or arrange for a private tutorial.

Shameless Plug

There are now many competent collodion specialists teaching the basics of the collodion process, and if you have the opportunity, seek them out and spend a week learning the process at a sane pace. I personally teach one- to three-person workshops in my studio in Dublin, New Hampshire. The process is a featured technique, as a thesis direction, in my MFA program at the College of Art and Design at Lesley University, where the spirit of the program is centered on alternative processes, artist books, and all of the ways that photography is integrated into all mediums.

Mark Osterman and France Scully Osterman have long been champions of the process and conduct private tutorials in their studio in Rochester, New York. Mark teaches the technical evolution of photography, from the earliest Niépce processes to making gelatin emulsions at the George Eastman House/International Museum of Photography. His wife, France, is equally skilled as a practitioner and artist. The Ostermans were among the first to pursue serious research on the modern collodion process and continue to be an influence on the photographic fine art community.

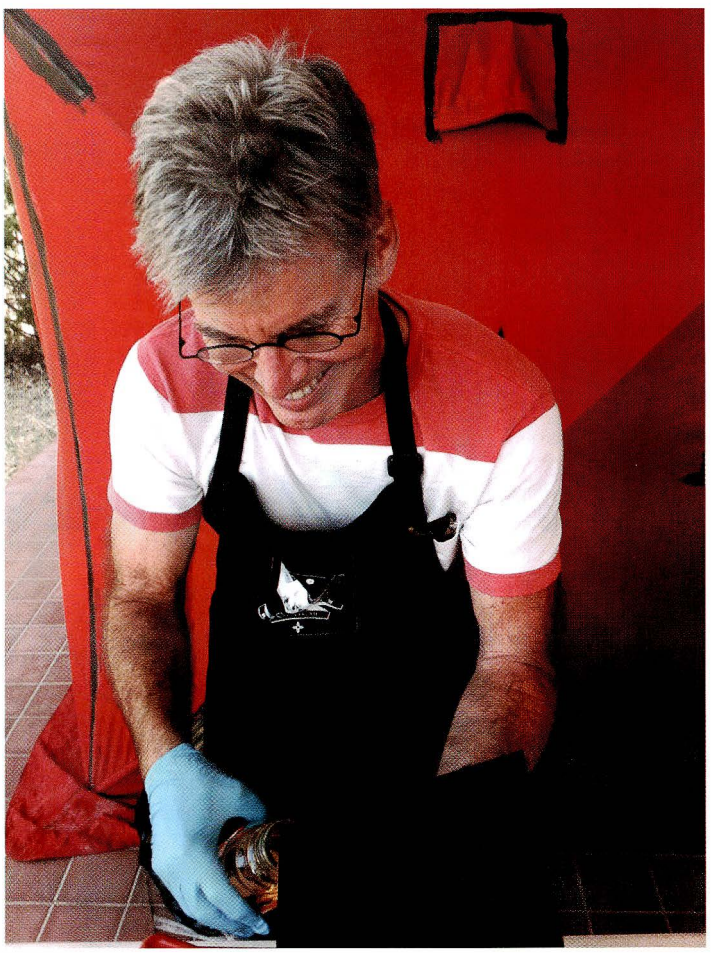


Figure 17–59
Christopher James, Keith Carter w/ Eskimo QuickFish 3 Ice-Fishing Tent, Santa Fe Workshops, 2012
This is a picture of my friend Keith at the end of a collodion pour. Behind him is an Eskimo ice-fishing tent that I use as a portable darkroom when teaching wet plate on the road. Interior safelighting is either a string of chili lights or a cave explorer's red headlamp. Pouring is done outside; sensitizing, development, and first rinse inside the tent; and fixing outside. This tent can hold two people and a 6-foot table without a problem.
(Courtesy of the Artist/Author)

Another workshop experience that would be outstanding for those really dedicated to "old-school" experiences is John Coffer's Dundee, New York, wet plate collodion camp. At John's Camp Tintype, everything is made from scratch, and the atmosphere can only be described as "authentic." If you are on the West Coast, Will Dunniway, in Carona, California, offers workshops on a regular basis and is a master technician.

A FEW RESOURCES

Bostick & Sullivan—
http://www.bostick-sullivan.com
Dick Sullivan, Dana Sullivan, and Melody Bostick have been my friends and suppliers of chemistry for decades. B&S is a great and trusted business for all your alt pro needs. It also sells prepared wet collodion kits and prepared, cut-to-order black plates.

Niles Lund—
http://www.lundphotographics.com
Niles is an engineer and avid wet plate photographer. He has a full range of uniquely designed wet plate products and adaptations such as dip tanks for silver and fix. He also makes custom lens boards and plate holders out of a black lexan polycarbonate resin that doesn't break down or absorb silver or collodion. Niles also sells a heavy-gauge tintype stock that is white enameled on one side and gloss black, with protective film, on the other.

Artcraft Chemicals—
http://www.artcraftchemicals.com
Mike Jacobson is a very knowledgeable chemist and businessman and can answer most every chemical question as well as supply anything you need for wet plate chemistry.

Alpine Stained Glass—
http://www.alpineglass.com
The store sells a full selection of glass and cutting material and tools. Look for deep purple, black, ruby, and deep blue glass for ambrotypes.

Main Trophy Supply—
http://www.maintrophysupply.com
Supplier of prepared, cut-to-order black plates with a protective film. The store also sells plate cutters that are relatively inexpensive and cost efficient if you are cutting a lot of plates for multiple-size plate holders.

Black Art Woodcraft—
http://www.blackartwoodcraft.com
The company makes all sorts of wet plate objects such as cameras, tanks, plate holders, etc.

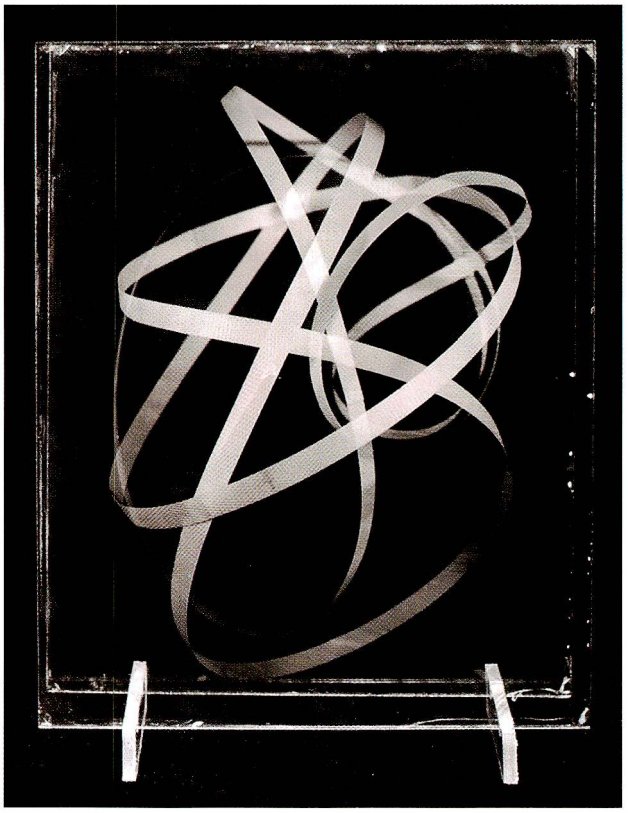


Figure 17–60
Michael Kolster, *Ribbon*, 2012 (double ambrotype)
Michael writes, *"During the colder months when shooting outdoors was not possible, I began to work indoors photographing various items I have been collecting in the studio. I played with tacking plastic strapping to black velvet and became particularly excited when I saw two of the plates stacked together in a drying rack. Viewing them as variously opaque and transparent focused my attention on the paradox of the ambrotype, itself a negative and positive image at the same time." (Courtesy of the Artist)*

Western Bellows—
email: westernbellows@aol.com
Jim Ormand makes replacement and new bellows for your camera.

Clarkson Laboratory & Supply Inc.—
http://www.clarksonlab.com
Wet plate chemistry, including the hard-to-order potassium cyanide.

Eskimo Ice Fishing Gear —
http://www.geteskimo.com
This company makes a nice selection of outdoor environments in the form of ice-fishing tents, notably the QuickFish 3, that accommodate two and four people, tables, and chemistry. You may need to paint the outside roof area white to keep the temperature cool in the summer and/or reinforce the seams with a liquid black electrical tape solution. These tents are lightweight and inexpensive and great for workshops and travel.

In Camera Industries—
http://incameraindustries.com
This a customized plate holder manufacturing enterprise run by noted wet plate collodion artist Jody Ake. Jody is making 4" × 5" and 8" × 10" holders presently but will have 5" × 7" and 11" × 14" holders by the time you read this sentence.

Unlike standard wood plate holders, each plate holder design is more precise, lighter weight, and far less vulnerable to staining and decomposition. These holders can be used for wet collodion (ambrotype/tintypes), paper negatives, dry plate, daguerreotypes, and any in-camera process. In addition, the holders are crafted to fit all standard cameras, barring the need to retrofit, trim, or alter the camera, plate, or holder.

WET PLATE COLLODION SIZE DESIGNATIONS

Traditional Whole Plate:	6 ¾" × 8 ½"
Japanese Whole Plate:	6 7/16" × 8 7/16"
American Half Plate:	4 ¼" × 5 ½"
European Half Plate:	4 ¾" × 6 ½"
Japanese Half Plate:	4 5/8" × 6 7/16"
American Quarter Plate:	3 ¼" × 4 ¼" and 3 ½" × 4 ⅛"
Kodak Brownie 3A with bellows:	4 1/16" × 4 ¾"
Kodak Brownie 2C box/no bellows:	3 3/16" × 5 11/16"
Holga with gaffer's tape shelf lip:	2 7/16" × 2 11/16"
Eighth Plate:	2 ⅛" × 3 ¼"
Ninth Plate:	2" × 2 ½"

The Gum Bichromate Process

OVERVIEW & EXPECTATIONS

Here's the truth . . . in the gum bichromate process there are very few *absolutely correct* ways to do anything. Here's another nugget of dependable veracity . . . in my experience, gum bichromate printers are the most passionate and hard-headed of all alternative process artists when it comes to their particular way of performing the process. I can just imagine so many of my friends reading that last sentence and saying, "I just know he's talking about me!"

When the gum bichromate process is broken down into its three-component steps and explained in the most elementary way possible, it appears to be amazingly uncomplicated. However, to nearly every one of my students who has been taken with the process, and for those artists who are dedicated to it for life, gum bichromate slowly reveals itself to be one of the most complex in the alternative process genre.

The gum bichromate process is ridiculously seductive. This is primarily due to its very limited chemistry, oh-so-simple water development, unlimited color palette using the watercolors of the artist's choice, and very flexible ability to be coupled with a wide range of other alternative and graphic arts techniques such as platinum/palladium, cyanotype, and all forms of printmaking and artist's books. I think of gum as the photographic ambassador to the fine arts. Because of its pigment, substrate options, and brush application, gum bichromate printing is one of the few photographic processes capable of achieving that wonderful element I refer to as *gesture*—gesture being the evidence of the artist's hand in the creation of an expressive and graphic mark. Sadly, in conventional photography, the element of gesture is rare and often simply mistaken for camera movement or a technical flaw of some sort, as in the case of so many "artistic" wet collodion plates. With the consumption of the medium by digital technology and software, this beautiful moment of gesture is often even more difficult to find, despite the mimicked canned gestures of an applied "app."

Figure 18–1
Christopher James, *Alicia in Gum #2*, 2012 (gum bichromate)
(Courtesy of the Artist/Author)

In this chapter I will, as always, offer you "a little history" and describe the basic personality of the process. I will discuss the negative, how to generate a set of CMYK (cyan-magenta-yellow-black) negative separations with ink jet printer output, and relaxed registration techniques . . . as shown in my first image in this chapter, *Alicia in Gum,* 2012. This basic and straightforward workflow will get you in shape to make your first gum bichromate prints on your first day with the process. You will quickly learn how to make a gum print from conventional films (yes, I believe there will be silver gelatin films for some time to come) or digitally produced ink jet contact film negatives . . . perhaps both at once!

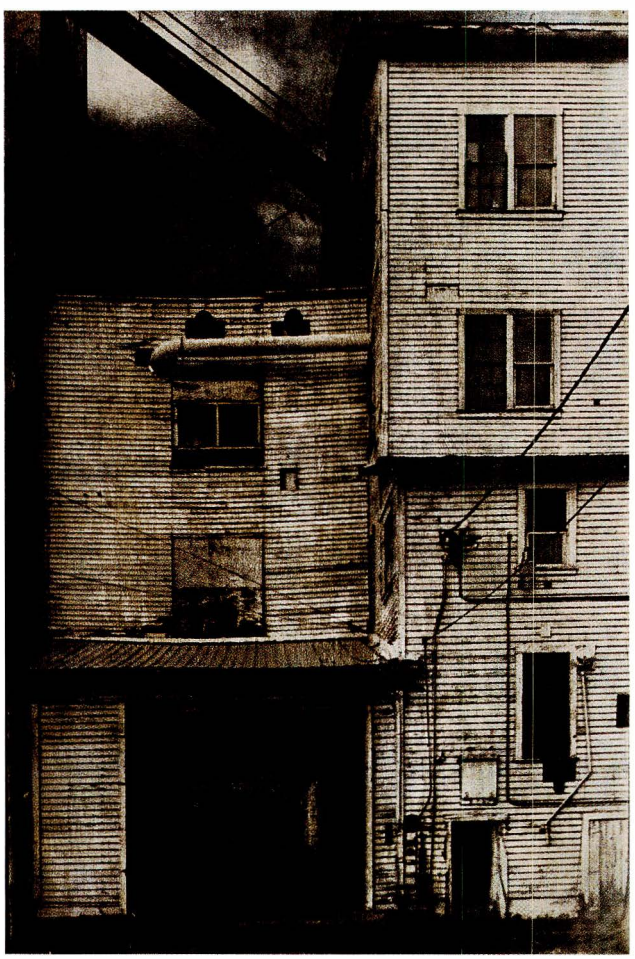


Figure 18–2
Keith Gerling, *White Elevator, Montana,* 2012 (gum)
Keith Gerling produces large and amazing gum bichromate pieces on wood and aluminum substrates and prepares their surfaces for gum printing with a base composed of marble-dust, pumice, acrylic gesso, and water.
(Courtesy of the Artist)

I'll provide Keith Gerling's workflow, in which he produces beautiful gum bichromate pieces on wood and aluminum substrates and explains how he prepares their surfaces for printing with a base composed of marble-dust, pumice, acrylic gesso, and water.

For those of you who are seeking a very sophisticated and controllable gum bichromate process, I will also incorporate the very extensive research that has been created by my friend Tony Gonzalez on the workflow of gum-specific CMY digital negatives and printing so that you can produce outstandingly accurate color renditions from fully realized and registered digital negatives. Tony's technique is pretty impressive, and whether you want to have the raw organic technique that usually defines gum printing or the far more refined technique that defines Tony's work, you will find good information that will serve both intentions well.

You'll learn about mixing the chemistry for the sensitizer and the relationship of the three primary ingredients in the technique: gum arabic, a dichromate (potassium or ammonium) sensitizer, and pigment . . . generally watercolor. This will be coupled with instructions for applying the sensitized emulsion, processing the print, and re-applying sensitized coatings for subsequent layers and depth . . . all without the need of a darkroom! I'll also discuss the clearing gum of print highlights and conclude the chapter with a comprehensive troubleshooting section.

Considering the basic simplicity of the process you'll notice that there seems to be an unexpected abundance of information. Part of the reason is that I want you to see the infinite menu of variables within gum printing. If you investigate the process beyond this book, you will find published evidence that will occasionally seem contrary to some of the information in this chapter. You need to be aware that gum bichromate printing suffers from the same problem as many other alternative processes: untested and erroneous instructions are endlessly repeated as gospel.

You'll find that you will not have trouble making good gum bichromate prints if you follow the instructions carefully. I will give you the gelatin–glyoxal paper sizing techniques for gum in this chapter and then add

options to this sizing stage in the Paper and Alternative Substrates chapter of this book. This is a very important part of the process, as without a hardened sizing stage, the pigment in the sensitizing solution will often stain your highlights.

Of course you're going to have issues to deal with . . . everyone does with gum. But, the path I'm laying out for you is a well-tested one and you'll be fine. Just relax, take your time, keep notes of what you are doing, and realize that the gum bichromate process will reward you individually as you modify the myriad elements of the process to suit your own personal working style, imagery, and intentions. The most important thing to remember when exploring gum is to play.

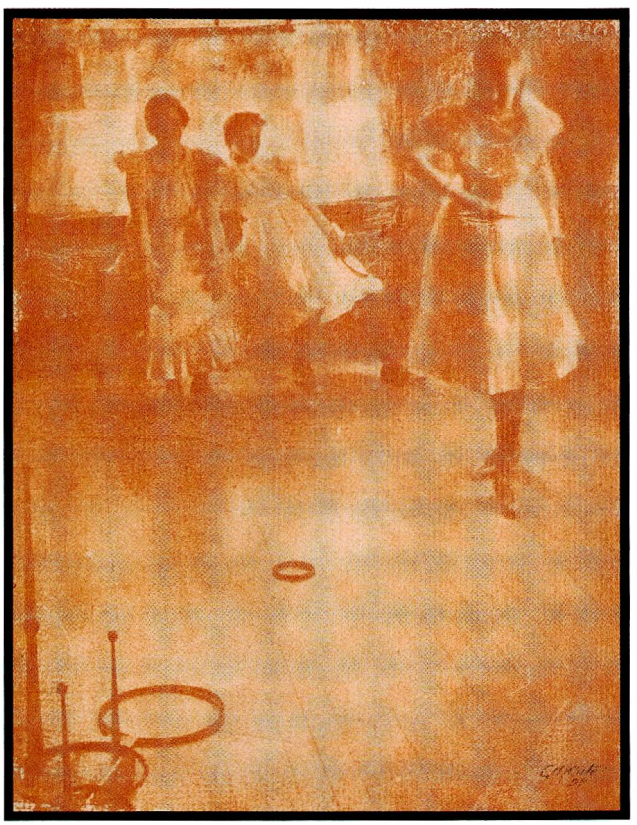
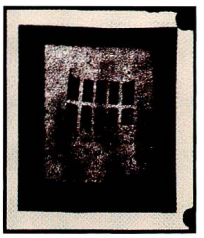


Figure 18–3
Clarence White, *Ring Toss,* 1899 (Ransom Center, Stieglitz Collection)
Clarence White, along with Alfred Stieglitz and F. Holland Day, was a founding member of the urban-based Photo-Secessionist movement even though the bulk of his most important work revealed his affection for small town life in Ohio, where he supported his family as a grocery store bookkeeper. In *Ring Toss,* White's use of the light orange gum bichromate mix emulates the traditional red chalk or conté crayon that was traditionally used in a pre-painting sketch, or formal drawing, by more traditional artists in mediums such as painting.
(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY)



A LITTLE HISTORY

To begin, there is an odd and interesting hypothesis from a book I found a few years ago. It was written by Picknett and Prince and entitled *Turin Shroud—In Whose Image? The Truth Behind the Centuries-Long Conspiracy of Silence* (Acacia Press, 1994). This book suggests that Leonardo da Vinci (1452–1519) may have created the Shroud of Turin by using a mixture of dichromated egg with human or animal urine. Guess whose image is on the Turin shroud... none other than Leonardo da Vinci's, of course. The book's authors, if correct, would give Leonardo da Vinci credit for the first photographic image, several hundred years before the medium's "official" beginning in 1839.

To put this curiosity in context, the publisher's catalogue is rife with books dealing with conspiracy theories dating back to the fourteenth century. The only problems with the theory are that carbon dating on samples of the shroud in 1988 by the University of Oxford, the University of Arizona, and the Swiss Federal Institute of Technology concur that the shroud was created in the Middle Ages between 1260 CE and 1390 CE. This pre-dates da Vinci's birth by a few years, but who knows . . . considering everything else da Vinci accomplished, it might very well be true.

The earliest attributable record regarding the effect of UV light on bichromates appears to be the intellectual property of the French chemist Louis-Nicolas Vauquelin (1763–1829) at the tail end of the 1700s. Although Vauquelin published over 370 separate papers on the subject of chemistry, the bulk of his writing did little more than provide analytical observations and data. Interestingly, he was one of the first academics in history to consider instructing his students by means of actual, hands-on practice in the laboratory, and for that he gets a big round of applause.

Mungo Ponton (1801–1880), the Scottish inventor with the all-time best name in the history of photography, expanded on Vauquelin's analytical wisdom in 1839 (there is that year again) when he discovered

Figure 18–4
The Shroud of Turin
(© Godong/UIG / The Bridgeman Art Library)

Figure 18–5
Aspen Hochhalter, *hair-2,* 2011 (dusting-on process)
Aspen writes, "I am collaborating with a modern dance choreographer to create a set of movements that i will then perform and photograph. These are the first two pieces, preludes to the full body of work. The first is a clear gum, the second is a 'dusting on' process, i made a clear gum and at the point when the paper was dry but the gum was still soft and sticky, i sprinkled the ashes of burned human hair on the print, thus the photographic self-portraits gain form, content and imbibe strength from the hair."
(Courtesy of the Artist)

that paper impregnated with potassium dichromate (bichromate and dichromate are the same thing, by the way) was sensitive to light. In Ponton's process, paper was coated with a potassium dichromate solution and exposed to sunlight using objects to create a photogram negative image. The exposed print was then washed to remove any unexposed dichromate and dried, leaving a light buff-colored sepia impression that was constructed of chromium dioxide. The print was rather handsome at first but tended to fade to a delicate gossamer-like green after several months. Ponton's single solution Pontontype is directly related to the idea behind Poitevin's dusting-on process (1858) and a sizing technique for liquid emulsions on paper, both of which are covered later in this text.

One year later, in 1840, Edmund Becquerel (1820–1891) added to the rapidly expanding base of photographic knowledge when he observed that Ponton's images were the result of dichromates reacting with the starch sizing in the paper he was using. Becquerel went further, conducting experiments incorporating iodine in combination with starch and establishing that a water-soluble colloid, like starch or gum arabic, when sensitized with a dichromate would become insoluble when exposed to UV light; thus, the foundation of the process had been defined.

As an aside, Becquerel also demonstrated that he could produce electrical currents by exposing certain liquids and metals to UV light, and he invented a machine called an *actinometer* that could calibrate and measure the response of those materials to light. This discovery eventually led to the development of the photoelectric cell. It was also Becquerel, by the way, who first figured out that continuing the exposure of a daguerreotype through a red glass filter could intensify the image's contrast on the plate.

In 1854, William Henry Fox Talbot began investigating the ability of potassium dichromate to have a hardening effect upon a colloidal gelatin that was directly proportional to the degree of UV light that

the gelatin received. Fox Talbot's modest success was followed by the work of Alphonse Louis Poitevin (1819–1882), who continued the investigations of how bichromates were able to render gelatin insoluble when subjected to light.

Then, in 1856, Honoré d'Albert Duc de Luynes, an exceedingly wealthy arts patron, put up a huge prize of 10,000 francs to anyone who could describe, and prove, a photographic printing process that was permanent. Poitevin won the prize for two processes: the carbon print and the collotype. Additional history will be forthcoming in the Dichromate Options chapter, but in the meantime, here are a few other related techniques to consider.

Woodburytype

Walter Bentley Woodbury (1834–1885) is credited with the creation of the Woodburytype (a.k.a., *Photoglyptie–Stannotype–Photomezzotint*) in 1864–1866, a process that was widely practiced for nearly 25 years and known for its amazing tonal range and ability to render values without any grain whatsoever. In fact, as is true of most people who invent new processes, Walter Bentley Woodbury was assisted by several decades of experimentation by a host of other artists, scientists, and entrepreneurs such as Mongo Ponton, Becquerel, Fox Talbot, Poitevin, Beauregard, Paul Pretsch, and John Pouncy.

To produce a Woodburytype, the artist would make a thick gelatin relief on a piece of carbon paper by exposing it to a continuous-tone negative. The relief image was dried and then compressed into a lead intaglio plate under enormous pressure from a hydraulic press. The lead, having taken the details of the hardened gelatin impression, would now become the printing plate for the next step.

The lead intaglio plate was then encased in a mold and pressed against a fine-quality paper. Pigmented gelatinized ink was then poured into the mold, where it deposited its pigment in proportion to the depth of

Figure 18–6
Felix Nadar, *Portrait of George Sand*, 1877 (Woodburytype)
Nadar had a brief, but stunning, career as a photographer in the mid-1800s primarily due to his extraordinary social connections within the French artistic and literary circles. His list of occupations and interests included poacher, freedom fighter, smuggler, cartoonist, and proponent of heavier-than-air-flying machines. His photographic studio became the main office for the Society of the Encouragement of Ariel Locomotion by Means of Heavier than Air Machines. Nadar was the president, and Jules Verne was the secretary. This is a Nadar Woodburytype of his friend and novelist George Sand, who is remembered for her notorious affair with Chopin, her wardrobe of men's clothing, her feminist politics, and for writing eighty novels about love, nature, and morality.
(Courtesy of George Eastman House, International Museum of Photography and Film)

the plate. Interestingly, the Woodburytype is generally a dark reddish-brown and is seldom printed in black, even though any color could have been used.

Corot's Cliché Verre Negatives on Glass

A fascinating bit of information from the same time period is that the French painter Jean-Baptiste-Camille Corot (1796–1875) tried his hand at processes utilizing bichromates and colloids and made cliché verre prints on glass using pure albumen as his sizing agent. This was a really fine idea because it put photographic syntax in the hands of a painter.

In the middle of his career, Corot made colloidal etchings by coating glass plates with wet sensitized collodion emulsion. The plates were then exposed to light, which darkened them entirely. Corot then etched into the darkened emulsion and when finished contact printed the plate to a piece of sensitized paper for a paper print. Corot and others also utilized a technique in which they would burn a tallow candle close to a glass plate, leaving a soot-blackened sheet of glass. The soot was then drawn into with a variety of mark-making tools to create a negative plate of lines and textures. The etched soot on the glass was then used as a contact negative in conjunction with a dichromate-sensitized sheet of paper. You can see an example of this in the Alternative Negative chapter.

The Fish Glue Process

Also included in this menu of really interesting ways to make images is another technique known as the fish glue process, which applies these same principles on a metal plate substrate. Alphonse Louis Poitevin is credited with the invention of this process. In the fish glue process, ammonium dichromate and water-soluble fish glue were mixed and coated on a metal plate. Following exposure, the unexposed and unhardened glue (acting like gum arabic does in a traditional gum process) washed off the plate, which was then dried and heat hardened. The heat hardening produced an enamel-like surface that was subsequently acid etched (likely a Dutch Mordant recipe: 3 parts water to 1 part nitric acid) and used in an intaglio press, uninked, to make a bas-relief image. Fish glue is still being manufactured and can be purchased should you get an urge to try this seldom-used technique. You might also want to test it with household white glue. See the Resource section in the appendix of this book for a supplier of fish glue.

Figure 18–7
Robert Demachy, *Cigarette Girl*, 1902 (gum)
Robert Demachy was an artistic force in the 1880s and began to interpret his work in gum in 1894, as it allowed him to work in the manner of a painter and was similar to the feelings he had when looking at Impressionist paintings. Demachy founded the Photo-Club de Paris and was a stalwart member of the Linked Ring as well as an honorary member of the Royal Photographic Society. This image of *Cigarette Girl* is a gum bichromate print reproduced as a photogravure in *Camera Notes,* Vol. 6, No. 1, July 1902. In spite of his success, Demachy divorced himself from photography in 1914. *(Courtesy of George Eastman House, International Museum of Photography and Film)*

Gum and Pictorialism

In the late nineteenth and early twentieth centuries many photographic imagemakers viewed themselves as dedicated fine artists rather than as the gentleman scientist imagemakers of a half-century earlier. Some even began referring to themselves as *Pictorialists.* They worked extensively with the gum process, due to its ability to mimic the *painterly* gestures

and chromatic opportunities that painters enjoyed. Because of these attributes, they were also able to imprint their unique intentions and feelings upon the photographic impression. Critics of the Pictorialist movement condescendingly categorized their imagery as warm, romantic, and fuzzy. It was hardly the sharp-edged, scientific perfection that had long been the ideal of the photographer scientist.

Indeed, gum bichromate was championed in America by the Photo-Secessionists (first cousins of the United Kingdom's the Brotherhood of the Linked Ring), a coalition of photographers such as Edward Steichen, Gertrude Käsebier, Clarence White, and Alfred Stieglitz, who were dedicated to Pictorialist expression in the medium. Their inspiration came from the aesthetic integrity of multiple European organizations, such as the Wiener Kamera Club in Berlin, which struggled to have its artistic photography appreciated within its own unique context rather than as an imitative reflection of photographic "reality." This is, of course, the principle argument born of the aesthetic ruckus started by Peter Henry Emerson in 1889. I'll expand on this idea a bit more under the heading of Pictorialism in the Platinum–Palladium chapter.

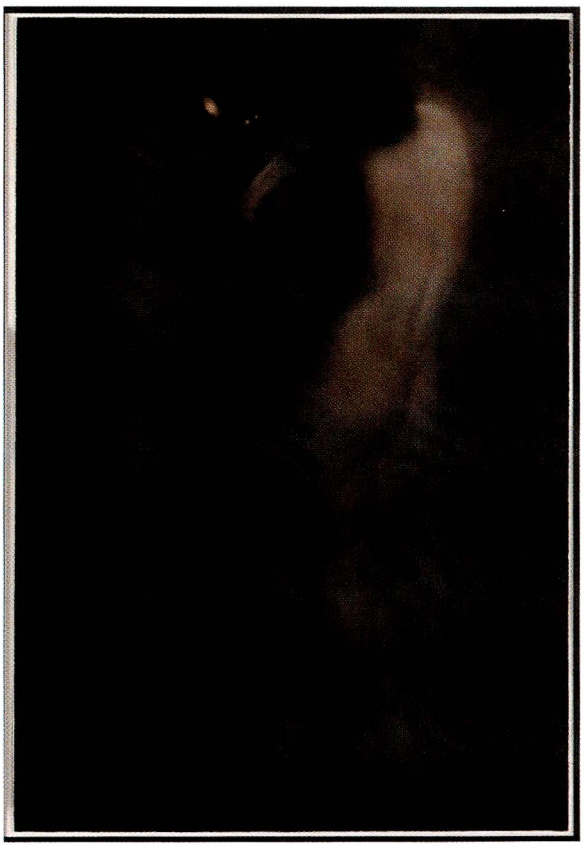


Figure 18–8
Edward Steichen, *Little Round Mirror*, 1905 (gum over platinum)
I can't improve on what the Met wrote about this piece, so I'll just quote its catalogue: *"The Little Round Mirror and In Memoriam (33.43.48) were made in Paris in 1901 as part of a series of nudes that combine classical artistic tropes with the moody, attenuated style of the contemporary Symbolist movement. The creation of these prints required diligent, time-consuming darkroom work and multiple photographic printing processes—a fact somewhat at odds with their seemingly spontaneous, gestural appearance. In both pictures, Steichen applied layers of dark pigment, obscuring and masking the identity of his model and transforming her into an aesthetic element in harmony with the rest of the picture."* *(Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY. © PERMISSION OF THE ESTATE OF EDWARD STEICHEN)*

HOW GUM BICHROMATE WORKS

In the late 1850s, John Pouncy came to the conclusion that the portions of the sensitized paper affected by UV light through the negative become insoluble in direct proportion to the amount of light received. The underlying principle is that a mixture of a potassium, or ammonium, dichromate salt (dichromate and bichromate describe the same thing) in a saturated solution is mixed with a colloid, such as gum arabic, gelatin, glue, or starch. This UV light-sensitive liquid mixture is then applied to a paper substrate and dried. A contact negative, the same size as the finished print, is placed in direct contact with the dried sensitized coating in a contact-printing frame and exposed to UV sunlight.

By itself, the dichromated salt and the gum arabic (sap from an Acacia tree) will produce a buff or tan-colored image. This particular sensitizer is often employed as a preliminary sizing layer for hand-applied liquid emulsions and unique substrates. If a coloring agent, most often watercolor pigment but occasionally a gauche or a metallic powder, is added to the dichromate–gum arabic-sensitized mixture, the color of that pigment will remain in the UV light-hardened emulsion and will not wash out except in the highlight areas where exposure has not hardened the pigment, gum, and dichromate solution. Again, this is because the pigment, gum arabic–dichromate mixture will harden in direct proportion to the degree of UV exposure received.

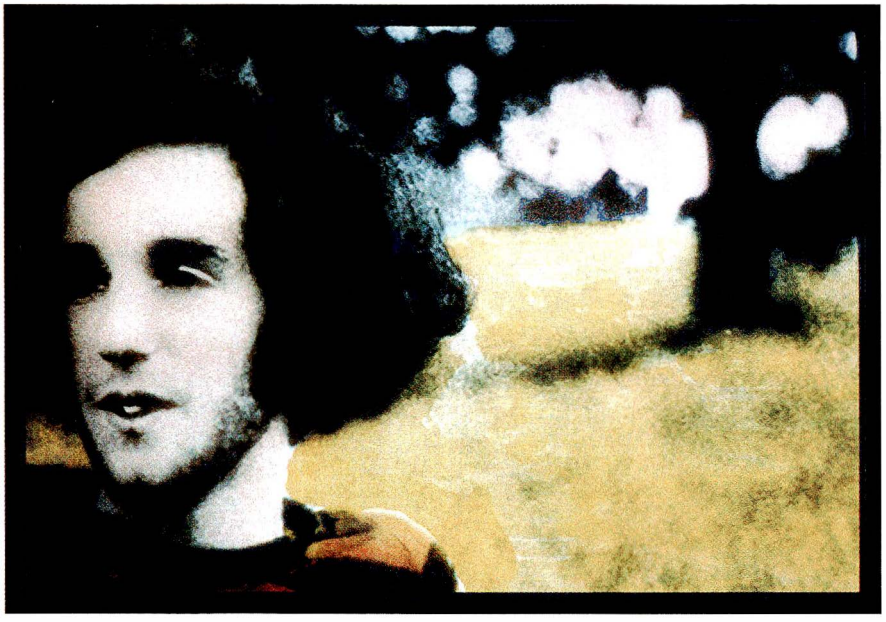


Figure 18–9
Christopher James, *Tony, Cummington Community for the Arts,* 1968 (gum over cyan)
In 1968 I was living in a commune in western Massachusetts in the rural town of Cummington. We were all young and idealistic artists to be with a mandate to create in mediums that were new to us . . . I suspect to see if talent translated conceptually and artistically between mediums. I was a painter/printmaker and decided that I would teach myself photography. Here's a shot of my fellow Cummington Community member, Tony, translated in cyanotype, gum bichromate, and a little paint.
(Courtesy of the Artist/Author)

In a first exposure, the thinnest parts of the negative (the shadows) will allow the most exposure and will cause the image upon the coated paper to become the most insoluble and hardened in those areas. The densest parts of the negative (the highlights) will require more exposure and will, as a result, harden less during the same exposure time. This means that during the wash-development stage the unhardened pigment simply falls away from the paper, leaving the highlights color-free. This is exactly why gelatin–glyoxal paper sizing is so important. The other factors that will influence the outcome of your gum print are many, but the most relevant includes the dichromate sensitizer-to-pigment ratio and the amount of pigment in the sensitizer mix, the paper you choose, water type and temperature, paint type and color, and how all of these work with the chemistry and your individual technique.

A FEW WORDS BEFORE WE BEGIN

Any changes in the principal components of the gum process (gum arabic quality, sensitizer type and strength, ratios of one to the other, water type, temperature, paper, time of year, etc.) on any given day may change the final results in a gum print. This is exactly

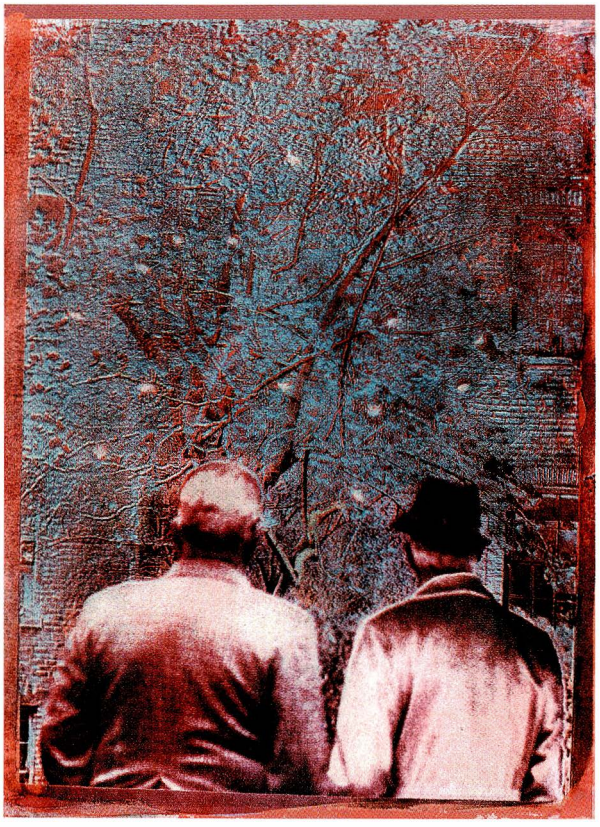


Figure 18–10
Judy Seigel, *Two Men & Tree,* 1983–2000 (gum)
This piece has 3 separate coats of sensitizer exposed through a single negative on Strathmore Bristol. It also has a coat of blue-green pass applied around the figures using a film positive of the same image.
(Courtesy of the Artist)

what makes the process so interesting and so much fun. As long as you avoid investing your self-worth and abilities as an artist in the success of every print, you will be just fine.

Be patient and don't try to become the "best" at this process. My long-time friend, Judy Seigel, probably spent more time and energy exploring the variables of this process than anyone I know, and she came face-to-face with its unexpected tricks or treats. It would be a "fool's errand" to try to conquer gum bichromate printing in a short time. Judy offered good advice when she suggested that one could come to a working truce with gum simply by paying attention. The gum bichromate process is amazingly fluid and flexible and should be approached with a spirit of play, adventure, and discovery.

PAPER PREPARATION FOR GUM BICHROMATE

Note: This first paper preparation section is duplicated in the Paper and Alternative Substrates chapter along with a large menu of other paper and alternative surface options. I felt it belonged in the Gum Bichromate chapter as well so you wouldn't have to go hunting for it . . . seeing as it is one of the most critical steps leading to success in the gum bichromate process. When you go to the Paper and Alternative Substrates chapter, don't forget to check out the section on amino silane application to glass and ceramic surfaces.

The most important reason for sizing your paper is to prevent your paper substrate from absorbing the pigment in your sensitizer formula, which will prevent you from realizing clean highlights and detail within the print. Watercolor paints were designed to adhere to the paper they were applied to, and what you are trying to do is harden the surface of the paper with a layer of gelatin that has been combined with a hardening agent such as glyoxal or formalin. When the pigment and gum arabic are applied to this hardened gelatin, they sit up on the surface of the paper, preventing all of the unexposed/unhardened pigment from making an impression in the paper. Instead, unexposed pigment simply softens and falls from the paper's surface in the water development bath. I know that I am repeating this, but once you make a mental picture of what is happening, it begins to make a lot more sense.

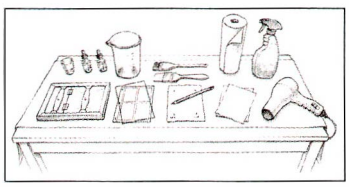
There are a few ways to go here. The simplest and most effective way to size and harden your paper is to use a monobath method, in which gelatin and glyoxal (sizing and hardening) are combined and used simultaneously. This method works well, and I have found it quite satisfactory and easy to do. The technique is an excellent single-stage option in a class or workshop situation where space and time are considerations. The only other consideration that you will want to keep in mind is whether you single- or double-coat your paper. This will be decided based on how thick and absorbent your paper is and whether or not it has a manufacturer-integrated sizing such as Aquapel in it already.

You can also consider the traditional two-stage sizing and hardening technique, which has been used by gummists for ages. Hardening a gelatin emulsion with glyoxal after the gelatin has been applied to the paper will help in some single-pass alternative processes where you might be experiencing dull or flat imagery due to the paper absorbing too much of the sensitizer. There are several traditional sizing and hardening methods to choose from, and in this section I will detail the "old-school" two-stage method and the more modern single-stage one. The traditional technique involves hardening gelatin with formaldehyde or formalin, and I am recommending that you consider glyoxal because it is a simple matter to order it in a 40% concentration from Bostick & Sullivan.

The caveat on the glyoxal MSDS data sheet indicates that insufficient testing has been done with glyoxal, making it difficult to determine if it is actually less toxic than formalin. The possibility that glyoxal is less dangerous does not excuse you from wearing gloves and a dual-filter respirator when working with it. I make this point because the fumes from the glyoxal are less acute than

those of formalin, and that fact may cause you to let your guard down . . . don't. Glyoxal is, however, easier to buy in this age of homeland insecurity. In that regard, I have included two variations: a single- and a multiple-step version of the glyoxal hardening formula.

I strongly recommend that you do not work indoors with formalin or glyoxal unless you have a lab designed with an excellent in-flow to out-flow ratio of air. A casual attitude about liquids that can mummify dead things is unwise. See the appendix for vendors of formalin and glyoxal.



TRADITIONAL TWO-STEP GELATIN & GLYOXAL SIZING: FOR GUM BICHROMATE

Table Setup For Glyoxal–Gelatin 2-Step Traditional Sizing Process

- 28 g Knox gelatin (four 7-gram packets per box)
- Baking soda (bicarbonate of soda) (1/2 teaspoon)
- 1 liter cold distilled water
- Electric kettle to heat water to 140°F
- 1 large and clean tray (for hot water)
- 1 smaller and very clean tray—paper size (for gelatin and sizing solutions)
- Pencil for marking paper
- 2"–3" foam brushes
- Beaker with water for brush cleaning
- Paper towels
- Clothesline and clothespins
- Paper: (Lana Aquarelle, Fabriano, Cot 320, etc.)
- Ziplock bag (freezer type) for storage after drying
- 40% glyoxal (Bostick & Sullivan)

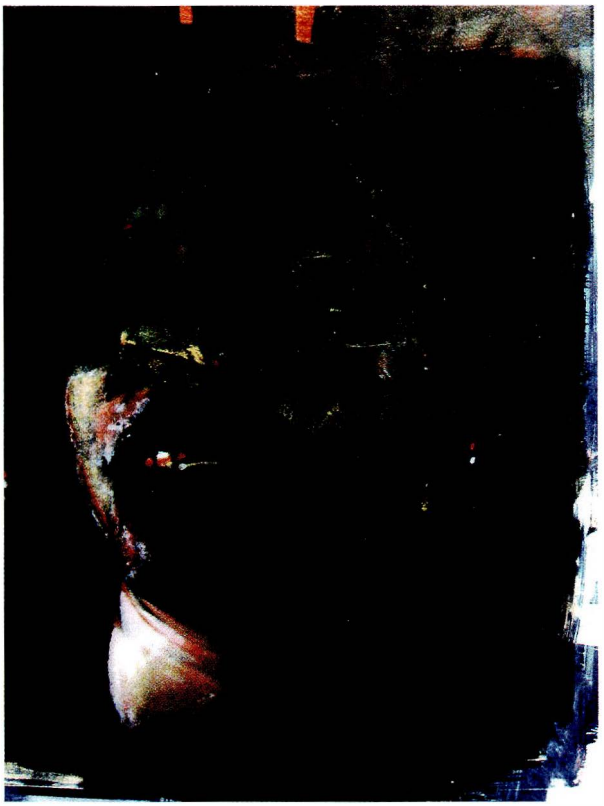


Figure 18–11
Natalie Rzucidlo, *corpse,* 2008 (gum & cyan)
I first saw this print in a student critique where I was a guest "critter" for Sarah von Keuren's class at the University of the Arts in Philadelphia. I loved the image and stayed in touch with Natalie. She is now in her last year of my MFA program at the College of Art and Design at Lesley University. To make this image Natalie used a copy camera and distorted her features with a sheet of glass. By intuitively adding a variation of colors and slightly off registering each layer, she created the finished gum print. *(Courtesy of Natalie Rzucidlo)*

Gelatin Sizing

The first stage of a sizing and hardening process involves coating your paper with a plain, unflavored gelatin. This step will prepare the paper for the glyoxal, formalin, or chrome alum hardening step. In a single stage, monobath variation, both the sizing and hardening stages are done at the same time.

In my watercolor painting, I always pre-coat my 1100 lb Arches watercolor paper with multiple coats of a gum arabic and water wash solution. The gum arabic creates a barrier between paper and paint that can only be compromised with excess water. This technique protects the paper's whites from one or two

invasions of painting with a wet brush and allows me to re-enter the dry painting and open up highlight details. In alternative processes, gelatin sizing performs this same task (except that is hardened with glyoxal), protecting the paper from pigment and multiple extended water exposures. This assures that the highlights will remain clean and white and that the shadow details will be defined.

Gelatin: Photo or Food Grade

You need a good quality gelatin with a "bloom" value between 200 and 250. Bloom value is the measure of the gelatin's strength or firmness. The best grade of gelatin is referred to as photographic grade, and that can be purchased at any decent photographic or chemical supply. Bostick & Sullivan sells a photographic-grade gelatin with a bloom value of 250.

A simpler option is to go to the market and buy a box of Knox (or some other brand) unflavored gelatin (28 grams), which generally is sold in a pack of four or more envelopes containing 7 g each. Do not buy Jell-O®, even though it could work, because it stains and sugar is not good for you. Knox gelatin tends to be a little soft bloom value-wise, but it is perfectly suitable for learning the process.

While you're at the market, buy a few gallons of distilled water. You will also need a pot and a hotplate to heat up the water–gelatin mix, a tray for the paper and solution, and a clothesline to hang the paper to dry. You may find it necessary to have a glass rod or a squeegee to pass over the gelatinized paper after it comes out of the tray to eliminate air bubbles. If this is so, you will also need a clean and flat surface to squeegee on.

Figure 18–12

Christina Z. Anderson, *Crack a Girls Ribs,* 2005

One of the true believers in the alt pro renaissance, Christina Z. inspires and turns her students into disciples. I know because I have had them in my workshops and MFA program in Boston and they are very well schooled and enthusiastic. This piece is from her series *The Love Comic Project*. From the late 40s to the 70s, love comics taught romance rules to women: girl falls in love at first sight, some conflict arises, but she finally gets the guy and after a single kiss they marry and have babies. All stories end happily with a "completed woman" in 3 to 6 pages. They are perfect illustrations of culturally distilled encoding that, unfortunately, still influences entire sections of the country. Christina prints her gum from tri-color separation negatives with a cyanotype first layer. *(Courtesy of the Artist)*

TRADITIONAL GUM BICHROMATE GELATIN SIZING

Step 1 **The Gelatin Bloom** Begin by adding four 7 g envelopes of gelatin (28 g) to about 300 ml of cold distilled water. The total volume, when mixed, will be 1 liter (1000 ml). Stir the solution gently to avoid creating bubbles and then let it "bloom" (swell up) for about 20 minutes. For smaller batches of sizing simply proportion the gelatin and water to make the amount that you need, for example, 7 g of gelatin to 250 ml of distilled water.

Step 2 **Heating the Gelatin** Add the rest of your water and slowly heat the water and gelatin solution, stirring gently, until the temperature reaches approximately 120°F. Then pour your heated gelatin solution into a warmed tray that is large enough to accommodate your paper. If you can't find a large enough tray, then try using a Pyrex lasagna tray or a wallpaper paste trough and hand rolling your paper through the sizing. These troughs are available at local hardware or paint stores and are also excellent for processing RC mural paper. When you're there, be sure to buy Nitrile gloves. While the solution is still hot, immerse your paper in the warmed gelatin solution, being sure that it is completely covered. Rotate the papers and keep them in the solution for about 3 minutes.

Note: The best way to accomplish this, and subsequent steps, is to use the same double-boiler method. Take a tray that is larger than the one your gelatin and paper will be using and fill it halfway with very hot water. Then float your smaller gelatin-paper tray in it like a boat and this will keep your gelatin warm and free flowing during the coating.

Step 3 **Drying** After the paper is saturated, drag it slowly over the edge of the tray, being sure to eliminate any air bubbles that have formed. One technique I have used is to lay the paper on a clean sheet of Plexiglas (larger than the paper) and drag a glass rod, windshield wiper (VW type), or rubber squeegee over the surface. This drives the sizing into the paper's fibers and also leaves a drip-free piece of paper. Size as quickly as you can, because the gelatin becomes increasingly difficult to work with as it cools. Gelatin will also go bad and has a disgusting smell after a few days, so coat as many paper sheets as you intend to use.

Hang the sheets to dry on a clothesline. After the gelatin-sized sheets have dried, it will be time to work with the glyoxal that will harden the gelatin that you have just applied. Remember, if you are only going to make a single pass on this paper, the hardening stage may be unnecessary. However, be aware that in the gum bichromate process, an unhardened gelatin sizing will often stain the paper far more easily than one with glyoxal-hardened gelatin.

An Optional Gelatin-Sizing Application: Brush Coating

I generally encourage immersion in gelatin simply because of the importance of keeping the gelatin in a warm state during the process. However, this does have a downside, as over-saturated gelatin areas occasionally make it difficult for the gum emulsion to adhere to the prepared paper. A more economical technique is to keep your gelatin in a warm state and with a foam applicator brush quickly coat the gelatin solution on the side of the paper you intend to make your print on. You may have to coat twice when using thick and non-traditional porous papers, but the technique is not complicated and the paper dries quickly. If you are going to make multiple passes, be sure to shrink your paper with a hot water bath and dry your paper first before brush sizing. I will add that if you like the idea of using Fusion 4000 to mount your paper to a thin aluminum sheet as a support for your gum bichromate paper, this technique may be faster and easier than the immersion steps followed by mounting.

Traditional Gelatin Hardening with Glyoxal

Step 4 **Glyoxal Options** To ensure that you have the best paper surface to make your gum bichromate print upon it is necessary to harden your gelatin coating from Steps 1–3, and there are a few options for you to consider. Glyoxal and formalin produce pretty nearly identical results and play the same role in the gelatin and gelatin-hardening sizing process. Most importantly, these two hardeners must be treated with equal respect. Glyoxal is the hardener that I use personally and the one that I teach with. Here are a few important options for you to know about before using this chemical.

A Working Glyoxal Solution

To make a working glyoxal hardening solution, add 15 ml of a prepared 40% glyoxal solution to every 1000 ml of distilled water. You may make smaller total volumes by proportioning the amounts of glyoxal and distilled water to suit your working needs. A 40% glyoxal solution can be purchased through Bostick & Sullivan, Photographers Formulary, and Artcraft. See the Resources section of the appendix.

Glyoxal and Bicarbonate of Soda Solution to Strengthen the Bond

Mix the glyoxal and water into solution in an extremely well ventilated space . . . preferably outdoors. To your prepared glyoxal solution of 15 ml of glyoxal to every 1000 ml of distilled water, add 1/2 teaspoon of baking soda (bicarbonate of soda/sodium bicarbonate). *The addition of baking soda makes the bath more alkaline, and this helps to strengthen the bond between the gelatin sizing and hardener.* Bicarbonate of soda can also be added to a formalin solution to perform the same function. If you intend to save the glyoxal beyond a single day you should consider adding 10 ml of methyl alcohol to it. This will keep it viable for a few extra days. Formalin, on the other hand, will keep indefinitely.

Again, be aware that there has not been enough long-term testing of glyoxal to know whether it is more or less toxic than formalin. That alone is reason to always work with it in a very well-ventilated space. One thing for sure: a glyoxal-hardened paper, even after drying outdoors, will continue to outgas for a day or so and this will cause unpleasant things to happen to your eyes, nose, and throat if you subject those delicate parts to this chemical. You should be aware of this when working with it and the paper that has been treated with it. Try your best to dry the recently sized and hardened paper in a well-ventilated area, away from your living and sleeping space—in the garage or outdoors are good options.

Total Immersion Option in Glyoxal

Another option in the gelatin hardening process is, in Step #4, to execute a total immersion of the gelatin-sized paper in the glyoxal. Prepare your double-boiler tray setup once again. In the smaller, floating, tray, add your water, baking soda, and glyoxal solution. The lower tray will be filled with hot water to keep your hardening solution warm and fluid. Then, immerse your gelatinized paper in the tray of glyoxal hardening solution for 5 minutes.

Rinsing after the Glyoxal

There will be sufficient time for you to be able to give your recently gelatinized and hardened paper a nice cold-water rinse without undoing the act of hardening. After the glyoxal is allowed to permeate the sized paper completely, it should be rinsed for a few minutes in a fresh, cool water bath before it is hung to dry on a line. This removes excess glyoxal from the surface of the paper. If you forego this step the paper may turn a little butterscotch beige in the highlights down the road . . . sometimes even before you use the paper. Rinsing permits you to store the paper for future use. The cold-water rinse also resets the gelatin–glyoxal coating. Hang the paper up to dry in a well-ventilated space and let it dry for a day. That's all there is to it. Now for the less complicated technique, the single coat sizing option.

Figure 18–13
Christopher James, *John Q. w/ His Own Negative*, 2005 (cyan & gum)
This portrait of photographer John Quackenbos began its life as a relatively high-contrast cyanotype. Once dried, the print was sized with gelatin and hardened with glyoxal so that I could do multiple gum bichromate passes. The reptilian texture in the face is made by splashing water on a fresh gum application and blotting with paper towels prior to exposure.
(Courtesy of the Artist/Author)

Step 4 **Glyoxal and Gelatin Single-Step Immersion Option** Put on a new pair of examination gloves, make sure your ventilation is excellent (preferably outdoors), and protect your eyes. This single-step option takes the place of the two-step gelatin and gelatin-hardening process of paper preparation for gum bichromate. For quite a long time, especially in workshops, I have been using this single-step immersion option for glyoxal sizing. It works very well and is an excellent alternative to multi-stage sizing if you are only going to be doing a single gum bichromate pass on an existing print done in another process, as in the cases of the Photo Impressionists who routinely enhanced the black values in their platinum and palladium, and cyanotype prints with a single pass of black gum.

In this gelatin sizing and hardening procedure, the glyoxal is added to the prepared warm gelatin and the paper is subsequently immersed in the combined bath solution for 5 minutes, rinsed in cold water to harden the gelatin, and hung to dry. When hanging, hang by one corner for about a minute and then take the paper and hang it on the opposite corner. This will prevent a buildup of gelatin in one corner.

Single-Step Glyoxal & Gelatin Brush Coating Option

If you are in a particular hurry, you can simply coat the warm gelatin–glyoxal solution on your paper with an inexpensive foam brush in a single step and hang it up to dry. In both of these scenarios you should rotate the sized-hardened papers on the drying line every minute or so until the gelatin begins to set up. This prevents the gelatin from building up too heavily in the lower end of the paper. Here's the technique.

Step 1 Weigh out and mix 6.5 g of gelatin into 250 ml of distilled water and let the solution sit and bloom quietly for about 15–20 minutes. It is easier to make a larger volume of solution if you intend to coat a lot of paper. Keep your proportions the same, for example, 250 ml water, 6.5 g gelatin, and 15 ml 40 % glyoxal. You may add the baking soda for better bonding, but it is probably overkill.

Step 2 After the 15–20 minute "blooming" period, slowly bring the solution to a temperature of 120°F and be sure to not let it get hot enough to boil. I prefer to prepare the solution in a plastic beaker, which is placed in a pot of hot tap water. In this manner I can better control the temperature, and the beaker's shape allows me to stir the solution more easily.

Step 3 When the solution has warmed to approximately 120°F, add 15 ml of the prepared 40% glyoxal and stir easily until it is in solution. This all-in-one solution can then be used to prepare your paper either using an immersion

technique or coating with a foam or synthetic brush. When brush coating, be quite careful to go lightly with the brush so as not to disturb the surface of the paper. A single coating will be sufficient. Personally, I prefer the immersion technique but have had fine results with brush coating . . . either is fine.

Step 4 Cold water rinse: This step is quite important. Be sure to rinse the paper in a bath of cold, fresh water after using the immersion technique. If you're brush coating, the rinse is probably unnecessary. Hang the paper to dry and flip it over after 1 minute to prevent buildup of the gelatin on one edge. Let it hang for about a day and then get to work.

You can make up as much paper as you think you will work on in the next few years because that organic gelatin, just like the frogs you dissected in high school, is thoroughly preserved. I generally keep my prepared paper, like my gelatin-salted paper, in the freezer, in a freezer ziplock bag, because there is no humidity present.

The Formalin Option

If you have some formalin hanging around the lab, formalin sizing works well as a sizing-hardening agent and was, at one time, the only sizing choice for serious gum bichromate printers unless they wanted to use formaldehyde. Formalin and formaldehyde are interchangeable in this context. Formaldehyde (HCHO) is a colorless, flammable, poisonous gas with a stifling odor. Although *formaldehyde* is a term applied to many hardening instructions in alternative texts, pure gaseous formaldehyde is uncommon because it readily polymerizes into solid para-formaldehyde that I have never seen and cannot accurately describe for you.

Formalin, a 37% (by weight) solution of formaldehyde in water with 15% methyl alcohol is commonly used as an antiseptic, disinfectant preservative for biological specimens and as the only alternative hardening agent for gelatin in this section.

Working Formalin Solution

To make the formalin hardening solution, you will need to add 25 ml of formalin to 1000 ml of distilled water. You may make proportionately smaller total volumes if your needs do not call for 1000 ml of solution.

Set up your trays outdoors, where it will be a good idea to stand with the wind at your back, and prepare the formalin solution. Wear Nitrile or latex gloves and a good dual-filtered respirator. Then set up a clothesline for hanging the hardened paper and take your dry gelatin-coated paper and immerse the sheets, one at a time, in the formalin solution. Add other dry gelatin-coated

Figure 18–14
Sarah Van Keuren, *Black Sweatshirt*, 2011 (gum)
Sarah is one of the leaders in the alternative process resurgence and has mentored hundreds over the years she has worked at the University of the Arts in Philadelphia. This gum bichromate print is one in a series finding the abstract and beautiful in the simple moments in life that we often overlook. In this case, a black sweatshirt on a clothesline.
(Courtesy of the Artist)

sheets to the tray and shuffle them gently, from bottom to top, until they are completely coated. Carefully remove the sheets and hang each on the clothesline to dry.

There are no safety shortcuts here. Do not take chances with formalin. There is a reason it was the primary chemical used by morticians to embalm bodies and why every frog you ever dissected in high school was in a bottle filled with it. Don't even begin to think about the fact that your nose was inches away from that formalin-preserved frog, indoors, during all of those biology labs. Remember, please, that chemistry that can preserve dead frogs is probably not healthy for the living tissue. Of course, you can argue that food preservatives perform a similar task, but that is a different book.

Clean up by pouring any leftover formalin hardening solution into a labeled glass jar and tape it shut. Be sure to store the jar in a place that cannot be reached by small children. This working solution will obviously keep indefinitely.

THE GUM BICHROMATE NEGATIVE

Because gum bichromate, like other alternative processes, is a direct contact printing process it is necessary to work with negatives that are the same size as your desired final image. It is certainly possible to make a fine gum print using a single negative by altering the sensitizer specifics such as amount of pigment and overall exposure. The majority of your gum printing experience will utilize sets of different density negatives in order to perform multiple "passes" (applications of sensitizer and exposure) of sensitized color. For this reason, it is common to have a set of *registered* negatives with which to successfully print a selection of highlights, midtones, and shadow details on the same paper substrate. Of course, if you wish to be more free form than that and not have anything match up, that's perfectly fine as well. Registration is important if you really want to control how specific the details and placement of the negatives are during the evolution of the gum print.

If your intention is to have a single color gum with many applications of the same color, one negative may be all that you will require, providing it is well defined and full of tonal values to manipulate. If your intention is to deepen the shadows of a previously made print, or perhaps alter that print's coloration in the shadows, such as a gum over a cyanotype or platinum/palladium, then a single negative may also be adequate. With a single negative, it's only necessary to adjust the

Figure 18–15
Aris Slater-Sandoval, *Expectations*, 2011 (gum)
Aris made this gum bichromate image in her first year in my MFA in Photography program in Boston. It is part of a series about the ending of a relationship and visually saying goodbye.
(Courtesy of the Artist)

concentration of pigment, exposure, and or amount of sensitizer in order to make a fully resolved image . . . as long as your negative is a good one.

It is advisable to have negatives that would be appropriate for a normal grade of silver gelatin paper (if that were still a relevant reference—insert sad emoticon). This means that the negative will have an average negative density of 1.0 to 1.8. This is a very general suggestion, unless you intend to make gums with inter-disciplinary intentions, where the tonal values are somewhat secondary to the concept. In that case, just go and play and see what happens. If you are looking for a full tonal range, and gum is more than capable of giving this to you, it is best to avoid negatives that are too high in contrast, unless, of course, that is what you're looking for. One thing is for sure: you can't go wrong pairing gum and high-contrast negatives, as they are practically fail-safe in providing a graphic impression.

There are far fewer film varieties and developers available than there were when the last edition was published a few years ago, so I'm going to keep my suggestions relatively uncomplicated. In the recent past I have been separating transparencies and print scans into separate C-M-Y-K (C = cyan, M = magenta, Y = yellow, K = black) files in Photoshop and printing them out digitally on Pictorico Ultra Premium OHP inkjet films http://diamond-jet.com/pictoricotop.aspx.

I have also been taking original color or black and white negatives and converting them to CMY and CMYK digital inkjet negative sets when I get in the mood to do some gum printing. My particular method is very easy, and it provides me with just enough control so I get what I want without having a geeky brain

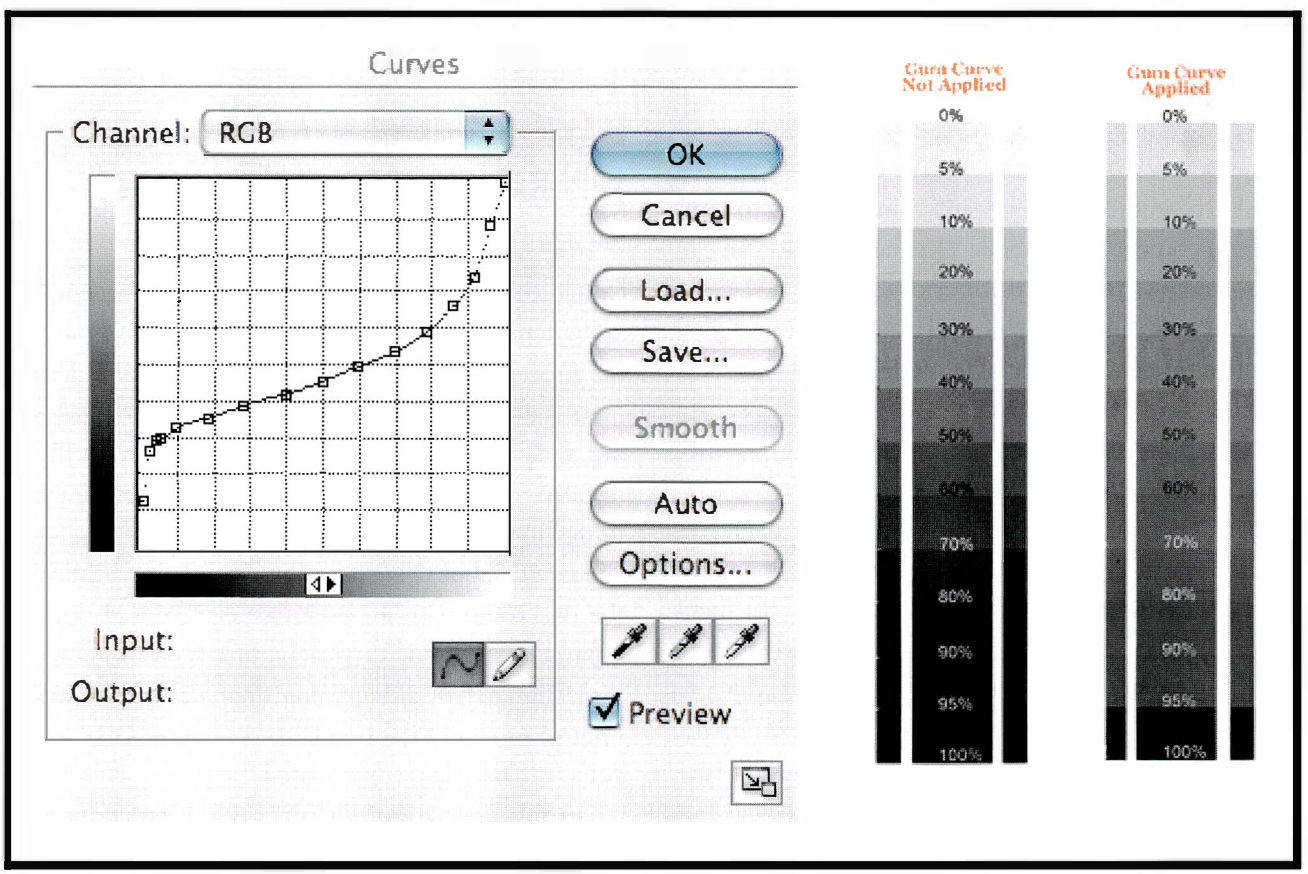


Figure 18–16

Applied Gum Bichromate Curve and Comparative Step Wedges

As an example of the tonal increase possible with custom curve profiles, I went to Malin Fabri's alternative process web site and took advantage of a free custom curve download made by David Hatton. This illustration shows what the adjusted curve looks like and how a step wedge indicates the increase in steps due to the curve adjustment.

(Courtesy of www.alternativephotography.com)

Figure 18–17
Peter Lindstrom, *Camden Street, No1*, 2009 (gum over cyanotype)
Former workshop student and friend Peter Lindstrom created this lovely and atmospheric gum bichromate over cyanotype image in Camden, Maine. I think that if you look closely you can see the Belted Galloway cows in the meadow.
(Courtesy of the Artist)

melt and ending up becoming overly compulsive about the perfect digital negative. There are books written about this subject, and my intention here is to simply help you get a nice serviceable negative so you can learn gum bichromate printing.

That said, in almost every situation these digital negatives are perfectly satisfactory for gum bichromate printing, and they provide a flexibility and speed in negative reproduction that only Polaroid Type 55, once upon a time, matched.

You may also wish to consider using negatives made from laser copy machines or making your own with a cliché verre technique. Cliché verre, as mentioned earlier, describes a handmade negative on a transparent base of glass or acetate. It is usually created by applying liquid resists, such as paint, syrup, asphaltum, varnish, oils, or ink, to a transparent substrate such as glass or Plexiglas. As always, the degrees of transparency, or zones of density, in the various resists allow light to pass through according to their level of translucence; less resist equals more exposure and vice versa. I suggest these more playful alternatives because gum invites those associations.

MAKING DIGITAL NEGATIVE SEPARATIONS FOR GUM PRINTING

Simple Workflow in Photoshop

Gum bichromate artists have always had to accomplish a few tedious tasks before getting to the fun parts of the process with all the colors and splashing around their trays out in the sunshine. Along with paper sizing, making CMYK (Cyan, Magenta, Yellow, & Black) negative separations was one of my least favorite things to do for a day in the studio. In the beginning you could shoot the separations in camera or move to the darkroom with an existing negative and do your separations there with various film types, filters, and projection. Then along came digital imaging, Adobe Photoshop, and Pictorico Ultra Premium OHP and it got a whole lot less complicated.

In the first edition of this book I was impressed with Photoshop v.5 and by the fact that I could make CMYK separations from a black and white source with only 26 easy steps. I called it the "speedy, non-fussy version" at the time. In the second edition I wrote, "Now I'm using Photoshop CS2. Next month I'll probably be

using Photoshop CS3." Well, now I'm using Photoshop CS5 and upgrading to CS6 in a month to make sure this advice still works. No matter, the fact is that with CS2, CS3, CS4, CS5, or whatever, I can describe for you how to go from a black and white grayscale to a CMYK, or from an R-G-B (red-green-blue) source to C-M-Y (cyan-magenta-yellow), or grayscale, in a flash. Best of all, it really is speedy and simple, even for the technical neophyte or Neanderthal.

The following sequences are a good start. They are absolutely *not* the last word in making digital separations on Pictorico Ultra Premium OHP film or designing your own custom curve profiles, and they're not the most sophisticated way to go from grayscale to RGB to CMYK. They are, however, designed for play and simplicity and offer the opportunity to make negative separation sets that will look different and that are unique, creative, and innovative.

These particular workflows are ones that I've been working on with the help of several friends: David Stinchcomb in Oklahoma, Tony Gonzalez in New York, and xtine Burrough in California. Their brains don't melt when they think about digital things, and they were a great help in getting much of this information into a simple and easy-to-follow workflow. What I ended up doing was taking their good advice, and in some cases, condensing it even more so that someone with the most rudimentary Photoshop skills could make serviceable gum bichromate negatives. As I wrote a few paragraphs earlier, Tony Gonzalez's very sophisticated, 3-color CMY digital negative and registration workflow will come later in this chapter. If you want real perfection, this is the workflow for you.

As with any alternative syntax in any medium, individuals will adjust the steps in any process to suit their individual needs. Again, these are only workflow recommendations, but they do work well and will certainly get you started.

I want to emphasize this: the separations I am offering here are simple workflows designed for those who just want to have an easy and adequate way to generate their digital negatives quickly. If you are really serious about perfection and knowing everything there is to know about this subject, then you will want to consider graduating to advanced-level considerations such as those developed by Dan Burkholder or Mark Nelson. Dan's web site (http://www.danburkholder.com) and book are amazingly complete, and he has custom profiles and instructions for just about everything you will need. You can find Mark Nelson's advice in Dick Arentz's *Platinum and Palladium Printing*, second edition.

GRAYSCALE TO RGB TO CMYK SEPARATIONS FOR GUM BICHROMATE

Alicia, New Mexico, 2012: Gum Separation Sequence & Workflow

In this example, I made a wet collodion plate of Alicia, who was a participant in one of my annual wet plate collodion workshops at the Santa Fe Photographic Workshops. A month later I was teaching a workshop at the Center for Photography in Woodstock, New York and decided to use the plate as an example for a very simple gum bichromate separation workflow that would serve as an introduction to the concept of making your own negative separations from an existing image.

Note: In this grid: Top Left: Original wet plate collodion. Top Middle: RGB interpretation from scan of wet plate and adjusted for subjective intent in Photoshop. Top Right: After conversion to CMYK and separated into channels this is the cyan channel. Bottom Left: Magenta channel. Bottom Middle: Yellow channel. Bottom Right: Black channel

For Output on Pictorico Ultra Premium OHP in Photoshop

I began this gum separation sequence by taking one of my recent wet plate collodion plates (grayscale) and scanning it into Photoshop as an RGB file so that I might play around with it a little before making my gum separations in CMYK. I then made coloration adjustments using a few of Photoshop's tools, for example, Levels, Curves, Hue and Saturation, and Color Balance.

Figure 18–18

Christopher James, *Alicia*, New Mexico gum separations, 2012

In this grid: Top Left: Original wet plate collodion. Top Middle: RGB interpretation from scan of wet plate and adjusted for subjective intent in Photoshop. Top Right: After conversion to CMYK and separated into channels, this is the cyan channel. Bottom Left: Magenta channel. Bottom Middle: Yellow channel. Bottom Right: Black channel.

(Courtesy of the Artist/Author)

Step 1 Scan the image into Photoshop and save it as an RGB file.

Step 2 Open up your image file and work on it in Photoshop until it meets your expectations and intentions. Save it with a label that will indicate that it is specifically for the particular set of CMYK negatives you are making.

Step 3 Go to > Menu Bar, and then to > Image, and then to > Mode, and then click > CMYK.

Step 4 Go to > Image, then to > Adjustments, and click > Invert.

Note: You have an option at this point in the process. Some gummists are seeking a set of negatives that are really "punchy" and have a good deal of contrast. If you are one of these folks then this is where you will go to > Image, then to > adjustment, and click > Curves. In Curves, set the center point on the diagonal line and then make an "S" curve out of that diagonal line until your contrast level pleases you. This is really elementary stuff and not an academic exercise in scientific perfection . . . that will come later. This is about play.

If you are seeking a more true-to-life CMYK interpretation of an actual color set, then you might want to skip this step. Try it both ways and see what you like. At some point in the process you will be

adjusting levels, and by doing so, the contrast levels of your negatives. Depending on the type of negative separation set you want—contrasty or sort of true-to-life—you can adjust now or after you make your separation set.

Step 5 Next, go to the information palette that is probably on your screen, the one indicating Layers, Channels, and Paths. Click > Channels and then look for the tiny arrow pointer in the top right corner of the palette box you just opened. Click > Split Channels and Presto! Photoshop will automatically create four separate, distinct CMYK negatives for you. These are your separations.

Step 6 For each of these negatives go to > File and to > Save As. Title your negative whatever you need to name the file in order to remember it. I name my sets by the title of the image and what color negative I will be applying when gum printing, for example, Cyan, Magenta, Yellow, or Black.

Step 7 Go to > Image, then to > Adjustments, and > click Levels and adjust the Levels manually, bringing the left and right adjustment markers to the extreme ends of the Levels histogram. Do this step for each of your separations. Keep in mind that you are making a unique set of negatives here and that you can adjust the contrast of these negatives using Levels or Curves to suit your needs or the type of color you are using. This will make sense once you begin doing the actual gum printing.

Step 8 Go to > Image, to > Canvas Size, and give yourself a black or gray border to use for registration marks, pin holes, or other miscellaneous marks that will be your guide for gum registration. You can apply registration marks automatically with your printer in > Print With Preview . . . see below.

Step 9 Print out the CMYK negative separations using Pictorico Ultra Premium OHP ink jet film.

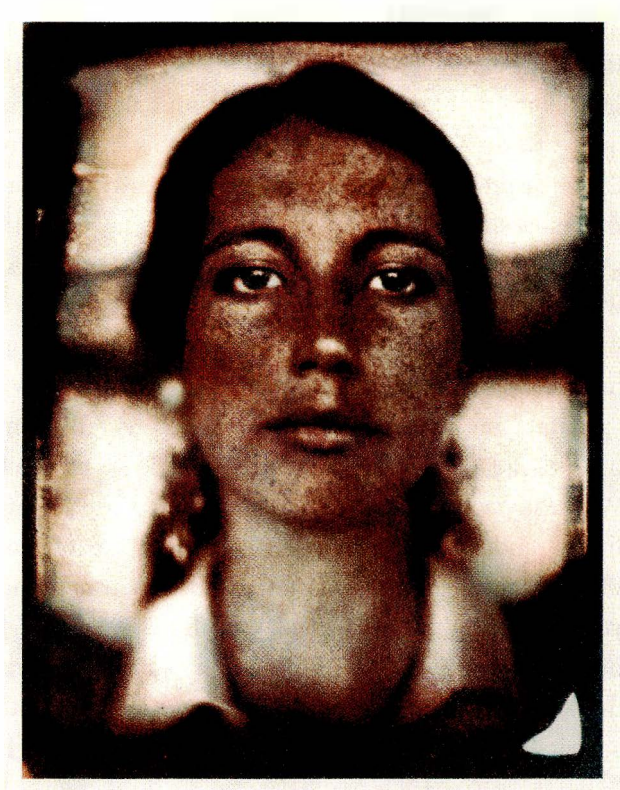


Figure 18–19
Christopher James, *Alicia in Gum #2*, 2012 (gum)
The finished gum print from a CMYK negative set made of scanned wet plate collodion image.
(Courtesy of the Artist/Author)

Final Print Sequence

1. Naples Yellow in sun for 2 minutes
2. Permanent Carmine (magenta) in sun for 1.5 minutes
3. Phthalo Blue in sun for 1.25 minutes
4. Separate Phthalo Blue in eyes for 1 minute in sun

Note: From this point on, remove the sensitizer coating in the eyes with a slightly damp Q-Tip before each exposure.

5. Lamp Black in sun for 2 minutes
6. Naples Yellow and Permanent Carmine mix in sun for 45 seconds
7. Naples Yellow and Permanent Carmine mix in sun for 45 seconds—second coat
8. Naples Yellow for 20 seconds in sun
9. Lamp Black for 30 seconds in sun

Adding Registration Marks

If you want to add registration marks to your film make sure that you have enough room outside of the image to do so. I will add here that this is how my Epson printer software allows me to create registration marks. Most printer software packages come with a method of adding registration marks to the printed works, but you may have to dig around in your own print dialog box to find something like "output," "crop marks," "printer marks," or "registration."

After you check to see if you have enough room on the outside of your image, go to File > to Print With Preview. There is a blue box under the Preview image, and if you click on it you will get a choice of Color Management or Output. Choose Output and you will get a rather large menu of things you can set up before printing. One of these items is registrations marks. Check that box, and if you have enough white space around your negative the marks will appear. If they don't appear, check the box that says "scale to fit media" and they will pop up because the program automatically resizes the image to include everything necessary.

If you really want simplicity, just make your own set of registration marks, sharpen them up in filters, make them the size that will fit into an area that you will surround your image with in the "Canvas" command, and cut and paste them into each corner of your negative set. Photoshop will help you line them up perfectly with guidelines. Flatten the entire image when you're done and you are good to go.

RGB to CMY GUM SEPARATION NEGATIVES

In the previous example (*Alicia, New Mexico*) we started with a grayscale image, converted it to RGB to work with it in color, and then converted that file into CMYK gum separations for the actual gum-printing

Figure 18–20
Tony Gonzalez, *Jaclyn* CMY Separation Set
This is the negative separation pack that was generated with the negative and custom curve profile shown earlier.
(Courtesy of the Artist)

sequence. In this example we are starting with an RGB color file, like one that you would get from your iPhone.

The workflow's intention is to convert it into a set of CMY (and possibly K if needed) grayscale separation negatives that you can use in your gum bichromate printing.

Step 1 Open up your image file and work on it in Photoshop until it meets your expectations and intentions. Save it with a label that will indicate that it is specifically for the particular set of CMY negatives that you are making.

Step 2 Go to > Image on the Menu Bar, then to > Mode, and then click > Multichannel.

Step 3 Next, go to the palette that is likely on your screen, indicating "Layers," "Channels," and "Paths." Click > Channels, and, using the tiny arrow on the top right corner of the palette, in this box click > Split Channels. You will automatically create three separate and distinct B and W positives for your CMY separations. Execute the following steps for each of the CMY files.

Step 4 Go to > Image, to > Adjustments, and click > Auto Levels. Or click > Levels instead and adjust your negative manually to your own taste. At some point in the process you will be adjusting levels, and by doing so, the contrast levels of your negatives. Depending on the type of negative separation set you want—contrasty or sort of true-to-life—you can adjust now or after you make your separation set.

Step 5 Go to > Image, to > Adjustments, and click > Invert.

Step 6 If you are advanced and have a gum bichromate curve that serves you well, go to > Image, to > Adjustments, to Curves, and click > Load.

Step 7 Find your Gum Curve in your curve folder and click > Load.

Step 8 Go to > Image, to > Canvas Size, and give yourself a black border to use for registration marks, pinholes, or other miscellaneous notes.

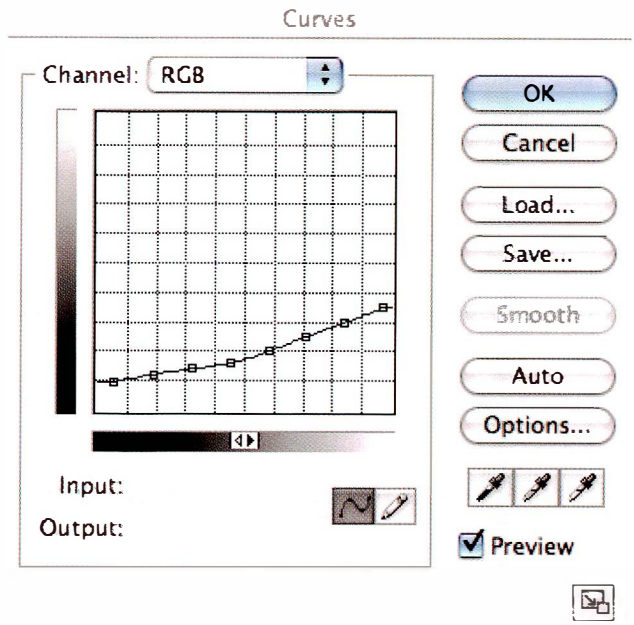


Figure 18–21
Gonzalez CMY Gum Curve Profile
This is the CMY (no K = black) custom curve profile that Queens College, CUNY professor and artist Tony Gonzalez applies to his gum bichromate negative set.
(Courtesy of the Artist)

Step 9 Go to > File and to > Save As and title your negative whatever you need to name the file in order to remember it. I label mine by the title of the image and what color negative I will be applying when gum printing.

Step 10 Check your levels one last time and continue to print out the negative separations using Pictorico OHP inkjet film.

REGISTRATION

Registration is done after sizing/hardening. If you intend to make multiple passes, or if you are working on a more complex gum, such as trying to duplicate a color transparency from four CMYK separations (see the previous workflows), it will be necessary to register your negatives. If you don't register them, you will often get curious and unexpected results where none of the CMYK separations line up. This accidental out-of-register image may well be a *good* technique, providing a cool looking bas-relief-like effect, if you use it intentionally.

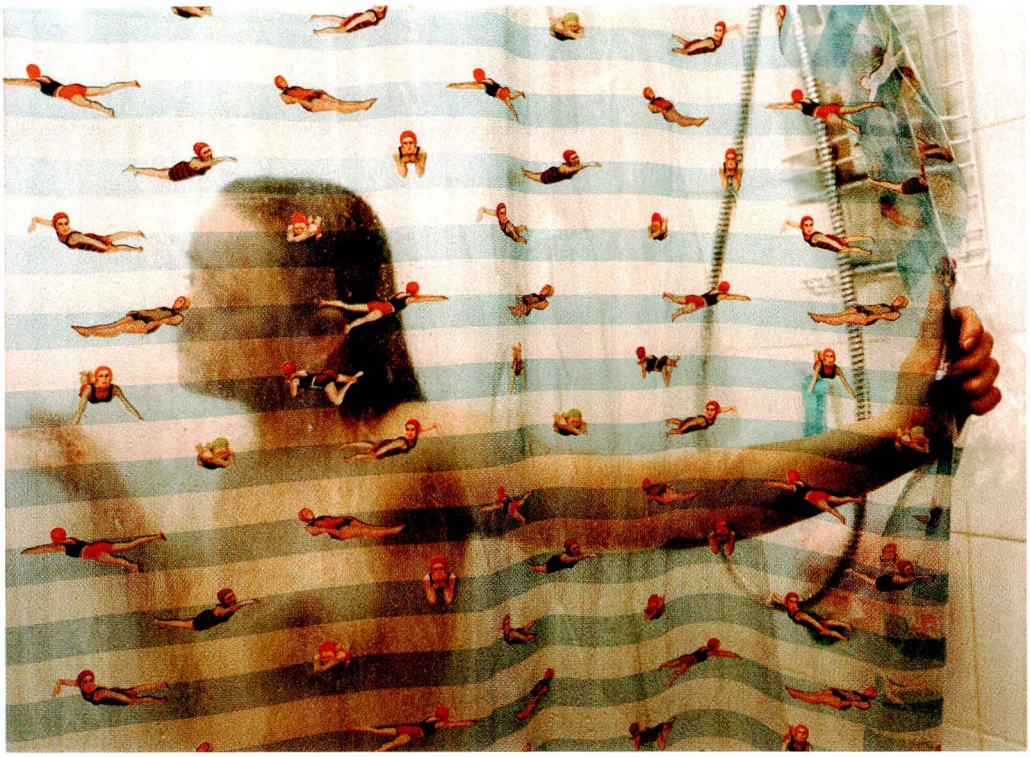


Figure 18–22
Tony Gonzalez, *Jaclyn Curtain*, 2005 (CMY gum)
Here's Tony's finished CMY gum bichromate print from the negative set in Figure 6–12. I really like the delicate tonal nature of Tony's custom curve profile for gum printing. It permits delicacy and allows the process to express subtle tonal shifts, something that gum has not been given a lot of credit for being able to do well.
(Courtesy of the Artist)

There are many ways to register negatives and paper. Some of the methods include Photoshop registration marks (see earlier discussion), paper punches, pushpin holes, stick-on transparent registration targets applied during negative production, or an old dye transfer punch-board that can easily be found on eBay. You can also register simply by laying your coated paper on a light table and quickly registering your negatives to the sensitized paper, and locking it in with pieces of transparent tape. This is harder to do with darker color layers, of course. Don't stress about the light from the light table. Even though your dried sensitizer is sensitive to light, you still have plenty of forgiveness in the exposure speed of the dichromate sensitizer and will have time to secure the registration without fogging the image, as long as you're efficient. The point of registration is to give you a repeatable, predictable, and mechanical way of accurately aligning your single or separation negatives on the same piece of paper. This is especially true when a different color is assigned to each negative and where it is difficult to see the base image after re-coating.

A Simple Registration Technique

On a light table, register all of the negatives to be used in your print. With a mat knife or sliding blade paper cutter, trim the top margin of each film separation so that all of them, except one, will be at different lengths when they are in perfect registration. On a light table, put them in registration and then run a strip of tape across the top of the packet of trimmed edges so they can be picked up as a set.

When this is done, place the packet of taped negatives on the area of your *sized* paper that you will be printing on. Move the sized paper and the taped negative pack to a clean and porous surface (such as Foam Core) that will accept a pushpin and poke a pinhole through at least three margins of the negative set and paper. These holes will serve as your registration reference guides later on. You can also successfully use a single-hole paper-punch in several locations outside of the picture area. Of course, if you wish to have a lot more control, then your registration techniques will have to be a lot more sophisticated than what I've described. If you have a strong urge to make this process more complicated, please feel free to do so.

Figure 18–23
John Quackenbos, #*A—gum*, 1999 (original 35mm)
The original 35mm transparency that was separated in a CMYK set in the darkroom on orthochromatic film.
(Courtesy of the Artist)

Figure 18–25
John Quackenbos, *Cyan Mural*, Maine-4 color gum, 1999
This is a gum bichromate print made from the CMYK set of separations.
(Courtesy of the Artist)

Figure 18–24
CMYK Gum Separation Grayscale Sequence
This is a CMYK set of separations, in grayscale, made to print a 4-color gum bichromate.
(Courtesy of the Artist/Author)

THE GUM BICHROMATE RECIPE

The sensitizer emulsion (I'll refer to this sensitizer with the word *emulsion* for the moment as it incorporates the very emulsion-like gum arabic in the formula) for gum bichromate printing is prepared in simple and separate steps. You begin by mixing up a saturated dichromate solution. Most gummists use either potassium or ammonium dichromate, but it is also acceptable to use sodium dichromate . . . although I don't know anyone who does.

Potassium dichromate is a bit softer than ammonium dichromate but clears out in the highlights better than ammonium dichromate. Potassium dichromate is also a slower sensitizer than ammonium dichromate and tends to yield a bit more contrast. Potassium dichromate takes a little bit longer to make a complete exposure, which is good; it also avoids yellow dichromate staining most of the time. Most serious gummists that I know use potassium dichromate.

For your information, the difference in total saturation (that point when no more of the chemical can be dissolved in water) between ammonium dichromate (25%) and potassium dichromate (13%) may be the reason they behave differently. If you were to add water to the ammonium dichromate, taking it to a 13% solution like the potassium, it is possible that you would avoid some of the less aggressive traits of ammonium dichromate.

The potassium or ammonium dichromate sensitizer is added to a mixture of gum arabic and watercolor paint to make the complete sensitizer solution for coating. Additional water can also be added and will help make your coating smoother and softer. The proportions of gum arabic to sensitizer can be adapted to suit your contrast and exposure time requirements as well. Some gum practitioners have been known to substitute a liquid rabbit skin glue or albumen for the gum arabic. Immediately you can begin to see that this process is not one in which hard and fast rules apply.

Potassium & Ammonium Dichromate

Potassium, or ammonium, dichromate is your UV-sensitive component and is added to your mix of liquid gum arabic and watercolor pigment to create the sensitized emulsion that will be coated upon your paper. Although this sensitizer is sensitive to UV light and is suitable only for contact printing under UV light,

Figure 18–26
Sarah Van Keuren, *On the Line,* 2010 (gum)
Another gum bichromate print of Sarah's discovering the aesthetics and painterly associations of something as simple as laundry drying on a line.
(Courtesy of the Artist)

you don't have to worry very much about working with it under normal low-light conditions because your sensitizer isn't all that sensitive until it is dry. I once gave a gum printing demonstration in a motel lobby where the motel's yellow sheets were hung over sun-filled windows. I performed another gum demonstration in the back of a van in a parking lot on a rainy day and had no problems with fogging there either. Avoid long periods of time under excessive fluorescent light as you would with other alternative processes.

An Interesting Fact Regarding Dichromates and the pH of Water

The speed of the emulsion will be slower in correlation to the pH of the water used in creating the coating sensitizer. The more alkaline the water is, the higher its pH (above 7), and the lower the dichromate's sensitivity to UV light. Conversely, the more acidic the water, the lower the pH (less than 7), and the greater the dichromate's sensitivity to UV light.

Making a Stock Saturated Dichromate Solution

Dichromates are used in gum sensitizers in a saturated solution. Again, a saturated solution is defined as one in which no more of the dry chemical can be dissolved in water without creating insoluble sediment.

As mentioned earlier, ammonium dichromate is saturated at around 25% to 28%, while potassium dichromate is saturated at 10% to 13%. Ammonium dichromate is more sensitive than potassium dichromate (due to more dichromate ions in the solution), but the only differences that you might notice will be shorter exposure times and a slight increase in contrast. Potassium dichromate is a little softer, and you will experience an easier time clearing the print with potassium in your sensitizer. Again, one factor will impact another, such as the pH of the water you saturate with, and you'll need to work out your own system to accurately predict outcome.

Let's say that you are going to use potassium dichromate in your sensitizer and you need to make a saturated solution. Knowing that potassium dichromate becomes saturated between 10% and 13%, take a digital gram scale and weigh out 10 g of potassium dichromate and stir it into 100 ml of water. This makes a 10% working dichromate solution . . . simple, huh?

There is a range here, and if you opted to make a saturated solution of 13% then you would be using 13 g to the 100 ml of water and this would be making a slightly faster sensitizer. In truth, you don't need a scale at all. Just keep adding the dichromate to the water until the dry chemical ceases to dissolve any more. When you have chemical "crumbs" on the bottom of your mixing container, you will have a saturated solution.

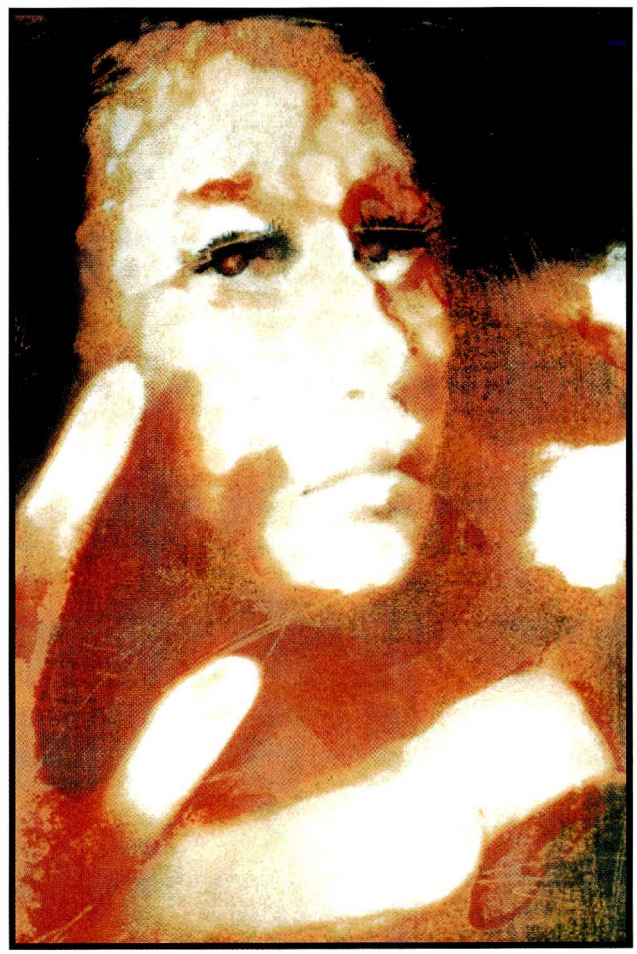


Figure 18–27
Christopher James, *Grace in Gum*, 1989 (gum)
This is from a series of gum bichromate portraits that I made from damaged inter-negatives that had been thrown in the trash in the Harvard photography labs. The final negative was enlarged on SO-132 direct duplicating film (sadly no longer made) and then used for several days' worth of gum bichromate exposures with paint, ink, dyes, bleaches, and etching tool abrasions in wet gelatin emulsion.
(Courtesy of the Artist/Author)

You can experiment and decide what strength is best for your own work. In any case, this saturated dichromate solution, whether it is the potassium or ammonium type, will last for a very long time when stored in a dark airtight bottle. Be sure to label the bottle with information regarding its contents, its percentage, and the date it was mixed. Be sure that the bottle has a plastic cap . . . —no metal ever! Lastly, be sure to store it in a safe place where children cannot reach it; when mixed, dichromate solutions look a lot like a sugared drink!

Note: Be cautious in how you handle ammonium or potassium dichromate: they are dangerous and poisonous and highly allergenic. Never put bare skin in contact with any dichromate solution. This chemical can cause lesions on your tender flesh through contact and can damage your lungs by breathing it in its dry state. Be very careful with storage, and never leave the chemistry unlabeled or where children can get their hands on it. Never throw dichromates in the trash dry, as they are self-combustible. Please reference the chemical section in the Appendix before using dichromates.

Watercolors: Artist Grade and Academy Grade

The watercolors you use must always be "professional" artist quality, *not* student or "academy" grade paint. Inferior paint often does not clear well in the highlights or the shadows, and it can be one of the primary reasons, besides poor paper preparation, too dilute a sensitizer, poor grade gum arabic, and too much sensitizer in the formula, for paper staining. There are almost no exceptions to this warning about academy grade paint.

The best paints that I've used have been manufactured by Schmincke Horadam Aquarell, Winsor & Newton (professional grade only), Linel (Lefrance & Bourgeois), and Sennelier. Stephen Livick once recommended adding twice the amount of pigment-to-gum ratio if using Sennelier (12 g pigment for every 12 ml of potassium dichromate), but his personal technique, which is pretty impressive, mandated that ratio. Each of these manufacturers has types of paint that are better than others, and you will spend a little money testing them.

Watercolor paint is composed of finely-ground microscopic pigments mixed with gum arabic or synthetic glycol for body and, as a binder, a brightener in the form of white crystals, glycerin or honey for viscosity and to assist in bonding the color to the substrate, and corn syrup to act as a humectant, helping the paint to stay moist. The only other ingredients you're likely to encounter will be clove oil, which is added on occasion to prevent mold growth, and dextrin to thicken the paint.

It would be a simple task to begin writing about watercolor paint but a much larger one to finish telling you everything there is to know about it. I'm going to explain a few basics and then leave the rest up to you. I would like to recommend that you try to locate a book called *The Wilcox Guide to the Finest Watercolour Paints,* by Michael Wilcox. You may also try to access the related web site, which is mind-boggling . . . just Google it. This site should satisfy even the most demanding scholar, which is lucky for you because copies of the book are quite rare. When I wrote the last edition, the book was very precious and I wrote that I had found two copies on Amazon for $165.00 each. Today, there is a far less expensive edition on that same site for $30.00, and even if it does use the word *best* instead of *finest* in the title, it would still be a most valuable addition to your library.

For beginning work it is a good idea to have "primary colors" from a single maker on hand. Schmincke or Winsor & Newton are good choices. The primary colors include red (alizarin crimson or permanent carmine), blue (phthalo or cobalt), and yellow (lemon yellow, new gamboge, or cadmium yellow medium). Winsor & Newton's Naples yellow is also a really nice color and is creamier than the other yellows, as is transparent yellow. You may also wish to have a black (lamp black) and a gray such as davy's gray, which is a very pale, creamy, greenish slate color. If you need a stronger green I would recommend oxide of chromium over a straight green, as it will clear better. You can also mix your own green from the blue and yellow you have in your primary set. Of course, you may use any color you wish from the manufacturer's stock as long

as the quality is good. Be aware that some colors are suspect with regard to permanence and ability to clear in the wash development stage. Those of you who are color blind or color-impaired might be considered very color-creative, so don't avoid the gum bichromate process for those reasons.

It would be numbing to provide a complete list of recommended paints because there are so many different brands of watercolor and gouache (watercolor with white pigment added), and a color from one manufacturer will behave quite differently than the identically named color from another. You will have to discover those that are best for you within the parameters you work in. Keep careful notes and you'll work it all out eventually. I would recommend going to the firestorm that is the alt process newsgroup and checking out its archives that discuss gum bichromate color.

Figure 18–28
Christina Anderson, *6 Can I* (gum over cyanotype)
A very powerful example of a multiple gum bichromate printing workflow on top of a cyanotype. Christina is one of the best in this genre of printmaking. *(Courtesy of the Artist)*

Note: Daniel Smith, one of the best art suppliers to be found anywhere, gives information regarding such things as "lightfastness" in its catalog. Daniel Smith also makes and sells its signature line of high-quality watercolors, and these can be found on its site: http://www.danielsmith.com.

Testing Pigments for Gum Printing

One of the best methods of testing a particular pigment for gum bichromate printing is to mix together a gum formula consisting of 12 ml gum arabic, 12 ml saturated potassium dichromate, and 1 g of the pigment being tested. Coat and dry your glyoxal–gelatin-sized paper; place an opaque object, like a coin, in the sensitized area; expose it to UV light for 15–20 minutes; and then process it normally in a soaking wash-development bath for 30 minutes. The paper under the opaque object should clear completely in the wash development bath. If it does not, the paint is not a suitable one for gum bichromate printing, or you may have over-exposed the test color, or you need to work on your sizing technique.

Recommended Paints Based on Gum Performance

OK, I know that I said I wasn't going to list all of the paints, but this short list will be enough to get you started on your experimentation with color and paint.

Schmincke Horadam: These are the colors that Tony Gonzalez uses: phthalo blue for cyan, permanent carmine for magenta, and cadmium yellow middle for yellow.

Lefrance & Bourgeois/Linel (Founded in 1720!): natural earth (lightfast raw umber), helios yellow, ruby red, hortensia blue, ivory black, peach black, cobalt blue, warm green, warm sepia, bayeux violet, naples yellow, viridian, venetian red

Winsor & Newton: cobalt blue, permanent rose, terre verte, oxide of chromium, naples yellow, rose madder, alizarin crimson (hue), lamp black, permanent magenta, davy's gray, cobalt violet, cerulean blue

Sennelier: cobalt blue, phthalo blue, lamp black, phthalo green deep, sennelier red, viridian, warm

sepia, permanent magenta, cerulean blue (very heavy paint!), yellow ochre

Daniel Smith: hansa yellow medium, prussian blue, permanent alizarin crimson

Papers for Gum Bichromate

It is important to use a paper that is well made, able to stand up to all sorts of abuse, and has superior wet strength. No wimpy papers are suitable for gum bichromate printing. They must be able to withstand repeated washing times of extended duration, as the process requires a complete wash after every pass and there is no limit to the number of passes you might perform on a single print. For minimal passes, a paper with a weight of 140 lb might be adequate.

For gum projects with several applications, exposures, and development experiences, a 300 lb paper will work well. I have used 1160 lb Arches when I have intended to make gums where I could use power tools and sanders as part of the working process. In all cases, even with high-quality watercolor papers, you must glyoxal–gelatin size the paper if more than a single pass is planned. My personal paper favorites are 300 lb Lana Aquarelle, well-sized 300 lb Fabriano Artistico (a luxury experience), Cot 320, and 300 lb Arches Aquarelle.

Mounting on Aluminum for Extended Gum Stages

In the last year or two, thanks to a recommendation by Keith Gerling, I've been recommending to students that they mount their paper on sheets of thin aluminum. The aluminum can be purchased easily at any hardware or Home Depot like store. The mounting tissue is a variety called Fusion 4000. All you need is your glyoxal–gelatin sized paper, a sheet of Fusion 4000 cut to size, a piece of thin aluminum slightly larger than the paper and tissue, and a dry mount press or flat iron.

Mounting the paper securely takes a minute or two in the press. If you wish to remove the paper from the aluminum at some point, you will need to return to the dry mount press and very patiently heat the paper and pry it away from the aluminum. I would strongly advise just leaving it alone once it is mounted.

Figure 18–29
Keith Gerling-Magnolia, *MN*, 1999/2010
Gum bichromate artist Keith Gerling has a really nice substrate preparation for his gum printing that is reminiscent of the way traditionally trained painters were taught to prepare wood and plaster panels for their paintings. Keith coats a wood panel with a mix of standard acrylic gesso and either powdered pumice or marble dust thinned with water. It's pretty much a 1:1:1 mixture by volume. There is no glyoxal in this formula, as there is nothing organic, like gelatin, for the glyoxal to affect. For aluminum he uses a mix of gelatin, glyoxal hardener, and marble dust (calcium carbonate) that works great and is impossible to remove. *(Courtesy of the Artist)*

A Different Sizing Option for Mounting on Aluminum

Here is one more great suggestion from Keith. He writes, "For aluminum I used a mix of gelatin, glyoxal hardener, and marble dust which works great (and is impossible to remove)."

Keith Gerling's Wood & Aluminum Substrates for Gum

Gum bichromate artist Keith Gerling has a really nice substrate preparation for his gum work that harkens back to the way traditionally trained painters were taught to prepare wood and plaster panels for their paintings. My grandfather, who was trained in Paris, used to prepare

his plaster panels in this manner, and they were flawless in their surface quality and light years different from other painting substrates like canvas and paper.

Keith coats a wood panel with a mix of standard acrylic gesso and either powdered pumice or marble dust thinned with water. It's pretty much a 1:1:1 mixture by volume. There is no glyoxal in this formula, as there is nothing organic, like gelatin, for the glyoxal to affect. Keith stresses that this "sizing" only works on wood, which has some natural absorbency.

Keith also works on aluminum sheets (discards from a printing supplier), and if he uses the same mixture as the one for wood panels, he will eventually have water seep under the gesso, causing blisters that peel off. For aluminum he uses a mix of gelatin, glyoxal hardener, and marble dust (calcium carbonate) that works great and is impossible to remove. Marble dust can be found in any decent art supply. He sands between coats for smoothness but leaves the rough surface alone if he wants the image to display a more significant surface texture and added "character" to the final image.

Keith writes, "I have no issues at all regarding the resiliency of the gesso in water. A much bigger issue is the wood itself (even marine plywood) swelling or warping, and that is only with very long immersions. In my 10+ years of printing gum I have used many substrates and the gesso coated wood panel is, by far, the easiest and most reliable. I arrived here by testing everything I could find that was large, inexpensive and didn't shrink: aluminum, tarpaper, and Tyvek."

The Positives

1) The panels are re-usable, which is very economical . . . very similar to making ambrotypes with wet collodion. If you don't like what you see, just remove the gesso-pumice and water mix and start over. 2) The wood panels are very easy to handle in the development process. Keith puts a screw-eye in the edge of the half-inch panels and uses it to remove them from the water, and hangs them up with s-hooks. 3) Also, there is no need for frames. The panels can be hung as modular units without the need of expensive framing. 4) Registration is done with a low-tech ice pick.

The Negatives

The 4' × 8' sheets of ½" plywood are difficult to move around and bring home from the lumber supply. Once cut into panels, the work is still expensive to ship and takes up a lot of studio storage space.

Figure 18–30
Keith Gerling, *Ranchester, WY,* 2012 (gum)
Here is another of Keith's powerful gum bichromate prints on a prepared alternative substrate.
(Courtesy of the Artist)

GUM ARABIC

Gum Arabic: Acacia Tree Sap

Gum arabic, or gum acacia, can be traced back in time to 2650 BCE, when it was harvested from the sap of various species of Acacia trees in Nigeria, Cameroon, Chad, Mali, and the Sudan. Acacia trees grow primarily in sub-Saharan (Sahel) areas of Africa, and the Sudanese variety is considered the premium grade.

Historically, gum arabic was the source of natural sugars and syrups, and in the Middle East the natural sap is sweetened, chilled and flavored, and served as a dessert. The primary components of glycoproteins and saccarides found in the acacia sap give it a glue-like adhesive property while simultaneously remaining non-toxic and edible. It is the binder in watercolor paint and in gum printing. The dichromate is added to the gum arabic to create the liquid foundation of the gum sensitizer. Gum arabic is also a main ingredient of gummy candies, marshmallows, cake decorations, and edible underwear. It is also used in soft drinks around the earth. This is funny . . . sort of.

In a 2007 press conference held in Washington, John Ukec Lueth Ukec, Sudan's ambassador to the United States and a politician who gained notoriety for downplaying the genocide in Darfur, threatened to stop the exportation of gum arabic from the Sudan if diplomatic sanctions due to the suspected relationship of the Sudanese government with the Janjaweed militia were imposed. During the speech, Ukec was surrounded by Coca-Cola products and was quoted as saying, "I want you to know that the gum arabic which runs all the soft drinks all over the world, including the United States, mainly 80 percent is imported from my country." He then raised his Coca-Cola bottle as if making a toast. A reporter then asked if Sudan was threatening to end the export of gum arabic from the Sudan and bring down the Western world. Ukec replied, "I can stop that gum arabic and all of us will have lost this," gesturing to the Coke bottle. I digress . . . consider that a commercial break.

Grades of Gum Arabic

Gum arabic can come in a variety of purities. Superior Selected Sudanese/Nigerian gum arabic is considered the premium grade and has a very pale color and clarity. This gum arabic is hand-selected, cleaned, and sifted free of any impurities and alien organic matter, and it is the grade of gum arabic that you would want to use with delicate colors such as yellow. It's also very expensive. Winsor & Newton sells this expensive Sudanese grade in tiny bottles for a lot of money.

Kordofan No. 1 is a good grade of gum arabic and is quite excellent for gum printing. This grade has a slight haze and is pale to dark yellow. This brand is good for just about everything and is sold by Bostick & Sullivan. After #1 comes the "Siftings" grade, which can be recognized by its cloudy and yellow amber color. This is pretty common and a step up from the lowest grade, "Dust #3," which is opaque and dark amber-brown. You'll find this grade in printmaking studios in art departments with restricted budgets. To be considered saleable, the gum arabic must have minimum moisture content of 12%–14%.

New versus Old Gum Arabic

One thing that seems to make a difference in gum printing is the age of the gum arabic. I've often heard that the way ammonium dichromate mixes with pigment, and the way it hardens during UV exposure, is better when the gum has aged a bit rather than when it is fresh and new. Older gum arabic tends to adhere to the paper more effectively and is somewhat responsible for more predictable and cleaner looking prints. Tony Gonzalez told me that he has four gallons aging in his darkroom.

A few gum bichromate artists claim that different types of gum arabic have different printing speeds. They are probably correct, but I'm not sure you should lose sleep over this possibility, as the process has enough complications as it is.

Essentially, you are buying the sap from an acacia tree, and its color does not always determine its quality. Most art supply outlets sell it by the quart or gallon to meet the requirements of printmakers and lithographers. In a pinch, you can use this grade of gum arabic and it will work out for you.

Preparing a Gum Arabic Solution From Dry Gum

Mixing gum arabic from a dry state is relatively simple; it just takes a little longer to get to the stage

where you can use the gum. The mix is essentially 1:6, for example, 30 g of photo-quality gum arabic to 180 ml distilled water. Put the two ingredients together in a glass or plastic beaker and let them stand for several days until the gum dissolves. Any residue can be filtered or strained off, leaving you with clear gum arabic to work with. Some of my friends add 0.50 g of mercuric chloride to the solution as a way of preventing bacterial and fungal growth in the solution. I'm not interested in being an advocate of this practice if you are not extremely familiar with chemistry and related safety precautions. Mercuric chloride is poisonous and lethal.

Using Glue as a Substitute for Gum Arabic

There is a nice idea for using liquid glue as a substitute for gum arabic. This formula is from the Randall Webb and Martin Reed book *Spirits of Salts*. First, make up a 5% potassium dichromate sensitizer (5 grams to 100 ml of distilled water). Next, place a small amount of watercolor pigment, about the size of a #2 pencil eraser, in a ceramic cup. Then add 5 ml liquid glue to the cup and stir it into the paint. The Webb–Reed book indicates that you shouldn't be concerned if the mixture is a "rubbery mess," but that could just be their sense of humor.

Add 5 ml of the 5% potassium dichromate mix to the "rubbery mess," mix the ingredients together, quickly coat your paper with a thin coating of the solution, dry it thoroughly, put the coated paper and negative in a printing frame, and expose in UV light. Presto!

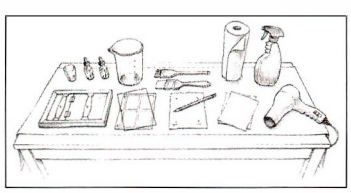
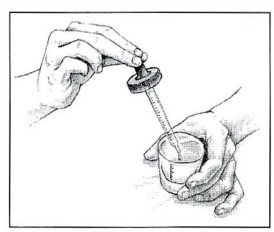


TABLE SETUP FOR THE GUM BICHROMATE PROCESS:

- Glyoxal and gelatin–sized paper
- A small measuring beaker able to measure in single ml increments
- Clean paper for the table surface
- A selection of brushes for coating; foam, Richeson or hake
- Clean water in a beaker for brush washing
- Pencil for marking paper with procedure notes
- Contact printing frame
- A selection of professional quality watercolor paints in tubes

  (Basic colors will include red, yellow, blue, and black. If separating CMYK, variations of cyan, magenta, yellow, and black.)
- Gum arabic
- A saturated solution of potassium (13%) or ammonium dichromate (25%)
- Negatives/CMYK or grayscale negatives for contact printing
- Paper towels
- A collection of small and sealable containers for the sensitizer mixes. The best ones tend to be urine sample containers or high-end plastic storage ware with rubber gaskets to prevent the mixed sensitizer from evaporating or leaking.



GUM BICHROMATE SENSITIZER

The Best Gum Sensitizing Emulsion

I imagine that this headline got your attention. The truth of the matter is that nearly everyone I know who is good at this process has a unique way of performing it, and this includes a recipe for the sensitizer. There are also so many variables to take into consideration that it is a small wonder that anyone agrees on anything connected to the process. As I wrote in the beginning, gum bichromate printers are generally the most stubborn and hard-headed of all the alt pro tribe.

The common consensus among contemporary gum bichromate printers is to use a sensitizer that will expose easily and clear quickly. The gum-to-sensitizer

Figure 18–31
Rebecca Welsh, *Gum Flower*, 2012
This is a very classic and elegant gum bichromate print by my wife Rebecca. *(Courtesy of the Artist)*

ratios run from 3:1 to 1:1 (ratio of gum arabic to potassium dichromate) with variations in the proportions depending upon when the "pass" occurs in the printing sequence and the gram weight of the paint used (which is really compulsive). We'll get to this later, but essentially what this means is that if you're making a yellow pass, your first sensitizer might be a gum-to-dichromate sensitizer ratio of 1:2. A second pass might then change to a gum-to-dichromate ratio of 1:1, and by doing this you will experience an increase in printing speed and a reduction in contrast.

If you take all of the variables out of the equation—the paper is fine, the sizing is perfect, the paint and gum is of excellent quality, and the dichromate is mixed to a perfect saturated state—then the ideal base sensitizer emulsion would be 1 part gum to 1 part dichromate sensitizer and usually ½" to 1" of watercolor paint out of the tube.

A Standard 1:1 Gum Sensitizer Using Potassium Dichromate

If all of the variables are under control and in good order, this formula is generally very successful, and the proportions of potassium dichromate to gum are similar to the mix used by many of the most technically successful gum artists. Use the following ingredients and mix them accordingly. Pigments have different densities, and different manufacturers make similar colors in different concentrations. Therefore, the amounts used in an 8" × 10" formula such as the one in the next example will fluctuate, depending upon the color and make of the paint. As an example, if you mix together a pinch of cadmium red and an equal amount of cerulean blue, thinking about making a purple, the cerulean blue, being heavier, will sink in solution and make its personality known on the substrate before the cadmium. This knowledge can help you make some pretty nice effects. Figure a half-gram weight to an average ½" to ¾" of paint to be in the ballpark.

6 ml gum arabic
½" to 1" watercolor pigment
6 ml saturated potassium dichromate solution

Begin by taking a clean paper cup and adding 6 ml of gum arabic to it. Then add your watercolor paint and stir it into the gum. You can add a little water if you want a less dense solution and a smoother coating and softer tonalities in the final print. Once into solution, add the 6 ml of potassium dichromate and stir it into solution. Your sensitizer is now ready to be applied to your glyoxal–gelatin sized paper.

Gum bichromate artist and friend, Carmen Lizardo uses a thinner sensitizer and mixes her formula using simple "kitchen" measures: 1 tsp gum, 1 tsp ammonium dichromate, 1 tsp pigment, and 1 tsp distilled water. There isn't much chance of this formula being misunderstood. Carmen says that she does alter the pigment-to-gum sensitizer ratio depending on the intensity of the pigment, for example, cadmium red versus a davy's gray.

Stephen Livick, who is one of the very best gum printers, has a very basic initial sensitizing emulsion formula that is similar to many other great gum

Figure 18–32
Carmen Lizardo, *American Flag Blue House,* 2006 (gum)
This great 22 × 30 gum is from Carmen's *American Flag* series. Carmen talks about this piece better than I can: "How do I belong to America when I belong no place else? This is one of the questions that birthed my American Flag series. I was born and raised Dominican yet have come alive, as an artist, as a woman, in America. Come alive in a culture, and English tongue, that is as alien and ambivalent to me as it is welcoming and inspiring. This series is a narrative of the journey of discovering the American in me. The source images were taken in the Dominican Republic, my home country, and in New York, my home."
(Courtesy of the Artist)

printers. The sensitizer is based on a 1:1 ratio of gum-to-potassium dichromate sensitizer with varying degree of paint depending upon color. He mixes 12 ml of gum and 12 ml saturated potassium dichromate. To this he adds the following:

- First Coat: 2.5 g linel's helios yellow
- Second Coat: 2.5 g linel's ruby red
- Third Coat: 4 g linel's hortensia blue

Figure 18–33
Stephen Livick, *Kali Mural #528,* 1991 (gum)
This image is an example of Stephen Livick's artistic and technical dexterity. This Canadian artist is one of the most fearless gum bichromate artists that I know of. Each of his mural size works takes a minimum of three months to execute.
(Courtesy of the Artist)

Notice that Stephen doesn't have a black (K) pass as he feels the three-color sequence makes quite enough black for his imagery. Tony Gonzalez is another gum printer who also foregoes the black pass in favor of a double cyan pass if needed for density.

THREE-COLOR CMY GUM BICHROMATE

It isn't always critical to have a set of CMYK separations to make a beautiful gum bichromate exposure. My friend, Tony Gonzalez, who teaches at Queens College in New York, has a terrific workflow that utilizes cyan, magenta, and yellow negatives that are made on Pictorico OHP ink jet film and an Epson 1400 printer (Figure 16-12).

In detailing the way he makes his CMY negatives Tony explained that he did extensive testing using his Epson 1400, Pictorico Ultra Premium OHP film, and Epson's Claria® Hi-Definition inks. Using the X-Rite Densitometer Model 331C, he determined the percentage of black ink that would be equivalent to the density of silver in the Stouffer 21 Step Tablet. Knowing that a 21% black density is equivalent to step #2, 49% black is equivalent to step #3, and so forth, Tony then based his curve profile on an 8-step (including D-min and D-max) tonal scale that is more or less the tonal range he concluded that he could achieve in his gum prints.

As you can see in the following description of an 11-layer set of exposures, Tony is printing a very short black pass at the end but is using his cyan negative for the exposure. (If you forgot how to make a cyan negative, you can refer back in this chapter for instructions or go to the Alternative Negative chapter). In the following gum workflow set, Tony uses the following Schmincke Horadam watercolor pigments. These are not the most expensive watercolor paints, but they work extraordinarily well for him and for his system.

Gonzalez CMYK Gum Color Equivalents

- Magenta: Schmincke Horadam permanent carmine
- Yellow: Schmincke Horadam cadmium yellow middle
- Cyan: Schmincke Horadam phthalo blue
- Black: Winsor Newton lamp black (using the cyan negative)

Tony's Gum Recipe

For the sensitizer, the gum-to-dichromate ratio is 1:1. For his negatives, Tony uses 12 full eyedroppers of gum and 12 full eyedroppers of ammonium dichromate to start with and then increases the gum-to-dichromate ratio to achieve greater contrast in subsequent layers. He uses a 1" worm squeeze of pigment for cyan,

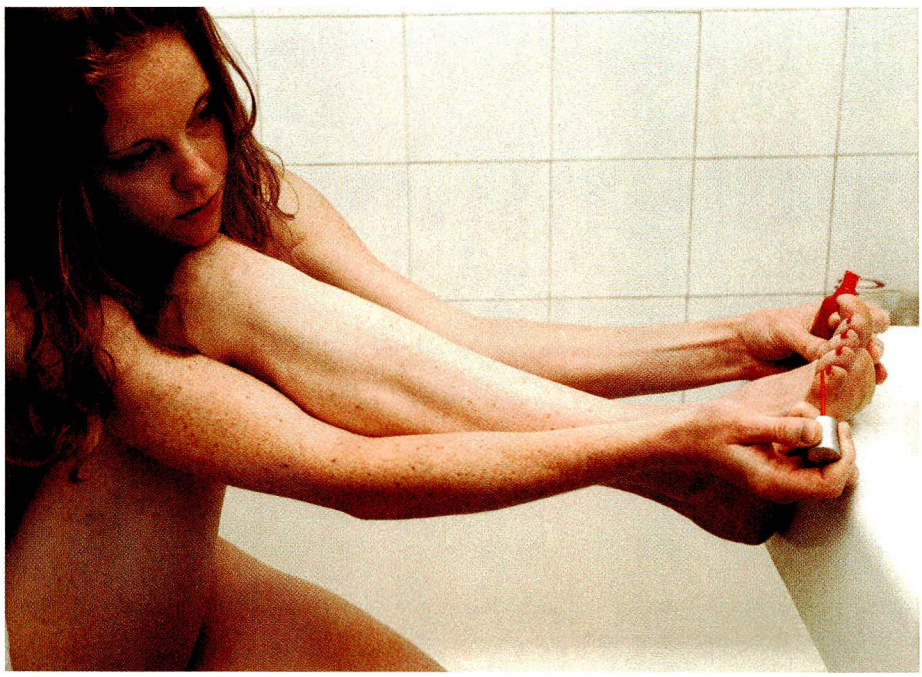


Figure 18–34
Tony Gonzalez, *Rachel, Nail Polish,* 2004 (CMY gum)
Here's another example of Tony Gonzalez's gum bichromate work from his *Bather* series. These images are generated from CMY digital negative sets printed out on Pictorico OHP inkjet film.
(Courtesy of the Artist)

magenta, and yellow paints. For the black equivalent, use a 1/4" worm squeeze of W & N black paint, but use the cyan negative for the last exposure.

Gonzalez Exposure Unit

Note: Exposures are made using an exposure unit with an outside dimension of 18" × 32". Inside the unit are eight Sylvania 20 W 24-inch bulbs (F20T12/350BL/ECO) about 3 inches away from the print. All bulbs are connected to a GraLab Timer, which turns off the bulbs at the end of the exposure time. You can purchase these bulbs inexpensively. See the Resources section in the appendices.

Gonzalez's Gum Bichromate Workflow

Layer #1 Cyanotype: 10 ml of each A & B Cyanotype sensitizer chemistry. Expose for 10 minutes in a UV unit—enough to make step #3 on a step scale disappear.

Layer#2 Magenta Negative: At a 1:1 gum-to-sensitizer ratio (12 full eyedroppers of gum and 12 full eyedroppers of ammonium dichromate), expose for 1 minute and 30 seconds—enough to achieve a slight tone in step #3. Develop in "still" cold water for ½ hour.

Layer#3 Yellow Negative: At a 1:1 gum-to-sensitizer ratio (12 full eyedroppers of gum and 12 full eyedroppers of ammonium dichromate), expose for 1 minute and 30 seconds—enough to achieve slight tone in step #3. Develop in "still" cold water for ½ hour.

Layer #4 Cyan Negative: At a 1:1 gum-to-sensitizer ratio (12 full eyedroppers of gum and 12 full eyedroppers of ammonium dichromate), expose for 1 minute and 30 seconds—enough to achieve slight tone in step #3. Develop in "still" cold water for ½ hour.

Layer #5 Magenta Negative: Combine 13 full eyedroppers of gum and 11 full eyedroppers of ammonium dichromate. Expose for 6 minutes and 30 seconds—enough to achieve slight tone in step #8. Develop in "still" cold water for ½ hour.

Layer #6 Yellow Negative: Combine 13 full eyedroppers of gum and 11 full eyedroppers of ammonium dichromate. Expose for 6 minutes and 30 seconds—enough to achieve slight tone in step #8. Develop in "still" cold water for ½ hour.

Layer #7 Cyan Negative: Combine 13 full eyedroppers of gum and 11 full eyedroppers of ammonium dichromate. Expose for 6 minutes and 30 seconds—enough to achieve slight tone in step #8. Develop in "still" cold water for ½ hour.

Layer #8 Magenta Negative: Combine 14 full eyedroppers of gum and 10 full eyedroppers of ammonium dichromate. Expose for 1 minute—enough to achieve tone no greater than step #2. Develop in "still" cold water for ½ hour.

Layer #9 Yellow Negative: Combine 14 full eyedroppers of gum and 10 full eyedroppers of ammonium dichromate. Expose for 1 minute—enough to achieve tone no greater than step #2. Develop in "still" cold water for ½ hour.

Layer #10 Cyan Negative: Combine 14 full eyedroppers of gum and 10 full eyedroppers of ammonium dichromate. Expose for 1 minute—enough to achieve tone no greater than step #2. Develop in "still" cold water for ½ hour.

Layer #11 Lamp black pigment using cyan negative: Combine 14 full eyedroppers of gum and 10 full eyedroppers of ammonium dichromate. Expose for 30 seconds—enough to make step #2 disappear. Develop in "still" cold water for ½ hour.

A Traditional Gum Sensitizer Option

9 ml gum arabic
1/2" to 1" artist's grade watercolor pigment
3 ml saturated ammonium or potassium dichromate

This is a time-honored formula that you'll find in a lot of literature and one that tends to clear very well due to the abundance of gum arabic in the sensitizer. It does, however, provide a rather soft impression in each pass. Begin by adding the 9 ml of gum arabic to a small plastic or glass container. Next add the watercolor paint and stir the paint into the gum until it's smooth. Add a little water if you want a smoother coating or if the air is very dry. To sensitize this paste, add 3 ml of a saturated ammonium, or potassium, dichromate solution and stir it into solution. Please be aware that this formula is one of those old "horses" that has made its way from one source to another since the beginning of gum's time (more or less). It works perfectly well,

but it isn't by any means the last word in gum formulas. I like it for workshops because not many things go wrong with it. Individuals will adopt thier own personal working styles, techniques, and mixes to suit their intentions and their imagery. In addition, each person's coating technique, washing style, or purist to non-purist approach will be different according to who that person is and what is needed from the ratios and combinations of gum, paint, and dichromate. As they say in the gum circles, "It's not how impeccable your formula is; it's how you use it."

An Alternative Sensitizing Formula: "The 5-10-10"

Here's another formula that I like for large pieces because the sensitizer doesn't dry as quickly and the details are pretty nice after each pass. This sensitizer formula makes a coating that is texturally smooth and a bit pale. As I said, it's a good choice for print details that are delicate and built up patiently over subsequent exposures. This is also a great formula for darker colors used to increase shadow depth in gum and combination processes such as gum and cyanotype.

10 ml gum arabic
10 ml warm distilled water
1" or more of quality watercolor paint
5 ml ammonium or potassium dichromate

FIRST PASS OPTIONS

When your paper has been correctly sized and hardened and you have registered your negatives with the paper so that multiple applications of exposure are possible, it is time to coat the paper. If this is your first experience with gum, or if you have not had much success with the process before, choose one of the dichromate formulas given previously.

Figure 18–35
Aspen Hochhalter, clear gum test, 2011
This is an example of a clear gum test made with gum arabic and the dichromate on her way to creating a dusting on process as in Figure 18–5.
(Courtesy of the Artist)

Gum and Dichromate Only Without Pigment First Pass

It is not uncommon to make a first exposure pass using only the gum arabic and the dichromate sensitizer. The exposure with this two-part mix will give you a light, tan-colored positive image from your negative. The benefits are that this light tan pass will not be too influential upon other subsequent colors and it will give you a very uncomplicated way to register visually.

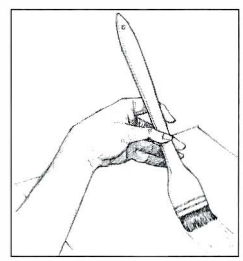
Cyanotype as a First Pass

Another option is to make your first blue pass with a cyanotype. In this case, your initial base color will be blue and will take the place of the cyan in your CMYK sequence. The benefits of this are immediate. A first layer of cyanotype will give you great detail and do a lot to enhance the D-max (maximum density) of the final image faster than building it up through multiple exposures of watercolor. This means less time for the paper in wash water. A good piece of advice is to add a few drops of 1% ammonium dichromate to the cyanotype A & B mix to increase contrast in the cyanotype. This means there will be less influence on subsequent colors in the middle range tonalities.

Straight Sensitizer Formula First Pass

Select the color(s) you wish to mix for the first coating. Generally, a lighter value is used first so that you can get a sense of where you will be going with the print. Sometimes it will determine if there is actually anywhere to go with it. This is one of the reasons why a gum dichromate or cyanotype first pass is often a great place to begin. Measure a small amount of watercolor pigment into the gum and stir it well until it is thoroughly in solution. Now add the dichromate sensitizer under low light and stir slowly until all of the ingredients are melded together as one.

It is quite permissible to work under normal ambient room light conditions, but I generally prefer to *mix* my colors and gum solution under a brighter light so I can better evaluate them. It is also a good idea to paint a piece of the scrap paper with your intended emulsion and blow-dry it to quickly see what the color will look like when it's not wet. Keep in mind that when you add the dichromate to the watercolor/gum arabic solution the color will change due to the orange color of the dichromate sensitizer. Please don't worry about this change, because the orange color will wash out during processing.



COATING

Coating a gum bichromate sensitized emulsion on paper is not difficult, but it requires practice. There are several ways to coat well. The standard technique is to work on dry, glyoxal–gelatin sized watercolor

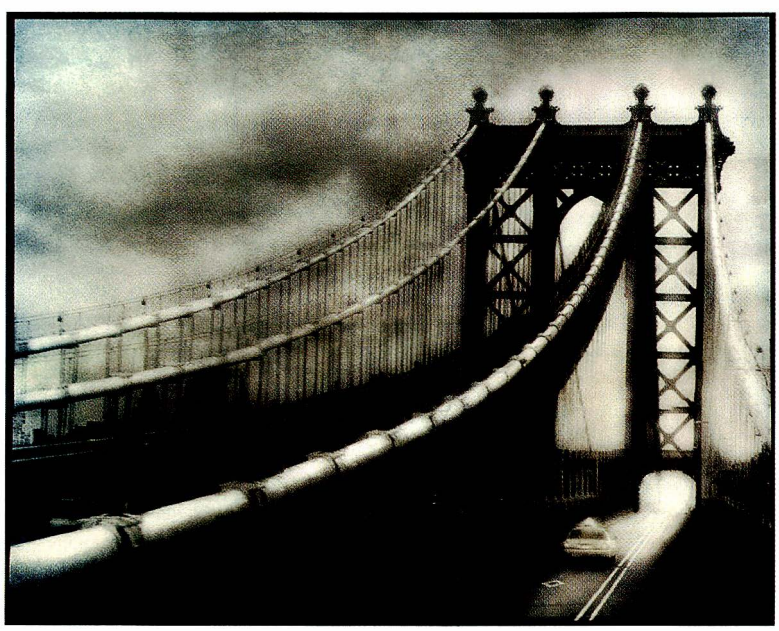


Figure 18–36
Peter Liepke, *A New Day*, 2011, (gum over cyan over Pt-Pd)
Peter's triple process image is quite extraordinary. The paper was first prepared by dry-mounting it permanently onto a substrate sheet of aluminum and with pin registration to allow for multi-coating. Coat #1 is a Pt/Pd 20-minute exposure. Coat #2 is a cyanotype for 40 minutes in direct sunlight. Once the print was washed and dried, it was brushed the print with two coats gelatin and glyoxal hardener. Coat #3 is a gum coat for 10 minutes using Sennelier watercolor Lamp Black and a slight amount of Paynes gray pigment. All of the coats were done with my usual method of using a digitally enlarged waxed paper negative.
(© Peter Liepke Photographs)

paper using a hake or foam brush. Mark the printing area with light pencil registration marks, and quickly brush-coat the sensitizer in even vertical, and then horizontal, strokes. Work fast, lightly, and smoothly until the emulsion just begins to become tacky. You will feel the brush begin to drag a bit because the tacky gum arabic is becoming less fluid.

Select the width of your brush by the size of the area that you are coating. A very simple and inexpensive solution to brush coating is to go to a hardware store and buy a selection of various width foam brushes. These can be discarded after the end of a working session, and you eliminate the risk of contamination and hake hairs falling into your tacky emulsion. I personally prefer working with synthetic Richeson brushes because they coat very smoothly and are very easy to wash out and dry quickly, something the foam brush can't boast about. The Richeson brush, being synthetic, absorbs practically no sensitizer. A strong case can be made for using the foam brush as well in that all you need to do is gently moisten the brush with a dropper of distilled water and gently blot it with a paper towel and get to coating. Be careful to paint lightly, cover the entire area that will be printed quickly, and be graceful with the coating.

When the emulsion begins to "set up" (looks and feels more gummy than liquid), take a clean, dry 4" hake or Richeson brush and very gently whisk it back and forth until all of your application streaks have blended into a smooth coating. Barely touch the paper when doing this and you will appreciate the results. Of course, if your intention is to have a coating that is not smooth, but more "painterly," just go with your instincts and coat gesturally to your heart's content.

When you are satisfied with the look of the coated surface, allow the sensitized paper to dry in a low-light environment; don't force-dry it with a hairdryer unless you have the dryer set on a cool setting. Write down all of the technical information, such as the coating formula, paint amounts, paint type, date, time of exposure, and stage of the print. Write this information also on the back of the paper for reference. Gum printing is about strategy and acquired knowledge more than intuition and impulse.

An Alternative Wet Coating Technique

An alternative method of coating is to initially soak the glyoxal–gelatin prepared paper in room temperature water for a few minutes. If you have a way to evenly

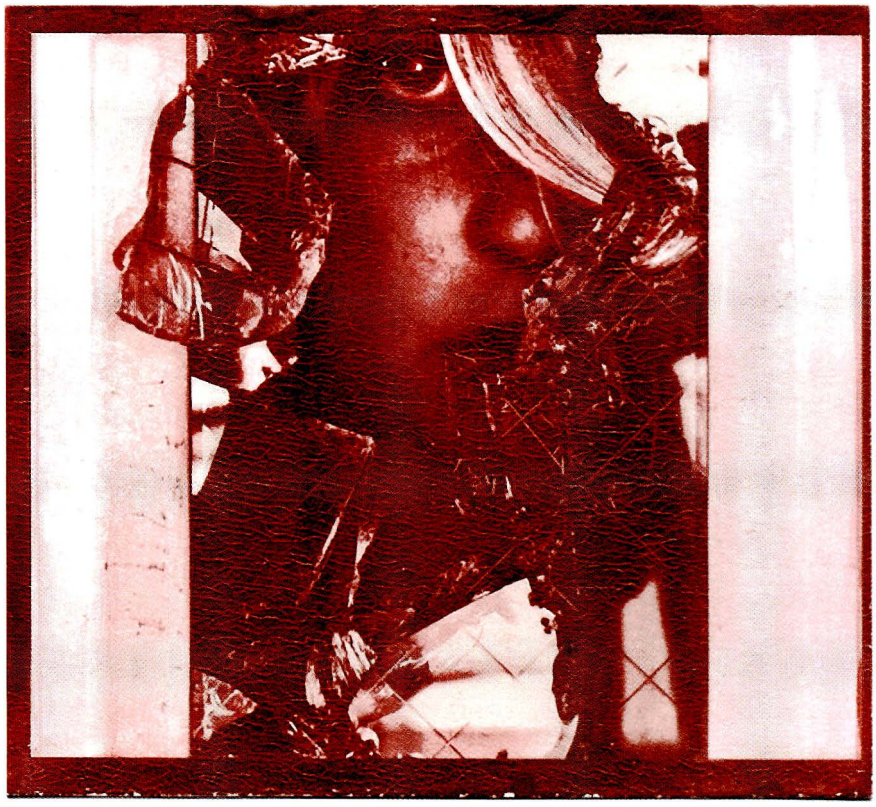


Figure 18–37
deRosette Dobelman, *Casual Panic*, 2012
An impatient self-portrait by former student deRosette Dobleman. She created this demanding image in a workshop I was teaching in 2012. Working quickly, with thick and successive layers of cadmium red, she dried the images in the uncompromising Santa Fe sunlight, resulting in the pigment cracking like an ancient painting. I think the effect, accident or not, is pretty nice.
(Courtesy of the Artist)

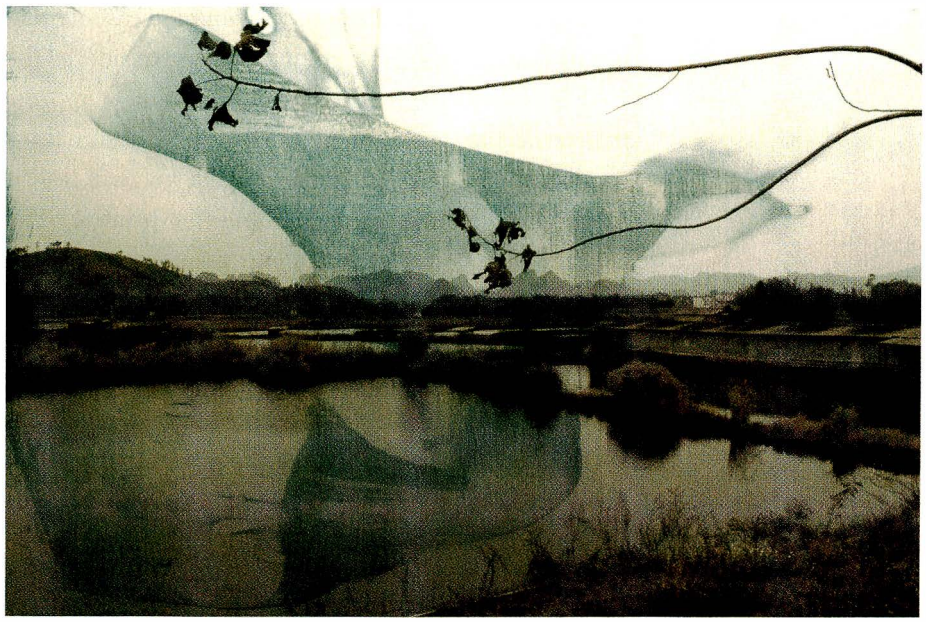


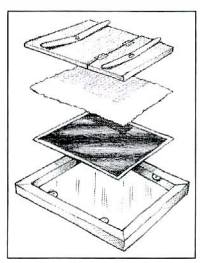
Figure 18–38
Ernestine Ruben, *Big Bird, China*, 2007 (gum)
Ernestine has been making powerful visual statements for most of her artistic life. This piece is from her China portfolio. *Big Bird* is a gum print utilizing two negatives with the second negative created from digital captures of reflections of metallic materials. She described the reflection as being made in freezing cold weather so that she could introduce the feeling of fresh air, breezes, and birds in a rather dormant landscape. She combined the images digitally, and *Big Bird* was given cobalt blue as a color instead of white, making it appear that it is a gum over a cyanotype. *(Courtesy of the Artist)*

humidify the paper, that would also be appropriate. After removing the paper from the water bath, gently blot it until it is slightly damp with no visible water reflection on the surface. Be careful not to abuse the paper's fibers when blotting.

Coat the paper in exactly same manner as you would with dry paper. You should notice a smoother coating and will probably find it unnecessary to use the 4" hake brush for smoothing out the coating application. Dry the coated paper in a low-light environment or force-dry the print with a hairdryer set on a cool setting. It is a good idea to contact print immediately after the paper's fresh emulsion has dried. The wet-coating method will give you a somewhat lighter image, which is perfectly fine because you will be building your image over time with multiple applications.

An Alternative Spray-Coating Method

For really large gum bichromate pieces, you might want to investigate the possibility of spray coating your sensitizer. The proportions are identical to the smaller print sensitizer formulas; you just use a lot more of the stuff. Don't even think about this idea unless you are willing to build a spray booth with great ventilation, are willing to wear a full hazmat body suit with goggles and dual-respirator, and are all alone. I wouldn't dream of spray coating a liquid dichromate in a group experience or without a superior ventilated environment . . . perhaps an auto body spray booth.



EXPOSING THE NEGATIVES

It is folly to attempt, or recommend, a uniform gum "standard" for exposure, as the variables are far too numerous to define such a standard paradigm. These variables include the chromatic density, quality, and type of pigment; humidity; time of day; negative density; strength of sensitizer; type of gum arabic; type of paper; humidity in the air; and anything else that is a part of the process. There is no such thing as a "correct" exposure. As with most elements of this process, each variable will change when another variable enters the equation. To compound the problem, you need to know what the exposure time will be, as checking on the print during the exposure will tell you next to nothing about how things are going. You could check the exposure and see an impression where the UV light had altered the color of the sensitizer, but when you water-develop the print, it could all go down the drain

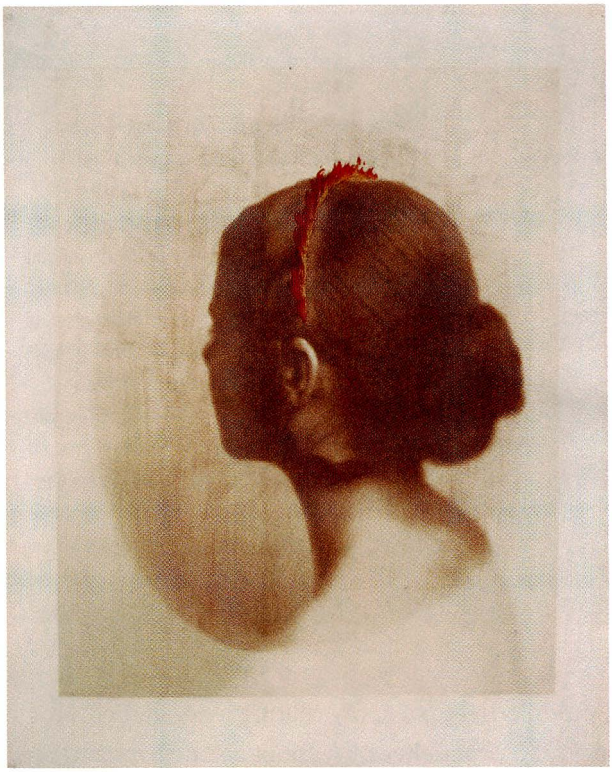


Figure 18–39
Dan Estabrook, *Small Fires*, 2012 (calotype & gum)
This delicate and haunting image is a visual lament to a romantic ideal... perhaps.
(Courtesy of the Artist)

(not enough exposure) or not clear in shadows and highlights (too much exposure).

The exposure must be made, as in every alternative processes, with a UV light source such as the sun or a UV exposure unit like the beautiful ones Jon Edwards makes at Edward's Engineered Products. Living in the northeast, I have been using both of these options for decades and they have never failed. I particularly like Jon's larger exposure units that utilize high output 60-watt tanning booth lamps that are imported from Holland. You can also try a 1000-watt quartz lamp or a hellaciously expensive graphic arts vacuum frame exposure unit with a 3000-watt ultraviolet light source. I really like these units, but they generate a ton of heat and are really only practical for the idle rich.

The advantage of a mechanical UV printing unit is that it is consistent year round, 24 hours a day. Gum artists working with a UV exposure unit are able to calibrate their work with less guesswork, and they can better evaluate exposure times in a "deductive" manner. Other gum artists like the more organic and casual ritual of printing in the light of the sun. This is considered the "seductive" manner. In my experience, sunlight appears to provide a "crispier" image and a faster exposure time. As with all of the alternative processes, you will need a hinged-back contact-printing frame for printing. You can also use two sheets of plate glass, especially for larger works where a contact sheet is impractical.

It might be a good idea when beginning a new print to make a test strip of exposures using a Stouffer 21-step wedge. If you don't have one of these, lay opaque strips over the contact frame holding the negative and sensitized paper. Remove a strip every 20 to 40 seconds during the exposure. When using dark colors it is not a bad idea to increase the number of test strips. Don't forget to keep notes of what you are doing, including formula, time of day, and test strip times. After making the test exposures, develop the test print and you will have a pretty good idea of what exposure times you should use that day. Remember that the gum process is an evolving one and is more like printmaking than like traditional silver gelatin printing. Make a plan for your printing strategies and be patient. Here are some basic starting exposure times to work with. Mind you, I have no idea what your variables will be, so don't be upset if my suggestions are not right on the money.

In the sun, in the middle of the day, in the summer, with a light color and a perfect coating on a beautifully glyoxal–gelatin sized paper that is perfect for gum printing, with a negative that is not too dark and not too light, in a geographical location that is temperate and bright, with a 1:1 gum-to-sensitizer ratio . . . I have no idea. You're going to have to make a few test strips.

If you are lucky enough to be using an Edwards UV exposure unit, it will be comparable to the sun if the bulbs are not worn out. Make test strips or consult your notes from previous exposures with the same sensitizer and color mix and make an educated guess. My best instinct with a light color, like a yellow, will be 2–4 minutes for both sources in mid-day. As for the more powerful units, the same advice is given: do your testing until you begin to develop a set of working notes that will inform all subsequent work in the process. If you need to adjust, only change one element at a time when figuring out your strategy for exposures.

Figure 18–40
Lisa Elmaleh, *The Long Goodbye,* 2006 (gum)
Lisa made this very large (30 × 90) gum bichromate print in one of my advanced alternative process workshop in Maine in the summer of 2006. It was generated from a small series of boxed photographs of herself, her mother, and her grandmother. Those were translated into large contact films and printed sequentially, each image with ten passes of color.
(Courtesy of the Artist)

Printing a Single-Color Gum with a Single Negative

Quite often, especially in a workshop environment that compresses many alternative processes into a very short time, it is common to demonstrate the techniques of gum with a single negative. This is a cost-effective and time-efficient method of illustrating how the gum bichromate process works without taking the time to produce complex multiple densities with complete sets of C-M-Y-K negative separations for everyone in the class.

Figure 18–41
Cheryl Harmeling, *Brynmore,* 1998 (single color gum)
This is an image from a portrait series that Cheryl created while at the Art Institute of Boston. Cheryl used the plastic camera to generate negatives for her black gum bichromates because of the camera's facility with mass over detail.
(Courtesy of the Artist)

By this point you should be getting a good idea of how to think about gum printing, so I won't take a great amount of time discussing single-coat strategies. Essentially, you're going to be using a single negative throughout the process. To get any kind of exposure diversity you'll have to switch up the following variables: gum-to-sensitizer ratio, choice of colors going from lightest to darkest, length of exposure times, and amount of water in the sensitizer, for example, the thinness or thickness of the coating that the UV light must penetrate to harden the sensitizer to the gelatin on the paper.

In order to penetrate the highlight densities (the darkest parts) of your negative, make your first exposure a fairly lengthy one so that the highlight details will show. You may also refer to an earlier mention of printing with only a 1:1 ratio of gum arabic and dichromate (no pigment) in order to lay down a tan-colored base to show highlight detail.

In a single negative/single color gum it is advisable to make the coatings thinner and less sensitive rather than use a normal sensitizer mix, playing with the ratio

theories mentioned previously. On subsequent exposures you can increase the ratio of gum to dichromate back to the standard formulas, adjusting your elements as you see the need. One thing to keep in mind when making a gum print from a single negative is that you do not want to print for the finished image on a single pass. To be honest, that expectation is not often possible. The reason for this is that your shadows will block up. It's better to parcel out exposure time over several exposures, each taking a percentage of the total time necessary to complete the finished density. Again, keep notes on everything you do. Remember, you build density detail through repeated short exposures, not single, all-at-once ones.

A Simple Single Negative Strategy for a First Good Gum Print!

This is really basic, but it does the job of letting you teach yourself the process. I'm going to keep this vague purposely because I want you to delve into the chapter and look for the answers. If you are brand new to this technique and have one contact negative to play with, here is a possible strategy for you. First make sure that you have performed the glyoxal–gelatin sizing process perfectly.

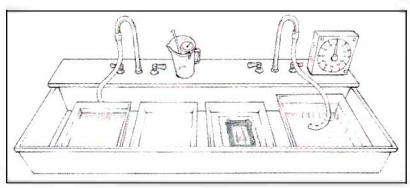
1. Now, try printing a single negative with a quarter inch of paint and a longish exposure.
2. For a second pass, after washing and drying the first pass, use an inch of pigment and a shorter exposure.
3. For a third pass, try using the right amount of pain—about ½" with the right amount of exposure. You should end up with your first good-looking gum print.

A Dichromate-Coated First-Step Strategy From the Past

A caveat: although I haven't done this gum variation it sounds like it might be fun and a good solution for going on a gum-printing vacation in the wilderness with pre-dichromated sensitized paper, a bottle of gum arabic, and a few tubes of paint . . . and making gum prints.

A while ago I heard about a technique that Robert Demachy and some old time Gummists used to do. It's a different approach to gum bichromate printing, and it works in an odd kind of way. Begin by gelatin sizing and hardening your paper as you would normally. Then make up a saturated solution of potassium dichromate (13%) and coat it directly on your dry paper. The light level should be pretty low, but the paper, once dry, will keep for a long time.

When you are ready to print, make up your gum and pigment formula and, if you think the solution is too thick, add distilled water in place of the dichromate, since it is already on the paper. Then all you do is expose and wash-develop in the normal manner. Pretty simple don't you think?



SINK SETUP FOR GUM BICHROMATE

All of this can be set up outside on a picnic table if you have the time, location, and weather. Exposed gums can see the bright light of day easily, and once you immerse the exposed print face down in water, it will begin to be less sensitive to continued exposure.

Tray #1 A very clean tray filled with clean water. Hot water will always clear a print faster than cold but at the expense of subtle details. You may also want a soft hake brush for gently feathering the print during washing.

Tray #2 A 1% solution of potassium metabisulphite for clearing highlights and intensifying, by association, contrast and color values. There are other metabisulphite types, sodium metabisulphite, for example, but I prefer the potassium version.

Tray #3 If you use potassium metabisulphite you will need to have a tray #3 for a 30-minute final wash in cool running water. Some practitioners like to spray on a mist of potassium metabisulphite rather than immerse the print in a complete bath. This is fine, especially for selective brightening and larger sheets.

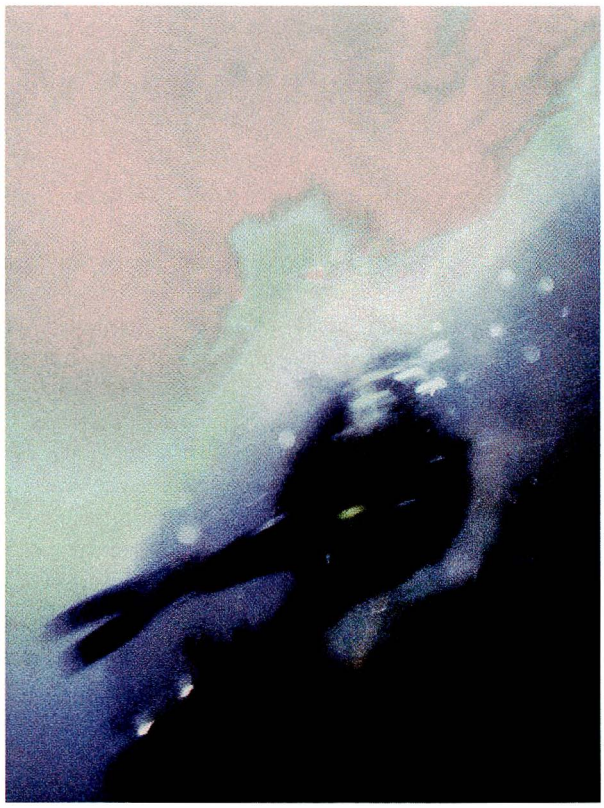


Figure 18–42
Christopher James, *Diver,* 2002 (gum)
This gum print was made using a single contact negative and selectively applying diluted sensitized coatings while building up the densities of the darker areas and leaving lighter areas more translucent.
(Courtesy of the Artist/Author)

WASH DEVELOPMENT & CLEARING

Development of the exposed gum print is very simple. You really only need fresh water to complete the process. However, there are a few things you need to pay attention to.

Following exposure, immerse your paper in a tray of ambient temperature water that is larger than your paper. If the water is too hot you will unwittingly erase subtle details. If the water is too cold, the clearing will take much longer. Gently agitate the paper, face down, for about 30 seconds and then very carefully change your water, holding on to the edge of your paper so that it stays still during the change. At this point, after the first immersion, the surface of the gum print is fragile. Place the print face down in the new fresh water bath and *leave it alone.*

The unexposed areas of the image will soften and drop gently to the bottom of the tray. If you agitate aggressively or run water on the surface of the print you will cause a little damage to the wet and fragile details in the image. Look across the paper's surface after your highlights have cleared and you will see a distinct bas-relief of the image. This relief exists because the exposed (hardened) areas of the image are still on the paper and swollen with water. The unexposed portions of the image should be lying peacefully on the bottom of your wash tray, providing your exposure was correct. If you exposed for too short a time, everything will fall off the paper. If you exposed for too long a time, nothing will.

In my experience, light colors will yield a perfectly developed print within 10 minutes. Black pigment prints will take much longer to clear than will prints with lighter colors. Single exposures with very thin colors such as Naples yellow or davy's gray may take only a minute to clear. *Clear* means that the highlights are paper-base clean and the well-exposed shadow values have tonal delineation and detail.

Often you will initially see nice separation within your shadow details only to have them float away or drip off your print's surface. This indicates that you are close to having a correct exposure time but those particular areas simply haven't had enough exposure yet. Don't throw away the print. Wash it well, dry it, re-coat with the same or a different color, and expose the negative again for a slightly longer time.

Ammonia–Bleach Bath for Over-Exposed Images

Prints that have been overexposed will show less contrast, flat highlights, or blocking in the shadows. Immersing in a bath of 15 ml of ammonia, or household bleach, to 1 liter of water can often repair these flaws. Be careful because this bath is very efficient at removing a lot of detail in a hurry, especially if the solution is hot. This particular remedy often becomes a technique, like spraying your cyanotypes with a mist of Tilex® toilet bowl cleaner for an unusual reticulated effect. If you are not into really aggressive gum printing (some people live for those effects), I would simply re-do the print.

Or . . . the Overnight Soak

Another method for clearing heavily stained or over-exposed prints is simply to let them soak overnight. Again, if you underexpose the print you only have to

Figure 18–43
Dan Herrera, *Dance of Cthulhu's Daughter*, 2012 (5-color gum)
Dan constructs miniature sets out of found objects. He then combines images of these miniature sets with photographs of real people and life-size props. He prints using CMYK separations on a cyanotype base. Gum bichromate printing allows him to make gestural effects that enrich his exploration of distinctions between photographic realism and painterly illusion and bring together the techniques of the nineteenth century and sci-fi film narratives.
(Courtesy of the Artist)

dry it, re-coat it, register, and reprint the same color and negative. Your exposure on your second "pass" will likely require less time to achieve the effect you were going for in the original exposure because you will be building upon a layer of detail that already exists. Personally, I always prefer a series of small exposures to one big exposure, but this is just a matter of personal taste and workflow.

Stopping Development and Re-Exposing

There will be times when you may not want to develop the print to completion or, conversely, when you wish to produce an image that is significantly different from one where you left the print to gently soak for a total clearing of the highlights. Incomplete development, in which you leave a good deal of original color behind (especially in the highlights), can be achieved

Figure 18–44
Sandra Davis, *Mother Mary*, 2006 (gum on glass)
Philadelphia artist and professor at the University of the Arts, Sandra is well known for her gum bichromate transparent illusions on glass, most often a custom made light-box. When I first saw her work on glass she was a graduate student and was immediately intrigued by her theory about why her gum layers stayed put on the non-porous glass substrate. Following each pass, the dry gum impressions are post-exposed under UV light for ten minutes and this action strategy provides an excellent tooth for subsequent gum passes of ivory black, Antwerp blue, pyralene green, transparent yellow and alizarin crimson.
(Courtesy of the Artist)

by stopping the development about halfway through and laying the paper flat, face up, on a blotting surface. If you hang it to dry, the colors will run. If you decide to abruptly stop development in progress because you like the way it looks, you have the option of hardening the image by re-exposing the paper to UV light after it has dried. This actually works most of the time.

Forced Wash Development

On the other hand, forced development of the print, in which you wish to eliminate or transform detail, can be achieved by running water directly on specific areas of the print. You may also change the way a print will look by using a brush, gloved finger, pencil, watercolor pencil, or etching tool to mark in the soft and swollen pigment.

Remember, in the wet state the emulsion is very sensitive to abrasion, and abrasion is not always something to avoid. I have used a commercial handheld garden sprayer, the type that allows you to adjust water stream pressure and flow size, to "draw" into the soft emulsion. Use your imagination and have a good time with the options. If the end result is a mess, then chalk it up to experience and see if you can use the knowledge in a positive way. The fundamental wisdom of this is that the relationship of exposure and development depends upon a good marriage between the gum and the dichromate. The paint is the "unrequited suitor" and only stays in the relationship if the gum hardens and refuses to wash away.

A FEW WORDS: CONVENTIONAL WISDOM & STAINING

The Relationship of Paint to Staining

One of the "old rules" stipulates that a greater concentration of paint than "normal" (whatever that means) will result in the staining of your print's highlights. I have found that a greater concentration of paint in the emulsion will actually have the opposite effect and will result in *less* staining. Judy Seigel confirmed this point in issue #2 of her excellent, but sadly no longer published, *Post-Factory Photography Journal*.

Figure 18–45
Christopher James, *Irezumi #2*, 1986
This 40" × 60" watercolor is an example of how I work with highlight areas within my paintings by first laying down washes of gum arabic and batik resist.
(Courtesy of the Artist/Author)

For many years, I have been laying multiple gum arabic washes, with batik resists, on watercolor papers prior to making my watercolor paintings. By doing this I was able to paint and then return to specific sections with a wet brush to pull away painted pigment and expose highlights. This was possible because the paint was sitting on the gum arabic rather than in paper's fibers. This makes sense. The extra paint would not be a significant factor in staining when sitting on a gum-arabic-layered solution. In fact, I have always considered extra pigment (more than 1" but not so much that flaking occurs) as a quasi filter, resulting in cleaner values and less stain potential. Be aware that a greater concentration of paint may also result in a shorter tonal scale, higher print contrast, and possible flaking.

Rinsing After Glyoxal Hardening to Prevent Staining

There is a relationship between the sizing formula you select and the final colors and highlight tonalities in the print. A hardened gelatin sizing, which allows for the successful clearing of highlights, will occasionally hold fast to the dichromate and stain your image. The result, in some cases, is a yellow tinting of lighter values within the print. These yellowish flaws can generally be cleared with a potassium or sodium metabisulphite bath following the wash-development, but there is a better solution to this problem: a cold freshwater rinse directly after the 5-minute glyoxal hardening of your gelatin sizing. This removes excess glyoxal from the surface of the paper. If you avoid doing this step, the paper may turn a little yellow-beige in the highlights down the road, sometimes even before you use the paper for an exposure.

Clearing Stains with 1% Potassium Metabisulphite

In the event that you have tan-colored dichromate stains in your highlights or borders you may clear them out with a 1% solution of potassium metabisulphite. Simply mix 10 grams of potassium metabisulphite into 1000 ml of distilled water. Prints can be immersed or you may elect to spray the solution on the surface of a damp print. You might even consider selectively painting the potassium metabisulphite on problem areas. You can also try potassium alum, but this chemical may not help the archival intentions you have for your image.

Clear the print in the potassium metabisulphite bath until the stain goes away and then wash it for 30 minutes in clean running water. Be cautious of the percentage concentrations of the metabisulphite because it may be more aggressive than you anticipate. Also, don't use a sodium *bisulphite* bath, as it softens the gum too much. Be sure to do a test piece before committing your print to a clearing bath and adjust the percentage strength as necessary. I suspect the 1% will work fine as long as your stains are not caused by over-exposure, in which case you are out of luck.

You may also spot-clear with this solution using a small brush. If you notice that your emulsion has become fragile in the potassium metabisulphite bath, you may want to consider drying the print and going to the final wash later on. If all attempts to clear your gum print have failed you can try a few things in the next printing session to avoid the same problem.

Figure 18–46
Stefanie London, *Tulips*, 1989 (gum and mixed media)
Stefanie works with many materials in the translation of her intentions. This piece, made while a student of mine at Harvard, uses cyanotype, acrylic, gum bichromate, and watercolor.
(Courtesy of the Artist)

TROUBLESHOOTING GUM BICHROMATE

Note: Any of these suggestions may be disregarded if they don't fit your working style.

First Rule of Fixing Gum Bichromate Problems

Many of the solutions for gum problems are mentioned in the earlier sections of this chapter. There are a lot of things to consider when tracking down gum vexations, and this next section will deal with a lot of them. However, there is a rule: when hunting for remedies to problems, **ONLY FIX ONE THING AT A TIME.**

Sizing

If I were experiencing staining, the very first thing I would look at is my glyoxal–gelatin sizing, hardening materials, and technique. Did I take shortcuts? Did I make do with what I had rather than use the correct solutions?

Fix this part of your gum technique and you are pretty much assured of eliminating the biggest staining problems. While you're on this theme, you might also consider using a different variety of paper. One more time: simply because it really does prevent the problem of yellow staining most of the time, after you glyoxal-harden your gelatin for 5 minutes, *remember to rinse the paper in cold running water for 5 minutes* and line dry. Yes, I know, that was more than one change at a time.

Paint

Try duplicating your technique with a different brand of paint. Always use the highest-quality watercolors you can buy. Student-grade, or academy, watercolors often have little quality to speak of and will often end up staining your print or washing out in splotches. Some colors are particularly tough to clear, and personally I've had my biggest problems with greens. When I want a green I will generally make my first pass a cyanotype or mix a safe primary blue and a yellow rather than opt for the out-of-the-tube green. I will also lean toward greens that I trust and that always clear well, such as Winsor & Newton's oxide of chromium.

Add Pigment

You might want to try adding more pigment to the sensitizer if you want better contrast. This often is the first fix I'll attempt and it does work in spite of the nasty things people in the alt pro discussion groups say about the idea.

Gum Arabic

Another fix is to try using a higher grade of gum arabic or add a little more of it to your sensitizer formula.

Dichromates

Try re-mixing a fresh dichromate in case of contamination or using less dichromate in the sensitizer mix. In my experience, potassium dichromate demonstrates less staining than ammonium dichromate.

Changing Exposure Time

You might consider changing your specific color exposure times for multiple, and shorter, exposures.

Curve & Color Layer

Try using a custom gum curve and color layer. You can get one off of the Internet or make up your own customized version. Simply having a negative that is less difficult to print will often eliminate the subsequent staining of your image.

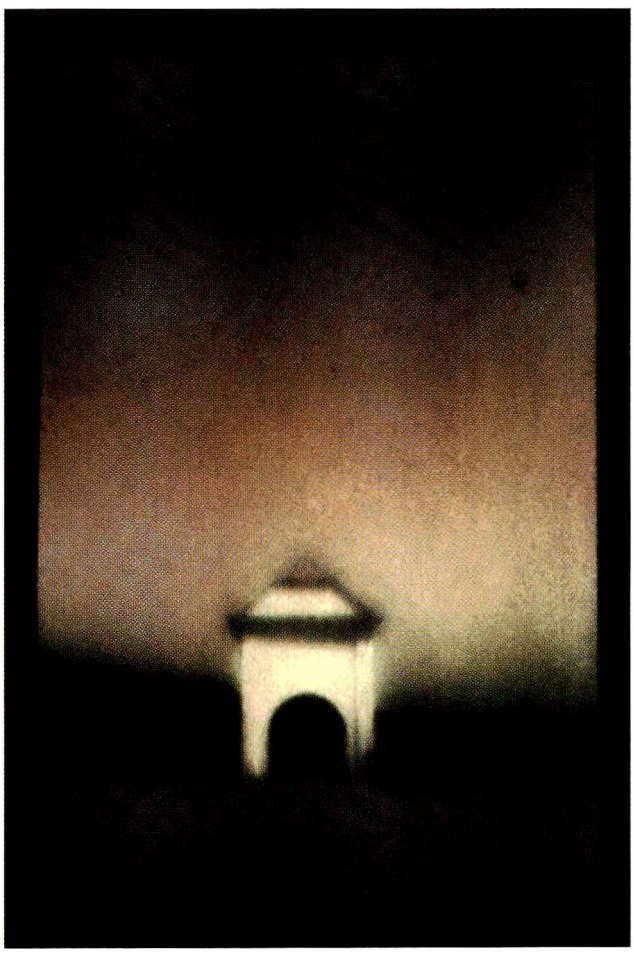


Figure 18–47
Diana Bloomfield, *Saint Sebastian on the Hill* (gum)
Diana Bloomfield, is a native North Carolinian and a prolific artist specializing in nineteenth-century printing techniques. This is another terrific example of the ambiance she is able to achieve in her work whether it is of her daughter, a landscape, or a midway.
(Courtesy of Diana H. Bloomfield)

The Last Resort

There is a chance that everything you are doing process-wise is correct and that you simply need a new negative. Then again, perhaps it's time to wave the white flag and give up on the one you're using for this process. This begs for the Pictorico Ultra Premium OHP solution to the problem, in which you make the absolutely best set of negatives, or single negative, that you can, and work with it. Last, but not least, you can be upbeat about the entire experience, think about how much fun gum printing is, and start all over again. You might also consider using the print as a base for another process or as a canvas for you to paint, a page of a book, a place to collage and re-photograph for a new negative . . . a new place to play.

First Impressions: Cyanotype First Pass

If you are having a hard time establishing a foundation for your gum print you might want to try one of my favorite techniques: consider making a cyanotype as your first color impression. It provides a strong and finely detailed blue (or some other color if you tone it) and gives a fine visual map to work upon.

You may also consider making a gum "pass" on top of a platinum or palladium print if you want to raise some eyebrows. Actually, this combination was quite popular with many pictorialists in the early part of the century. The additional gum bichromate step helps bring out and define complex shadow details and often provides additional depth to the image. If you intend to try this, begin with a brief green or blue gum exposure as Stieglitz did.

To Darken an Image

Perhaps the solution is to simply repeat the negative, in registration, but with a less intensive exposure. You can expose for a shorter time, add a little water to your sensitizer, try a darker paint, or try a lighter version of the negative, especially if it's a digital negative—just adjust your curves. Also try a complementary color or a

Figure 18–48
Carmen Lizardo, *Santo Niño de Antoche*, 2006 (gum)
Here is wonderful nice example of Carmen's mastery of the gum bichromate process.
(Courtesy of the Artist)

little more dichromate in the formula. If you add more dichromate to the sensitizer mix you will experience a reduction of contrast and an increase in your exposure time. Adding more pigment to your sensitizer, which may initially seem like a good idea, may or may not work, and the success of this choice will depend on a few other variables.

To Lighten an Image

The easiest solution to this problem is to use a lighter color or to dilute your sensitizer formula with a little water. You can expose your print for a shorter exposure, but that really isn't the best approach to the problem because you want the exposure to be complete enough to harden everything in the print that needs hardening. Printing a lighter, or dilute, color is better than under-exposing. Short exposures will often yield more contrast because only the thinnest parts of the negative, your shadows, will react to the hardening effects of UV exposure; that is, more of the pigment will remain unhardened during the exposure and will wash out during the wash-development.

Using less dichromate in the formula will result in a solution that is slower (reduced sensitivity) and has more contrast because only shadows will print out. You may lighten the entire image by using less pigment in the formula, and this will result in less contrast and possibly some unwanted tonalities in your highlights.

The cave person approach to the problem would be to wash the image in very hot water or try using a 5% solution of potassium metabisulphite or ammonia.

To Increase Shadow Density Without Changing Highlights

The first thing I would do in this situation would be to make sure my negative set would accomplish this task for me. If you're impatient, try decreasing the exposure times of subsequent coatings. You may also try using less dichromate in the formula. Also try adding proportionately less pigment, by half, to each subsequent formula and exposure. This allows shadows to build slowly and may help minimize staining in the highlights. Many alternative gum artists will add more pigment to subsequent coatings to increase contrast. If you have the time, try both methods and determine which works best for you.

To Enhance Highlights Without Blocking the Shadows

Is your gelatin sizing and hardening technique imperfect? This could be a reason your shadows are blocking. Is your negative set right for your formula and exposure time? Those are the first questions I would ask, and then I would make a quick print and see if I could fix the problem by adding additional gum to the sensitizer formula. Next, try a decrease in the amount of watercolor pigment you add to your sensitizer and modestly increase the exposure time. Both of these options will result in less contrast in the print. You can also achieve a full tonal range by altering the amount of pigment added to each additional coating, but the success of this tactic will be dependent on several other factors.

To Reduce Contrast

Try using lighter colors, using potassium dichromate instead of ammonium dichromate in the sensitizer, diluting the ammonium dichromate, using a higher concentration of dichromate sensitizer and decreasing the amount of pigment, exposing longer, or developing for less time. Dilute the sensitizer with gum or water. To tone down colors, try using their complements instead of immediately reaching for a tube of black watercolor paint.

If the Highlights Will Not Print at All

This isn't unusual, especially if you are using a pinhole camera or making your negative set with ortho film. The first thing I would recommend would be "flashing" your entire image area without a negative in the contact printing frame with only a 1:1 sensitizer coating of gum arabic and dichromate. Expose quickly, and you should be able to inspect the exposure (as there is no paint in the formula), looking for a "whisper" in the highlights. Eliminating the paint will make your

highlights a tan color and will, if you get the exposure right, give you some highlight definition.

To Place Color in the Shadows

Mix together a sensitizer formula with a greater amount of paint than you usually use and shorten the exposure time. This will place the color primarily in the shadow areas of the print. You can also selectively paint the new color into the shadow areas with a brush, soften the hard edges with a damp brush, and reprint the negative in a contact frame.

To Place Color Primarily in the Highlights

Mix together a sensitizer formula with less paint than you would usually use. This thinner sensitizer solution, coupled with a longer exposure, will place color primarily in the highlight and lighter values within the print.

A Full Color Inventory

Some gum artists like to make up their color and gum emulsions in larger batches and store them in Tupperware® or urine sample containers from the local HMO health provider. This allows you to establish a color inventory and save time. Urine sample containers are great since most have an embossed graduate scale on the side and a very secure cap. Next time you go in for a physical check-up, pick up a few for free. *Do not add the dichromate yet.*

The dichromate is added just before you intend to use the color. Keep the proportions of gum to color the same as when mixing small batches, for example, 50 ml of gum to a 15 ml tube of watercolor paint. This is not a recipe set in stone. Your gum, and the type of paint that you select, will dictate the proportions, and that will take a little testing. You are seeking a solution so that when the sensitizer is added and the exposure is correct, your print will clear quickly and easily with no staining.

Make Color Charts

Each new paper, paint type, sensitizer, sizing, hardener, and emulsion will show you a different look. Write this information on swatches, cut them into slide-size shapes, and keep them in a slide sheet to use as a reference chart. I generally adhere my paint chips to the top of my gum and paint pre-mixes.

Try Painting on Your Gum Layers

Try painting on gum emulsions in selected areas of the print (for example, eyes, clothing, lips, and so forth) instead of total paper coverage in the traditional manner. This allows you to add specific areas of color without affecting the entire print. To avoid a hard edge on the selective color, wet a fan-shaped watercolor brush in clean water and lightly drag it along the edge of the recently applied selected color before it dries. This "feathering" creates a softer edge line.

Create Area "Masks" Using Gum Arabic

Selectively painting an extra coating of gum arabic in the areas you do not want to accept a lot of color during the exposure works quite well. You can also use other

Figure 18–49
Christina Z. Anderson, *Ketchup*, 2010 (gum)
(Courtesy of the Artist)

masking devices in conjunction with the negative, such as rubylith film or Mylar®. I like gum because it washes out well and can be blended, unlike rubylith. The image in the emulsion achieves its tonalities based on the degree of its hardening. The harder it is after exposure, the less of it washes off. The less it is hardened, the more of it washes off. Pay close attention to your exposure times and your printing strategy.

Exposure

Exposure is controlled by several factors that you can keep in mind when creating a print strategy. What is your source of UV light, the color of the pigment in the emulsion, the expected exposure time, the proportion of dichromate to gum, the thickness of the sensitizer, and the humidity?

Some practitioners find that the higher the humidity, the shorter the exposure. Others report that the opposite is true in their work . . . go figure. The best bet in my experience is to keep the humidity above 45% and below 65%. Long exposures will result in less contrast because more of the sensitizer becomes insoluble and refuses to clear in the wash-development. Shorter exposures work in the opposite manner. Use your exposure control as a minor player in this drama. Although it will take considerably longer to make an exposure, you can also try printing in open shade rather than direct sunlight. This will, as it does in many of the other alternative processes, give you greater contrast potential.

Your Print Does Not Clear

There are a few things that could cause this problem. The first, and most common reason, is that the idea of spending time gelatin sizing and hardening didn't appeal to you, so you thought that maybe, just this once, you could make a nice gum

Figure 18–50

Erin Mahoney, *Behind the Birch Tree*, 2012 (tri-color gum)

Erin wrote, "This image is a part of the self-portrait series called *Another Me*. I utilize Korean folklore, myths, and stories as a way to reconnect and embrace my heritage since growing up outside of my birth country as an adoptee. The images are printed in gum bichromate to represent the feeling of the watercolor illustrations in children's storybooks where I found many of these amazing stories."

(Courtesy of the Artist, Erin Mahoney)

print without doing that step. Sorry . . . if your pigment goes into the paper's fibers rather than sitting on the surface of the hardened gelatin sizing, it will grab on and stain the paper exactly as paint is supposed to do. Other things that could have caused the print not to clear include over-exposure or too much hairdryer heat.

Your Print Washes Down the Drain

This is really simple . . . only a few things could have gone wrong for the print to completely leave the paper during the wash-development. Nearly 90% of the time the reason is that your exposure wasn't long enough to harden the dichromate-gum pigment sensitizer. The other 10% of the time is that you forgot to add the dichromate to the gum and pigment, the emulsion was still wet when you made your exposure, or the gum arabic that you used was impure or rotten . . . don't forget, it is vegetable matter.

Your Print's Surface Texture . . . .

If your surface looks uneven, you can take a piece of fine sandpaper or steel wool and gently give it a nice matte-luster finish by softly sanding the surface in small circular swirls.

Emulsion Flaking Off

This problem generally happens when you have used too much paint or your sensitized emulsion was too thick when you painted it on. Add a little water to the sensitizing formula to thin it out. This will soften your image for that pass and give you a chance for some fine details.

Streaks in the Print

This generally means that your coating technique needs some work. It isn't fatal. Simply get some scrap paper, say the backs of prints that you don't like, and practice coating them with a non-sensitized mix of gum and paint. You'll be good at it soon. Another reason you might see streaking is that you didn't attend to your print in the wash stage. In other words, it stayed in the water but not necessarily evenly or completely.

Coating streaks can also be remedied with one or more of these options. Try adding a few drops of Everclear grain alcohol to your sensitizer before coating. This generally takes care of most streaking issues.

Figure 18–51
Barbara Eberhard, *Pizza-Joint*
Barbara wrote, "After a 20-year hiatus from gum bichromate, I have returned to the fold with the realization that since the digital age was upon us, I had a whole new way of working to learn. Might I add your book has been of invaluable help. Street photography has always been my passion. I was sitting at a Pizza Joint in Chicago, saw the possibilities out the window and waited for what I consider the right moment. I always believe people are alone in their thoughts. This piece has 3 layers—blue, yellow, and red—on Fabriano Watercolor paper using Pictorico OHP film for the digital negative."
(Courtesy of the Artist)

Other additives to your sensitizer to play around with could include Tween 20, diluted dish detergent, and scuba mask anti-fogging drops. You can also try humidifying your paper first and then coating with a large Richeson synthetic brush.

Random Last Thoughts

Take your time learning gum printing and enjoy the simplicity of the process as well as its often maddening complexity. Unless you wish to show evidence of working stress on the surface of your print, sometimes you just have to put the print face down in the water during the development clearing stage and do something else for a while (this will make sense later on). Gum bichromate is different from other techniques in the alternative process genre, and it is unhealthy for your creative self to think that there is a perfect way to do it. It's like thinking there is only one way to paint or cook or kiss.

I write this even though I know of at least six gum printers who claim that their technique is sublime perfection and the "only way" the process can ever be performed. They are wrong. Being dogmatic about how to make a gum bichromate print is like telling a child that only blue crayons are acceptable for coloring a sky. The variables in gum printing are infinite, and each individual's intentions will never be exactly like another's. Play and practice are the secrets to becoming a good gummist. Play with the myriad elements of gum and practice to make your personal technique compatible with your intentions . . . so that it works for you.

Dichromate Process Options: Gumoil, Photo-Resists, Chromatype, Bichromated Wash Drawings, Dusting-On Process, Gum Bichromate on Glass, Herschel's Breath Printing, Estabrook's 3-D Gums, Winther's Bichro-Silver Process

OVERVIEW & EXPECTATIONS

In this chapter you will be introduced to a few simple and esoteric chromium/dichromate-based processes that are contemporary adaptations of older procedures that enjoyed a certain degree of popularity at the time they were conceived.

The first process that I'll describe in this chapter is Karl Koenig's gumoil process, which incorporates the concepts in gum bichromate but uses oil paints, etching bleach, and stencil brushes to create the image. This is a supremely fun process and one that is adaptable and flexible enough to use for personal work, as a recent graduate of my MFA program at the College of Art and Design at Lesley University, Cotton Miller, did this past year. It is primarily Cotton's version of the technique that I am describing in the chapter.

From there we'll investigate Robert Hunt's chromatype process from 1843 and then move on to a totally charming and head-banging technique called the "dusting-on process" and how to incorporate the dusting-on ingredients and workflow when working with ceramics and glass. I'll also touch on gum bichromate on glass photoresists, Dan Estabrook's 3D gum, bichromates and related dichromate tangents and techniques.

One late addition to this chapter is Hans Thøger Winther's reversal direct positive on paper bichro-silver process from 1845, with generous contemporary workflow notes from Wlodek Witek, Paper and Photography Conservator at the National Library of Oslo.

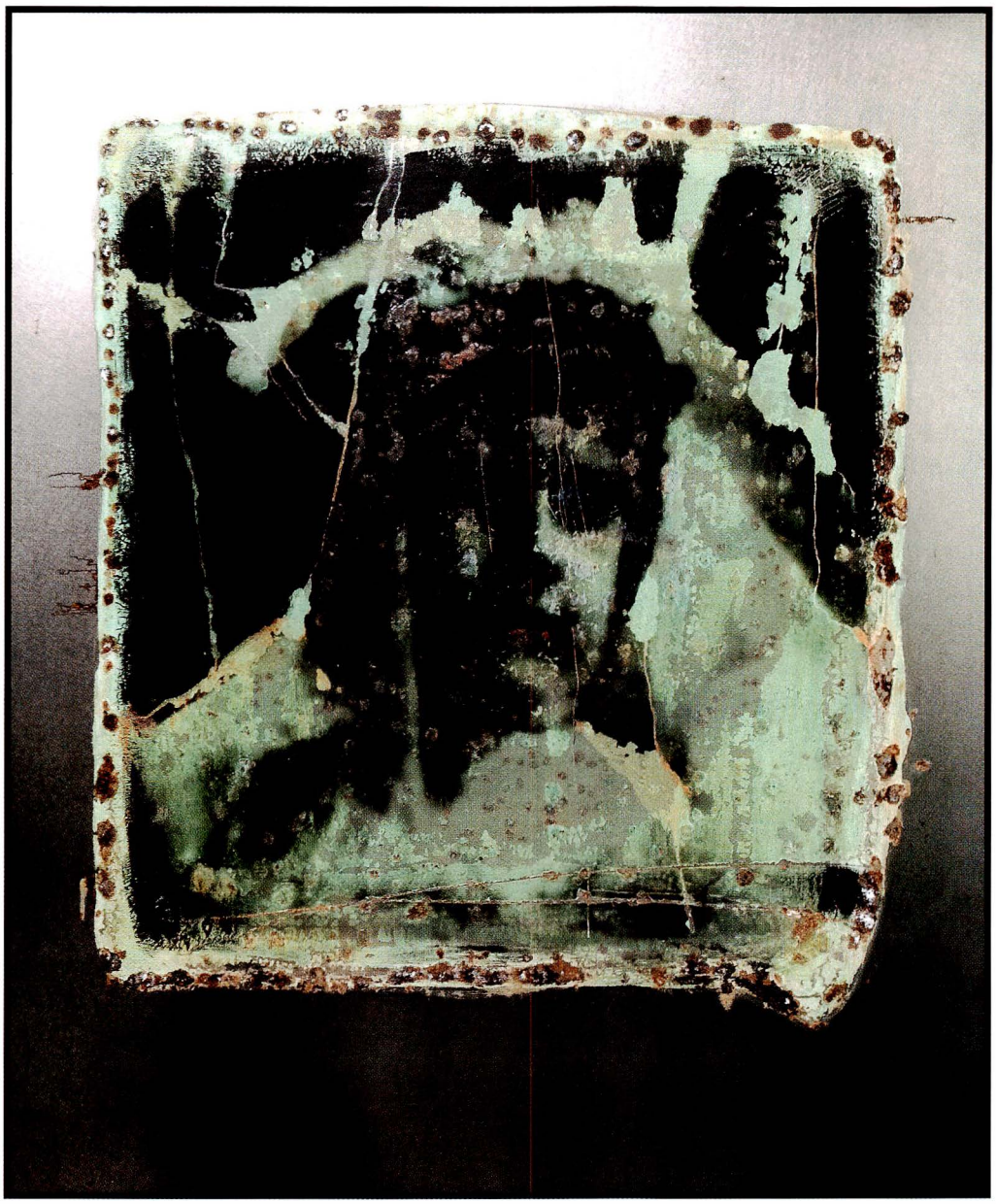


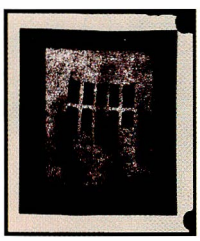
Figure 19–1

Christopher James, *Vatican Bride,* 1996 (steel, acid etched steel plate with colloidal emulsion)

This piece is part of large series utilizing steel plates that I attempt to destroy with acids, and when satisfied with the surface, coat with a dichromate, pigment, and gum sensitizer for printing. The plate is then subjected to the influence of power sanders, hammers, etching tools, oil paint, carbon, pastels, and toners.

(Courtesy of the Artist/Author)

There is more, but essentially the intention of this chapter is to stimulate your interest in inventing something new for yourself by using your knowledge of light-sensitive dichromate solutions. In its most basic form, UV light causes a dichromate salt (potassium, ammonium, or sodium dichromate) to make a colloid—like gum arabic, gelatin, or honey—insoluble in water in proportion to the degree of exposure. After that stage, the work and concepts evolve.



A LITTLE HISTORY

In 1849, considering that photography had only been in existence for 10 years, Henry Hunt Snelling (1816–1897) published a fascinating book . . . *The History and Practice of Photography* (G.P. Putnam, NY). In his book Snelling discussed the efforts of several enterprising individuals who utilized chromic acid, a corrosive oxidizing agent that is made by adding a concentrated sulphuric acid to a dichromate, as an active agent in the making of photographic images. He documented how, in 1839, Mungo Ponton discovered that paper impregnated with bichromate of potash, known as *potassium dichromate*, was sensitive to UV light.

In his pontontype process, paper was coated with the bichromate of potash solution and exposed to sunlight using objects to create a negative photogram image. The exposed print was then washed to remove any unexposed dichromate and dried. What remained on the paper was a light buff-colored orange-sepia print that was the physical impression of chromium dioxide, a substance later used as a primary component in the manufacturing of magnetic recording tapes. It is not known if Ponton was aware of the 1832 observations of Gustav Suckow regarding the sensitivity of chromates.

Snelling went on to describe how Edmund Becquerel advanced the work of Ponton a year later, in 1840, by sizing the paper substrate with starch prior to sensitizing it with bichromate of potash (potassium dichromate or some other salt of chromium) and how that enabled the conversion of a negative image to a positive "*by use of a solution of iodine, which combined with that portion of the starch on which light had not acted.*" He then went on to say, in a passive and nonjudgmental way, that clear and distinct pictures failed to be realized in either Ponton's or Becquerel's process.

A few years later, in 1843, Robert Hunt had an inspiration that incorporated the use of copper sulphate and potassium bichromate and that resulted in direct positive orange and lilac images in the camera obscura. In his book, Snelling related his impressions about Hunt's chromatype process as being exceedingly simple to perform, resulting in images with a pleasing character, and ideally suited to making images of botanical specimens, engravings, and the like . . . if only it were a bit more light sensitive. That particular wish may have been answered by Hans Thøger Winther's reversal direct positive bichro-silver process, in 1845, that incorporated a bichromate exposure for the highlights followed, after washing and drying, with a two-part sensitizer application of potassium (or ammonium) chloride, followed shortly by silver nitrate for the shadows. You'll find this process near the end of this chapter.

Unfortunately for Winther his process did not have a chance to develop a large following as it, and his passing in 1851, coincided with the Crystal Palace exposition in London where Archer introduced the wet collodion glass plate negative . . . leading to an unlimited number of paper prints from a detailed and totally transparent negative source.

Several years later, in 1854, William Henry Fox Talbot added to this chronology by observing the ability of potassium dichromate to have a hardening effect upon a colloidal gelatin that was directly proportional to the degree of UV light that the gelatin received . . . the primary explanation of all processes that utilize the principle of hardening dichromates with UV light.

THE GUMOIL PROCESS

Introduction to Gumoil

The gumoil process was developed by the late Karl Koenig, a former University of New Mexico professor who was a passionate advocate for alternative processes and traditional printmaking techniques such as lithography,

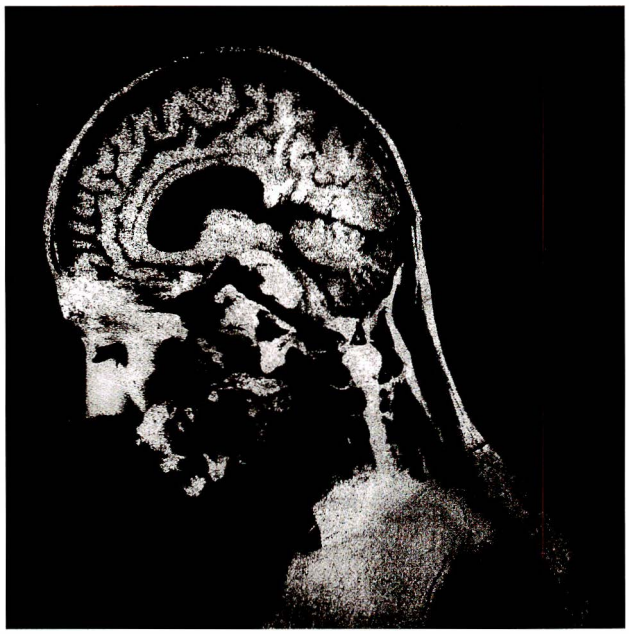


Figure 19–2
Cotton Miller, *MS Self Portrait*, 2013 (gumoil)
My former MFA student, and friend, Cotton Miller taught me this process. It begins with the creation of a positive transparency that is made using Pictorico Ultra Premium OHP inkjet film and Photoshop. You can also use a cliché verre or an acrylic lift from a printed source. This positive transparency is contact printed against a gum and dichromate coated paper, washed in water, dried, impregnated with oil paint using a stencil brush, wiped, bleach-etched, washed again, and dried, and then the process is repeated with additional colors or intensified with the same color. Each print is one of a kind, and the possibilities are virtually limitless. *(Courtesy of the Artist)*

gravure, and screen printing. In the early 1990s, Koenig completed his development of the gumoil printing process that was subsequently published by Focal Press in 1999 under the title *Gumoil Photographic Printing*. I'll paraphrase a quote by Karl about his process: "*I was dissatisfied with conventional photographic printmaking and began looking for more interpretive processes in the 1980s. In fact, I invented one to meet my needs, which I call gumoil. I use the gumoil technique because it facilitates a greater range of emotional expression than straight photography can. Gumoil and gravure are both positive-to-positive processes. I work from film or digital images and make the large transparent positives via Photoshop. The final image is printed on a heavy, high quality watercolor paper.*"

The simplified version of this technique, and one that you will be able to easily assimilate and use in a creative manner, was demonstrated for a workshop of mine at the Santa Fe Photographic Workshops by Cotton Miller, a recent graduate of my MFA in Photography program, the College of Art and Design at Lesley University. I watched Cotton demo this technique and subsequently saw people with no knowledge of gum printing, or dichromate sensitizing, produce excellent results that same day.

Gumoil is fun and not as persnickety as gum bichromate or bromoil. The process is very straightforward and consists of several consecutive steps beginning with the creation of a **positive** transparency that is easily produced using Pictorico Ultra Premium OHP inkjet film and Photoshop. You can also use a cliché verre or an acrylic lift from a

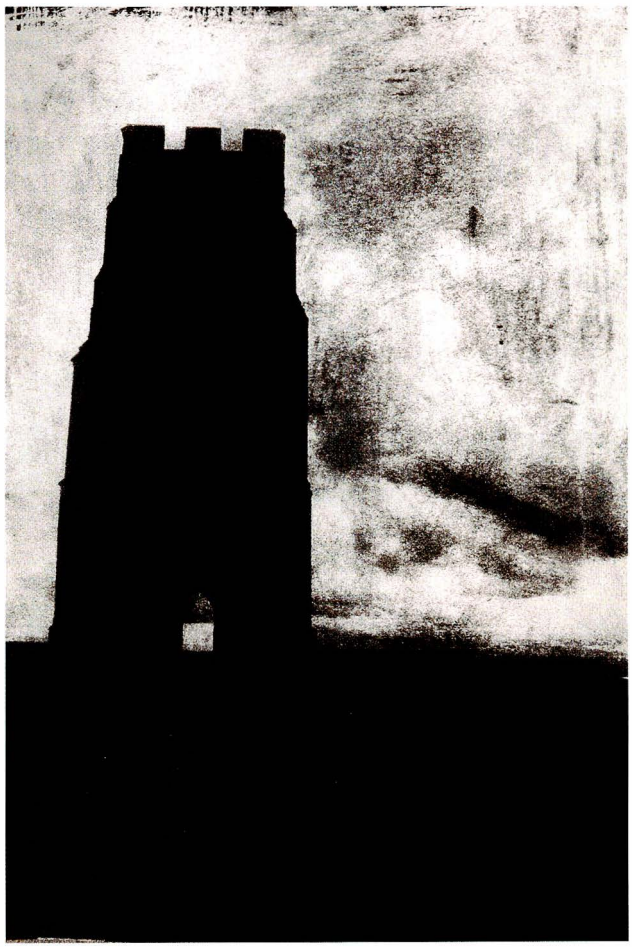


Figure 19–3
Michelle Rogers Pritzl, *Untitled*, Glastonbury, 2010 (gumoil)
This gumoil piece is from another former MFA student of mine, Michelle Rogers Pritzl.
(Courtesy of the Artist)

printed source. This positive transparency is contact printed against a gum/dichromate-coated paper, washed in water, dried, impregnated with oil paint using a stencil brush, wiped, bleach-etched, washed again, dried, and repeated with additional colors or intensified with the same color. Each print is one of a kind, and the possibilities are virtually limitless.

Materials You Need

- Cot 320 is the paper of preference and works best for multiple passes. Stonehenge is less expensive and works very well, but it gets fragile when it's wet and can tear easily if mishandled. Arches platine also works well as does Lana Aquarelle or other heavyweight hot press watercolor or printmaking papers.
- Distilled water
- Gum arabic
- Potassium dichromate in a saturated solution. The recipe is one part saturated potassium dichromate to three parts gum arabic. Apply a fairly thick coating to your substrate.
- Smooth foam brushes for the application of the gum sensitizer. Be sure to buy the highest quality foam brush you can find, as the cheaper ones make bubbles in the coating.
- Pictorico OHP Ultra Premium to make a positive film image. Or, a film positive, or cliché verre, or acrylic lift positive.
- Paper or vellum paint palette
- Professional artist's grade lamp black or ivory black oil paint. Also payne's gray, or any other colors of choice. Do not use "academy grade" or cheap paint.
- Paper towels (preferably the blue paper shop towels)
- Stencil brushes in a variety of diameters
- Household bleach

Preparing the Sensitizer

First, make up a saturated solution of potassium dichromate. You can weigh it out and make a 13% solution (potassium dichromate is saturated between

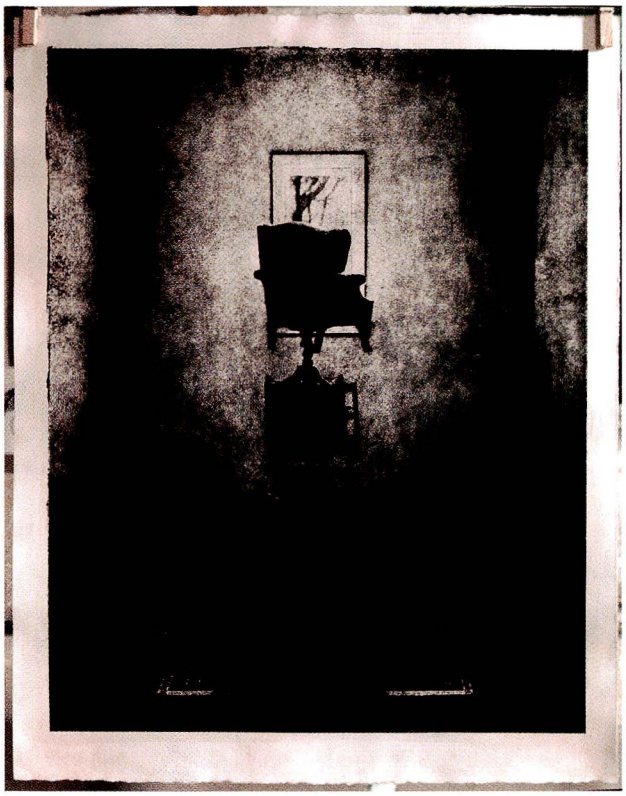


Figure 19–4
Kelly Wrage, *Stacked Chairs*, 2013 (gumoil)
This is an excellent example of a gumoil print from another former student of mine, Pennsylvania alt pro artist Kelly Wrage. In this piece she continues her series using miniature tableaus and oddities as an abstracted representation of domesticity.
(Courtesy of the Artist)

10% and 13%), or simply add potassium dichromate to a specific amount of distilled water until the chemical no longer dissolves in the water . . . meaning it is saturated.

Next, make up the gumoil sensitizer in a 1:3 mix by combining one part saturated potassium dichromate with three parts gum arabic. Make as much or as little as you wish and then apply this mixture with a brush or roller, and keep it thin, to your heavyweight paper of choice. If the coating is too thick, the exposure will take longer. I will recommend a paper that is at least 300-pound weight (such as Cot 320) at a 22" × 30" size, as it will need to stand up to repeated applications of paint and long immersions in water. The process works a bit better if you apply a fairly thick coat of the gum sensitizer. This will certainly help with retaining your highlights through multiple passes. Coat the paper smoothly and let it dry thoroughly on its own or force dry it with a hairdryer. You will likely find that

you will be able to get closer to "paper-white" highlights if you let the paper dry on its own and then blow dry it vigorously prior to exposure. You will not have to re-sensitize the paper to do multiple coatings of paint.

Film Positive Exposure

The next step is to place your film positive against your sensitized and dry paper so that the image will be *right reading* and load it into a contact-printing frame for exposure to UV light. Expose in the sun or in a UV printer for 2–10 minutes. As you increase the exposure time you will increase the contrast in the final image. Be careful that you don't destroy any chance of subtlety by overexposing. The important thing to keep in mind is that you need to expose long enough to be sure that you have pure white areas within the image . . . these will be your shadow areas.

Note: A thick gum sensitizer coating will usually require a longer exposure time. My friend, and former student, Kelly Wrage wrote that she needed 8–13 minutes with her silkscreen exposure unit. This created a nice, hard gum layer that withstood more than one pass, even with a tough-to-remove paint in the second pass. Exposing to the point where she was just about to lose her highlight detail worked best. Areas that are going to be white in the end should be getting to a middle grey or slightly darker value after rinsing the gum layer.

First Water Wash

After exposure, immerse the exposed paper in an ambient temperature water bath for 5–6 minutes or until the areas of the image that will eventually take on the oil paint are open and paper white. Dry the paper well and tape it down on a hard and flat surface for the next stage, which will be the first application of the oil paint. I use a blue painter's masking tape because it can be removed easily without harming the paper.

Once the paper is dry and taped down, using a paper or vellum palette, mix up some oil paint of your choice and load up your stencil brush. I recommend that you always use a professional artist's grade paint. Beginning your experience with gumoil with an academy/student-grade lamp black or ivory black paint will frustrate you just as it does when performing gum bichromate.

Using inexpensive oil paints that set up too quickly can be a problem when trying to rub them off. They can cover your darker first pass color and can be impossible to etch through if you don't remove them fast enough. Avoiding them altogether is best if you can find or mix another color that can sit longer. Additionally, the more white or chalk there is in a color, the more difficult it may be to rub off. Conversely, super-oily and saturated colors can be just as hard to work with because they can penetrate the gum sensitizer into the paper rather quickly.

Stippling the Paint with a Stencil Brush

Now, like a woodpecker making a staccato sound against a tree, apply a thin coating of the professional-grade oil paint, such as Winsor & Newton, to the entire exposed area of your dichromated image. If your paint is of a soft consistency, you may also apply it as you would paint on a canvas, brushing back and forth horizontally, and then vertically, until you have a smooth coating on the surface of the paper. If you elect to use the stencil brush stipple method, place some oil paint on your stencil brush, and with a stippling/dabbing action, continue the paint application action until the paint is solidly covering the image area. Now, let it sit for 15–30 minutes and as it settles, if you observe the paper at an angle, you will begin to see the image emerge. At that point the paint is set in the paper and you are ready for the next step.

Hand-Wiping

Now you are going to perform a hand-wipe removal of the paint that has not set into the paper. With paper or shop towels begin gently wiping the painted area in circular motion patterns, like waxing a car, until the image begins to emerge. Be patient, as this will take a little time. Little by little you will see the image emerge, and although the highlight areas are not clear yet you will get a good idea of what the image will look like following the bleach-etch and washing stages.

On occasion, when applying a second coat of paint in a different color, and if your gum sensitizer is thick enough, it may help to wipe the paint shortly after you apply it. This seems to work best when your gum sensitizer layer is thick and your paint is of good quality.

Second Water Wash

Once the image is present and the majority of the paint has been removed, place the paper in a tray of ambient-temperature running water and agitate it until the whites become brighter and clean. Do not stop this wash process until the paper is completely saturated. Running water is ideal, as it assists in removing all of the unhardened bichromate.

Bleach-Etching Stage

As you near the end of this step in the process, you will want to open up your highlights with a bleach-etching bath. To do this, make up a tray of household bleach and water at one part bleach to six parts water. I know of some gumoil artists who use a 1:4 strength bleach, but be cautious: that dilution will act very rapidly. Keep in mind that the more water in the dilution, the slower the bleaching action. If you bleach-etch too aggressively after a pass, you will find it difficult to make a successful second or third paint impression . . . so be gentle and don't linger during this stage. Immerse the print in this bleach-etch bath for 10–15 seconds and the highlight areas will rapidly brighten.

It is very easy to over bleach-etch so you may want to reconsider waiting until you see white highlights. I recommend stopping before the perfect white, especially if you intend to do multiple coatings, and end the bleach-etch stage when you see a dichromate tan-greenish tint where your pure highlights reside. You will still be able to get rich and dark color in the areas that weren't paper white. Kelly wrote, "*I don't know how Koenig was able to go to paper white and still get a great tonal range after the second pass. It looks like he really cooked his gum layer when exposing it*."

Third Water Wash

Always treat your paper and image with "kid gloves" following the bleach-etching stage and consider applying your third water wash with cupped handfuls of water as you would when rinsing shampoo off a baby's head.

You might try removing the print from the rinse bath for a few minutes and then returning it to the water. This seems to loosen and clear some tougher spots very nicely. This is a good alternative to doing something more aggressive for clearing, like running water over the print, spritzing, or applying tools like brushes or cotton balls directly to the surface of the print to force clearing. If you are overly aggressive with your clearing there is a better than even chance that

Figure 19–5

Naomi Savage, *Ozymandias*, c. 1965 (acid-etched plate)

The late Naomi Savage has always been one of my favorite artists, and she was always breaking the boundaries with her work. Really, Naomi was making alternative images before there were alternative images. She began her career in photography in the early 1940s, studying with Bernice Abbott at the New School. A few years later she assisted her uncle, Man Ray, and then set out on her own. *Ozymandias* is a prime example of Naomi's work. What you see here was a created with a bichromated emulsion on a silver-plated copper sheet. Following exposure, the plate was deeply acid etched, inked, and selectively wiped. Naomi saw her inked plate as the finished piece itself, and did not escort it through the traditional intaglio translation to paper. I have lived with this plate on my wall for years and never tire of its power and beauty. *(Courtesy of the Artist)*

you will not achieve success with subsequent coating and clearing stages.

After bleach-etching, move the paper to a fresh running water bath and wash the print for 30 minutes. It is important to wash very well or else the bleach will simply continue to work after you think you're done. Dry the paper for 24 hours before moving to the second and subsequent applications of oil paint, washing, bleach-etching, and drying.

As always, please try to enjoy yourself while learning the process and don't forget that you are making one-of-a-kind images that aren't supposed to look like digital pics on a social networking site.

PHOTO-RESISTS ON METAL

Photo-resists on metal are compatible with gum bichromate and gumoil because both use dichromates for sensitization and water as the vehicle for developing out the image. This particular section could have easily fit in the Inkjet Intaglio chapter as well, but I've included it here in Dichromate Options for variety and to make sure I reach additional readers with the concept.

The purpose of traditional photo-resists is to provide the artist with a light-sensitive coated plate (metal, glass, ceramic, etc.) that can be exposed to UV light and developed so that the un-exposed and un-hardened resist washes away. It's possible to buy UV-sensitive plates from Solarplate and Boxcar, but this section deals with preparing your plates by hand and puts more of the process on your shoulders. That will likely open up opportunities for surprise and new ideas as you work through the process. During exposure, light enters the transparent and translucent portions of the negative or positive film image and hardens the resist beneath it in proportion to the exposure. Simultaneously, the denser portions of the negative or positive transparency prevent light from hardening the resist, and these portions wash away in simple water development. When the development and subsequent etch are complete, the result is an intaglio metal relief of your photograph in either a positive or a negative, depending on the type of transparency used during the exposure.

At this stage of the process, the resist that remains on the plate after development is additionally UV-heat hardened, making it acid resistant. The areas of the plate without the resist are susceptible to change and are etched by the acid to create an intaglio-etched plate. This metallic photographic relief is then cleaned with a solvent and either considered a unique object by itself, or regarded as a plate that can be inked, wiped, and printed on paper with the aid of an etching press or hand/tool-applied pressure.

A Simple Photo-Resist Formula for Intaglio

The following is a simple formula for creating a resist for an etching plate using fish-glue, albumen, ammonium dichromate, and water. You will need the following:

- 30 ml fresh albumen
- 45 ml prepared fish glue (easy to find in an art supply)
- 6 g ammonium dichromate
- Distilled water

Step 1 Put 30 ml of fresh egg white in a mixing bowl, add 30 ml of distilled water, and beat it well. You may use powdered albumen , but because this formula requires only a single egg's albumen (approximately 30 ml) it really isn't worth the trouble to go get the powdered variety. You can also use the organic albumen in a paper carton container found in the supermarket with the eggs.

Step 2 In another bowl, mix 45 ml of prepared fish glue thoroughly with 30 ml of distilled water. Slowly pour the egg mixture from Step 1 into the glue mixture, stirring slowly.

Step 3 Mix 6 g of ammonium dichromate with 30 ml of distilled water. Under normal room light, add the ammonium dichromate solution to the glue–egg colloid so that it becomes light sensitive when it is applied to a surface and dries.

Step 4 Then add approximately 30 ml of distilled water to the solution. The amount of water you add depends upon how thin or thick you want the quality of the emulsion. You can also increase the sensitivity and contrast of the emulsion by adding more of the ammonium dichromate.

Before the plate is exposed it is a good idea to "bake it" with a hairdryer set on a hot setting. This step ensures the best chance of the resist adhering to the plate through the development stage. Just blow-dry for a few minutes; don't put the plate in the oven because excessive time and heat will fog the emulsion.

Step 5 In low-level ambient light, pour the colloid resist on your plate and rotate the plate in the air, emulsion side up, to ensure an even coating. You can try coating it like you would pour wet plate collodion (see the chapter for an illustration of what this looks like). You may want to use a brush for the coating, but the pour-and-rotate method seems to provide a smoother surface.

Step 6 Once the plate's surface has dried, you may place a film or waxed paper transparency (a positive or negative) in contact with the sensitized emulsion. Remember, your decision as to whether you will use a positive or negative transparency is dependent on the stages that the plate will go through and where you want to end the process. Use a contact-printing frame or lay a thick piece of glass on the transparency and sensitized plate to ensure a firm pressure between the film and the plate and expose this "sandwich" to UV light. You may use either an exposure unit or the sun, and you should definitely make exposure tests before committing your prepared plate to the UV light.

Step 7 Once the exposure is done, move to the lab for development. This stage is done easily in a bath of slightly warm water and continues, with gentle movement of the water, until the unexposed portions of the plate begin to fall away from the plate. The look here is quite similar to the way a gum bichromate print clears. Once you are content with the development, gently remove the plate from the water, blow-dry it, and place it on a hotplate to re-harden the resist that remains. Continue until the resist that remains turns a deep brown. Once that happens, take the plate from the hotplate and let it cool before etching it with acid.

Acid Etch Formulas: Nitric and Dutch Mordant

As a point of interest, you might want to know about several acids used in traditional printmaking when making an intaglio-etched plate. Nitric acid, in concentrations of 1:4 (for deep bites) to 1:12 (for aquatinting and fine line bites), is most often used on zinc or copper plates. A second type of acid etch bath, called a Dutch Mordant, is generally used on copper and is made by combining 10% hydrochloric acid, 2% potassium chlorate, and 88% water. A third type of acid etch is ferric chloride, normally purchased in a prepared solution. I specifically mention these formulas as the acid etching baths that you would most commonly find in a traditional printmaking studio.

There is enough to say about the subject of photoresists and printmaking to justify a completely new book. Here, I am briefly touching on a simple bichromate-based resist that can be applied to a metal plate and then acid etched following exposure. If this process instills a great curiosity in you about this area of image making, an abundance of other reference material awaits. Please take a workshop or a class as well; don't try to teach yourself about these techniques and materials. I should point out that the subject of non-acid intaglio is covered in the Inkjet Intaglio chapter, where saltwater is the processing solution.

Note Regarding Acid: Heat is released when strong acids are mixed with water, and increasing the amount of acid adds releases more heat. If you add water to acid, you will create an extremely concentrated solution of acid immediately at the point of the addition. So much heat is released that the solution may actually boil violently, causing eruptions of concentrated acid. Conversely, if you add acid to water, the solution that forms at the point of the addition is very dilute and the level of heat released is not sufficient to cause a violent reaction. *A*lways *A*dd *A*cid to water (Triple A), and never the reverse.

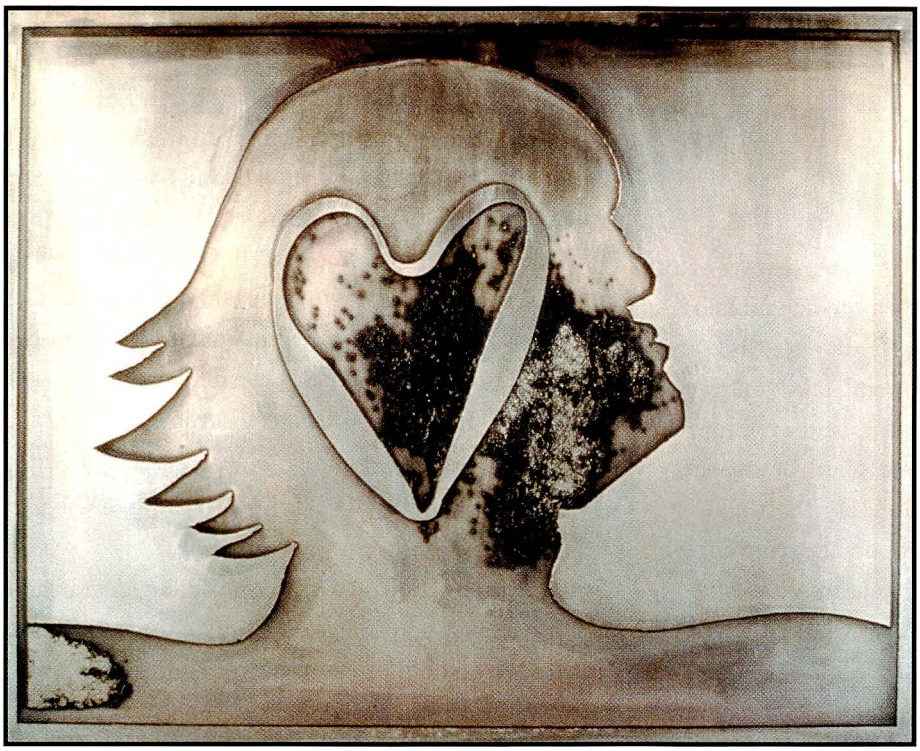


Figure 19–6
Naomi Savage, Contradiction
In Naomi Savage's powerful steel plate images she uses the process of plate making and photo-engraving out of context; allowing the plate, rather than the traditional intaglio end stage of a print on paper, to be the work of art. In this piece she endowed the plate with oxidized plating techniques, acrylic paint, ink, and lacquer.
(Courtesy of the Artist)

I want you to be very conscious of your safety while attempting these processes. Working with acids, dust, and chemistry demands that you pay close attention to your health. Be sure that if you work with acids you wear acid-resistant nitrile gloves, an apron, and eyewear. Also, if there are airborne fumes and dust, it is imperative that you wear a dual-filtered respirator. A painter's paper mask is worthless as a way of protecting you.

Etching

Again, I am recommending that you take a printmaking workshop or class before going much deeper into intaglio. That said . . . let's begin. Put on a pair of rubber gloves, eyewear, and a workshop apron and make sure that the etching area is well ventilated. If you have never worked with an acid-etching bath, it is imperative to talk with a printmaker about acids and options in plate biting. In this section I tell you how to use ferric chloride as your etching solution because it is one of the safer acid-etch options. Rather than make this bath yourself (because the process is rather tedious), I advise going to an art, printmaker, or chemical supply and buying a prepared ferric chloride etching solution. This will work on several types of metal, including the zinc that you are using.

Heat the ferric chloride to 100°F using a tray-within-a-tray method in which a larger tray with very hot water is holding an inner tray holding the acid and plate. Immerse your plate in the warmed acid bath and remember that the hotter the acid, the faster the etching action. Use a feather, or a hake fan brush (without a metal ferrule), to whisk away the bubbles in the areas of the plate that are being etched. Be gentle with the plate's resist emulsion.

Ferric chloride is a slow etch process and you may be feathering the plate for 30–60 minutes. Unlike nitric acid, there is no evident bubbling action (like water just before it boils) in a bite with ferric chloride. If you want to have bubbles, which will accelerate the etching energy, add 30 ml of hydrochloric acid to every 750 ml of ferric chloride developer solution. One additional piece of information regarding ferric chloride: unlike other etching solutions, ferric chloride turns the etched parts of the plate black during the bite. This black washes away with water and allows you to monitor the progress of your etch. Once the etching stage is done you may remove the resist, using water or solvents. What you will have is an intaglio plate with a subtle relief image. This plate can be used for very delicate embossing, inked and printed,

or simply inked as an object of art and inspiration. It's up to you to decide where to go and what to do next. My best advice would be to take an introduction to intaglio workshop or class and find out if it rings your bell.

A Few Words About Metal Substrates

Tooth is a word used to describe the surface texture of a substrate and what is needed to hold onto an emulsion, sensitizer, or image impression. To create tooth in an impenetrable surface like glass or metal, take your pick of a number of techniques including acid etching of metal substrates; sandblasting stone, glass, or any surface that can be scratched; steel wool abrasion; power sanding; multiple coatings of gloss polyurethane spray paint; asphaltum; albumen; glue; gelatin; collodion—whatever you can think of for putting a tooth or texture on whatever substrate you are using.

When I'm working on metal, I buy large metal sheets from an industrial roofing business, as it has the huge hydraulic cutting machines that can cut my plates to order. I degrease the plate with an industrial solvent because metal plates almost always come with an oil coating to prevent rust before the sale. When the plate is degreased, clean, and dry, I smooth the surface with steel wool and a power sander and proceed to give the plate multiple light coatings of spray gloss polyurethane . . . sanding or buffing with steel wool between each coating. It is important to use gloss polyurethane because both the matte and semi-gloss polyurethane finishes contain wax in their formulas to create their non-glossy appearance. Wax, as you know, is not conducive to holding onto a liquid emulsion. Don't feel that you are limited to a clear polyurethane . . . I often use a color gloss spray as a background launching pad, and the image *Vatican Bride on Acid* is an example of that.

Another preparation technique that I have used for metal plates is the application of a metal degrading acid before, or after, an aquatint . . . a melted resin on the plate used to create a surface texture for the ink after acid etching. The traditional acid to use in this instance is nitric acid solution mixed in a 1:8 to 1:12 acid-to-water dilution. (Again, never, ever add water to acid. Always add acid to water.) You may brush on the acid or immerse the plate (as in a printmaking lab setup), but be sure to pay attention to all safety recommendations. Nitric acid produces a dangerous nitrogen oxide gas when it is in contact with metal, and you MUST use a ventilating hood when working with it. If you have no experience with printmaking, or no access to a printmaking lab, you might consider using a copper plate and try the less dangerous ferric chloride to etch your plate with a texture. After etching and washing, seal the plate with several very thin coatings of gloss polyurethane spray. A good book on printmaking, such as *The Complete Printmaker* by Ross, Romano, and Ross, provides many ideas and suggestions for altering your metal surfaces.

Coating, Exposure, Development, and Re-Exposure

Let's return to the idea of simply using metal as a substrate for an alternative technique and not taking it to the etched state where a press will be required. Once the plate is prepared, it is time for an image. The first thing that I do is warm the surface of the alternative substrate that I'm using. This prevents the gum arabic, albumen, gelatin/glyoxal, etc., from "setting up" too quickly on a cold surface. For a metal or glass plate, I fill a tray, one that is smaller than the plate, with hot water and then lay the plate on the tray's top edges. The heat from the water in the tray below the plate keeps it at a constant warm temperature until I am satisfied with the look of the coating. Then I remove the plate and lay it on a flat surface to dry.

Coat the surface in the same manner as you would coat paper but with extra attention to getting the emulsion evenly spread, bubble free, and completely covering the entire printing area. You may, if your emulsion is fluid enough, elect to hand pour rather than brush. Allow the emulsion to dry on its own. If you use a hairdryer you will only harden the top of the emulsion. It also creates dust. You may find it necessary to add water to your gum sensitizer due to the thickness of the emulsion and the lack of friction between the emulsion and the surface. You'll have to make this decision once your surface has been prepared and you see how it behaves.

To make an exposure, place your enlarged negative in contact with the dry emulsion and put small pieces of tape on the edges of the negative to hold it on the surface of the plate. This allows you to monitor the exposure without losing your registration.

If your plate is thin enough, you may continue to use a contact-printing frame. Be sure that your image will be right-reading when done and then place the plate in the sun or UV exposure unit for your exposure. It is better to overexpose, due to the fact that the *hooking* abilities of the emulsion are not as tenacious as when you are using paper. I use the term *hooking* in teaching when I am trying to paint a word picture of what happens during a gum exposure. As exposure increases, the dichromated emulsion hardens in relationship to that exposure. In effect, it is hooking into the substrate. With metal or glass this can't happen and so the hooking must take place in the thin tooth or surface preparation.

Figure 19–7
Robert Hunt, *Leaves*, 1842 (chromatype)
Like Herschel, Hunt was enamored with the concept of making photographic images in color, but instead of the extracts of flowers, Hunt utilized elements such as iron, mercury, and copper and began to produce sun-dependent images on paper. With a tip of the hat to Vacquelin, Suckow, Ponton, and Becquerel, Hunt also found that he was capable of making either a paper negative or, with a longer exposure, a direct paper positive.
(Photography Collection / Harry Ransom Center / The University of Texas at Austin)

Development is the complicated part. Lay your exposed image in a tray of ambient temperature water for 10–15 minutes and very gently move the water within the tray. Do not run water directly onto the surface of the image and keep the image face up during the wash . . . unlike what you do with paper. Highlights can be assisted in clearing by means of gentle whisking with a watercolor fan brush, but keep in mind that the surface image is extremely fragile. When you reach a point at which the image pleases you, gently remove the plate from the tray, keeping it face up, and delicately begin to blow-dry the image. When it's dry, take the plate back into the sunlight for a re-exposure of 10 minutes, as this action will help harden the image and make it less fragile.

Note: If you are in a hurry, and like a more organic look to your work, you can force develop with brushes, your fingers, jets of water, sprayers, etching tools, etc.

Once the plate has been through those stages you may now go on to another coating, following the same sensitizing and exposure sequence. This process will require patience and skill. Your other option is to finish the plate with a spray coating of acrylic gloss polyurethane. If you find that you are having difficulty retaining the first impression in subsequent coatings, you might want to give each coating a gloss polyurethane spray followed by a light steel wool sanding. If you detest your image you can plug in the power sander and eliminate it and begin again or retain the base image as a "canvas" for painting. Use your imagination and enjoy the possibilities.

ROBERT HUNT'S CHROMATYPE PROCESS (1843)

A Little Chromatype History

In 1798, Louis Nicolas Vauquelin, working as an analytical researcher in the chemistry laboratories at Ecole Polytechnique, discovered chromic acid/chromium. He observed *"that chromic acid forms with silver a carmine-red salt which turned purple when exposed to light"* and subsequently named this new element

chrome from the Greek word *chromos,* defining the presence of color. Vauquelin's discovery was related to the light sensitivity of silver salt chromium compounds, and it wasn't until 1832 that Gustav Suckow observed the light sensitivity of an alkaline chromate (potassium bichromate) in the presence of organic salts that hardened organic matter in proportion to the degree of exposure to the sunlight.

Shortly thereafter, in 1838, Mongo Ponton observed that paper saturated with a salt of potassium bichromate, when dry and exposed to the sun's UV rays, would yield a yellow image on an orange ground until washed in water, whereupon it transformed to a white image on an orange ground. Two years later, in 1840, Edmund Becquerel announced his work on the insolubility of organic colloids sensitized with potassium dichromate, and that a piece of paper sized with iodide of starch, and subsequently soaked in a bath of potassium bichromate was, upon drying, sensitive to UV light.

Note: For an account of this process see Robert Hunt, *Researches on Light* (London: Longman, Brown Green and Longmans, 1844), reprinted (New York: Arno, 1973), p. 150. There is also a very interesting letter written to Hunt by Rev. J. B. Reade on February 13, 1854, that you may find most entertaining.

How to Make a Robert Hunt Chromatype (1843)

This is from *The History and Practice of the Art of Photography* by Henry H. Snelling (G. P. Putnam, 155 Broadway, 1849).

"Many efforts have been made to render chromatic acid an active agent in the production of photographs. M. Ponton used a paper saturated with bichromate of potash, and this was one of the earliest photogenic processes. M. Becquerel improved upon this process by sizing the paper with starch previous to the application of the bichromate of potash solution, which enabled him to convert the negative picture into a positive one, by the use of a solution of iodine, which combined with that portion of the starch on which the light had not acted. But by neither of these processes could clear and distinct pictures be formed. Mr. Hunt has, however, discovered a process which is so exceedingly simple, and the resulting pictures of so pleasing a character, that, although it is not sufficiently sensitive for use in the camera, it will be found of the greatest value for copying botanical specimens, engravings, or the like."

The influence of Robert Hunt on the medium of photography is nothing short of profound, and it is odd that his name doesn't have the same weight in the discussion of the medium's past as such luminaries as Niépce, Daguerre, Bayard, Talbot, and Herschel. He was, after all, one of the earliest advocates of the artistic possibilities of the medium and a clear and strong voice calling upon Talbot to release his stranglehold on the patent rights to the calotype in order to fully democratize the medium.

Hunt wrote what is arguably among the first photographic manuals discussing the promise and beauty of photography. In his book, *A Popular Treatise on the Art of Photography* (Glasgow, 1841), he wrote a concise and prognostic anthem to a medium that was barely three years old. "*Photography does not possess the advantages of perfection, any more than other human inventions. Had it been left where we found it when the discovery was announced, it would have remained a beautiful but useless thing—a philosophic toy, which lent little assistance to the cultivation of taste, but afforded none to the economy of manufactures: whereas it now promises to be of important use to many of the arts of industry.*"

In 1843, Hunt realized the chromatype process. Like Herschel, Hunt was enamored with the concept of making photographic images in color, but instead of the extracts of flowers, Hunt utilized elements such as iron, mercury, and copper and began to produce sun-dependent images on paper. With a tip of the hat to Vacquelin, Suckow, Ponton, and Becquerel, Hunt also found that he was capable of making either a paper negative or, with a longer exposure, a direct paper positive. Here are the simple step-by-step directions, with a detour or two, for Robert Hunt's chromatype process.

Step 1 Immerse the Paper in Copper Sulphate

Immerse the paper in a solution of copper sulphate made by mixing 3.70 g of copper sulphate to 30 ml of distilled water. After the

paper is sufficiently saturated, hang it on a line until it is partially dry . . . not wet but cool to the touch.

Step 2 **Immerse the Paper in Potassium Bichromate**

Next, immerse your partially dried paper in a moderately strong solution of bichromate of potash (potassium dichromate). I am assuming that since we generally use potassium dichromate in a saturated solution between 10% and 13% that Hunt means that this solution is pretty close to being saturated. Begin your testing at 11.5%. Other chromates can be used. Snelling, however, indicated that none were as successful as Hunt's chromate of copper.

Step 3 **Dry at a Little Distance from the Fire**

Now, according to Hunt and Snelling, you're supposed to dry your paper "at a little distance from the fire" and the paper, once ready, will be fine for use for quite a while. Since the majority of you probably don't have a hearth fire burning at all times, I think that hanging the paper on a line in low-level ambient light (not florescent) will be fine.

Step 4 **Exposure**

When the sun is out, try using a negative in a contact frame, or making a photogram of some sort directly on the paper's surface. Expose your chromate of copper paper directly in the sun for 15–20 minutes. The image that you will see after the exposure will be in the form of a negative.

Step 5 **Silver Nitrate Wash**

Now it is necessary to wash over the negative print with a solution of silver nitrate. This will provide, according to Hunt and Snelling, an immediate and beautiful deep orange image on a tan (and sometimes white) background. I would recommend beginning with an 8% silver nitrate solution and adjust up or down from there for the best results. It shouldn't take more than a few attempts before you know which percentage will work best. Be sure to wear nitrile gloves and eye protection during this part of the process.

Step 6 **Fix with Distilled Water**

The image must be fixed immediately by washing the exposed paper in distilled water, two running water baths at 5 minutes per bath, and then line dried.

Fixing Option: Talbot's Potassium Bromide Fix

Although water is the only fixing requirement indicated in Hunt's process, you might want to try an experiment if you find that your image is yellowing. Just for fun, try Talbot's potassium bromide calotype salted paper fixer recipe of 6.4 g of potassium bromide mixed into 300 ml of distilled water.

Lilac Positives After a Salting Bath

Here's some more interesting information from Snelling: "*If the positive picture be placed in a very weak solution of common salt (potassium bromide for instance) the image slowly fades out, leaving a faint negative outline. If it now be removed from the saline solution, dried, and again exposed to sunshine, a positive picture of a lilac color will be produced by a few minutes exposure. Several*

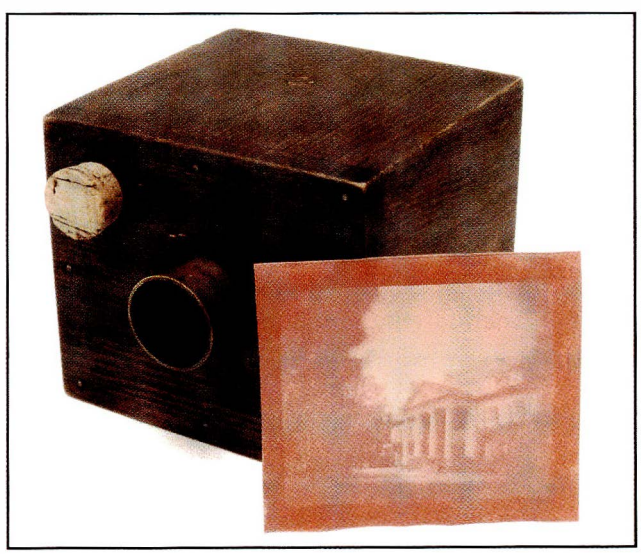


Figure 19–8
Mark Osterman, Chromatype of George Eastman House
Here's an example of a contemporary chromatype by Mark Osterman. *(Courtesy of the Artist)*

other of the chromates may be used in this process, but none is so successful as the chromate of copper."

If you elect to use the potassium bromide salt bath, you will likely experience what Snelling described and see your image slowly fade. If all goes well, you'll be left with a delicate negative outline of the original. If you then dry the paper and re-expose it to bright sunshine, a positive, lilac-colored image will emerge in a few minutes.

Snelling relates, regarding the relative strength of the solutions, that if they are saturated (such as the potassium bichromate at 10%–13%) a negative is produced. However, if the solutions are three or four times their bulk of water, the picture darkens initially and then a bleaching effect takes place, resulting in a faint positive that is then brought out with great delicacy by the silver nitrate bath.

Once again, it's important to enjoy the process of learning something new that is unpredictable, so have some fun!

BICHROMATED WASH DRAWING

Here is a funky variation of gum bichromate from the book *Photography: Theory and Practice*: 3rd Ed., by L.P.Clerc, Hon.F.R.P.S., published in 1954, that is particularly suited for creating large images from large film or paper negatives.

Materials You Will Need

- Hot press printmaking or drawing paper for the substrate
- Sugar
- Knox gelatin from the supermarket or photo-grade gelatin
- Distilled water
- A teakettle or pan for boiling water and creating steam
- Lamp black powdered pigment
- Gum arabic
- Starch
- A palette knife
- A sheet of glass
- A mixing vessel
- A glass or plastic beaker
- Sepia watercolor paint
- A flat-end Richeson synthetic brush
- A watercolor fan brush (also called a swallowtail brush)

Sizing and Steaming

In this technique, a printmaking/drawing paper is first sized with a very thin application of a weak gelatin solution. To make this gelatin solution, begin by taking a beaker filled with the following:

- 100 ml distilled water
- 4 g crystalized sugar

To this, add 4 g of gelatin.

Allow the solution to bloom for about 20–30 minutes. Then place the beaker in a larger container of warm water and bring the gelatin solution to approximately 115°F. You will need 1 ml of solution for every 16 square inches of paper surface and more if you are going to size your paper in an arid environment like Santa Fe.

Affix your chosen paper to a flat coating surface such as a level piece of glass, Lucite, or a drawing board. Now pour your gelatin and sugar solution into the center of the paper and using your brush of choice, spread a thin coating evenly, with some pressure, throughout the surface of the paper until it has a matte surface appearance.

Once you've completed this step, take the sheet of paper and pass it through the vapors of steam from boiling water in a teakettle or pan until the matte surface of the gelatin and sugar solution on the paper turns glossy. Don't let the gelatin in the brush dry in the brush.

Applying the Pigment

Now put 1 g of degreased lamp black powder pigment on a piece of glass, making a mini-volcano with a crater in the center. This is similar to how you make fresh pasta with your flour as the table-top mixing bowl for the eggs and water. Into the pigment crater, pour 2.5 ml of gum arabic diluted 1:1 with water. With your palette knife, mix these ingredients thoroughly and slowly add another

2 ml of water. In your mixing vessel, grind the paste until it is perfectly silky smooth . . . about 10 minutes.

To cover a sheet of 16" × 20" paper, you will need up to 2 g of the silky smooth pigment paste to which you will add ¾" sepia watercolor paint. This warms the color of the black and supports a better adhesion.

Now add to your mix approximately 16 ml of the following solution that you will prepare using boiling water.

2 g	crystallized sugar
2 g	starch
100 ml	water

After mixing thoroughly, this paste is placed at the center of the gelatin-coated sheet and spread with the same brush you previously used and that you have prevented from drying out. When the color begins to present itself and thicken, take your clean brush, preferably a flat tipped synthetic, and finish off the coating in as smooth and artistic a manner as possible. Try to avoid visible brushstrokes. Continue brushing until the sheet is surface-dry, and then hang it up to dry completely.

Figure 19–9
Galina Manikova, ID—04, 1993 (dusting-on/ceramic)
Galina Manikova is one of the most productive and innovative artists I have known. Much of her work is motivated by the memories of her childhood and the images found in her family albums. This is Galina at age 5 or 6, sitting on a bench.
(Courtesy of the Artist)

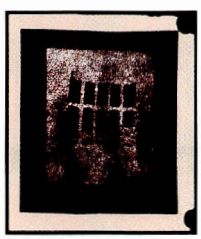
Sensitizing

To sensitize the paper, immerse it in a solution of 1% ammonium bichromate to which you have added a 1% solution of sodium or potassium citrate.

The negative best suited for this method of printing should have a density range of about 1.3, which is not terribly dense and is probably similar to a negative you would use to do traditional wet lab enlarging. The exposure should be equal to that required to make a POP print for toning and fixing.

Development

After exposure, and prior to development, the print is immersed face down for about 10 minutes in a dish of water at 115°F. Try to avoid air bubbles forming during this immersion. As the water slowly cools, remove it from the bath and adhere it to a rigid support that you will keep at a shallow angle. Development begins by squirting the surface with water at a temperature of about 18°F above that of the soaking water you just removed the paper from. This may be done with a garden sprayer, a sink spray attachment, or an airbrush. Hold the spray 12"–16" from the print, and squirt the entirety of the paper's surface. Development may be localized as required by bringing the sprayer closer to the print. Development takes between 20 and 30 minutes for a surface that has been correctly exposed.



THE DUSTING-ON PROCESS

A Little Dusting-On History

The dusting-on process is a curious alternative technique that has a complicated family tree with creative roots intersecting within the work and research of Vauquelin, Ponton, Becquerel, Talbot, Archer,

Garnier, Salmon, and Poitevin. It began to evolve, as mentioned earlier, with Vacquelin in the late 1700s and then expanded with Suckow's observation of chromate sensitivity in 1832. Mungo Ponton's revelation regarding the light sensitivity of potassium dichromate in 1839 was immediately followed, in 1840, by Edmund Becquerel's realization that the dichromate's unique properties and reactions were in part due to the organic starch used as a sizing in papermaking and that similar results could be recreated with any organic substance such as albumen, gelatin, gum acacia, and glue. In 1855, Alphonse Poitevin directed his attention to the application of the dichromates in the photomechanical production of permanent prints and filed for his first carbon process patent.

In 1858, Poitevin worked on a process that utilized a dichromate-sensitized colloidal solution of bee's honey and gum arabic. He is credited with being the first to then add pigment to the equation, as in the gum bichromate process, thus realizing a connection to painting. Poitevin also conducted variations on the dichromate theme . . . among them a perchloride of iron (a.k.a. ferric chloride and iron trichloride, a highly toxic brew used to engrave metal plates) and a tartaric acid solution exposed under a negative that had been covered with collodion and transferred to a gelatinized paper. When mixed with gelatin and perchloride of iron/tartaric acid, it was exposed under a positive and could then be "developed" by dusting-on directly. The best guide for this process is Poitevin's own book from 1863 in which he describes using both gelatin and gum base options.

Concurrently, in 1858, Henri Garnier and Alphonse Salmon observed an odd photochemical reaction that showed ferric citrate having less solubility in water, when it was combined with glycerin or

Figure 19–10

Aspen Hochhalter, *I Must Make My Bones*, 2011–2012 (dusting-on just dichromate and gum and burned hair ashes)

In this work, Aspen is collaborating with a modern dance choreographer to create a set of movements that she will then perform and photograph. These are the first two pieces, preludes to the full body of work. The first, on the left, is a clear gum sequence. The second, on the right, is a dusting-on process she made with a clear gum, and at the point when the paper was dry, but the gum was still soft and sticky, she sprinkled the ashes of burned human hair on the print. In this manner, the self-portraits gain form and content and imbibe strength from the hair.
(Courtesy of the Artist)

alcohol, in those areas of an exposure that had been subjected to UV sunlight. Based on this observation, Garnier and Salmon proceeded to dust on pine soot, colored dry powder, or metallic salt, which adhered only to the unexposed and still tacky (when humidified) portions of the image. The image was fixed by rinsing it in water, where the un-hardened, more soluble, and less exposed iron salt dissolved and dropped away from the substrate's surface, leaving a positive image as evidence of the process. This process became known as the dusting-on or powder process. By 1859, Garnier and Salmon had abandoned the iron-salt technique and switched to a hygroscopic layer of ammonium dichromate and sugar that eventually led to the technique of image transfers on ceramic surfaces.

How Dusting-On Works

In the dusting-on process, a transparent or translucent *positive* film or image is used rather than a negative. The reason for this is so a powdered colored pigment can be dusted on the exposed and humidified paper print to construct an image. The areas of the exposure that have not received a lot of UV light, and where the darker shadow areas will deflect exposure, will be tacky (as a tan un-hardened colloid/dichromate) and subsequently able to receive a powdered pigment or ash following the exposure. Printed without any post-exposure colored pigment application, exposures with this sensitizer will form chromium dioxide, sepia/grey-colored images. This type of print is essentially Mongo Ponton's *pontontype* technique, which employs potassium dichromate as a solo sensitizer; left alone, unwashed, the image will eventually turn a pale green similar in color to oxide of chromium watercolor paint.

Dusting-On for the Deceased

The most unusual and bizarre variation of the dusting-on concept is attributed to one of the several books by Fraprie and Woodbury . . . each one identically titled *Photographic Amusements: Including Tricks and Unusual or Novel Effects Obtainable with the Camera*. After a fun treasure hunt, I located and purchased a 1931 version of one of their books, hoping to find the exact description of the following dusting-on technique. Alas, it wasn't the right edition, but this is the basic idea.

In the Fraprie and Woodbury book I failed to find, there is a dusting-on technique that calls for the use of a dead person's cremated ashes for the pigment! The general idea is that you take a picture of the recently deceased . . . a practice that was very common in the past when people died at home instead of in hospitals. It is also why many older homes have double front doors—so that the coffin and pallbearers could comfortably exit the house. I digress . . . in any event, after making a transparent positive the photographer placed the positive in contact with a gelatin-sized paper that had been coated with a sensitizer solution of saturated potassium dichromate and honey.

Following a sunlight exposure of the film or paper positive, in contact with the gelatin sized and dichromate and honey sensitized paper, all that that was needed were the ashes of the departed. These were gently sprinkled over the humidified (probably using straws and hot breath) and sticky dichromated and honey parts that had not been excessively hardened by light. The excess ashes were then brushed away, leaving an image of the departed in his, or her, very own ashes! Since reading about this process I have this vision . . . I see the bereaved family sitting in a circle, each holding an edge of the exposed bichromated image of the deceased on their knees, straws between their lips, all gently blowing their warm and humid breath on the paper, humidifying the portrait so that it will accept the ashes. It is a scene suited for a Jeanette Winterson novel.

The dusting-on process can be used on a variety of surfaces, including paper, glass, prepared metal, and canvas. The primary rule for this technique is to have a good time with it and not expect too much until you modify it to suit your working style.

Dusting-On Process with Ceramic Pigment

Returning to the basic premise of making an image with a dichromate in a process such as gum bichromate, gumoil, chromatype or dusting-on, all of these processes are comfortably based upon the concept that a colloid (collodion, gelatin, gum, honey, syrup, bitumen)

can be made sensitive to UV light by the addition of a dichromate. When this sensitized colloid is exposed to UV light, the portions of the sensitized colloid that are exposed to the light will harden in direct proportion to the amount of the exposure it receives. In other words, the colloid hardens with increased exposure, becomes less sticky, will not dissolve in a wash-development bath, and will not accept pigment or any other matter that you dust on to it.

In the dusting-on process, unlike a gum bichromate process, the transparent contact film or paper is not a negative, but a positive. If you work on a metallic plate, the image is realized by brushing over the exposed surface of the prepared colloidal metallic plate with ceramic pigment or metallic enamels that will adhere to the exposed image in direct proportion to the amount of exposure the plate has received. After drying the plate, the image is covered with coat of gelatin or gum arabic, and after drying, it can be spray glazed and kiln fired. Metal enameling does not require spray glazing. If you are performing this process, don't forget to add special flux compounds to the pigments.

To see this in your head, imagine a clear film box with a black circle in the middle of it. If this is a positive image, and you lay this positive transparency in contact with the plate for exposure, the black circle in the positive film will prevent exposure, or hardening of the bichromated colloid on the plate, and that circle will remain sticky after the exposure. The outside clear area, around the black circle, will permit exposure by the UV light source and will harden. When a ceramic pigment is dusted over the exposed plate with a soft brush, the still tacky black circle will accept the ceramic pigment, while the hardened outside area will not.

A Contemporary Dusting-On Process

In Norway, artist Galina Manikova has been working since the 1980s with her own contemporized dusting-on process with ceramics. Galina's technique is a variation on classical ceramicist workflows and is so unique and mercurial that she describes her recipes and process as performances with an addition of intuition, experience, and science. Her way of working is quite like a chef in a kitchen, where a trip to the garden and the basic recipe are only the first steps in a greater cooking adventure.

Galina begins by spraying a layer of gum arabic on either a bisque-fired piece of ceramic or a metal plate. Bisque firing is the first kiln firing of a ceramic work and is done to prepare the ceramic piece for additional influences and coloration. Essentially, bisque, or biscuit, firing around 1,000°F changes the strength and physical nature of the clay while leaving it porous so that it can accept glazes.

The sprayer is a standard ceramic spraying gun used to apply glazes, and the gum arabic can either be a standard gum bichromate straight from the art supply or one that has been diluted with water. If you were going to mix a powdered gum arabic with water you would make this mix with 70 g of gum arabic in 400–500 ml of distilled water. In effect, the purpose of this step is to create a smooth surface so that the pigments do not hang themselves on the printing surface during the pigment dusting stage. Once this step has been performed, a solution of dichromated gelatin and sugar is applied and allowed to dry overnight.

Dichromated Gum Formula

30 ml	dichromated gum arabic (1:1 potassium dichromate and gum arabic)
70 g	sugar
15 g	bee's honey
150 ml	vodka (40% alcohol)

Note: Spraying a dichromate is a dangerous activity! Do not perform this technique without using a ceramic spraying box, working in a room with excellent ventilation, and wearing a dual-filter mask, safety goggles, and nitrile gloves. No shortcuts . . . be safe and smart.

In our correspondence over the years, Galina and I discussed using alternatives to sugar, due to its tendency to crystallize and caramelize, principally substituting the sugar with a thin dilution of non-crystallizing bee's honey or a syrup of any kind. The purpose of the syrup, honey, or sugar solution is to keep the surface emulsion slightly sticky and tacky. To sensitize the plate, a solution of saturated potassium dichromate (10%– 13%) is mixed with the gelatin and honey/syrup solution in a ratio of approximately 1:1.

An alternative to this coating method is one that Galina uses in which she coats the surface with the gelatin/honey/syrup as a base coat and when the surface is tacky, sprays, brushes, or pours a saturated solution of potassium, or ammonium, dichromate over the surface three times.

Note: If the emulsion is too tacky, the entire surface, even after the exposure, will accept the pigment. If the surface is too dry, the pigment will not attach to any of it.

In total darkness (important for long exposures), the image is exposed using a slide projector and its 250-watt quartz light source at a distance of 4–6 feet from anywhere between 30 minutes and 3 hours depending on the density of the *positive* transparency. Since slide projectors are almost a relic of the past at this point, you might consider making an inkjet positive with Pictorico Ultra Premium OHP inkjet film and contact printing it using a CFL lighting unit or a traditional 250-watt light source. The positive film is most successful if it is high in contrast.

Figure 19–11
Galina Manikova, Blue and Fireproof, 1989
In this work, the images are transferred to both ceramic and metal using the dusting-on method and very finely ground iron powder for dusting-on metal plates that give the impression of shadows. The finished plates are covered with an overcoat of hard glue to protect them.
(Courtesy of the Artist)

After the exposure, brush fine ceramic or enamel powders over the surface to reveal the image. The powders will stick to the fully and partially unexposed areas, while the other highlight areas that are clear on the film, hardened by the UV light during the exposure, will remain non-sticky and will not accept the pigments. Galina uses finely ground pigment powders. The benefit of using finely ground oxides, as opposed to stains or pigments, is that one can pre-fire before glazing in order to eliminate all organic matter that will sometimes cause the glaze to separate and lift off.

If there is no need to glaze, you can use any fine pigment powder and fire directly to the final temperature. That is what Galina did for her *Blue and Fireproof* installation, working at a brick factory and firing in a tunnel kiln along with the fireproof bricks at extremely high temperatures. One of her techniques was to use saturated oxide mixtures that gave a shiny golden luster color at that high temperature. When the application of the pigments is done, the ceramic pieces are fired at a high stoneware temperature (1,200°C–1,500°C) in a kiln. Metal surfaces are fired at a lower temperature than is stoneware (800°C–enamel/1,000°C–bisque) to get the iron powders to stick and are then re-fired at a stoneware temperature. In Galina's *Blue and Fireproof* she did not fire the stainless steel plates but dusted-on using finely ground iron powder and then overcoated the plate with a hard glue to protect it.

Dusting-On With a Glass Substrate

Another substrate that has all sorts of creative possibilities is glass . . . and in recent years, many artists have turned to this material as a surface for their work. Students often take the hand-applied liquid emulsion route when thinking about working on glass, while other artists are exploring wet collodion emulsions or dichromated colloids as in the example of Sandra Davis in this chapter. Galina Manikova uses a process

that incorporates a hardened/gelatin coating to prepare a surface for any number of applications including cyanotype, gum, and Van Dyke. To use glass as the substrate requires a slightly different strategy than does ceramic, metal, or other microporous surfaces.

Once your glass is thoroughly pristine and dry, you can begin to feel confident that the multiple gelatin–glyoxal solutions to come will adhere to the surface. When ready, pour a warm gelatin–glyoxal mix over a piece of warmed glass. It will be important to apply the warmed gelatin solution several times so that you have multiple thin layers rather than a single thick coating. Be very careful and move slowly, as you don't want bubbles in the gelatin. Dry the glass well between applications.

To begin, once the glass plate is clean and dry, lay it on top of a smaller tray filled with hot water in order to heat the glass from below to a constant warm temperature. This prevents the gelatin from setting up too quickly after you pour it on. Lacking a tray, you can also use a portable hot air heater to warm the glass. Be careful of using a hairdryer for this purpose due to the amount of dust it raises . . . that eventually settles into your gelatin and emulsion layers.

Now, begin to think about layering on successive coatings of *warm* gelatin and glyoxal. Please refer to the preparation instructions for gelatin–glyoxal sizing and hardening in the Gum Bichromate chapter before making up a solution. This is the difficult part of preparing your plate. Unless you have exceptional coating skills, don't try to gelatin-glyoxal size your plate with a single coat. Warm the glass, and the gelatin and glyoxal solution, and apply three very thin and delicate coatings . . . air-drying well between each one. Pour the warm solution into the middle of the warmed glass surface and gracefully move the glass plate around until the coating is smooth. If you are a good wet plate collodion practitioner, this part will be a lot easier for you. Do not mix up more solution than is necessary to coat the glass plate a single time. A new mix should be made for each of the three separate coatings. One good trick is to angle the glass so that the small amount of excess gelatin and glyoxal runs off into a separate tray. Once that step is done, lay the glass on a level surface and allow it to dry. Then repeat the process two more times.

Gelatin Coating Option with Separate Glyoxal Bath

Another coating option would be to apply a standard gelatin solution of 28 g gelatin to 1,000 ml of water. Pour, or spray, the gelatin on the glass plate and allow it to thoroughly dry. Following the dry stage, immerse the glass in a separate bath of prepared 40% glyoxal (available in a mixed state from Bostick & Sullivan) that you have set up outdoors or in a supremely well-ventilated space. The immersion time is very brief and once removed from the glyoxal, allow the print to dry completely in a clean space that is not in your living area.

After drying the plate, repeat the gelatin-to-glyoxal sequence two more times. When using this method you have to coat and dry your plate six times: three gelatin coats and three glyoxal hardener coats.

You can go a step further if you wish by applying an ammonium or potassium dichromate/gum arabic sensitizer to your hardened gelatin on glass plates. Make up a 1:1 saturated dichromate-to-gum arabic mix and coat the plate. Expose it to UV light for 10 minutes and wash for 20 minutes in running water. Then re-expose the plate to UV light one more time for an additional 10–15 minutes. For safety, throughout this process, be sure that you wear nitrile safety gloves, eye protection, and an apron, and make sure that you have fresh air or superior ventilation. Also, don't forget that glyoxal outgasses for about a day on paper, less I suppose on glass, but dry your plates away from where you eat and sleep.

What you are seeking is a smooth surface without bubbles, unless that is the effect you are looking for. The purpose of the gelatin is to allow the glass surface to accept a liquid sensitizer without running off or beading . . . like water on wax. Once you are ready to apply your liquid emulsion you may want to consider adding a bit of prepared gelatin to your sensitizer, as this will assist in the sensitizer adhering to the gelatin–glyoxal prepared surface. The emulsion itself should adhere just fine at this point, but if you are having issues with adhesion, it is another option to think about.

The Process on Glass Continues

Once the plate is base-coated and ready for the dusting-on process, it is coated with a saturated solution of potassium or ammonium dichromate mixed with dichromated albumen and honey. You may want to apply up to three separate coatings of the sensitizer with drying between each coat if you're looking for a very smooth coating. I'm not trying to be vague, but there are a lot of variables at play here and you'll need to determine the number of sensitizer coatings you need as you go through several experiences with the technique.

When the sensitizer coating is dry on the prepared glass substrate, it is exposed in contact with a *positive* film or projected positive transparency. The image is then revealed, after the exposure, by dusting-on colored ceramic glazing powders, with a soft brush, that will adhere only to the sticky unhardened parts of the exposure that have not been exposed to UV light.

For plates with a gelatin coating, the picture is then covered (fixed) with an alcohol solution containing a little acetic acid. The alcohol is a 96% solution, but in some countries "technical" alcohol is considered dangerous due to people drinking it and being poisoned. It is now harder to find, so, as a replacement, you can use vodka. After the alcohol fix, the plate is washed in freshwater until everything but the colored image on the glass has washed off. Galina points out that it is absolutely necessary to harden the gelatin before washing and it may be necessary to wait a few days before the washing step, as the hardening process of gelatin takes some time. When everything has been done, the glass plate is then fired in the kiln at about 580 °C.

Note: If you add acetic acid to gelatin it will not solidify so quickly. If gelatin is dissolved in acetic acid, you can mix it with alcohol without precipitation and this may be a way to prepare gelatin emulsions for spraying and airbrushing, etc.

You might be tempted to go to a monument company (the businesses that sandblast granite grave markers) to have a sandblasted tooth etched into your glass. This is really effective as long as you don't object to losing your glass transparency. If this is important to you, use the gelatin and glyoxal method.

You need to prepare a "Goldilocks" working space for dusting-on. Galina relates that it is important that the temperature, and humidity, of the working space be just right. By this she means that it is not too dry, not too hot, not too humid, and not too cold . . . just right. You will get the feel of what's right once you begin working with the process. The exception to the Goldilocks environment is if you are intending to put a dichromated gelatin on the glass for a dusting-on process using glass enamels and a firing temperature that is suitable for the type of glass (ceramic or metal as well) that you are using. The key is that everything must be hot and humid for this to work properly. Galina once mentioned that a Finnish sauna would serve well as a dusting-on studio.

Note: If you want to work in ceramics or glass for firing, then I strongly advise that you take a course or workshop in the ceramic discipline. As much fun as wet clay is, ceramicists have to deal with an abundance of less-than-safe issues (e.g., chemical glazes, kiln firings, etc.), and you will need to know of these things before you work in a ceramic studio on your own.

After all of the preparation it is absolutely necessary to expose the completed glass plate to UV light to harden the emulsion and allow it to air dry. It is important to be very careful when handling glass plates. In the wet stage it is quite easy to lose the entire image even after you have worked hard to make a surface for it. One last thought . . . if you just want to put an alternative process on glass, even if you have no intention of firing it in a kiln, you need to add a gelatin solution to the new sensitizer. By the way, firing a new sensitizer, like cyanotype, can be pretty interesting.

The proportion is 1/3 gelatin to 2/3 sensitizer, as in a cyanotype or Van Dyke, by volume. Prepare the gelatin "kitchen style" with 1 tablespoon of gelatin dissolved in as little water as possible. Begin with a little cold water, let the gelatin sit for 5–10 minutes and then add boiling water to dissolve any crumbs. When you're ready to use it, mix it in the 1/3 gelatin to 2/3 sensitizer proportions

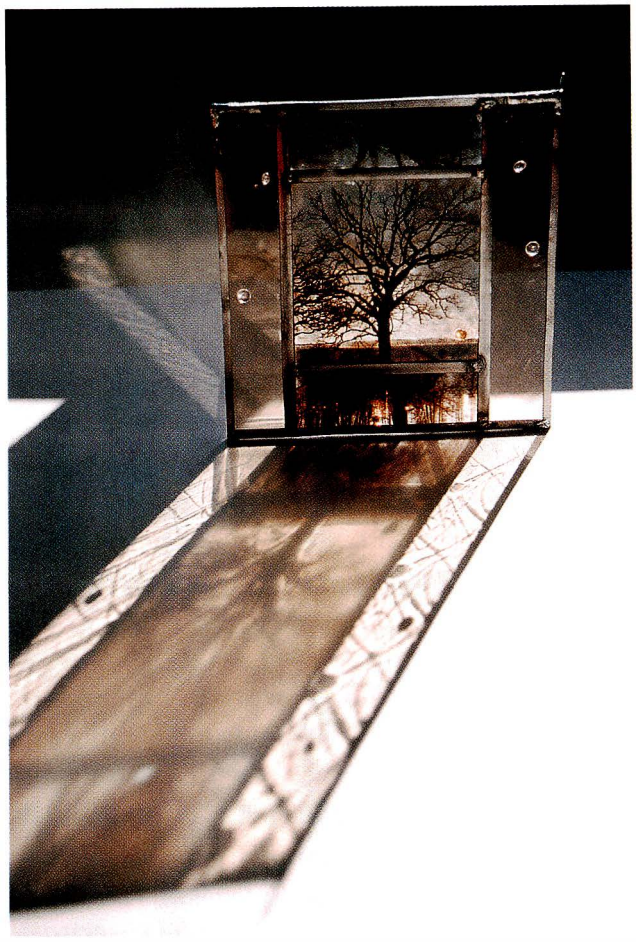


Figure 19–12
Galina Manikova, *Trees Series*, 1999 (Van Dyke on/glass)
(Courtesy of the Artist)

before applying it to the glass. This will greatly assist in the bonding of the sensitizer with the emulsion.

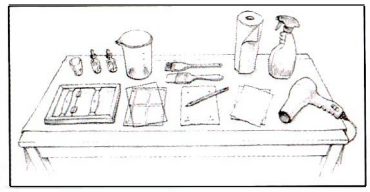
The Traditional Dusting-On Formula

Part A *(The Sizing)*

Mix together 28 ml of honey and 30 ml of gum arabic (albumen, fish-glue, or gelatin may also be used) in a beaker sitting in a tray of 130°F water. You can make a thinner solution if you need to by adding 10–15 ml of distilled water to the solution. This is a good idea in the event that you are spraying multiple coatings.

Part B *(The Sensitizer)*

Part B is a simple saturated solution of either potassium (13%) or ammonium (25%) dichromate. Don't forget that you're going to add a few drops of prepared gelatin solution to this sensitizer in order to help it flow more smoothly on the substrate.



Materials Needed For Dusting-On

- A good-quality paper or prepared sheet of glass, metal, or other substrate
- A high-contrast *positive* film image. The best way to get a great positive is to do it digitally using Pictorico Ultra Premium OHP inkjet film. This way you can easily go for contrast (very important), and if your positive is ruined while printing, then it is simple to make a new one. You can also use a single step ortho film positive, an acrylic lift positive, an RC print, a Calotype negative, etc.
- A hinged-back contact printing frame
- A few flexible plastic drinking straws or a piece of surgical tubing
- Hot, moist air from your body. You can also try using a travel-size clothes steamer.
- Feet from a pair of tights for holding the powdered pigment or for making a sieve-like cover for a jar holding the pigment
- Powdered color pigments or powdered graphite. A 400- to 600-mesh pigment is best.
- A shaving brush for sweeping away excess pigment
- Many small bottles to hold your powdered pigments
- Tape, or a rubber band, to secure the pantyhose feet on the jars

The Dusting-On Process on Paper

Size and harden your paper using the traditional honey–gum arabic method. You might want to experiment with the normal gum bichromate paper at some point as well. Mix two parts A sizing with one part B sensitizer under subdued light and coat your paper evenly using the same technique that you use would when coating a traditional gum bichromate. Dry the coating quickly with a hair-dryer on a *cool* setting. A second coat is optional and may be necessary if you elected to thin the solution

for a smoother first coating. Feel free to modify the proportion of Parts A and B as you delve into the mysteries of this technique. Remember, the higher the concentration of sensitizer in your formula, the faster the speed but the lower the contrast of the resulting image.

The next step is to place a high-contrast *positive* film in contact with the emulsion that will have a *slightly* tacky surface. This is when you will want to be using an easily replaceable inkjet film positive. A high-contrast positive is the best way to learn the process because the technique is not one that is designed for subtlety or perfection and detail. Because of the tackiness, you may require a Krystal Seal envelope or a sheet of acetate between the sensitized emulsion and the positive film, as in the Ziatype, to prevent the dichromate sensitizer from becoming a permanent addition to your negative. When the dichromated paper and film positive are set in the contact frame, expose the image under UV lamps or sunlight starting off with a first try of 6–8 minutes.

Hot and Humid Image Development

After the paper has been exposed you have a choice of how to humidify it. You can place the paper in a humid environment for 10–15 minutes, steam it with a handheld travel steamer, hold it over the whistle end of a boiling teakettle, suspend it over a pan of steaming water, or begin to add the pigment immediately, section by section, while blowing your warm breath through a short straw or flexible hose. If you are working with the technique during the humid part of the summer (like today while I'm writing this), it may not be necessary to do anything.

To make the image come to life, put some powdered pigment in a bottle (spice bottles work quite well), and cover the opening with the toes of the pair of tights. Using a wide rubber band, or a snap tie, secure the tight toes over the bottle opening so that the two won't separate when you shake the pigment. You can also put the powdered pigment in the toe of a synthetic or silk stocking foot and tie up the open part. Be very cautious about using powdered pigments. Some of them, particularly a few of the cadmium powders, are unhealthy if ingested or inhaled.

The traditional method of image development, and the one that will amaze your friends and relatives, is realized by blowing your very own warm and humid breath on small areas of the exposed image. You must be delicate here in order to make this process work. You also must work rather quickly. Humidify a small area on the image with your breath, exhaling through a short piece of ½" flexible rubber tubing or a drinking straw. You can get this tubing at a medical supply or a good SCUBA shop, as it is excellent for customizing your gear setup if you dive wrecks or caves. If the tubing is too long then your breath will cool too much on the way to the paper.

Then, gently tap the pigment in the toe of the pantyhose over that area. Do not take a deep breath when you do this. Wait a few seconds and delicately brush the excess pigment away with a soft brush. Quickly move on to another section, or re-humidify the same area, and repeat your previous actions. Areas that have not received a lot of exposure will not have hardened, and as a result, the gum in those areas will still be soft and tacky. Conversely, areas that have received a lot of exposure will have hardened, and the added humidity should not affect them.

Remember that you used a film positive for the exposure. What that means to the dichromate, gum arabic, and bee's honey sensitizer is that the highlight areas of the positive film allowed light to pass through the film and harden the dichromated bee's honey and gum in proportion to the degree of exposure. This is a little different than gum bichromate exposure thinking. In gum printing, the shadows are the clear portions of the negative and permit complete exposure and subsequently dark areas on the final gum print. In dusting-on, the shadows of the *positive* film are dark, preventing exposure and keeping the emulsion tacky so that it can take the colored pigment when the emulsion swells due to the application of humidity. When you dust a colored pigment onto the soft gum parts (shadows), those areas will accept and embrace the color. Conversely, the hardened parts of the exposure (highlights) will not swell enough to accept the color. Make sense?

If your pigmented image is too dark, it is likely that you have underexposed it. Conversely, if it appears too light, it is likely overexposed. Once you are happy with your print, re-expose it to bright sunlight until

Figure 19–13
Sandra C. Davis, *Serene Baby Sally*, 2012 (gum bichromate on glass and light box)
When I first saw Sandra's work on glass, she was a graduate student at the University of the Arts in Philadelphia. In her workflow, each B&W Holga negative was scanned into Photoshop and negatives were made on Pictorico OHP to form a set of CMYK color separations with custom curve profiles. The film was then outputted on a Scitex image setter. Sandra used double-strength window glass and sandblasted on both sides with medium-grade sand. The doll side of the glass used the CMYK separations and was rendered in gum bichromate. She printed the negatives on one side in reverse order: black, yellow, magenta, and cyan. On the other side of the glass, she printed a layer of Antwerp blue and a layer of Holbein shadow green. The glass was then installed in a darkroom safelight so that it could be viewed as backlit.
(Courtesy of the Artist)

the tackiness is gone. It is entirely possible that you will not be enthralled with the first application of pigment. Repeat the humidifying, dusting, and brushing sequence until you have created an image. You may mix, switch, and change colors as you go. After the pigmentation is satisfactory, you may fix the image with a delicate spray of artist's fixative, the variety used by artists working in charcoal.

You will notice by this point that dusting-on has a great deal in common with many of the other dichromate techniques. Feel free to mix and match processes if you're in the mood for inventing something unique.

Some Dusting-On Ideas

Try the technique on paper, and after you have washed the exposed print in water to clear away the unexposed dichromate, you will be left with a tan-colored image that is swollen with water. Allow the paper to dry until the image is tacky and proceed with the pigment application part of the process. If you re-expose the pigmented image in UV light it will help harden the image. Again, if you opt to leave the dichromated image alone without washing or pigment application, you will have a light sepia image that will eventually turn a pale oxide of chromium-like green over time.

As I've already written, I recommend using a high-contrast film positive and single-colored pigment to begin learning how to do the process. It will be far easier to control the density of one color (black or sepia, perhaps). Remember, another way to control contrast is to modify the concentration of the dichromate sensitizer in your formula. The more concentrated the sensitizer solution, the lower your contrast. Conversely, if you lower your dichromate concentration, your contrast will be stronger. This can be easily tested by using ammonium dichromate for one image and then re-doing the print with potassium dichromate. This will result in a higher contrast by comparison. Try a dusting-on technique on top of a traditional gum print or an inkjet pigment print on a rag paper. If you are using the same image at the same size, you may end up with a very interesting effect. Use your imagination and experiment.

GUM BICHROMATE ON GLASS

Sandra Davis's Step-by-Step for Gum Bichromate on Glass

The first time I saw a piece of Sandra Davis's gum bichromate images residing on the glass of a Thomas safelight I had no idea how prophetic and ironic its meaning would become . . . using no longer useful darkroom lighting sources to serve as a substrate and illuminate an alternative process. In retrospect it was brilliant!

There are many ways to prepare glass to accept an emulsion, and they are mentioned throughout the book using products like albumen, amino silane, collodion, glue, and sandblasting. What follows is how Sandra puts her gum bichromate images on glass.

Step 1 Your first order of business will be to thoroughly wash the glass with water to remove the dust, then wash with grain alcohol (like 190-proof Everclear if you can find it) to remove any grease or fingerprints, and then wash with water again to remove the alcohol. You can take this step to another level and clean the glass as you would when making an ambrotype or wet collodion negative on glass. In this case you would use the whiting glass cleaning formula and technique described in the Wet Plate Collodion chapter and follow it up with a dishwashing machine cycle with Bon-Ami as the cleanser.

Step 2 The next step is to mix the watercolor pigment to gum arabic in the same proportions that you would use for making a gum bichromate print on a gelatin–glyoxal-sized paper. I recommend a half-inch to an inch of paint from the tube.

Step 3 Then, mix the pigment/gum arabic solution in a ratio of 1:1 with saturated ammonium dichromate. You can use saturated potassium dichromate if you wish, but it will be a little slower and less contrasty. Brush the combined solution on the clean and dry glass using an inexpensive foam brush.

Step 4 Buff and smooth the sensitizer on the glass using two more sponge brushes. As you buff, try to be as gentle as possible so as to not physically push the pigment sensitizer to the edges of the glass. When it feels sticky and resists the brush, stop.

Step 5 Now move the coated glass to a dish-drying rack or lean it against a wall and let it dry on its own. You can set up a gentle fan breeze on it to assist in the drying. One thing that you will want to know about drying the plate . . . when you rush the drying by blow-drying the surface, the layer will not stick. Instead, it may roll off the surface of the prepared glass in chunks as soon as it enters the water bath.

Step 6 Once the plate is completely dry, place your film or digital negative (use Pictorico Ultra Premium OHP and a contrasty gum curve as described in the Digital chapter) in contact with the sensitized plate and expose it to UV light in a UV-exposure unit or in the sun. If you can make it work without breaking any glass, use a contact-printing frame. If the glass is too thick for that kind of compression, use a sheet of heavy glass on top of the negative to maintain a tight contact with the sensitized glass.

Step 7 After the exposure, gently slide the exposed glass plate face up into a tray of still and clean water. After 5 minutes of undisturbed soaking, using gloves, move the sheet of glass to a second tray of clean water. Again, keep the image and plate face up. Continue the washing cycle a total of 4 soaks at 5 minutes per soak. Then gently remove the washed plate to a dry tray and prop it up at an angle to let it drain. If you have cleaned your glass well the image should stay put. Sometimes it doesn't.

Step 8 Once the plate is air dried, you need to post-expose it to the UV light of a sun lamp for 10 minutes.

Sandra uses the glass from a Thomas safelight, and this glass is often sand blasted so that the illumination is scattered rather than direct. This "tooth" in the glass is a big advantage when it comes to holding the image on the glass plate. If you don't have Thomas safelight glass, I suggest taking glass to a gravestone marker company to sand blast it for you.

You can also try performing this gum on a transparent surface by using a sheet of Plexiglas that you have given tooth to by scouring it with 600-grit sandpaper. You can also use old Fresnel ground glass sheets that you might find very cheaply on Internet auction sites. The bottom line . . . if you blow-dry, only the top skin layer will dry, and when you put the plate in the washing bath, presto . . . a floating mess.

THE FERRO-TANNIC PROCESSES

This is an odd little hybrid technique that incorporates potassium dichromate in its material list, and even though it's actually considered an iron-based process I'm going to drop it into this chapter for your amusement. The ferro-tannic process makes an ink black image because of the nature of ferrous sulphate iron salts that turn black when exposed to tannic acid. The ferro-tannic roots are quite similar to several other processes, such as the ferro-gallic, colas, blackline, heliographic, or Makahara's processes, from the late 1890s, which also used ferric salts, such as ferric tartrate, chloride, and sulphate, that are developed with either tannic or gallic acids. These other formulas can be found in *Nadeau's Encyclopedia of Printing, Photographic and Photomechanical Processes* (Atelier Luis Nadeau, 1989) and Cassell's *Cyclopaedia of Photography* (London, 1911).

The following formula is a modified one that will produce a gray/black image, but there is no guarantee that you'll like it or that you will find it superior to toning your cyanotypes black. As an aside, the propyl gallate found in some of these older formulas is a white, odorless, anti-oxidant powder that has been used since 1948 primarily as an ingredient to stabilize cosmetics. It has also been used as a preservative for meat, oils, and edible fats. Its importance and relationship to us is that it turns black in the presence of iron or iron salts.

The Chemistry: The Ferro-Tannic Sensitizing Solution

Step 1 **Mixing the Sensitizer**

Begin by making a sensitizing solution consisting of 50 g of potassium dichromate (this bonds with the iron salts on paper) dissolved in 150 ml of distilled water.

Step 2 **Dry and Expose**

Next, coat the paper with this solution in subdued light and let it dry slowly on its own. Then put your negative and the sensitized paper in a contact frame and expose it in sunlight for 3–15 minutes (I know this seems like a guess rather than a recommendation) depending on the density of the negative you're using.

Step 3 **Wash**

Wash the print for 30 minutes and then move directly to the intensification stage.

Step 4 **Mixing the Intensifier, Intensification, & Wash**

Make up an intensifying solution consisting of 1.6 g of ferrous sulphate (a.k.a. *green vitriol*) dissolved in 150 ml of distilled water. Immerse the print in the intensifier for 2–5 minutes and then wash the print for 30 minutes before moving to the toning stage.

Step 5 **Toning & Final Wash**

The toning solution is made by dissolving 10 g of tannic acid into 150 ml of distilled water. Some find this dilution a little too anemic, so feel free to make it stronger if you need to. Immerse the print in the toning solution for as long as you want to. The tannic acid creates *tannate of iron* that will result in grey-black tonalities. This is similar to the reaction you'll get when subjecting a cyanotype to a very strong tannic acid bath for a lengthy period. Fixing the print is optional. Should you elect to fix the print, make a fixing bath of 1:10 standard paper fix to water for less than a minute. After the toning, or optional fixing stage, wash the print in clear running water for 20 minutes and hang it up to dry.

HERSCHEL'S BREATH PRINTING PROCESS

Although this little-known process doesn't truly fit in this chapter, it's a nice concept and conceptually it works as well here as any other place I've tried it. I could have left it out but then you wouldn't be able to read about it. In this process, you use your own warm breath to make an image visible. Herschel's breath printing process is like writing secret messages in lemon juice as a child and holding the paper over heat to bring the message out. In it, Herschel coated his paper with a dissolved *precipitate* (a solid separated from a solution by the action of a reagent) formed by combining silver nitrate with ferro-tartaric acid. He then exposed the paper with a contact paper

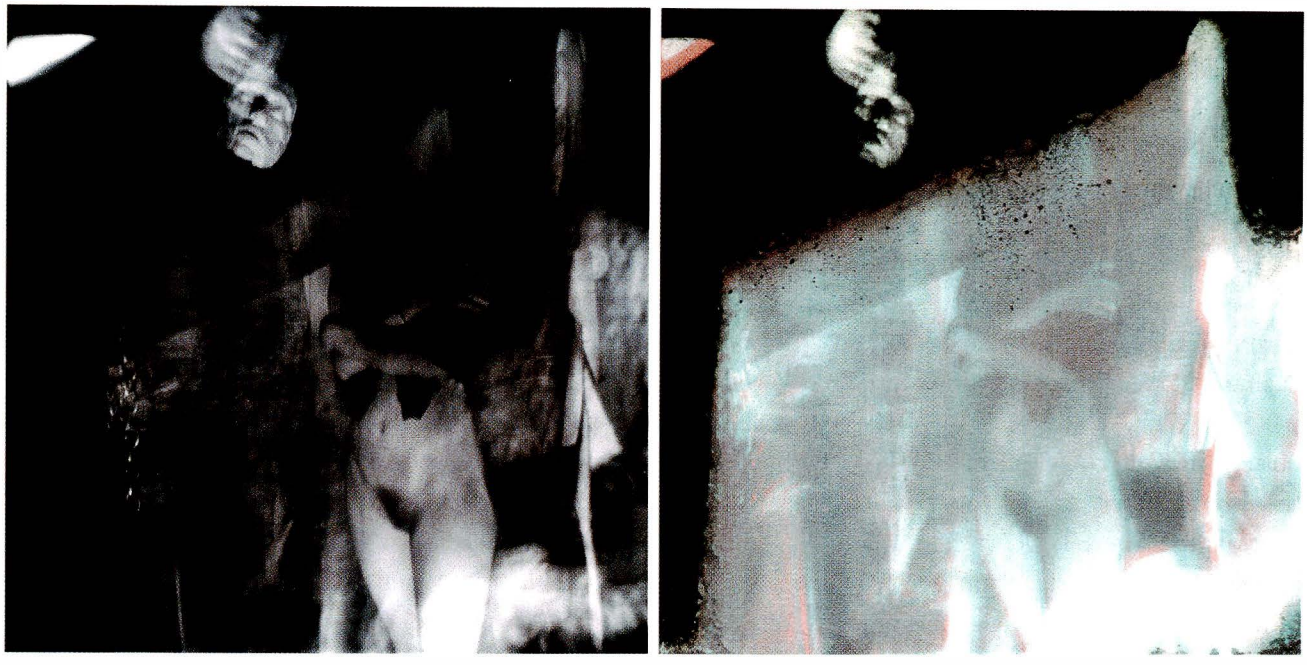


Figure 19–14
Dan Estabrook, 1990 (B&W/3D gum bichromate)
In this paired example you can see the transition of Dan's plastic camera image from black and white to a 3D color gum bichromate. The monochromatic version is a silver print from one of the duplicate negatives made for the gum print. The colored image on the right is the result of assigning a single color to each of the subsequent negatives. In this case the creamy orange and cyan blue, with a pass or two of black for shadow enrichment, provided a 3D viewing experience when the viewer wore red- and green-lens cardboard glasses.
(Courtesy of the Artist)

negative in sunlight and subsequently discovered that the latent image could be brought forth by breathing on the exposed paper, or holding the paper over a streaming teakettle. Once humidified, the image was reported to have an extraordinary intensity. And that's all there is to it.

ESTABROOK'S 3D GUM BICHROMATE PROCESS

In 1990, when Dan Estabrook was a student of mine at Harvard University, he decided to produce a 3D gum bichromate thesis that turned out to be a great deal of fun, due to the images themselves, but also because it required the often compulsively humorless faculty to critique the thesis defense while wearing Dan's custom-made, Buddy Holly-like, 3D glasses . . . I still laugh when I think about it. In any event, I thought Dan's 3D gum technique was really a great idea and a perfect balance of something complex and something amusing, the latter quality seldom found in the art world.

Because the gum bichromate process is able to create colorful prints in multiple layered exposures, it's possible to create 3D photographs. This red-green *anaglyph* (a composite picture printed in two colors that produces a 3D image when viewed through glasses fitted with colored corresponding lenses) form of 3D is pretty simple once the theory behind the visual illusion is understood.

How 3D Works

Fully extend your arms and hands in front of your face and using your thumbs and pointing fingers from both hands, make a ¼" diamond shape that you can see through. Look through the diamond-shaped hole, with both eyes open, and focus on something at a distance through the diamond. Now close your left eye. If you are right handed, and did not fall on your head when you were younger, the object should have stayed exactly where it was when you looked at it through the little diamond shape with both eyes open.

Now open both eyes and line up the object again within the small diamond shape. Close your right eye. The object should be gone from the diamond, giving you the impression that the object jumped to the left . . . or that your hands jumped to the right.

If this test didn't work for you, and you experienced it in completely the opposite way that I described, then you were born left-handed and society forced you to become a right-handed person. If this information explains a lot . . . you're welcome.

When your eyes look at a 3D object, each eye sees the object at a slightly different angle. When your brain puts these two different angular views together, it perceives depth and space. Likewise, when wearing 3D glasses, and looking at a 3D anaglyph, each eye sees a slightly different view of the image. One eye sees through a red lens, blocking any image in red; the other eye sees through a blue (occasionally green) lens, blocking out blue. The brain, all by itself, puts these two different views together to perceive a three-dimensional space.

The Negatives

I'll say up front that this is an "old-school" set of instructions using real silver gelatin film, and although it's possible to replicate the 3D effect of this with digital software, that kind of defeats the entire point of this adventure.

It is not enough to have to have slightly different views of the same subject printed on top of each other. For the 3D effect to work properly, you must have two separate views of the same subject. These are photographed side-by-side with a distance equal to the space between the eyes . . . approximately 2.5". One way to do this is to move the camera 2.5" to the left or right after one exposure and take another picture of the same non-mobile subject.

Of course, this way of working is a little annoying and only allows you to take images of things that don't move. The best way to make your parallel negatives is to get an old 3D camera like the ones that were popular in the 1950s. A homemade solution is to take two plastic cameras, like Holgas, and reconstruct them so that when they are cut and reunited they will make a single, elongated two-lens camera. Using a fine blade saw (a straight ridge-back Japanese woodworker's saw will work nicely), cut off the left side of one of the cameras and then cut off the right side of the other so that when the two large parts of the cameras are joined together, the center of each lens is 2.5" apart. You should have a long rectangular camera with two lenses. In the event that you are tool-impaired I recommend going to a machine shop and having them make the cuts with equipment that is probably superior to what you have at home.

Once the cuts have been made, super glue the two cameras together and add a stiff metal brace to hold the unit rigid. Place the brace along the bottom and maybe another, shorter one, in the front. If you decide to brace the back of the camera, make sure you do it in such a way as to allow you to remove the entire back to load your film. When you load 120mm film, you will insert the roll on the far left side and have your take-up spool on the far right side. I suggest practicing loading in the dark to prevent fogging. The new Holga models have foam behind the take up spools so you will be able to avoid the dreaded "fat-rolls." Making the new camera light tight is also an important consideration. Because you have heavily modified two cameras to make a single camera, it is likely necessary to tape the camera tightly before shooting it.

Creating a shutter release is also important because you will want both exposures to be made at the same instant. One solution is to shape a lightweight metal rod, like a firm coat hanger, like a big staple. Using super glue or a metal/plastic-compatible epoxy, fuse the ends of your big staple to each of the shutter releases. When shooting, depress both shutters at once by pressing down on the middle of the big metal staple. If you have made your camera well, it will give you two negatives shot at the same time. You'll get three pairs per roll of film and you'll have to figure out how many turns to wind the film for each of the three frames. Make adjustments for the fact that as the take-up spool gets more film on it, the number of turns to the next frame will be reduced. Do a test roll and begin to modify the camera until it works perfectly.

Negatives: Digital or Film

In order to make the 3D gums you will need to make enlarged duplicating negatives of both the left and right frames. Considering the process, I recommend

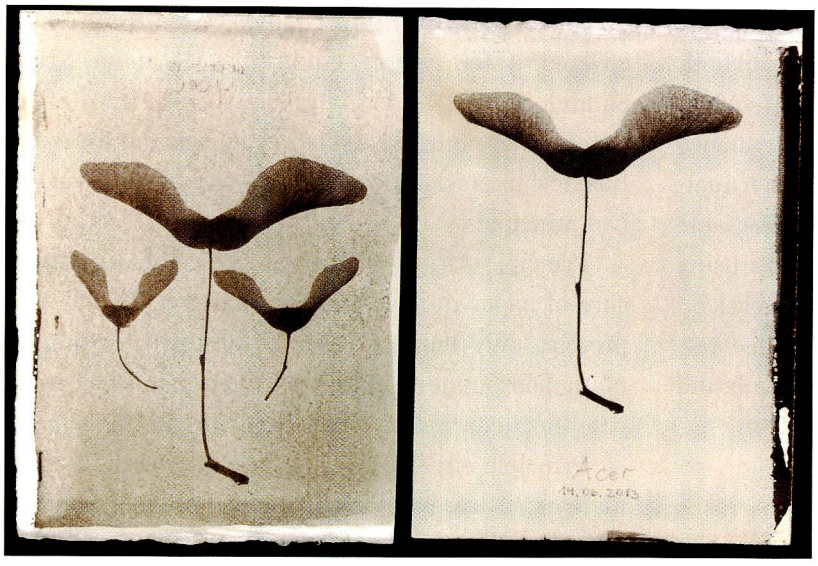


Figure 19–15
Wlodek Witek, Acer Flyers 2013 (Winther's bichro-silver process)
This piece by Wlodek Witek is an excellent example of Winther's Bichro-Silver Process, one that was in many ways similar to Bayard's but that was developed independently. Wlodek wrote, "*It is quite ingenious and different from any other early positive processes but exposure times are long, usually demanding an hour in full sun in the summer. It may have been the first time Ponton's discovery of the light sensitivity of dichromates had found an application in general photography.*" *(Courtesy of the Artist)*

doing this step digitally in Photoshop and printing your fine-tuned negatives on Pictorico Ultra Premium OHP inkjet film. The other option is to shoot traditional film in camera and work out a system for either moving your camera, or the subject, the required 2.5" so that you'll have two negatives to work with. Once the two negatives are made it is important to register them in order to get the proper separation for 3D. Be sure to label the negatives "left side" and "right side." This is an easy task to undertake digitally, and while you're at it, you can make separate CMYK color layers of your two negatives, assign them the correct 3D colors, put on your 3D glasses, and actually see if it's going to work.

Now that you have your 3D negatives, the rest of the procedure is the gum bichromate process from Chapter 18 with a few minor adjustments. Begin by preparing your paper for gum bichromate following the gelatin/glyoxal sizing instructions and then commence with the gum bichromate process.

3D Glasses and Color

Traditional 3D glasses are made so that the red lens is for the left eye and the blue lens is for the right. Quite often a 3D comic book or graphic novel comes with red and green lenses instead of red and blue. You'll get somewhat the same illusion, but the red and green glasses will function differently with the instructions provided in this chapter . . . I would recommend that you make your own. If you make the glasses yourself, try using an old pair of eyeglass frames without the lenses or construct a new design using a double-ply mat board. Theatrical acetates, the kind that are used to tint actors and theater sets, work exceptionally well.

The next stage is to create the right colors to make the best 3D illusion for the red/blue glasses. Use a 1:1 potassium dichromate sensitizer to gum arabic formula from Chapter 18. You may remember that 3D comics are generally composed of very light tonalities, and a successful 3D image is often perceived as being out of registration and quite "pasty" to the naked eye. For thinner coatings and a smoother image, you may well want to add some water to your sensitizer formula and think about building density over a period of several thin exposures.

For a pair of red/blue glasses, your primary gum bichromate colors will be a creamsicle-like sherbet-orange and a powdery cyan blue. You will have to make a number of color tests with different mixes and densities before you hit the perfect match while wearing the glasses, so be patient. Just remember to always use the same color, orange or blue, for the left and right negatives to correspond with the red lens or the blue lens. If you do not, your tests will not make any sense. I recommend buying a few 3D comics and using them for color matching.

At the conclusion of your orange and blue gum experience you can make several passes with a water-thinned lamp black gum formula for the final paint impressions. This additional black pass will enhance your shadow details and add an illusion of depth to the

print. Another added bonus of the black pass is that it will also make your prints a little more dynamic to both the naked eye and to eyes wearing 3D glasses. When you are done printing, you can touch up and enhance portions of your gum print with colored pencils. A quality colored pencil set should provide you with the same density and hue as the watercolors you've been using in the gums. When everything is done, you can bask on your laurels and spend some time making and decorating a selection of 3D glasses to give to your friends and neighbors so that they can see your new work.

WINTHER'S BICHRO-SILVER PROCESS

Winther's Bichro-Silver Process: A Little History

Just as I was about to put this third edition to bed and send it off to my publisher for months of production, my friend Finn Ó Súilleabháin, in Mozambique, sent me a note about one of his friends, Wlodek Witek, in Oslo, who was working with a process invented by Hans Thøger Winther (1786–1851) that Wlodek was referring to as Winther's Bichro-Silver Process . . . a reversal direct positive on paper technique from 1845. It was such an interesting process, I had to stop everything and have a few days of email exchanges with Wlodek to figure out how I could include it.

Winther's technique is a multiple-stage process in which the first part involves exposing a dichromate-coated stationery paper in camera for the highlights. This is followed, after washing and drying, by a two-part sensitizer application of ammonium chloride, followed shortly after a brief dry down, by an application of silver nitrate for the shadows. What really got my attention was the timing and whether Winther was another genius working alone who came up with a miracle in the same time frame as Talbot and Ponton.

In 1845, Winther self-published a small text detailing his three principal photographic inventions, developed in the period between 1839 and 1843. The text, *Anviisning til paa Trende Forskjellige Veie at fembringe of fastholde Lysbilleder paa papir* (1845), was transcribed in both Norwegian and German and printed in his own publishing house in Christiania (Oslo). Winther's own photographs have been lost except for just three positive images that were rediscovered a few years ago in the Hermann Krone Sammlung in Dresden, Germany. His Bichro-Silver process, developed in August 1842, was the third and final technique described in the book and was based on two principles.

Principle #1: The highlights are created by exposure of paper in a camera without any silver halides present, only the potassium dichromate (or ammonium dichromate as in Wlodek Witek's notes) coating, resulting in exceedingly long exposure times.

Principle #2: After washing and drying the dichromate exposure functions as a mask for the shadows, which are created and enhanced on the same piece by exposing it to direct sun/daylight after sensitizing the same piece of paper with silver chloride . . . as in the salted paper process.

Later, after curing (Winther suggested 24 hours between the pages of a closed book), an immersion into sodium thiosulphate hypo takes care of the unexposed silver. Winther suggested a nitric acid bath to clear the dichromate highlights from yellow to white, but Wlodek says that the hypo seems to take care of the problem without the nitric acid bath.

Wlodek writes, "*It is quite ingenious and different from any other early positive processes but exposure times are long, usually demanding an hour in full sun in the summer (my own experience). It may have been the first time (Mongo) Ponton's discovery of the light sensitivity of dichromates found an application in general photography. Winther advocated this method as the easiest for copying of existing images from paper originals like prints, copying flat objects directly to photosensitive paper in a direct positive way or to make exposures with the help of a Camera Obscura.*" Winther's images are one of a kind and, like daguerreotypes, are reversed. Unfortunately for Winther his processes did not have a large following and his death in 1851 coincided with the Crystal Palace exposition in London where Archer introduced the wet collodion glass plate negative . . . leading to an unlimited number of paper prints from a detailed and totally transparent negative source.

Hans Thøger Winther was a well-educated lawyer and publisher with a dedicated interest in the sciences.

His publishing business allowed him to have many contacts as well as familiarity with much of what was being published at the time. His experiments, performed independently, began with paint, then moved to plant extracts (like Herschel's anthotype studies), and eventually gravitated to chemistry. His writings, and formulas, about these experiments mention the extracts that were loaded with the tannins that he employed instead of gallic acid (similar to Talbot but developed a year later with slightly different chemistry). This was his second process, and he found it the best, as it gave him fast exposures and many prints could be made from the negatives, not only salted papers but some in color, using iron gall extracts for black and indigo for blue.

Winther mentions Daguerre, Talbot, Kobell, and Steinheil in an interesting introduction for his book and concludes the publication with a lithographic plate showing a model of a camera featuring an inspection lid, a hot plate for development, a printing frame, and a focusing frame. This focusing frame was like an opened film or plate holder with white paper folded behind a plate of glass within the frame. When focusing had been achieved, the white sheet of paper was replaced with sensitized paper and exposed. The inspection lid permitted the camera operator to check the progress of exposure.

His first process was very similar to Hippolyte Bayard's direct positive, but it seems improbable that he knew of the details involved in Bayard's work. Wlodek wrote that Winther, "rushed to write a document signed by witnesses and delivered for safe keeping to a trusted person in July 1839." . . . and this date is quite interesting because of this next story.

On the 11th of January 1839, there was an earthquake on the French island of Martinique in which up to 700 people were reported to have lost their lives. In response, the good people of Paris organized a benefit exhibition, in July, on behalf of those who were victims of that disaster, in which the works of such art-stars as Rembrandt and Titian were shown. With the assistance of Lady Elizabeth Eastlake, Bayard's calotypes hung adjacent to the masterworks . . . several weeks before the unveiling of Daguerre's work at the

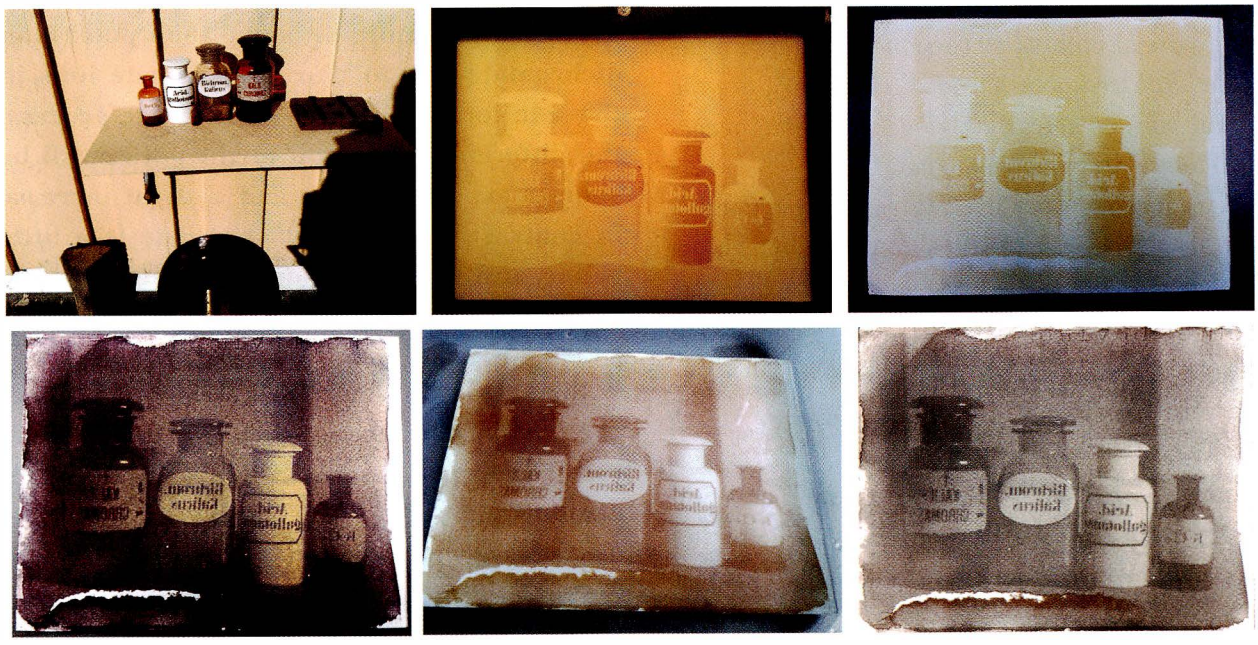


Figure 19–16
Wlodek Witek, Winther's Bichro-Silver Process Sequence, 2013 (Winther's Bichro-Silver Process)
Winther's technique is a multiple-stage process in which the first part involves exposing a dichromate-coated stationery paper in camera for the highlights. This is followed, after washing and drying, by a two-part sensitizer application of ammonium chloride, followed shortly after a brief dry down by an application of silver nitrate for the shadows. This is an illustration of the different stages of the process.
(Courtesy of the Artist)

French Academy of Sciences. This is thought to be the first formal, and solo, photography exhibition, and Bayard's work was highly praised for its artistic merit and was described by the major French newspaper, *Le Constitionnel*, as having an "exquisite fineness and softness of light . . ." like painting.

Winther's document has not been found, but is more than plausible. His process of reversal direct positive on paper with chemistry is similar but indeed differs from Bayard's on several levels. As an example, Winther's technique, from August 1839, encouraged the use of *magnesia alba* (magnesium oxide) as a stabilizer rather than Bayard's potassium bromide stabilization or sodium thiosulphate, which wasn't common until 1842. I should point out that the first process Winther described in his book was very similar to Bayard's. All things considered, it is another piece of the photographic puzzle from that incredible year.

Winther's Bichro-Silver Process Workflow

A direct positive on paper process with abbreviated summary instructions by Hans Thøger Winther published in Christiania 1845 . . . with contemporary process notes by Wlodek Witek. In reading this transcript, the notes are a compressed version of Winther's writing. The italicized notes, headed with W.W., are the personal working notes that Wlodek Witek has generously allowed me to present to you.

On the making of positive images, partly in Camera Obscura, partly by covering in a Copy Instrument in a new manner and by using two components where one produces the Highlights and the other the Shadows of the Image.

Paper

Needs to be compact, smooth, wove, even, and well sized. Solution no.1 is used in a weakly lit room and brushed with a clean squirrel hairbrush used for that purpose only.

Author's Note: Try pre-sizing your paper of choice with a 0.5% gelatin solution. In other words . . . very lightly re-sized. Too much sizing may result in little black spots. It will be important to experiment with different papers for this process.

W.W.: My choice paper is Arches Platine 310g. It is easy to coat with dichromate using a sponge brush reserved for that purpose only.

Dichromate Coating: Solution No. 1

Potassium dichromate saturated solution in water (solubility: 4.9 g/100 ml (0°C), 102 g/100 mL (100°C). Careful! Use every precaution against skin contact (gloves) and exposure (goggles, resp. mask). Do not dispose of in the drain. Brush generously until the paper takes on a bright yellow tint, as this will influence the sensitivity. Repeated brushing is advised.

Author's Note: A saturated solution is one in which there is a specific amount of fluid that continues to dissolve the chemical that is added to it until it can no longer perform that task . . . leaving sediment at the bottom of the mixing vessel. Ammonium dichromate is saturated at around 25%–28%, while potassium dichromate is saturated at 10%–13%. Ammonium dichromate is more sensitive than potassium dichromate due to more dichromate ions in the solution. In the gum bichromate process, the differences that you might notice will be shorter exposure times and a slight increase in contrast. Potassium dichromate is a little softer, and you will experience an easier time clearing the print with it.

W.W.: Repeated brushing of Arches Platine did not affect sensitivity in my experiments, only more unexposed dichromate was washed out of the paper after exposure. Ammonium dichromate could be tried for higher sensitivity.

Drying

The paper is hanged to dry covered by a thick board or dried in a drawer in order to shade it from light. The paper must be completely dry to work. Humid paper is not light sensitive. When Camera Obscura is to be used the drying is done by open fireplace away from

any daylight. This method is faster and the image will be stronger. This can be prepared the evening before exposure and placed in a portfolio until needed.

W.W.: I dried my papers on blotters in a drawer. Papers kept like this for many days may lose sensitivity when dichromate will harden without exposure.

Camera Exposure

Exposures in Camera Obscura require a lot more time than when used by direct daylight. The chemical components will decompose by the action of Sun in a few seconds, in daylight in one or two minutes. A minimum exposure time for a lens of 5½" focal length when it is directed at bright subjects in open spaces would be at least 15 minutes. When the subject is dark 30 minutes are often necessary. With a lens of 12" focal length and 3 1/16" diameter and a stop of 1 ½", some 30–40 minutes are needed, even 60 minutes may be needed following the principle that sufficient time is achieved when the picture is well visible. When the subject is well lit by the sun a prolonged exposure will not harm the image.

W.W.: My exposures started in August 2010 with 30 minutes at f/4.5 for 4 × 5 camera. On the last day of August I made exposures for 1 hour at f/3.6 for whole plate camera in sunny conditions. Exposing a still life for 2.5 hours on an overcast afternoon at the beginning of September was completely useless.

Development

The following procedure is easy and requires little previous experience. The paper is removed from its frame in a dark room and it will show a well-defined image with the finest detail but in reversed Light and Shade areas of the image.

A suitable vessel is filled with pure water (distilled or rainwater). The unexposed chemicals will be washed away during a 5-minute wash. This needs to be repeated with another 5-minute wash in pure water until the water removed has no color whatsoever. The paper is then removed, pressed with blotters and air-dried. Place it on a clean sheet of blotting paper and brush it with a very clean brush saturated with Solution no. 2.

W.W.: Papers that did not work well also bled longer in the wash after exposure. Arches Platine required only 3–4 changes of water.

Ammonium Chloride: Solution No. 2

Author's Note: For a 1.8% solution of ammonium chloride, mix 0.51 g to 28.41 ml of distilled water. In Winther's formula, 8 grains = 0.51 g and 1 oz of boiled water is an imperial ounce = 28.41 ml. For potassium chloride as your salt, use slightly less than a gram to 28 ml of boiled water.

8 grains	ammonium chloride (salmiak) or 15 grains potassium chloride
1 oz	boiled water

The salmiak (ammonium chloride) solution gives prettier image, while potassium chloride a stronger one.

Brush from left to right with a sure hand until it is fully covered. Put it away for the paper to evenly absorb and appear mat on the surface. At this stage the image is immediately brushed again with a new clean brush dipped in a small amount of Solution no. 3.

W.W.: I tried potassium chloride and preferred this salt over the ammonium chloride. My method of application was with a glass rod after using a plastic syringe dedicated for that solution. Wait till the paper becomes mat and the solution absorbed into the paper, keep it at an angle to avoid pooling, remove excess from edges with clean blotters.

Silver Nitrate: Solution No. 3

Author's Note: You may make this solution without stress by dissolving 1 g of silver nitrate in every 7 ml of distilled water. To this mix, add a pinch of citric acid.

1 part by weight of silver nitrate
7 parts by weight of distilled or rain water

Let the solution stand a few days before use stored in a dark bottle and place.

The brushing is again done so that it covers the whole paper surface with it perfectly, saturating

the paper fully. Then, it is put away to absorb it and turn matt on the surface, as described earlier. During this operation it will be noticed that the image is taking a Yellow color and becomes clearly defined.

As soon as it is just dry enough and matt, the paper is placed in a printing frame and covered with glass.

W.W.: My method of application was with a glass rod after using a plastic syringe dedicated for that solution. Wait till the paper becomes so dry that no stains result, keep it at an angle to avoid pooling, remove excess from edges with clean blotters. Almost dry is perfect. If it is too wet you will see stains for sure later on. Speeding up with a hair blower would not hurt if not too early.

Direct Exposure

The frame is exposed to direct sunlight at a right angle and the effect is observed. After a few seconds the image takes on a blue tone in the shadows and these will develop a speedy and sure result while the highlights will still retain a yellow tone. Now it is time for the operator to decide when is the right moment to finish the exposure, but not too early. The printing frame is taken to a dark room; the picture is removed for fixing.

W.W.: This is a magic moment, so enjoy it. My first exposures were to direct sun at midday, papers darkened quickly and stains from uneven/insufficient drying occurred. Later tests were a combination of shadow and direct sun. Find out what is best for you. Arrest the exposure when the highlights are still sparkling. The colors would change in the hypo baths where the yellow highlight nearly disappeared in my tests, while the dark tones shifted to reddish-brown.

Maturing and Fixing

As soon as the second exposure is finished and the image is visible in its beauty in a dark place, it is placed in a closed book for 24 hours.

W.W.: Depending on my day's workload I cut this time down to 20 hours several times and could not see that it mattered.

After this period of time the picture is fixed in a bath of Solution no. 4.

Fixer: Solution no. 4

Author's Note: Winther suggested a saturated solution of calcium sulphide as a fixing formula, a labor-intensive solution. Wlodek Witek's fixer is far more convenient and easier to make. His fix is a 12% solution, 120 g of sodium thiosulphate, and a pinch of calcium carbonate to make it slightly alkaline, added to 1,000 ml of water. Split the solution, and the time, into two baths.

Prepare a stock saturated solution of hepar sulphuria (calcium sulphide). The chemical must be left to oxidize for a few days in a dry place, spreading the powder and turning it over a few times for 3 days.

Make a working solution by diluting it 1:1 in water from the saturated stock solution (hypo).

Place the paper in the fixing bath, remove the air bubbles with a brush, and let it stay for 15–24 minutes agitating it continuously until the applied chemicals have dissolved and the image appears clean and when viewed in daylight shows no traces of red spots in the paper.

W.W.: In my tests I simply chose to use simple hypo for two baths 10 minutes each (120 g sodium thiosulphate for 0.5 liter solution). The image changes color to light brown but regains density after washing and drying. Some papers just bleached out at this stage and all contrast was lost.

Unnecessary Nitric Acid Bath

Author's Note: Winther's original instructions included a nitric acid bath to clear the yellow from the highlights. With the use of a sodium thiosulphate pentahydrate fixer this stage in the process appears to be unnecessary, as the highlights are clearing just fine in the fix alone. I would be happy to provide the original nitric acid directions and recipe to anyone seeking them, but for now I will leave it out of the instructions, as you really don't need it.

Surface Finishing

If the image is placed on a smooth polished copperplate and ran through an intaglio press or on a lithographic stone through a lithographic press, it would gain in elegance. When none such are available, the item can be placed on a thick slab of glass and polished with a burnishing stone or a good quality glass medicine flask which also can produce a shine and a fine result. The picture now is finished.

LAST THOUGHTS ON DICHROMATE ALTERNATIVES

Once you have worked out a way to be comfortable using the traditional gum bichromate on paper process, there are new worlds to conquer . . . including placing a gum image on an alternative surface. Paper is simple in that it is flexible and has a given *tooth* texture for the gum to *hook* into. Alternative surfaces, such as metal plates, stone, chalkboard slate, glass, mica, vinyl, or plastic, do not have this same tooth unless you make a conscious effort to create it on the surface or put a colloidal emulsion on it, like wet collodion, albumen, or gelatin, before sensitizing.

Another difference in working on an alternative/non-paper surface is that the issue of pigment staining becomes irrelevant. Literally any portion of the image can be dislodged with water, sanding, abrasion, or etching. The key task you'll face is to create a surface that will hold onto one or more coatings of a colloid-dichromate sensitizer through all of the process stages. Eventually you will discover that multiple coatings are significantly more complicated due to the tenuous hold the initial application has on the substrate. In this situation, you may need to re-harden between coats or seal each coat after it dries. In some cases, simply re-exposing the dichromate image to UV light again will harden it to a degree where it is safe to continue working on it. And, whatever fails to work as a stand-alone piece on an unusual surface, especially in the case of glass, waxed paper, or Plexiglas, can become a negative. In the case of wood or metal, it could be the beginning of a sculpture. You get the idea.

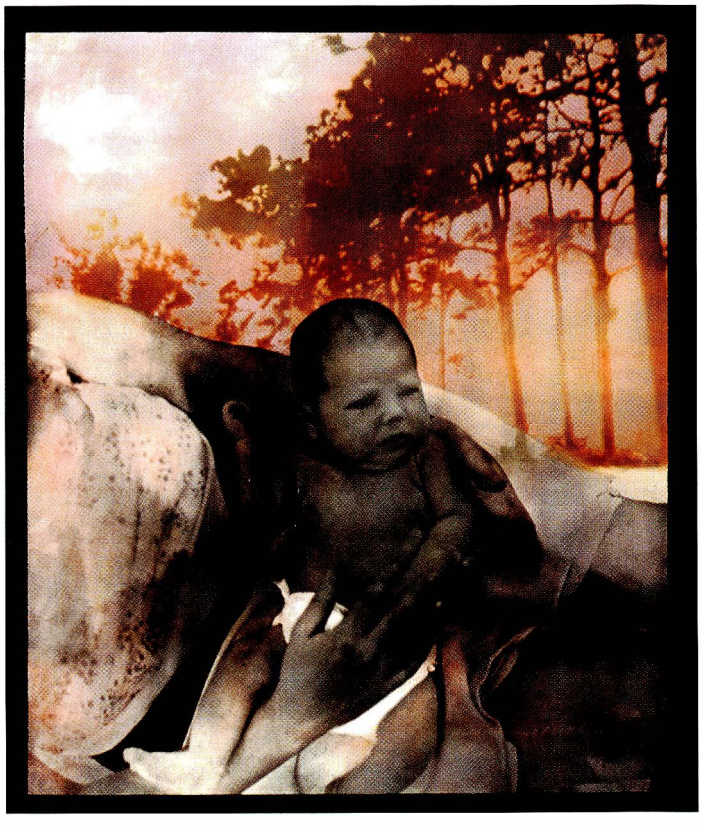


Figure 19–17
Bea Nettles, *Rachel in the Pines,* 1978 (gum on vinyl)
Bea Nettles has been an influence to so many young artists over years because of her fearless examination of personal family and friendship documents, her willingness to use any medium to express what she needs to say, and her many self-published artist's books. This piece is from her well-known book *Flamingo in the Dark* and measures 20" × 24". *(Courtesy of the Artist)*

The Carbon Print Process

OVERVIEW & EXPECTATIONS

In this chapter you will learn about the carbon process . . . in which a print is made with pigment, such as lamp black in a gelatin binder, and a bichromated colloid, such as potassium dichromate. The technique has several similarities to the gum bichromate process (primarily the phenomena of a bichromated gelatin hardening under the influence of UV light), but it is infinitely more refined in tonal values, in the subtlety of its highlights in combination with the depth and richness of its shadow details, and in having a true straight-line response to exposure. The carbon process is also well-known for its archival quality and for being labor intensive.

Curiously, in spite of its elegance and permanence, the carbon process is one of the least practiced of the alternative photographic processes. Part of the problem is that making your own carbon tissue is a bit difficult and finding a commercially made carbon tissue, until now, was equally so. Many years ago, the late Dr. Green, from Indiana, conducted workshops in carbon printing and sold Hanfstaengl carbon tissue directly to a small group of carbon process aficionados who were then working with the technique.

Within the last several years, Dick Sullivan, of Bostick & Sullivan, with the assistance of Gordon Mark and Howard Efner, has been dedicating the majority of his time to developing a reliable commercial carbon tissue in black or brown, that you sensitize with potassium dichromate, use to expose your negative in reverse, and then transfer to a final microporous support paper of your choice. In 2007, Dick wrote a manual to go with his new tissue, and I have relied on his expertise to a great extent in the production of this chapter. I have also worked with his research team, in his Santa Fe carbon facility, in order to be sure that these instructions, his tissue, and your experience making carbon prints, are in harmony. For a look at this document, go to http://www.carbonprinting.com.

I have also been able to use the invaluable, and often quirky, carbon instructions from A. M. Marton's *A New Treatise on the Modern Methods of Carbon Printing*: 2nd Edition (Bloomington, IN, 1905), which investigates carbon image transfers on a variety of substrates

Figure 20–1

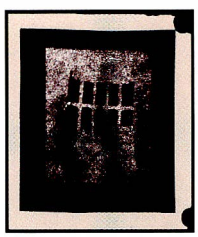
Christopher James, *Tea Boy*, Jaipur, India, 1994 (carbon)

This image was made in the *gullies* of Jaipur where precious stones are traded, bartered, and sold . . . and where naïve tourists are often recruited for simple transport tasks. As is the custom, a sweet milky spice tea magically appears as soon as you are seated. Here's the recipe for **India Street Masala Chai:** 1" stick of cinnamon, 8 cardamom pods, 8 cloves, 2/3 cup milk, lots of sugar, 3 teaspoons black tea . . . bring to boil and let it sit for a spell and then boil it again on a long reduction simmer. It is served in clay cups for two, and it is as delicious as it is addictive . . . in a good way.

(Courtesy of the Artist/Author)

including canvas and glass . . . for transparencies and for image transfer to another substrate. This document is available from http://www.openlibrary.org (https://openlibrary.org/books/OL22887819M/A_new_treatise_on_the_modern_methods_of_carbon_printing).

I'm also indebted to Sandy King for providing his expertise and for giving me permission to document his method of making your own carbon tissue at home. His instruction and technique are better than my own, and I'm grateful for his clarity on this part of the process.



A LITTLE HISTORY

Shortly after the celebration of the invention of photography, it became clear there was a problem with permanence. The days of exhibiting one's salted paper images by dim candlelight had passed and many of the first photographic treasures were rapidly disappearing as time, poor storage, and ineffective fixing or washing methods were causing the images to be plagued with "measles" or to fade away to become a gossamer shadow of the original.

In previous chapters I've discussed the experiments and process innovations, with dichromated salts conducted by Mungo Ponton, Edmund Becquerel, and Fox Talbot between 1839 and 1852. Ponton was the first to use these salts to make low-contrast images on paper. Describing his discovery, he wrote, "Paper immersed in bichromate of potash [potassium bichromate] is *powerfully and rapidly acted upon by the sun's rays. When an object is laid in the usual way on this paper, the portion exposed to the light speedily becomes tawny, passing more or less into deep orange, according to the strength of the solution and the intensity of the light. In this state, of course, the drawing, though very beautiful, is evanescent. To fix it, all that is required is careful immersion in water, when it will be found that those portions of the salt which have not been acted on by the light are readily dissolved out, while those that have been exposed to the light are completely fixed on the paper. By this second process the object is obtained white upon an orange ground, and quite permanent*."

Figure 20–2
Edward Steichen, *Mrs. Philip Lydig, Cyclamen*, 1905
This is a direct carbon print portrait of Rita de Acosta Lydig, an elegant lady of a certain social elevation most known for her great wealth, her beauty, and her affinity for beautiful objects of art. In this piece, Steichen chose the cyclamen as the flower to accompany Mrs. Lydig in the portrait, as she was also famous for her passion for flowers.
(The Metropolitan Museum of Art, New York, NY. Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY. © PERMISSION OF THE ESTATE OF EDWARD STEICHEN)

This last sentence, considering the recent concerns of permanence, was quite relevant.

In 1840, Edmund Becquerel figured that Ponton's process was greatly improved by the addition of starch, or other organic binders such as glue, albumen, gelatin, and sugar. This recognition led to the pigment and chromate investigations, in 1855, by Alphonse Louis Poitevin, who is generally given credit for inventing the carbon process.

In Poitevin's technique, powdered carbon soot, *lampblack*, was combined with a bichromated gelatin and applied to a paper support. This sensitized paper was then coupled with a negative and exposed to sunlight where the bichromated gelatin hardened and became insoluble in direct proportion to the degree of UV exposure it received. As in the gum bichromate

process, the least exposed areas of the print were most vulnerable to being washed away during the wash-development. Conversely, the areas receiving the most exposure were the darkest and the most permanent. Poitevin's process was similar to Ponton's, but in Poitevin's case, an actual pigment came into play, and this was the first instance in which a choice of color could be incorporated with a dichromated colloid. The process's sole weakness was the absence of half-tones . . . the print was entirely black and white.

This problem was partially rectified through the work of L'Abbé Laborde, in 1858. Laborde determined that the excessive contrast in the black-and-white image was due to only the most deeply exposed portions of the print remaining on the paper in the warm water wash-development following exposure. This happened because the uppermost surface of the dichromated colloid hardened first during the exposure, thus preventing additional exposure to the mid-tones, and highlights, beneath the hardened top layer. In the wash-development, the lower layers (those closest to the paper support) of the print were insufficiently exposed to anchor them to the paper substrate. Consequently, when the unattached lower layers were released from the paper support, the well-exposed upper layers of the print tagged along for the ride down the drain. This discovery meant that the solution to the problem was at hand.

In 1858, C.J. Burnett partially solved the problem by exposing his negative to the backside of the pigment and dichromated gelatin paper. The paper, oiled for translucency, was contact printed with the negative, and this strategy permitted mid-scale tonalities to be resolved properly . . . as the bichromated gelatin was hardening at the support layer first. To achieve the deep shadows, the exposure had to be quite lengthy, and the texture of the paper most often obscured the clarity and detail in the final image. Then, in 1860, a Frenchman by the name of Fargier patented a complex solution to the problem by incorporating the idea of image transfer with wet collodion. A description of Fargier's process can be found in Josef Maria Eder's book *History of Photography.* A.M. Marton also discusses a variant of this in his treatise previously mentioned.

In 1864, Sir Joseph Wilson Swan patented a practical, and easily applied, solution to the confounding problems of carbon printing. Swan is primarily remembered for receiving a British patent for an electric light bulb in 1878, a year before Thomas Edison. Edison, by the way, worked on improving Swan's invention and eventually obtained a U.S. patent for the bulb. Edison then oddly initiated litigation against Swan for patent infringement and simultaneously commenced an advertising campaign claiming to be the true inventor of the electric light bulb.

Note: Several years later, in 1883, Edison and Swan went into business together, forming the Edison & Swan United Electric Light Company.

In W. Jerome Harrison's *The Chemistry of Photography* (1892), Swan mixed a little sugar into the gelatin to make it less brittle when it dried. This gelatin was then combined with a dichromate and pigment. Swan also used red chalk (as well as carbon soot) for his pigment even though it lacked the archival attribute of lampblack. This solution was then applied to a glass plate. After making his exposure through a negative, the exposed glass plate was transferred under contact pressure to a microporous waxed or gelatined paper support. Swan employed a rubberized latex glue to hold the gelatin image to the support.

In 1865 Swan received a patent for his carbon process innovations and introduced a ready-made carbon tissue and transfer sheet that was manufactured by his new company Mawson & Swan. In the Dublin International Exhibition of Arts and Manufactures of 1865 (Dublin, Ireland), three landscapes were exhibited using Swan's patented carbon process, and these images were printed on tissue made by the firm of Mawson & Swan. Curiously, the company was also credited as being an artist.

The Mawson & Swan carbon tissue consisted of a film of gelatin, in which finely powdered carbon was incorporated and spread on paper. The gelatinized carbon tissue was sensitized at home by the photographer with a simple solution of potassium dichromate, and when dry, exposed to UV light under a negative. Following the exposure, the face of the carbon tissue was attached to a paper support and soaked in hot water until the original backing paper of the carbon tissue could be detached. At this point, the unexposed/unhardened soluble gelatin was dissolved by the hot

water and flowed from the paper's surface. As the picture was laterally reversed, it had to be transferred a second time to its final support.

In 1868, Swan sold his carbon patent rights to the Autotype Company of England. One of the vice presidents of that new firm was J. Robert Johnson, who improved upon the Mawson & Swan carbon tissue. In 1869, Johnson demonstrated that it was only necessary to first soak the carbon tissue in water for a short time in order to make it adhere to a waterproof support. The Autotype Company of England continued to improve the carbon tissue and process and when it was at the top of its game it was able to successfully supply carbon printers with over fifty varieties of tissue featuring thirty different colors and tonalities.

Improvements followed, and in the 40 years between 1870 and 1910 the carbon process enjoyed its greatest popularity and was employed as one of the primary processes for fine art photographic printing. Variations on the carbon and gum bichromate theme included Victor Artigue's artigueotype (1892), Thomas Manly's ozotype (1899), and the ozobrome (1905). The ozobrome was a variant of the autotype and was eventually given the name *carbro process.*

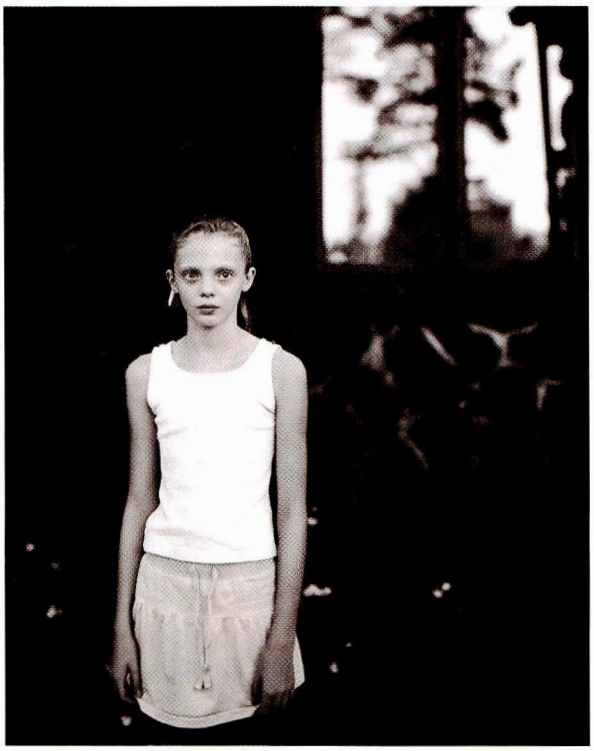


Figure 20–3
Gwen Walstrand, *Elizabeth (age 11)*, 2007
Alternative process artist Gwen Walstrand produced this beautifully rendered carbon print of her daughter Elizabeth at age 11. She writes, *"... carbon transfer prints are both the most beautiful versions and the most difficult to produce. I'm not an experienced carbon printer but have had success with the Bostick & Sullivan tissue and Baryta papers. The color and tonality of carbon is exquisite when it works and heartbreaking when it doesn't."* See her Ziatype of Elizabeth, Fig 14–4.
(Courtesy of the Artist)

HOW CARBON WORKS

The carbon printing process is one that requires many more steps than you will encounter in other alternative techniques, and each of these major stages has a number of smaller steps, so be prepared to spend some time making a print. There are four phases to making a carbon print. If you are inclined to really get into the process, you may add another by making your own carbon tissue. If this interests you, I will be incorporating Sandy King's technique, with illustrations, in this chapter. Until then, here are the four primary phases.

Phase 1 Sensitizing the carbon tissue

Phase 2 Exposing the carbon tissue

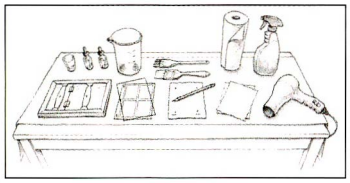
Phase 3 Mating the carbon tissue to the final support

Phase 4 Developing and drying the final image

A Quick Overview

Here's a quick overview of the process. A piece of very thin and flexible paper is meticulously coated with gelatin and a pigment. This prepared paper, or substrate, is then sensitized in a 10% (nearly saturated) potassium dichromate solution. This sensitized sheet, called *carbon tissue,* is then dried, mated with a negative, and exposed to UV light in a manner similar to most other alternative processes. The UV light causes the long chains of atoms making up the gelatin to become "cross-linked," and this entanglement hardens the gelatin, rendering it insoluble. As in the gum bichromate process, the degree of hardening is proportional to the amount of light received through the negative. The exposed tissue is then immersed in a cold water bath and mated to a sheet of microporous gelatinized or resin coated paper, squeegeed, and put under moderate pressure for a period of time. The mated pair is then immersed in a warm water bath

until there is visual evidence that the tissue is ready to be separated from the support. This is often recognized as a delicate black cloud on the edges of the mated pair. The tissue is then patiently peeled away from the support and immersed in water until the unexposed gelatin is washed away, leaving a permanent carbon image. If additional clearing of the highlights is needed, the print is immersed in a bath of dilute potassium metabisulphite.



PHASE 1: SENSITIZING THE TISSUE

The Table Setup

- A 10% potassium dichromate solution—100 g per liter of water
- 90% isopropyl alcohol (rubbing alcohol may contain additives)
- A clean tray for tissue sensitizing
- A larger tray to hold iced water and the tissue sensitizing tray
- Bostick & Sullivan carbon tissue cut to size
- A window squeegee
- A large piece of plate glass or solid Plexiglas—larger than the tissue
- A bag of ice
- A pair of nitrile gloves

About Sensitizing

In this step we will be making the carbon tissue sensitive to light. For convenience we'll make the working solution from a saturated stock solution of potassium dichromate. This is exactly the same saturated solution you use in the gum bichromate process. You may recall that potassium dichromate is saturated between 10% and 13% depending on temperature.

Changing the percentage of dichromate in the working solution can control contrast. You can work with saturations of 0.5%–6%, but the outer extremes can be difficult to work with and will often present problems. A 0.5% concentration will yield a contrasty print, will result in longer exposure times, and is used for lower contrast negatives.

The higher percentages of potassium dichromate are for very contrasty negatives and will make softer prints. Solutions over 4% will often dissolve the gelatin. To counter this possibility, you will need to lower the temperature of the working solution. Higher concentrations of potassium dichromate will also mean shorter exposure times.

The alcohol is not mandatory. Its purpose is to speed the drying of the tissue. Do not use ethyl or denatured alcohol, as this type forms chemicals that harden the gelatin and will result in fog on the exposure.

For a platinum-style negative that will print on a No. 0 enlarging paper, try a 2% solution. For a negative that prints on a No. 3 silver gelatin enlarging paper, try a 1% working solution.

Sensitized tissue may last for a day or so if left in a dry cool dark place and may last for weeks if frozen.

Figure 20–4
Dick Sullivan, *Spahn Ranch*, 2007 (carbon)
Dick Sullivan made this image at the Spahn Ranch, a 500-acre wilderness area in the Santa Susana Mountains. If you remember black-and-white TV and the Lone Ranger (Clayton Moore) and his sidekick Tonto (Jay Silverheels) galloping past giant boulders on their way to "save the day" . . . then you have seen the ranch. Unfortunately, the Spahn Ranch is also known as the one-time residence of Charles Manson and his disciples, known as "The Family," who lived there in the spring of 1968 . . . the year of their very evil deeds. *(Courtesy of the Artist)*

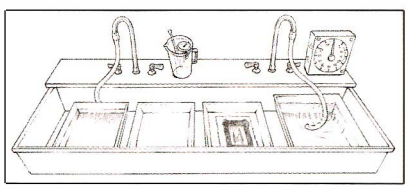
The Process: 10% Dichromate Stock Sensitizer Solution

EXAMPLE: 1 liter of 2% working solution from stock

Step 1 Put 200 ml of 10% saturated dichromate 10% stock solution in the beaker.

Step 2 Add 400 ml of 55˚F–65˚F cool water to the stock solution.

Step 3 Add the rubbing alcohol to bring the total to 1000 ml.



SENSITIZING THE TISSUE: COLD SENSITIZER SETUP

First, put on a pair of nitrile gloves before working with a dichromate, as it is carcinogenic. Second, if you have any dry chemistry left over, save it. Do not throw it out as a powder, as it may be self-combustible under the right circumstances. Only dispose of dichromates by diluting and flushing with large amounts of water.

The following can be done in a dimly lit room, and there should be no fluorescent lighting within range of the sink area during this stage. I've found that a cold sensitizer is better than sensitizer at an ambient temperature. The reason for this is that a colder sensitizer is far less likely to disturb the fragile state of newly immersed carbon tissue. When I teach this technique in summer workshops we always use iced water.

Half fill your large tray with some ice and water. Then place your smaller sensitizing tray in the larger one, so that it floats, and pour in the sensitizer. Let the solution chill. You will find it practical to wear a respirator mask along with your gloves, as the alcohol/potassium dichromate solution has a rather acrid and intense odor. Ventilation is important.

Place the carbon tissue in a clean tray and pour enough dichromate solution to cover and flood the tissue. Gently rock the tray, making sure the solution covers the tissue. If it becomes difficult to continue flooding the tissue with the solution, simply add more. With the iced tray system you shouldn't have any problems with the pigment. However, if you have not chosen to use the double-tray setup you may see changes in your tissue during the sensitizing. *If pigment starts to flow off the tissue, stop immediately.* If this happens you will need to lower the temperature of your working solution. Higher percentages tend to melt the tissue, causing a visual bleeding of the pigment. Flood the paper for 2–3 minutes in the sensitizer.

The tissue goes from being insensitive to UV light when it is very wet, to highly sensitive when it is nearly dry, to a little sensitive when it is dry and ready for exposure. In a dry climate, or during the winter when the humidity is very low, the tissue may curl tightly and may have to be humidified before exposure. In a humid climate, it is necessary to see a slight curl to the tissue before exposure. This indicates that the tissue has dried and can be used. You may employ a fan for drying.

Squeegee & Drying Steps

Set up your sheet of glass, or solid Plexiglas, in the sink. Be absolutely positive that the glass is clean or you will see streaks in your final print.

After 3 minutes remove the tissue and drain it briefly by holding it from a single corner. Then, place the tissue face-up on your plate glass in the sink. Very gently, squeegee the face of the carbon tissue to remove the remaining solution. Do not turn the tissue over to squeegee the backside, as this may damage the front.

Hang the tissue in a clean dark area to dry, as it is now light sensitive. Low ambient light will not expose the tissue, so please don't get compulsive about the luminosity in your working area. In dry climates, like Santa Fe or Aspen, the tissue will be dry in less than one hour. In more humid climates, like summertime in Maine, the drying time will be a good deal longer.

Note: Dry tissue should curl a bit when it is completely dry. If there is moisture in the tissue then the mating steps will not work as well, as the tissue will be too damp to create a vacuum with the microporous mating paper. Be sure that the tissue is completely dry before exposure and mating.

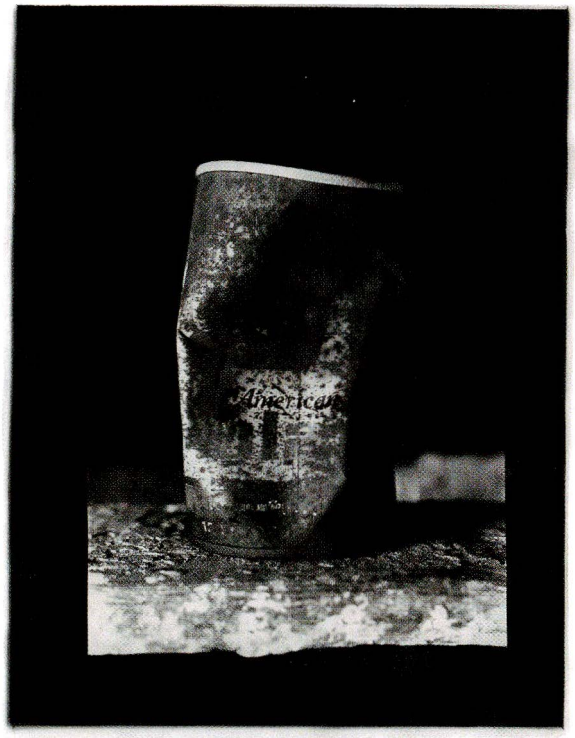
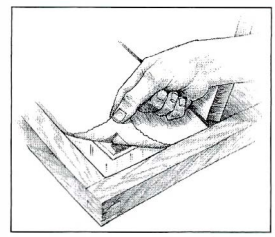


Figure 20–5
Brian Palm, *American Can*, 2005 (carbon)
Chicago artist Brian Palm found the can while on a walk in the woods in Wisconsin. When I asked him what he wanted to say about the can he replied that he could probably write a few paragraphs regarding the ironic relationship of the object and the text. Sufficient, perhaps, to say that it's a great carbon print of an interesting object found in interesting times. *(Courtesy of the Artist)*

Note: I've found that unexpected changes in temperature and humidity in our labs at the College of Art and Design occasionally make the tissue curl very tightly. One way to avoid this is to wait until your tissue is dry and is showing a slight curl. At this point, bag your dried tissue in a zip lock freezer bag. Store the bag in a freezer between printing sessions and the tissue should remain flat.

Spontaneous Exposure

As the sensitized carbon tissue ages it becomes more sensitive, and at a certain point it spontaneously fogs. When this is going to happen is unpredictable. Sensitized tissue will usually last for a couple of days, but in some cases it may spontaneously expose in 24 hours. If your tissue has "blown" or is having a "dark reaction," which is what spontaneous exposure is called by carbon printers, it will fail to stick during development and will peel right off the support. It will also be leather-like while sticking to the tissue backing.



PHASE 2: EXPOSING THE TISSUE

Comments

Carbon tissue is UV-light sensitive (as well as a little sensitive to visible ambient light) and can be exposed in mechanical light units that work for other alternative processes. The printing speed of the tissue will vary according to the percentage of potassium dichromate it was sensitized with. Higher percentages are faster, and lower percentages are slower.

Carbon tissue that is not dried sufficiently will melt and stick to your negative . . . this is obviously not a positive experience for your negative (sorry, couldn't resist). Carbon tissue that is too dry will coil up tightly and be difficult to manage. The tissue is best exposed when it has some moisture in it but not so much that it melts onto your negative. A slight amount of moisture will make it easier to handle while getting it into the print frame, and local humidity conditions will affect this. Dick Sullivan lives in Santa Fe, and the humidity there can be often be measured in single digits. As a result, he needs to humidify his drying cabinet to keep the tissue from curling too much. An artist living in New Orleans may have the opposite problem, with the tissue being too moist, and will likely need to de-humidify his or her drying space. When I work with this tissue in New England, in the summertime, the tissue takes several hours to dry properly. It should exhibit a slight curl when it is ready.

You can use either a 1- or 2-mil (a mil is one-thousandth of an inch or 25 microns/micrometers) piece of clear Mylar to separate the negative from the tissue. Mylar is Sandy King's preference, and he also uses it to simultaneously create a mask that keeps his borders clean. An alternative option is to use Krystal

Seal envelopes. These are thin, very clear envelopes that you can put your negative in. They are available from almost any decent art supply and range in size from 6" × 8" up to a larger 23" × 31".

The Safe Edge

One of the unique things you will do in carbon printing is to put a safe edge on your negative. The purpose of the safe edge is to prevent the overexposed area outside the image from flagging (it looks like what it sounds like) during development and tearing part of the image off the support during the separation stage.

Note: This is important. If carbon is exposed past the point of its Dmax it will not stick to the support. This is due to it having hardened past the point of being able to absorb water during the mating phase. It is this absorption that creates the vacuum to make it stick.

If you make digital negatives, put a 0.1"–0.3" border around your image in the canvas adjustment border around your print. After printing out on Pictorico OHP Ultra Premium digital inkjet film, extend the canvas border with an opaque material such as rubylith/red lithographer's tape. If they are in-camera negatives, extend the border in the same manner around the edge of the negative. You can also put the negative in a paper or rubylith matt or make an instant safe edge with adhesive metallic slide masking tape. This product is getting harder to find since slides have disappeared. This will leave a white edge around the negative that will not flag. If you are carbon transferring to an RC digital paper, a safe edge isn't necessary.

The Setup

- A UV light source
- A piece of sensitized tissue
- A negative . . . digital inkjet or silver gelatin
- A contact-printing frame or vacuum exposure unit
- Krystal Seal envelopes or 0.1 Mylar film
- Red lithographers tape, black tape, adhesive metallic slide tape

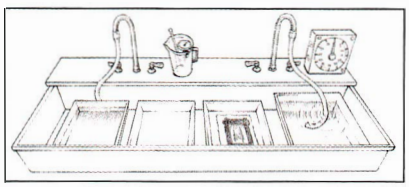
Exposing the Tissue

Expose the negative with a UV light source such as the sun or, for consistency, a UV exposure box, in the same manner as you perform the exposure in any other alternative process. Sunlight will work, but it is a second choice compared to using a controllable mechanical UV exposure unit with a vacuum frame or a hydroponics metal halide grow light. That said, sunlight exposure in summer, using a contact-printing frame, generally takes an average of 5–6 minutes at peak exposure hours in the middle of the day. If you are using a high-intensity exposure unit, your results will be far easier to calibrate and predict.

As with the gum bichromate process, a carbon print exposure will continue to "mature" after it has been removed from the exposure unit; therefore, it is important to go directly to the mating of the tissue to the

Figure 20–6
Vaughn Hutchins, *Oak Roots, Merced River*, 1994–1995
Vaughn Hutchins's name was constantly mentioned every time I asked someone who was doing really strong carbon printing. He works at Humboldt State University and has been making carbon prints for 15 years . . . after reading about the process in *View Camera Magazine* . . . and then it took him a few years before he was happy with the quality of his printing. Vaughn works with an 8" × 10" camera and contact prints directly from the negative.
(Courtesy of the Artist)

support phase of the process. As well, there will be no stage whisper or printing out of the image to guide you in judging exposure . . . nor will there be any chemical development control following the exposure.



PHASE 3: MATING THE TISSUE TO THE SUPPORT

Sink & Table Setup—What You Will Need

- An exposed piece of carbon tissue (from Phase 2)
- A piece of support paper cut to size (see later in the chapter)
- A tray of iced or very cool water
- A piece of plate glass to squeegee on
- A heavy-duty photo squeegee
- 2 sheets of Plexiglas larger than the tissue and the support paper
- Paper towels

Mating the Tissue to the Support

This is, without question, one of the most critical steps in the process, so be patient and allow for a learning curve.

In the mating step, you will fill a large tray with 65°F–70°F water and immerse the support paper and the exposed tissue in the water bath with the image side of the tissue facing down, toward the transfer support. If the water is too cool it will be necessary to lengthen the soaking time. In certain conditions, a lengthy soak, prior to mating the tissue and support, will prevent achieving a tight bond during the mating stage. If the water is too warm the tissue may absorb water too quickly. Upon immersing the tissue in the water it will begin to sink a little and you will then be able to guide it into the mating position with the support material. This will generally take 30–45 seconds. Mate the tissue and its support together while they are in the water, remove the mated pair from the water in a flat position, lay them on a sheet of Plexiglas, and with a good deal of pressure squeegee the pair together in several directions . . . then seal them together with a second piece of Plexiglas. Some practitioners like to put a weight on top of the second piece of Plexiglas.

Depending upon the support you choose, the mated pair will need to sit for as little as 5 minutes for small prints and up to an hour for larger ones. There is no reason to be in a hurry at this stage of the print. If you are using a support, such as Photo Warehouse's Photo Quality Luster, your contact time will be between 6 and 8 minutes. During this time, the water will migrate into the gelatin, creating a vacuum-like suction that pulls the tissue and the support together. The gelatin surface of the support and gelatin of the tissue will lock together. This happens at the molecular level where the long stringy strands of gelatin mesh together in the manner of a hook and loop fastener.

Support Options

Carbon has been put on a variety of surfaces; paper is the most common, but canvas and glass were often used in the past. Traditionally the surface to which carbon is transferred is called a "support." Here are some options for supports.

Inkjet Photo Papers

This is probably the best choice for a beginner. The variety of surfaces and weights are endless. However, you will want a photo-quality inkjet paper that is microporous. *Microporous* is not a term that describes papers that are blasted with tiny holes during manufacturing. In inkjet printing, the term indicates that the papers are manufactured with a coating of extremely fine silicon particles. There are millions of these silicon particles on the paper, and they are designed to bond with pigmented inks. During the mating phase, between the tissue and the paper support, the silicon particles grab ahold of the gelatin surface of the tissue and create a very efficient bond. Shedding and blistering, the most common problems with carbon, are almost nonexistent. Some of these inkjet papers wrinkle on their surface when they are wet, so you will need to test the paper before investing in a large batch. Digital papers come and go, so I'm not going to list a lot of them.

As of December 2013, one of the best digital papers for carbon printing support is Professional Grade Photo Quality Luster from http://www.ultrafineonline.com.

This is an excellent paper to use when you are first learning the process. You may, or may not, like the surface after the drying, as it looks a lot like inkjet paper. For a more artful surface you may want to consider glyoxal-hardened gelatin sizing on fine art paper, although I haven't had much success with this idea to date. Other inkjet papers that work well are Canon Photo Paper Pro, Ilford Galerie Smooth Gloss, and Moab Lasal Photo Gloss.

There are some very high-end inkjet papers that are similar to fine art printmaking papers that are not microporous . . . they do not work well. You will quickly realize this because the image will slide right off the surface as soon as you separate the tissue from the support in the warm water development bath. You might also notice that the tissue won't bond with the paper and that when you separate it all you will be left with is a yellow dichromate ghost of your image.

It would be terrific if any of the inkjet papers worked perfectly, but to date all that I've tried were imperfect to my taste. The primary problem is that the microporous surface traps soluble gelatin and causes highlight veiling. Also, many of the papers present an iridescent look with carbon under critical examination that is, to my mind and that of other fine art printmakers, very unattractive.

Figure 20–7
Sandy King, *Ancient Fig,* 2009 (carbon)
Sandy is a retired Clemson University professor with a Ph.D. in Spanish literature and a carbon process master. He recently wrote, "*This, on the other hand, is a truly noble subject. It is a 500-year-old fig tree, native to Asia but planted in the highlands of Veracruz in the very early 15th century. This huge tree is in the Hacienda Lencerro, an estate once owned by Santa Ana. It is unique in that there is not another tree of this type anywhere in Mexico, or so I was told.*" *(Courtesy of the Artist)*

Yupo

Yupo is a synthetic paper used for a wide range of printed applications such as maps, catalogs, manuals, and labels. It is very durable, category 5, polypropylene plastic film, completely recyclable, and available in most art stores. It has also become quite popular with watercolorists. Yupo also works without any additional sizing and is a good support for the beginning carbon printer. It is, however, a bit trickier than inkjet photo paper. Yupo has the added benefit of being reusable. If you don't like the print, wash it in some household bleach and rinse it in hot water and reuse it. Yupo should also be washed with some detergent and hot water before first use to remove any release agents left during its manufacturing process. If your art store does not carry Yupo, it is readily available from http://www.dickblick.com/products/yupo-watercolor-paper/, Bostick & Sullivan, and other art supply sources on the Internet. This is probably a better support option than any of the inkjet papers.

Fixed-out Photo Enlarging Paper

This is a choice of many contemporary workers. If you happen to find a load of out-of-date paper, consider yourself lucky. If it is foggy because it is old, fix it in Farmer's Reducer instead. It should be soaked for 5 minutes in warm water before mating it to the exposed tissue.

Art Paper

To date, no one has found an off-the-shelf art paper that works without extra sizing. Art papers, such as Rives BFK, need to be sized twice with a 4% warm gelatin mixture combined with 3 g of potassium alum (a hardening agent) per liter. Please consult the paper preparation chapter for full details on paper sizing. Caveat: in most cases the paper will need to be sized far more heavily than is normal for gum bichromate.
Another idea, and one that my students and I are just beginning to work with, is taking a traditional alt pro paper, such as Cot 320, and performing a glyoxal/gelatin hardening preparation on it, as you would for gum bichromate printing, and then using that paper as the transfer support. I suspect that you may have to do this sizing process twice before the paper is completely perfect for the transfer.

Preparing Fine Art Papers for Carbon Supports

I'm still working on this concept, and most of the solutions that I've run across don't work very well. Honestly, if the surface of the microporous Professional Grade Photo Quality Luster support was just a little bit more attractive, I wouldn't keep searching for a way to get printmaking paper to accept a carbon transfer. I know that I could muddle through a double transfer sequence, like carbon on canvas, but the fact is that the Luster works beautifully, and even the novice can make a carbon print in short order. Not so with exotic supports.

Mating the Tissue to the Support

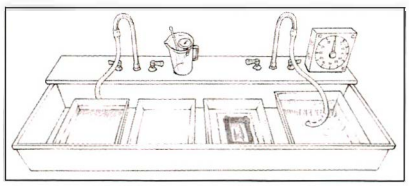
Step 1 Place the chosen paper support in the tray of cold water with the side you will mate to facing up.

Step 2 Place the exposed tissue in the tray of cold water, with the exposed side facing down toward the support paper, and allow it to soak for 1 minute. Agitate and wipe the surface of the tissue with a latex gloved hand to remove any microscopic or larger air bubbles trapped on the surface during this time.

Step 3 With the gelatin of the tissue directed downward, facing the support, put the two sheets together and pull them from the tray. Keep the pair horizontal and move quickly to the Plexiglas surface, where you will squeegee, carrying as much water as possible.

Step 4 Firmly squeegee the two together. The first stroke should be firm followed by increasingly firm strokes. Four to five strokes should be sufficient. The reason for carrying the water between the pair to the squeegee glass is to have a flood of water on the first stroke. This flood will carry away any air trapped between the mated pair.

Step 5 Allow the mated pair to sit for at least 30 minutes, pressed between two sheets of glass or thick Lucite if you are using a support like Yupo. If you are using a digital printing paper such as the Photo Quality Luster, the mating time is 5–7 minutes. Longer mating times will not hurt; in fact, they will actually help reduce the chances of blistering and shedding. In the early days of carbon printing it was common to expose and mate tissue in the morning and develop them in the afternoon.



PHASE 4: DEVELOPING THE PRINT

Table Setup

- A mated pair of tissue and its support
- A large and clean tray for processing
- A very good supply of hot water
- A thermometer that will read 105°F/40°C

The Procedure

Step 1 Fill the tray with 105°F–110°F water.

Step 2 Slip the mated pair into the tray, submerge them, and don't fuss with the tray or the water.

Step 3 Wait 3–5 minutes. Watch the edges where the tissue meets the support. When the pigment begins oozing from the edges and it looks like a grey silt-like cloud leaking from the pair's edges, you are ready to separate the pair. This oozing indicates that the gelatin is melting and that the tissue can be removed. In some cases, with the Bostick & Sullivan carbon tissue, the separation of tissue and support, in 105°F degree water, can take place in 45–60 seconds with complete development in 3 minutes.

Step 4 Peel the tissue from the gelatin support diagonally, from one corner to its opposite corner. There should be some resistance , so don't be afraid that you will rip the tissue or the support. If in doubt, let it sit a little longer. Make a small fold-up finger tab in one corner and pull slowly to the opposite corner. Hold the paper support firmly while removing the tissue.

Step 5 Once the tissue backing has been removed, dispose of it, as it is no longer needed in the process.

Step 6 At this point you should see a sheet of black and shiny, how do I put this . . . goo, gunk, crud, gloop . . . you get the picture. If the support floats, you can turn it over by holding two sides and letting it bow. This will prevent any air bubbles from forming. Most inkjet papers will sink, so just let them do that as they settle to the bottom of the tray. Inkjet papers should be agitated rapidly to speed development. There is little danger of shedding the image.

Step 7 Continue to monitor the temperature in the tray. If it drops below 95°F, add more hot water to bring up the temperature.

Step 8 Every so often, turn the print over and observe the development. There will usually be a fringe of tissue sticking to the print outside the image area. This can be removed during development by rubbing it off with a gloved finger. However, this task is a bit more difficult when using inkjet papers. The fringe can also be removed after the cold water step (coming up) by laying it flat on the glass and wiping it off with a paper towel.

Step 9 When you hold the print out of the water, and do not see the carbon leeching off of the support (it looks like gray water), the development is complete. Look at the white border color . . . if it's not completely white when the water runs off then it's not ready to be transferred. Place the print in a tray of cold water to set the gelatin.

Step 10 Allow the print to dry.

Step 11 If the print appears to need a little clearing or brightening, clear it in a solution of potassium metabisulphite that is made by dissolving 5 g per liter of water. Clear until there is no yellow from the potassium dichromate in the print. This may take up to 10 minutes or longer. If the clearing is difficult, the rule is warmer, stronger, or longer.

Step 12 Hang the print to dry again.

Figure 20–8
Maggie Hall, *Emmaline, 4 o'clock Sun*, 2007 (carbon)
Outstanding maker of artist's books, Maggie made this carbon print during one of my advanced alternative process workshops in Santa Fe. She writes, "*Going home to Kansas from Boston, my sanity returning slightly as I finally got to photograph those I love.*"
(Courtesy of the Artist)

Toning: Chocolate Brown

If you want a chocolate-brown carbon print you can purchase brown carbon tissue from Bostick & Sullivan or exert a little more control by engaging in a toning process. If you feel like toning your carbon print, there is a chocolate-brown toner that is quite excellent.

Step 1 Immerse the carbon print in a 1.5% solution of ammonium dichromate for 2–3 minutes.

Step 2 Wash the print in running ambient water for 5 minutes.

Step 3 Fix the print in standard silver gelatin print fixer for 3 minutes.

Step 4 Wash the print for 20–30 additional minutes.

Comments

Every carbon printer will have her or his own technique for developing prints. The variations are endless. Typical of alternative process artists, no two carbon process printers agree on, or follow, all the details and phases of the process. Depending upon whom you talk to, development time varies from 5 to 15 or more minutes. Some printers develop face up and agitate the print in the water. This speeds development but risks edge frilling . . . just as in gum bichromate wash-development.

CARBON ON CANVAS

A.M. Marton's Carbon Transfer to Canvas

You can make some very interesting carbon images on canvas that serve as a final image or the first stages of a painting that will follow the creation of the carbon image. The initial setup is time consuming but it is not particularly difficult to do. A.M. Marton's *A New Treatise On The Modern Methods of Carbon Printing* (1905) explains it pretty well, and as he wrote in the beginning of his explanation, "*Pigment pictures on canvas make an almost perfect basis for pictures to be finished in oil colors.*"

Step 1 Scrub the canvas well with a brush and soap and dry it completely.

Step 2 Make a gelatin solution consisting of 80 g gelatin and 1 liter of cool water. Allow the gelatin to bloom for 30 minutes and then add 2 g of chrome alum that has been dissolved in a small amount of hot water. Add and stir the dissolved chrome alum into the gelatin solution in small increments. You may elect to add 10 ml of formalin as a substitute to the alum.

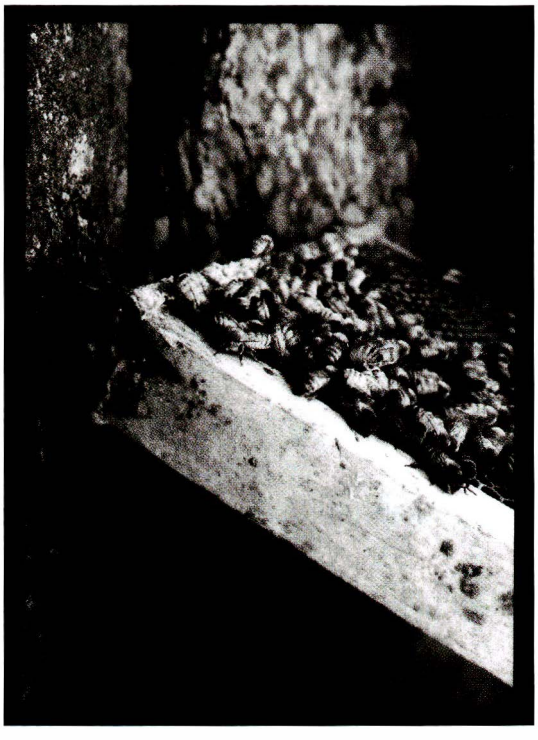


Figure 20–9
Molly Geiger, *My Bees*, Vermont, 2007 (carbon)
Molly, a former student of mine and a true animal whisperer, grew up on a farm in Vermont and has a passion for honeybees, whose hives she tended with her father . . . who knows everything about them. Like Winnie the Pooh, she is fascinated with how they work, live, and produce her favorite food in the world, honey. This image was taken during a day of beekeeping and honey collecting.
(Courtesy of the Artist)

Step 3 Apply the gelatin–alum solution to the canvas with a brush. Dry the canvas and repeat this step with a second application. Before applying the gelatin–alum solution for the third time, follow Step #4.

Step 4 Go through the carbon steps and have your carbon image on a temporary support and ready to transfer. This is a technique referred to as a double transfer because you are transferring your carbon image to a support that will then be used to transfer to a second, more stable, support. A temporary support will be glass, a sheet of white Lucite, or sheet vinyl (like the material grandparents often use to cover their furniture between holiday gatherings). Each of these materials needs to be cleaned with bleach and hot water and then coated and buffed with Johnson's Floor Wax. This leaves a super thin molecular film that will release the carbon image to the second support/canvas. Car wax does not work well.

Step 5 The next step is to put a third coat of the gelatin–chrome alum solution on the canvas. The carbon print is then transferred from the temporary support, of glass, Lucite, or vinyl, by pressing it into direct contact with the wet third gelatin–alum coating. Squeegee the mated pair to create a tight bond and leave undisturbed until it is perfectly dry. After drying the permanent support will readily release from the temporary support, leaving the carbon image on the canvas.

If you want the glossy new transfer to dull down a bit simply soak it in cool water and hang it up to dry. If you want a matte surface, mix a little cornstarch or tapioca starch (as in matte albumen) with your gelatin solution and brush on a thin coating. At this point you have a carbon print on a piece of canvas or the beginning of a very interesting adventure

Figure 20–10
Rachel Brace-Stille, *Quiet*, 2007
Rachel made this carbon print during one of my advanced alternative process workshops in 2007. Rachel's ability to make carbon prints in high heat and high humidity is, in part, due to having learned the process from the master, Dick Sullivan, in his carbon facility in Santa Fe a few weeks earlier . . . where the conditions were ideal.
(Courtesy of the Artist)

into painting on carbon-based photographic imagery on canvas.

If you intend to paint on the canvas following the transfer, Marton recommends painting on a solution (he doesn't provide the recipe) of isinglass, a substance obtained from the dried swim bladders of fish, such as sturgeon. It is a form of collagen used primarily by home brewers of beer for the purpose of clarification.

CARBON POSITIVE & NEGATIVE IMAGES ON GLASS

Although this carbon variant is not for the faint of heart, it is quite interesting and worth your time and effort should you have a practical reason for investing in experimentation. We will deal with carbon positives on glass rather than transparencies, as that is a far more complicated matter requiring a carbon tissue prepared for the purpose that is charged with 50%–75% more pigment, such as filtered India ink, than is customary for regular carbon transfer tissue. Transparent carbon images on glass were traditionally employed for lantern slides and enlarged contact glass negatives. My guess is that interested readers may be more inclined to use this glass preparation as contact negatives with other alt processes, installations, and such.

This technique briefly addresses the traditional method of making a carbon print on glass, and the bulk of it is directly indebted to A.M. Marton's *Modern Methods*. In a nutshell, warm gelatin when applied to clean glass will dry and stick to glass. Carbon prints, however, will not stick to glass as adhesion success is predicated on a vacuum-like effect created by the capillary action of water moving into the gelatin. A carbon print *will* stick to gelatin, so the glass first needs to be prepared with a gelatin surface to hold the carbon image. In the past it was common to use opal glass, essentially normal glass with a super thin coating of white glass, made from an oxide of zinc or tin on the surface, but either clear or opal is acceptable.

The first step is to clean the glass exceptionally well with ammonia followed by a thorough rinse with hot distilled water. You may also wish to clean the glass with the ambrotype glass-cleaning method that incorporates whiting slurry and Everclear . . . or the Bon Ami dishwashing-machine technique. Both of the latter glass-cleaning techniques are found in the Wet Plate Collodion chapter.

A.M. Marton's Method #1

For A.M. Marton's recipe you will need to begin by making an insoluble substrate that will hold the film in contact during development, and once dry, will cause it to adhere to the glass plate.

Step 1: Insoluble Substratum on Glass

You will need the following:

- 28 g hard gelatin
- 880 ml distilled water or rainwater
- 10% chrome alum solution
- 80 grains or 5 g bichromate of potash/potassium bichromate
- A sheet of ultra clean glass
- Latex or nitrile gloves

Place 28 g hard gelatin in cold water and let it soak in the water for 60 minutes. Next, pour off the water and add 880 ml of distilled water. Dissolve the gelatin with gentle heat in a water bath. When dissolved add the dichromate to the warm solution and strain through a fine muslin. Keep the solution at 85°F and flow on the glass plate as you would with a wet plate collodion pour. Be sure that you are wearing nitrile or latex gloves while pouring.

Thoroughly dry the plates in a warm and dustless environment, and when completely dry, expose them to strong sunlight for a few minutes. This hardens the gelatin substratum and makes it insoluble. These plates, in this state, will keep indefinitely.

Step 2 Preparation of Glass Following Insoluble Substratum

You will need the following:

- 28 g hard gelatin
- 590 ml distilled water or rainwater
- 10% chrome alum solution
- 20 grains or 1.3 g chrome alum
- Acetic acid
- Prepared glass from Step #1
- Latex or nitrile gloves

Place 28 g hard gelatin in cold water and let it soak in the water for 60 minutes. Next, pour off the water and add 440 ml of distilled water. Dissolve the gelatin with gentle heat in a water bath.

Next, dissolve the chrome alum in the remaining distilled water and proceed to add it to the gelatin solution a little at a time, stirring constantly. If the gelatin shows signs of thickening or becoming rope-like, add a little acetic acid until it becomes fluid again, but no more than is necessary. When done, filter this solution through several layers of muslin. When that is complete, flow this solution on the glass plate in the same manner as you did in Step #1. The glass plate is now ready to be used as a transfer support for your carbon images both positive and negative.

Sullivan's Method with Amino Silane

Dick Sullivan's method from his book, *The Book of Modern Carbon Printing,* is efficient due to the use of amino silane. Amino silane is used in the glass industry to get glue to adhere to glass. It has two molecular hooks: one for protein (glue) and the other for silicon (glass.) One hooks to glass, the other to proteins (gelatin in our case.) You will need the following:

- Sheet of ultra clean glass (see earlier in the chapter)
- Bottle of A-1100 amino silane (solution available from B & S)
- Paper towels
- Foam brushes
- Isopropyl alcohol

Clean the glass thoroughly using the glass-cleaning methods found in the Wet Plate Collodion chapter. After the glass is thoroughly clean and dry, make a pad out of paper towels and dampen it with isopropyl alcohol. Polish the glass with the alcohol-dampened paper towel and some Bon Ami powder. Dust off any powder left when dry.

Using a foam brush, coat the glass plate with a thin layer of amino silane. You do not need much, just a thin coating. Let the plate dry overnight. Use the glass as a final support by squeegeeing the tissue to it in the normal manner.

When making carbon prints on glass your image should be at least one stop darker and one stop more contrasty.

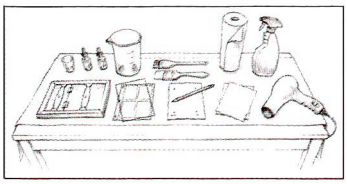
MAKING YOUR OWN CARBON TISSUE

There are several good reasons to learn how to make your own carbon tissue, not the least of which is that there is presently only a single commercial source for carbon tissue and the selection of color is limited. This tissue, made by Bostick & Sullivan, is very good and I've used it for years, but there will be a time when you want to change a color, or experiment with a new idea, and being able to make your own tissue is important. Secondly, carbon tissue has a limited shelf life, and making it fresh guarantees that you will always be in control of your tissue's health. Third, you are no longer limited to the size of the commercial tissue. Finally, making your own tissue is going to make your carbon technique predictable, and when it's predictable, you will know what to do to fix almost any problem you encounter.

There are three stages in making your own carbon tissue: A: Mixing the pigmented gelatin solution,

B: Coating the base (in this case Yupo), with the pigmented gelatin solution, and C: Drying the tissue.

One of the top carbon printers in the country is Sandy King (http://sandykingphotography.com/), who has sent me his carbon tissue recipe and sequence. Since I like his method more than the one I've been using for the last several years, I'm going to cut and paste, with his gracious permission, his process so that you can be sure to have success.



Mixing the Pigmented Gelatin: What You Need

For this stage you will need the following:

- A bain marie, double boiler, crock pot, or small beer cooler
- A 1-liter wide-mouth plastic beaker
- A rubber kitchen-type spatula. A spoon will do in a pinch.
- Squeegee
- Yupo paper. There are other materials such as wallpaper liner or non-woven interfacing material from a fabric store, but Yupo is the easiest to use.

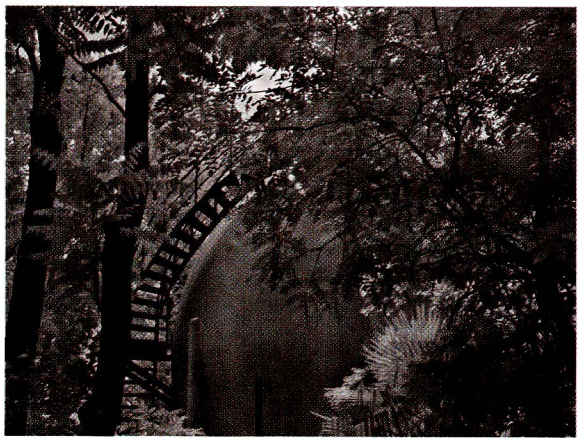


Figure 20–11

Sandy King, *Nanjing Storage*, 2012 (carbon)

This image is an interesting example of how "seeing" with a different light creates ambiguity, transforming a rather mundane object into something enigmatic and mysterious. The print is a 12" × 16" carbon transfer on Canson art paper, printed with a digital negative on homemade carbon tissue. *(Courtesy of the Artist)*

- Distilled or de-ionized water
- 100 g of 175–250-bloom gelatin. Knox gelatin from the supermarket is generally fine. Some practitioners claim that it tends to wash out in the highlights, but I've not seen this problem in my own work . . . yet.
- 30 g pure cane sugar
- 90% isopropyl alcohol
- 12 g Dick Blick Black Cat India Ink lampblack pigment
- 20% solution of thymol in alcohol

A: Mixing the Pigmented Gelatin

Step 1 Add 900 ml of water, distilled or de-ionized, to a wide-mouth plastic container. The water should be cool, 55°F–60°F. Stir 100 g of 175–250-bloom gelatin into the distilled water, and let the mixture stand for about 0.5 hour.

Step 2 Put a lid on the container and place it in a small cooler or ice chest filled with warm water at around 110°F–120°F (43°C–49°C) and allow the gelatin solution to slowly melt. This will take about 0.5 hour.

Step 3 When the gelatin has melted add 25 g of plain white sugar and stir until dissolved.

Step 4 Add 12 g of Dick Blick Black Cat India Ink to the gelatin solution. Black Cat is a dense black carbon ink composed of fine soot, water, and some binders. Black Cat goes into gelatin solutions readily, so just add it to the gelatin solution and stir for a few moments. Carbon black is one of the most permanent pigments available and is the one that gives its name to the carbon process. Prints made with Black Cat will have a warm black color.

Step 5 Filter the warm pigmented gelatin solution by pouring it through a thick cotton cloth, or some other filter with a fine mesh.

Step 6 Mix 25 ml of 90% isopropyl alcohol with 25 ml of water and stir this solution into the pigmented gelatin solution. Also add four to five drops of a 20% solution of thymol in alcohol. The thymol solution serves as a preservative and prevents the formation of mold on the tissue. Both the alcohol and the thymol in

alcohol solutions help to eliminate air bubbles in the pigmented gelatin solution.

Step 7 Return the container to the cooler or ice chest, and add water at about 110°F–120°F (43°C–49°C). After about 0.5 hour most of the bubbles will have dissipated and you can begin the coating operation.

B: Hand Coating the Carbon Tissue

You will need the following:

- Spirit level
- A tissue support such as Yupo is recommended in this set of instructions.
- Porcelain steel dry erase board, about 18" × 24" (45 cm × 60 cm) in size. The least expensive dry erase boards are made of Melamine, a resin-infused paper; the most expensive and durable ones are Porcelain or enamel on steel. Magnetic dry erase boards are sold at office supply stores like Staples and OfficeMax.
- Table or countertop with smooth surface on which to place the dry erase board. You may also use a flat piece of plate glass at least 2" inches larger in all directions from the size of the tissue to be made. Level the glass on four pieces of modeling clay using a spirit level. Have the edges of the glass sanded by your glass shop or tape them to prevent cuts.
- A sheet of flexible magnetic sheeting, 1/32" thick × 12" wide × 24" long (0.9mm thick × 30 cm wide × 60 cm long). The sheet will be cut into strips about 3" (8 cm) wide. These strips will be placed over the tissue support around the edges to form a frame that will form a dam for the pigmented gelatin you will pour on the support. The thickness of the sheeting (1/32", or about 0.9mm) will determine the wet height of the tissue coating. Cut the strips so that they will overlap the tissue support by about 1/8"–1/4" on all four sides.
- You may also consider using a modular picture frame the size of your tissue. This can be one of the many brands of metal frames commonly used for photographs and other art.
- Clean towel
- 10"–12" squeegee

THE COATING OPERATION

Room Conditions

For the coating operation, the room temperature should be at about 70°F–74°F (21°C–22°C). The pigmented gelatin solution should be at about 100°F–110°F (38°C–40°C) when poured onto the carrier. Maintain the temperature of the coating solution at a constant level throughout the coating operation. If the conditions are too cold the pigmented gelatin will set quickly and

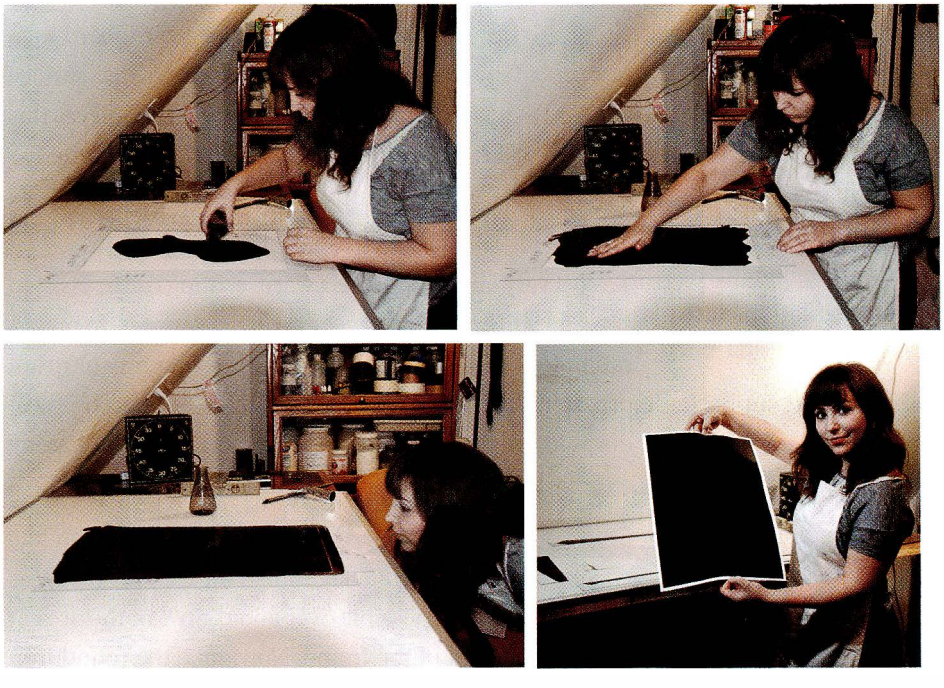


Figure 20–12
Sandy King, Kellye Eisworth Making Carbon Tissue
Sandy's publishing credentials are impressive and include *The Book of Carbon and Carbro: Contemporary Procedures for Pigment Printmaking.* A second edition was published in 2002. This sequence was part of a set of images, of the carbon tissue production process, that Sandy and Kellye Eisworth made during one of his workshops.
(Courtesy of the Artist)

it will be impossible to achieve a smooth coating without surface bubbles. If conditions are too warm the pigmented gelatin will take a long time to set, causing it to pool at the low end or side of the frame. Coating should be done in a clean room free of dust particles. Mist the room before you begin the coating operation and wear clean clothing and a hair bonnet if your hair tends to shed. Coating entirely by hand is quite easy to do and works fine for small tissues up to about 12" × 16" in size. For coating tissue larger than 16" × 20" the use of a warm coating rod is recommended, as it is very difficult to evenly spread the pigmented gelatin on areas this large fast enough to prevent the formation of bubbles.

After the pigmented gelatin solution has been soaking in water at about 110°F–120°F (43°C–49°C) for 30–60 minutes the coating operation can begin. If it is not convenient to carry out the coating operation at this time, the solution can be refrigerated and used a day or so later. Or, the solution can be frozen and used to coat tissue some weeks or even months later.

Step 1 Carefully level a table or counter top. Use a spirit level of good quality and adjust with shims until the support is as level as possible.

Step 2 Place the magnetic dry erase board on the table and make sure to have the strips of flexible magnetic sign material on hand.

Step 3 Determine how much volume of the pigmented gelatin is needed to fill the frame formed by the flexible magnetic strips. To do so, multiply the width of the frame by the length of the frame by the thickness of the magnetic sheeting material. To coat by hand a tissue 11" × 14" (28 cm × 36 cm) in size you will need a minimum of about 80 ml of pigmented gelatin solution to achieve a wet coating height of 1/32" (about 0.9mm). The calculations are 28 cm × 36 cm × 0.08 cm = 81.3 ml.

Step 4 Wet the front and back of the Yupo support, squeegee it to the dry erase magnetic board, and wipe the water away with a clean towel.

Step 5 Place the flexible magnetic strips around the edges of the Yupo, covering the four edges by about 1/4". Make sure that the strips are butted up to each other at all four corners.

Step 6 Pour the necessary amount of pigmented gelatin solution from the main container into a small beaker and atomize the surface of the solution with isopropyl to get rid of any bubbles that may have been formed in pouring the solution.

Step 7 Pour the pigmented gelatin on the support. Keep the container as low to the surface as possible and pour the solution in the center, forming a large circle. Spread the solution with your fingers as evenly as possible, first from the center toward the four corners, and finish by filling in the edges. You will need to work very quickly because the pigmented gelatin solution will begin to set as soon as you begin to spread it.

Step 8 The coated tissue will need about 10–15 minutes to set. When set run a sharp point (toothpick or sharp pencil point) around the inside edge of the mask. Carefully remove the tissue and transfer it to a drying screen. Alternatively, you can dry the tissue on sheets of thick cardboard, attaching them at the corners with pushpins. Drying time will depend on the relative humidity of the drying room and can be accelerated by the use of a small fan. With an RH of 50% the tissue should be dry in about 24 hours.

Step 9 When the tissue is dry either flatten it and store in a box or roll it around a cardboard tube of 3"–4" diameter. Do not leave the surface exposed to the air for long periods of time, as this will cause the gelatin on the surface to harden.

Coating with a Heated Rod or Tube

To coat very large tissue use a warm coating rod to assist in spreading the pigmented gelatin on the support. In preparation for coating place the rod or tube in a tray or drum of water at about 122°F (50°C). Follow the same procedures as previously discussed when spreading the coating entirely by hand, but follow this procedure for Step 7.

Step 7 **Variant:** Pour the pigmented gelatin on the support and quickly spread it with your hands as evenly as possible over about 80% of the area at one end of the frame. Now, take the round iron

or steel rod, preheated to about 122°F (50°C), and roll it over the pigmented gelatin solution from one side to the other, beginning at the side where you have an excess of solution. With practice one should be able to distribute the pigmented gelatin solution evenly with just one passage of the rod from side to side. Done correctly the surface of the tissue will be as smooth as glass after coating. The use of the warm rod also reduces the possibility of bubbles on the surface of the tissue because any bubbles that come into contact with the rod will stick to it.

C: Drying the Tissue

When the tissue is dry store it so that the surface is not exposed to air by rolling it around a cardboard tube with an outside diameter of about 3" and then placing the tube inside a plastic bag. When stored this way the tissue should be good for at least 6–12 months.

TROUBLESHOOTING

- If your tissue curls up and prevents you from achieving a flat contact with the negative, it is likely that your tissue is too thick or that after sensitizing the excess fluid was not removed evenly from the back of the tissue.
- If during sensitizing there is evidence of the carbon coating on the tissue softening and running down the surface in streaks, it would be a good idea to cool the bath to 50°F and to cool down your work area.
- If your tissue does not adhere to the transport surface or final support substrate, a few things might be going badly for you. They include a mating bath that was too warm, a mating time that was too short, staying in the water too long, inadequate sizing on the paper substrate you were transferring to, or karma not being on your side.
- If the edges of your image tear and lift off the main image, there is a good chance that the tissue remained in the water bath too long before the mating stage. Other possible culprits include a mating bath that was too warm or margins of the print that were insufficiently dried and cleaned after mating.
- If after the development the image is too dark, the problem may be that the print was overexposed, the tissue was out of date, or the tissue was left too long after sensitizing.
- If the image appears too grainy the problem is likely to be that the tissue was dried at too high a temperature or the tissue was not in contact with the support for an adequate amount of time.
- If the image appears cloudy in the lighter areas of the image, then the problem is often connected to too much pressure when doing the initial transfer.
- If the image is too light, develops rapidly, and has little evidence of half tone values, the problems may include underexposure, a weak sensitizing bath, sudden temperature changes during wash-development, hard water (lots of mineral content and/or acid water), or gelatin that was too soft.
- If the tissue does not adhere to the support, the problem may be found in the fact that the tissue remained in cold water too long before mating to the support.

Figure 20–13
Brian Palm, *Long Lake Ladder*, 2005 (carbon)
(Courtesy of the Artist)

The Van Dyke Brown Process & Variations

OVERVIEW & EXPECTATIONS

In this chapter I'll introduce you to the Van Dyke Brown (VDB) process and several variations on the theme including B-V-D (Blue-Van-Dyke) split printing, Van Dyke on porcelain, and Van Dyke on digital inkjet printing. You will see their relationships to one another and to others in the alternative process family. Iron-based alternative processes fit into two separate, but often confused, categories. One group incorporates ferric ammonium citrate, like cyanotype and Van Dyke, in its sensitizer. The other group incorporates ferric oxalate in its sensitizer, as in the kallitype and platinum and palladium processes. The group with the ferric ammonium citrate in the sensitizer "prints out" (POP) during the exposure and is wash-developed in water. The group with the ferric oxalate in its sensitizer prints-out as well but in a "stage whisper" of sorts and requires a developer (DOP) to "develop-out" and be fully realized.

In the first edition of this book I incorporated the Van Dyke Brown and kallitype processes into a single chapter, as both were often considered to be part of the kallitype family and tradition. In this edition, as in the second, I am splitting them up so that there is a clearer distinction between the Van Dyke, its variations, and the kallitype. Both techniques are able to provide the romantic warm tonalities often associated with the Van Dyke, but the kallitype is more flexible in its menu of options due to its choice of developers, selected for color shift, and its sensitizer chemistry, which is closer to Pt–Pd. The Van Dyke, however, is loaded with charm and, because of its simplicity, is able to be combined easily with a wide assortment of techniques and media.

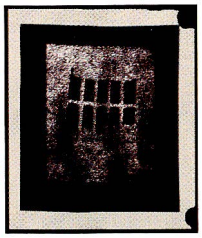
I will explain how to make and use the original Arndt & Troost VDB sensitizer as well as the more contemporary version, how to contrast control, how to tone and process the Van Dyke, and how to avoid a few of the pitfalls that have been an itch for practitioners of the process from its inception. I'll also give you a quirky little process called B-V-D that is a combination of an over-exposed cyanotype and a half-strength Van Dyke. It never comes out the same way twice, and that is why most students seem to love doing it . . . it's like opening a present.

Figure 21–1

Christopher James, *Ferris Wheel & Corpse*, Delhi, India, 1995

This image describes the way I think about India when I consider all of the images I've made within her borders. This is one of those India "gift" moments when reality and its metaphors merge. Bergman's cloaked death chess player from *The Seventh Seal* and a Ferris wheel of life incarnations. The plastic toy camera was the ideal tool for me to use, as it captured the image moment the way I would remember it in my imagination.

(Courtesy of the Artist/Author)



A LITTLE HISTORY

Arndt and Troost Brown Print Formula—1889

The standard Van Dyke formula that we use most often for the process is not very different from the original brownprint ferricitrate–silver nitrate and water-developed process developed by Arndt & Troos in 1889. In that A&T formula, the instructions called for mixing all of the ingredients and then adding the solution to warm gelatin just prior to use. The majority of contemporary commercially sized papers have a gelatin, starch, or other organic binder in them already so the gelatin part of the formula is unnecessary.

100 g	ammonio-citrate of iron (*ferric ammonium citrate*)
20 g	silver nitrate
20 g	tartaric acid
15 g	gelatin
1 liter	distilled water

For about 40 or 50 years, the Arndt & Troost brownprint, or sepia print, process was not referred to as *Van Dyke*. In that era, the term *Van Dyke* was reserved for a specific photolithography process used in map production. You may recall reading earlier about Elizabeth Fulhame's brilliant prognostication that silver-salted paper could be used for that purpose in the late 1700s.

In the early 1900s, someone in the United Kingdom looked at the color of her brownprint and was impressed by the print's painterly and romantic sepia hue. The color characteristics are reminiscent of the paintings of Sir Anthony (Anton) van Dyck (1599–1641), a Flemish artist well known for his subject's sharp, pointy beards and lush sepia tonalities, and for being the top-dog court painter in England.

HOW VAN DYKE WORKS

The VDB process, like the cyanotype, creates its image as a result of the reaction and reduction of ferric (iron) salt to a ferrous state during exposure to UV light . . . a Sir John Herschel Argentotype observation from 1842. The Van Dyke process employs a sensitizer formula consisting of ferric ammonium citrate, tartaric acid, and silver nitrate and is wash-developed in distilled and fresh water. The print is then either toned in one of several toning options, with color and archival intentions, or immediately fixed in a 3% sodium thiosulphate bath and washed for permanence . . . an oxymoronic term when applied to Van Dyke prints due

Figure 21–2
Gwen Walstrand, *Arbor*, 2007 (Van Dyke)
Another in Gwen Walstrand's ongoing work with her daughter Elizabeth . . . this one a diptych in Van Dyke.
(Courtesy of the Artist)

Figure 21–3
Deborah Copaken, *NYC*, July 1987 (Van Dyke)
Deborah, a student of mine at Harvard and author of the book *Shutter Babe*, began her career as a student by interpreting her powerful documentary images using alternative process techniques. This is a Van Dyke from a late 1980s series she called *Shooting Back*.
(Courtesy of the Artist)

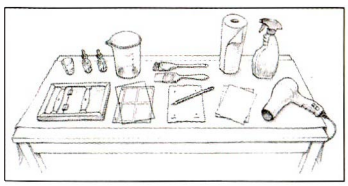
to the process's long history of dysfunctional processing directions . . . passed along for a very long time in alternative process texts and teaching. This problem, compounded with inadequate final washing, has led to a lasting perception of impermanence. The rap, under any of its names, has been a lack of archival integrity due to the problematic issue that plagues much of alternative process technical history . . . that one piece of bad information is like a line of bad genetic code that just keeps being passed along from one generation to the next. That's just one of the problems.

The other issues circulate around the failure to completely remove the residual iron compounds from the paper or fixing recommendations that called for concentrations that are far too strong along with immersion times that are far too long. There is also the issue of dealing with the silver chloride or silver chloramine formed in the wash-development. Chlorine will react directly with image silver to form silver chloride. A thiosulphate fixer is then needed to remove the silver chloride trapped in the paper's fibers, and this step has to be done very well in order to prevent fading problems down the road. For such a simple process, one that is almost as basic as the humble cyanotype, it has truly been a "Cinderella" in the alternative process family. This is unfortunate because it is really a lovely technique.

The brownprint's sensitizer is similar to the Van Dyke's, except that it incorporates oxalic acid in place of the VDB's tartaric acid, and it is used to assist in keeping highlights from getting muddy. The brownprint also requires development in a borax and water formula, like one of the kallitype developers, versus the water-only wash-development required by its Van Dyke cousin. The brownprint's borax developer is highly alkaline, and that fact leads to the formation of iron hydroxide (close to being rust but still wet) that is quite difficult to remove. However, should you want to try it, just employ the salted paper technique of immersing your print in a bath of salted water that has been made slightly acidic, lowering its pH, with the addition of a healthy pinch of citric acid. More on this idea is presented later in the fixing instructional stages of the Van Dyke process.

Figure 21–4
V. Elizabeth Turk, *Fall 2006 #11* (VDB)
Atlanta alternative process artist and professor V. Elizabeth Turk made this compelling and iconic hand photogram, like the hand traces at the Lascaux Caves, using the Van Dyke process. The integration of vegetation within the hand is visual poetry.
(Courtesy of the Artist)

You will notice that when a Van Dyke image is immersed in the sodium thiosulphate fixer, the pleasant, warm orange-yellow-brown-colored image that emerged in the wash-development will change to a cool brown. Depending on the strength of the sodium thiosulphate fixer concentration, the print may also begin to show signs of etching and image deterioration. As fixing times approach traditional recommendations, more of the image may slowly disappear, and if the subsequent wash times are inadequate, the residual fixer trapped in the fibers of the paper will compound the problem. It's important that your prints are not overfixed due to either concentration or immersion time and that you clear the paper of absolutely all trapped chemistry by the conclusion of the processing sequence.



THE VAN DYKE PROCESS

Table Setup for Van Dyke

- A Van Dyke kit or a digital gram scale to weigh your raw chemistry
- Paper towels
- One dark brown glass bottle for 300 ml of sensitizer
- Stirring rod
- Dry chemistry for A, B, C (and Contrast A) formulas
- Plastic or glass beakers (three of them) for mixing the A, B, C sensitizer parts
- Tape for labeling
- Sharpie/waterproof marker for labeling
- Clean paper or a large piece of lucite for the table surface coating area
- Distilled water

VAN DYKE SENSITIZER

If you are not buying a pre-measured Van Dyke kit, you will require three primary chemical components to create a Van Dyke sensitizer:

- Part A: ferric ammonium citrate (brown or green)
- Part B: tartaric acid
- Part C: silver nitrate

Note: Ferric ammonium citrate is an "ill-defined" compound. There is no formula for it in the Merck Index, and each batch of ferric ammonium citrate is slightly different from another. After a batch of sensitizer has been made and sits for a day or two, a white precipitate will often form. This formation can be restrained by adding a small amount of tartaric acid to the ferric ammonium citrate solution. Regarding the preference between brown or green ferric ammonium citrate . . . brown works equally well, and it appears to hold onto the precipitate a bit better than the green version. Use either color with confidence.

You have a choice . . . you may make up the Van Dyke sensitizer from scratch, a relatively simple task and good for you to do, or you may purchase the sensitizer in kit form and get right to making prints. If you mix the sensitizer yourself, you will need to let it age for a few days. We'll cover that homemade method now.

You will be mixing three separate solutions known as A, B, and C, in three separate glass or plastic beakers. Parts A, B, and C will then be combined, in a specific sequence, into a single solution. Once combined, you will store the solution in a single dark brown glass bottle that must hold the total volume, at least 300 ml, of liquid sensitizer.

When mixing the sensitizer, be sure to only use *distilled water* and non-metallic stirrers. You can work easily under low ambient light when preparing the component Van Dyke sensitizer solutions, but once they are combined you must be careful of exposing the sensitizer to strong UV light. The final mixing of A, B, and C should be conducted in a low ambient light environment. This recommendation does not imply that you will require safelights and a darkroom—that is hardly ever necessary in this genre—but you should be cautious about direct sunlight illuminating your working space and newly prepared chemistry.

There are several excellent businesses that prepare and market wet and dry pack versions of mixed Van Dyke and kallitype chemistry in kit form (see the Resource Appendix). Each of the VDB kits essentially follows a narrow variation of the traditional Van Dyke formula in this chapter. Of course, it's always more economical to buy the raw chemistry and mix the formula yourself, but the kits are terrific if you are into instant gratification and don't want to wait for your sensitizer to age. Use a digital gram scale to weigh out your chemicals. I started using a 200 g capacity digital jeweler's scale, sometimes referred to as a street-business scale, that I got on eBay for a few dollars, and I prefer it to the triple beam. It also fits in your pocket.

The Van Dyke Formula

Van Dyke Part A

27 g	ferric ammonium citrate (brown or green variety)
100 ml	distilled water at room temperature

Place the distilled water in a plastic or glass beaker, slowly add the ferric ammonium citrate, and stir the solution until it is uniform.

Van Dyke Part B

4.5 g	tartaric acid (*Note: This is 4 point 5, not 45.*)
100 ml	distilled water at room temperature

Place the distilled water in a plastic or glass beaker, slowly add the tartaric acid, and stir the solution until it is uniform.

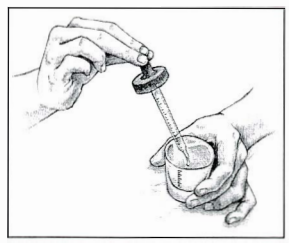
Van Dyke Part C

12 g	silver nitrate
100 ml	distilled water at room temperature

Place the distilled water in a plastic or glass beaker, slowly add the silver nitrate, and stir the solution until it is uniform.

Silver Nitrate Advisory

Be very careful not to get silver nitrate on your skin or clothing. It is an oxidizer and is caustic. Be extremely careful about accidentally putting silver nitrate in your eyes. Do not touch your face when mixing the chemistry or making Van Dyke prints. In fact, keep your hands away from your face whenever you are working with chemicals. I advise you to read about silver nitrate in the chemical section and be sure to wear safety goggles during all stages of chemical preparation. If you happen to get raw silver nitrate on your skin, flush the exposed area with an abundance of cold water and treat it as you would a burn. The silver nitrate will give you a brown henna-like tattoo, which means that the silver has simply bonded with the proteins in your skin. You will wear this silver nitrate stain for several days, but it will not hurt or harm you. It's possible to scrub off the stain with a pumice stone, but that causes discomfort, and your skin is in no immediate danger. Eventually, a new layer of skin will grow and replace the stain.



Mixing Sequence for the Van Dyke Sensitizer

When the Van Dyke Parts A, B, & C have been successfully and separately mixed, you will be able to combine them into a single UV-sensitive solution that you will store in a dark glass bottle. All chemical resource suppliers carry these bottles. Follow the sequence carefully.

Step 1 In moderate ambient light, add Part B (tartaric acid) to Part A (ferric ammonium citrate). Gently stir the two parts together into a single solution.

Step 2 Then add Part C (silver nitrate) to the new solution that is composed of Parts A and B and pour the newly combined solution into the dark glass bottle that will hold the total volume of the liquid. Label the bottle, noting contents and date, and allow your new Van Dyke solution to age for 2 to 3 days before using it. Do not put it on the windowsill. If your working lab is a place frequented by young children, you need to secure this and all other dangerous chemistry.

Figure 21–5
Francis Schanberger, *Don't Take This Personally*, 2011 (VDB)
Scientist/artist Francis Schanberger writes, *"Like the naturalists of the nineteenth century who used photography to record their botanical specimens, I use the parts of trees I collect on walks (or lately find in the produce section of a supermarket), scanning them into the computer to make a negative and printing them in the historical Van Dyke Brown process. Using Kozo Unryu Japanese paper, the intensity of the brown color and the interaction of the swirling paper fibers provide the unexpected to an image so grounded in the scientific. The final image alludes to the dreamy, somnambulant state of observation I find myself in early April under the influence of pollen and antihistamines."*
(Courtesy of the Artist)

The mixed Van Dyke sensitizer will stay useful for about 12 months if stored in a refrigerator. However, do not store this, or any other chemical solution, in your family refrigerator. It is not worth the risk that someone in your home will mistake the contents for a food product and do harm to him- or herself. Instead, especially if you have children in the house, purchase a small dorm-size refrigerator for your darkroom and keep it locked.

CONTRAST CONTROL FOR VAN DYKE

It's always interesting to listen to the "my-way-or-high-way" pontifications of a few alt pro gurus surrounding the control of contrast in ferric salt and silver processes. Generally speaking, subtle adaptations to Van Dyke and kallitype are inconsequential. Major changes, such as adding a dichromate to the first water development bath or to the sensitizer itself, are often far too aggressive and end up creating a blown-out aberration of the reason you chose to do the process in the first place.

Here are three recommendations for making a difference in your print's contrast with the best one, in my opinion, presented first. As an added thought, don't forget that if your negative isn't correct for the process you are performing, you can always go and make another, more appropriate, one in Photoshop with Pictorico Ultra Premium OHP inkjet film.

The Liam Lawless Contrast Control Sensitizer for Van Dyke

In this unique, and effective, contrast control formula, Parts B and C are identical to the traditional formula and are mixed the same way. Part A, however, is different, as you can tell by the addition of the ferric citrate to the Part A component. Don't get upset when the ferric citrate doesn't completely dissolve into solution immediately . . . it will eventually. You are going to make this sensitizer in the same manner that you made the traditional A, B, and C ones. The only difference will be in Part A's ingredients and how you mix the modified contrast control sensitizer.

Liam's Contrast Control Part A

18 g	ferric citrate
9 g	ferric ammonium citrate
100 ml	distilled water

Notice that this is different from the traditional Part A in that it now includes ferric citrate and has less ferric

Figure 21–6
Niles Lund, *Gateway*, 2008 (Van Dyke)
Niles, owner of www.lundphotographics.com, is an artist as well as an engineer of premium wetplate collodion equipment.
(Courtesy of the Artist)

ammonium citrate. Place the distilled water in a plastic or glass beaker, slowly add the ferric citrate and then the ferric ammonium citrate, and stir the solution until it is uniform.

Standard Van Dyke Part B

4.5 g tartaric acid (*Note: This is 4 point 5, not 45.*)
100 ml distilled water at room temperature

Place the distilled water in a plastic or glass beaker, slowly add the tartaric acid, and stir the solution until it is uniform.

Standard Van Dyke Part C

12 g silver nitrate
100 ml distilled water at room temperature

Place the distilled water in a plastic or glass beaker, slowly add the silver nitrate, and stir the solution until it is uniform.

Mixing the Van Dyke Sensitizer

When the Van Dyke Parts A, B, and C have been separately and successfully mixed, you will be able to combine them into a single light-sensitive solution that you will place in a dark glass bottle. All chemical resource suppliers carry these bottles. Follow the sequence carefully.

Step 1 In moderate ambient light, add Part B (tartaric acid) to Part A (ferric ammonium citrate and ferric citrate). Gently stir the two parts together into a single solution.

Step 2 Then add Part C (silver nitrate) to the completed Step #1 solution (Parts A and B) and pour the combined solution into the dark glass bottle that will hold the total volume of the liquid. Label the bottle, noting content and date, and allow the new Van Dyke solution to age for a few days before use. Do not put it on the windowsill. You now have a new Van Dyke sensitizer formula to play with.

Step 3 To make a 1:1 Van Dyke contrast solution all you need to do is take a fresh dark brown glass bottle and fill half of it with the traditional Van Dyke sensitizer and the other half with your new Van Dyke contrast control sensitizer. Label the bottle "Van Dyke Contrast Formula 1:1" and date it. Allow the new Van Dyke solution to age for a few days before use.

You can make a different variation on this contrast control theme with any proportion that you wish, but keep in mind that the more aggressive your sensitizer concentration, the more aggressive the results. This often means that your tonalities might be a bit ragged and unsmooth if your contrast concentration is too aggressive. That action does indeed increase contrast, but too much of it has a distinctive downside. The traditional Van Dyke sensitizer is pretty fast and will give you 10–12 steps on a 21-step calibrated scale. If you use a 1:1 Van Dyke Liam's contrast control sensitizer you are going to lose a few steps overall, and this relationship is what visually provides the sensation of higher contrast. Bottom line: if you need to increase the contrast in your Van Dyke, this is the very best way to do it. Just be conservative in how you apply the idea to your negative and it should work out well for you.

10% Potassium Dichromate Contrast Option

A second way to affect contrast is to use a traditional dichromate additive. This particular contrast control technique irritates many people . . . but like most things that irritate some people, it is a blessing for others. No matter, it is an aggressive solution to a low-contrast problem, and it does work. To see if it works for you, mix up a 2%, 5%, and 10% solution of potassium, or ammonium, dichromate and put it in a labeled bottle. Do not store it anywhere where a small child could get access to it and mistake it for a refreshing lemonade-like drink.

To make a 10% solution, mix 10 g of potassium, or ammonium, dichromate with 100 ml of distilled water. If you see that additional contrast is required in your print, go through your first 5 minutes of distilled water wash-development and then add 10 drops of the dichromate solution to every 500 ml of water in a second, and separate, water tray and immerse your print. If you find that the contrast is a little too intense, simply add a lighter percentage to the water bath next time.

Sun and Shade Contrast Control

When I'm printing outdoors in most alternative processes, I make small contrast alterations during the printing stage of the process by conducting a percentage of the exposure time in open shade and then, at the end of the exposure, intensifying my shadow depth with a good blast of direct sunlight or exposure in a UV-exposure unit. It is a low-impact solution, and it works well for my students and me. Don't expect to see major contrast changes . . . this technique is for fine tuning.

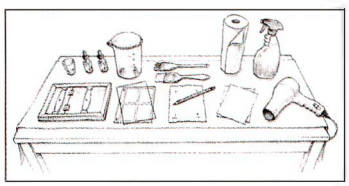


Table Setup for Van Dyke with Pre-Mixed Sensitizer

One of the nice things about the ever-growing popularity of alternative process photography is that many of the formulas and materials are available as pre-mixed wet and dry packs in kit form. Companies like the venerable Bostick & Sullivan, Montana's Photographer's Formulary, and Artcraft are the best. If you are just "taste testing" different processes then ready-to-go chemistry is the best. If you elect to buy the chemistry pre-mixed, here's your setup.

- Van Dyke A, B, and C sensitizer (*made up 24–48 hours in advance*)
- Plastic beaker or Pyrex measuring cup for sensitizer
- Heavy-duty shot glass and an eyedropper to prepare formula by drop counts
- Clean paper or lucite sheet for the table surface coating area
- Paper for coating
- A super-clean Richeson or hake brush
- Clean distilled water in a beaker
- Pencil
- Hairdryer
- Contact printing frame
- Negative for contact printing

Figure 21–7
Karén Oganyan, *The Market*, 1997 (Van Dyke on newsprint)
Karén made this terrific piece when he was a student in my department at the Art Institute of Boston (now called the College of Art and Design at Lesley University). Karén, from Latvia, had a very unique perspective on life and made a series of Van Dyke prints on the pages of the world's newspapers . . . while listening to Jimi Hendrix at full volume.
(Courtesy of the Artist)

The Paper

Many papers will work well with this simple iron process, but using the best that you can afford will usually yield a better image in any alternative process. There are notable exceptions, however. One of my former students at the Art Institute of Boston, Karén Oganyan (from Latvia), made a wonderful portfolio of Van Dyke images on newsprint. Although these prints will eventually decompose, due to the quality of newsprint in general, the effect was excellent. I will add that I've had this print in a frame on a shaded wall in my studio for 15 years and it looks as good as the day I put it up.

Among papers that I feel perform well, my top picks would include Cranes Platinotype and Stonehenge 90# white. Both provide rich, deep brown-black darks and clean contrast in the whites. One of my personal favorites is Bergger's Cot 320, but it is necessary to use a drop of Tween 20 in the A, B, and C sensitizer formula, as the paper has a luxurious finish and weight and needs help absorbing the solution. Cot 320 is a bit expensive, but if you can afford to give yourself a treat it is a nice paper for most processes. Other papers that work well include Ruscombe Mills Buxton, Weston Parchment, Lenox 100, Arches HP 90#, Arches Aquarelle, Saunders Somerset, Whatman's Watercolor, and Fabriano Artistico. Each of these papers will exhibit a unique set of traits and colors. Of course, the choice of paper is entirely dependent on your intentions for the image, so play around with several and see what works best for you.

Sizing

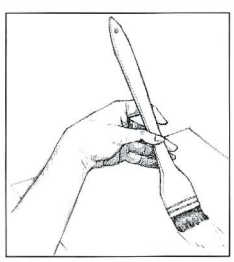
Sizing is not a critical step with either Van Dyke or kallitype. If you are using high-quality watercolor, stationary, or printmaking papers, they are likely to be adequately sized during manufacturing and will stay in decent shape even in processes that require extended immersion times. There are some exceptions to this, but you'll discover them pretty quickly when the papers show translucent watermarks or fall to pieces when you remove them from water baths.

If you are using inexpensive, esoteric, or homemade papers, please refer to the sizing recommendations given in the Paper chapter and in chapters that cover processes in which sizing is critical, such as gum bichromate and salted paper. If you decide that sizing is part of your strategy, whether in an effort to produce an image with deeper tonalities or because you intend to incorporate a good deal of post-print manipulations, I recommend using the gelatin sizing. A good reason for sizing your paper is that these extra steps will often result in an increase in the print's D-max and simultaneous crispness in the highlights.

The Negative

The Van Dyke process is a contact printing process, and once again you will need a negative that is the same size as your final print. Van Dyke has a fairly extended tonal range, and negatives that work well can be compared to those you would use with platinum/palladium, kallitype, and argyrotype (having a negative density range of 1.5 to 1.8). In other words, a bit less contrasty and dense than those you would want for albumen or salted paper. Equating it to traditional wet lab printing, you can expect to achieve decent results with negatives that would print well on a normal grade 0 or 1 silver gelatin photographic paper. You will find that the Van Dyke process is a forgiving and flexible one.

My best recommendation to you is to begin learning the process of making enlarged duplicating negatives on Pictorico Ultra Premium OHP inkjet film. I would also strongly recommend adopting the habit of using customized curve profiles for the particular process you are performing. There are several areas in the book that deal with the creation of custom curves and inkjet negative production, and those will serve as fine guides to begin learning this system.



Sensitizing the Paper

To apply sensitizer you can use a synthetic Richeson brush, a high-quality hake or Jaiban brush, or a glass rod Puddle Pusher. Don't be tempted to use a foam brush, as it is false economy . . . an inexpensive brush that absorbs more sensitizer than you need to coat your print area and one that can't be cleaned well for second or third sensitizing attempts. A Richeson brush or a glass rod are the best bets because they will be good for a variety of processes and will last for years.

Work in subdued ambient light on a clean surface. I like coating on a 14" sheet of lucite that can be cleaned and used forever. After measuring out your drop count in a heavy-duty shot glass (see the drop count charts in the Ziatype and Pt/Pd chapters for approximate volume), pour the measured solution into the center of the print area and brush the sensitizer on your paper in delicate vertical, and then horizontal, strokes. Work quickly with a very light

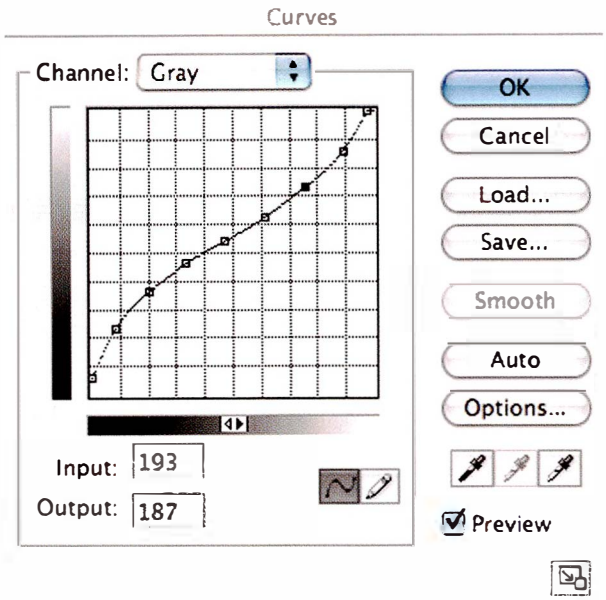


Figure 21–8
Van Dyke Custom Curve Profile Sample
This is one example of a custom curve profile for Van Dyke and how it would look after loading it following a curve profile adjustment.
(Source Adobe® Photoshop®)

touch on the paper surface so that you don't rough up the delicate fibers of the paper once they are wet. Pay attention to what you're doing and do not text and coat at the same time. Do not splash because the silver nitrate component in the sensitizer is not good for your skin, or eyes, or similar body parts belonging to people who may be sitting next you. Be sure to complete the entire print area in the vertical strokes before changing direction and going horizontal. If you neglect to do this, your surface area will have an uneven application of sensitizer, and in the Van Dyke process, more than any other except for salted paper, you will see your mistakes.

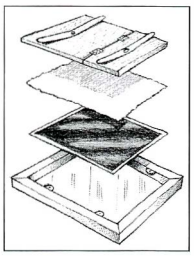
Coating Van Dyke sensitizer can be tricky. Once the sensitizer begins to set up and lose its wet reflectant sheen during coating, continued brushing will often show up as streaking or will exhibit a mottled appearance in your final image. You can determine when the sensitizer has begun to set up if you look at its surface reflection and observe that it is more matte than wet-glossy. As long as the surface appears wet and reflective you may continue to lightly coat your paper. Again, excessive brushing, or brush pressure, will adversely affect the fibers and the smoothness of your paper's surface.

If you have too much sensitizer on your brush you will probably end up with puddles of sensitizer on the surface of your paper. These puddles will dry thickly and often appear as dark metallic islands of solarization in an exposed and undeveloped print. These solarized islands will deteriorate in the initial wash and fixing stages, leaving you with discolored and vacant areas within the coating. Most often you will see this flaw in the corners of your coated area and they, more than anything else, will be the areas that will end up destroying your negative, especially in a humid environment. You can remove the puddles with the corner of a clean paper towel by dipping the towel in the sensitizer puddle and letting the sensitizer climb into the paper. Do not wipe or blot, as it will look sloppy.

If you are new to the coating experience I strongly recommend practicing the coating technique with a yellow/green watercolor solution and working in the same level of light that you will be working in when you do the actual sensitizer coating. This practice will improve your coating skills and will save you a great deal of aggravation and money. If you are "brush impaired," consider purchasing a Puddle Pusher from Bostick & Sullivan and learning how to use it. One additional piece of information that you may find useful . . . I have found that excessive humidity sometimes leaves a less than pleasant speckling effect on the print. This is especially noticeable in the kallitype process, and I recommend being sure that your emulsion is bone dry before exposure. If your working space is besieged with excessive humidity, you should consider investing in a dehumidifier.

Once the paper is coated, allow it to sit for 1–2 minutes before accelerating the drying process with a hairdryer set on a cool setting. During this waiting period, wash your brush in distilled water and pat it dry with a paper towel. This may sound a bit compulsive, but be careful not to let a wet brush rest on a paper towel . . . the reason they are so white is because of the bleach used in production, and you do not want the bleach to become a part of your sensitizer for subsequent applications.

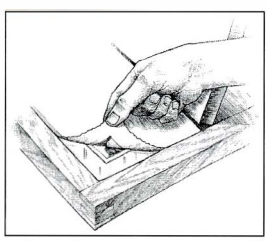
You can play around with the print color and hue of the Van Dyke by making very slight adjustments to your sensitizer coating solution. Experiment with a drop, or two, of 1%–5% gold chloride, or a 1% potassium chloroplatinite, for every 25–30 drops of solution.



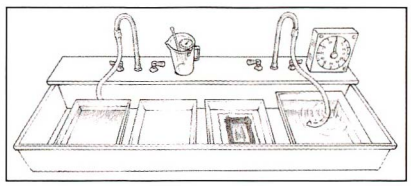
Printing-Out

Van Dyke is an iron-silver printing-out process. This means that it does not need a developer to be realized following the exposure. It can, like other alternative processes, be examined during the exposure as long as you maintain the registration of paper and negative. A contact-printing frame is ideal for this purpose due to its hinged back, as this construction will allow you to release the tension from one half of the contact frame and lift a portion of your paper to examine the exposure. The other half of the frame will continue to be closed, keeping registration of the negative to the coated sensitized paper. Examine and evaluate your exposure in low illumination to determine when your exposure is complete.

Unlike a kallitype exposure that is ready when there is a *stage whisper* of an image, the Van Dyke requires you to expose until you have a moderate overexposure. Although the image will darken and cool, from warm orange to dark brown, through the processing stages, the "bleach-back" effect on the Van Dyke process is a constant threat to the perfection of your image. Van Dyke also has a significant dry-down factor.



I recommend that you do some test strips, or use a Stouffer grayscale step strip film that you can print simultaneously with your negative, to provide you with an idea of where to go with your exposure times. Obviously, each negative, time of year, time of day, and type of light source will require a different set of calibrations. Begin your exposure tests with 30-second intervals in the sun, and write all of the pertinent information for your image in pencil on your print in order to evaluate your printing strategy. A Van Dyke, on a nice summer's day with bright sun and a decent negative, will be properly exposed in about 2–6 minutes. A UV Box exposure will be just slightly slower. Unlike several of the other processes, it is less necessary to use a shade-to-sun split-exposure to manipulate the contrast of the image. Like cyanotype, Van Dyke is not a particularly fussy or sophisticated technique.



SINK SETUP FOR VAN DYKE

Processing the Van Dyke Print Following Exposure

Tray 1 Perform a first wash-development in *distilled* water for 5 minutes. If you must use tap water, add a pinch of citric acid to the water tray to make the wash more effective. The chloramine in tap water will have an effect upon the exposed image. It will not hurt to add the pinch of citric acid even if you are using distilled water.

Tray 2 Wash-develop in running water for an additional 1–2 minutes. Split this wash time up into two parts. The first part will be a tray of freshwater with a pinch of citric acid. The second part will be simply fresh running water.

Tray 3 Make up a 3% sodium thiosulphate fixing bath by mixing 30 g of sodium thiosulphate, 2 g of sodium carbonate (an alkali), and 1,000 ml of water.

Tray 4 **Optional** You can make up an optional sodium sulphite fixer clearing bath by mixing 10 g of sodium sulphite with 1,000 ml water. Or you can use a working Perma-Wash mix (3 oz to a gallon) diluted 50%/50% with water. Both baths assist in removing residual fixer from the paper's fibers.

Tray 5 The final wash will last 20–30 minutes.

After the exposure, go to a low-light wet working space and remove the print from the contact-printing frame. Write down the time of your exposure along with the other print info you already have on the paper: paper type, process, where you are, time of day, date, light conditions, humidity, formula, sun–shade times, exposure time, etc. You are going to wash-develop your newly exposed Van Dyke in two successive water baths and then tone if you desire, or go directly to the fixer. In the wash-development you will see a pleasant warm sepia-orange image that will make you feel good. Don't fall in love with this color because it will be leaving you soon.

Even if you coat and expose well, the success of your final print is only partially guaranteed. In Van Dyke, success is determined by how well you finish processing your image following the exposure. Van Dyke is a printing-out process versus a developing-out (DOP) process and so the exposure and first, and second, wash-development baths are critical.

Figure 21–9
V. Elizabeth Turk, *Summer 2006 #2* (Van Dyke)
This is another wonderful example of the Van Dyke process by Atlanta artist V. Elizabeth Turk.
(Courtesy of the Artist)

Tray 1 Use Only Distilled Water and a Pinch of Citric Acid

A great deal of the literature, and "expert" Internet newsgroup information, regarding Van Dyke processing instructs one to use a single water wash-development bath followed by the sodium thiosulphate fixer. Most of the time this suggestion only applies to Van Dyke prints that turn a dull coffee and cream brown in their highlights and then sadly leach out of the paper during and following the final wash. There is nothing so disconcerting as hanging a new Van Dyke on a line and watching the brown values slide off of the print like rain on a dirty window. If the print manages to survive the wet stages, it may still fade away due to the inefficiency of the processing cycle. This, of course, is why the reputation of the potentially amazing Van Dyke has always been less than positive.

The first step in the wash-development part of this process is to immerse your print in a clean tray of distilled water with a pinch of citric acid added to it to slightly acidify the water. Do not use tap water for this first wash-development, as there may be chlorine in the water supply. Chloramine is often added in low concentrations as a disinfectant in municipal water supplies, and it is a powerful oxidant. Chloramine is a replacement for the older free chlorine because it is more stable. However, and this is important if you are drinking it, chloramine may increase your exposure to lead, especially in antiquated systems or older homes, and this can result in increased levels of lead in your bloodstream . . . not a good idea. If the silver in your Van Dyke oxidizes during the wash-development stage, highlights will likely turn a light coffee tan. This is why I recommend using acidified distilled water as a first wash.

Dechlorination Issue

Here's the same issue with a twist. If your image makes it to the fixer stage and then disintegrates, it may not be silver chloride that is the problem. It is, however, related to the chloramines. Chloramines are a combination of chlorine and ammonia (both of which are toxic to fish life, by the way) and it's quite possible that silver chloramine compounds are even less soluble than silver chloride. If you are experiencing a chronic degradation of your image's integrity in the fixing stage, and you have acidified your distilled water and extended the wash-development time, then you may have to resort to a dechlorinator . . . a chemical that home aquarium and aquaculture enthusiasts use to dechlorinate their fish tanks and ponds. You can find this product at your local pet store, and each has a different dosage per amount of water to dechlorinate. A few drops to a tray of tap water will probably do the trick. Uber-chemist Howard Effner writes that this solution to the problem is "overkill":

The little bit of free chlorine or chloramines in tap water will not survive long once the print goes into the wash water. The residual Fe^{2+}, from the image, will quickly reduce elemental chlorine to chloride ion (Fe^{2+} goes to Fe^{3+}). If there is silver ion present (from silver nitrate) it will quickly precipitate the chloride ion as insoluble silver chloride. This is the basis for the classical gravimetric chloride determination. The silver in an image will not be attacked by chlorine. thiosulphate will be needed to remove the silver chloride that is attracted to or trapped in the network of paper fibers. The anti-chlorine stuff is probably something like a solution of sodium thiosulphate–thiosulphate will take chlorine to chloride ion quantitatively. Just add a ml or two of 10 percent thiosulphate to the wash water and POOF it's gone.*

Is that clear? Because there will be a quiz in the morning.

Note: One of my chemist friends disagrees and says that the silver will be attacked, especially if it's colloidal (nanoparticle).

If you do not use distilled water, water from a dehumidifier, or rainwater in your first wash-development bath, you will notice a milky white turbidity, or liquid cloud, leaving the print. This is a silver chloride (AgCl) precipitate due to chloride ions in the wash water reacting with the excess silver ions of the sensitizer. This is to be expected for the first wash . . . especially if you are using tap water. You're going to see a little of this turbidity in distilled water, but you will not see as much, nor will your print be as likely to turn the dull coffee color in the highlights or break down in the fix.

Tray 2 Lightly Acidified Fresh Water

The second tray consists of a lightly acidified fresh water bath. Very simply, fill a tray with tap water, add a pinch of citric acid to it, and agitate the tray and print for 2–3 minutes. Then let freshwater run into the tray for an additional 2–3 minutes, and that should do it. You may notice that your print is fading a little in these successive acidified baths, but the image will return nicely in the fix . . . yes it will. It will not, however, be the romantic orange brown, so get used to the idea that the print will cool off in color in the fixer.

What You Are Looking At After the Wash

Another thing you will have to get used to . . . the "dry down" or the darkening and closing up of the print's separation values as it dries. Van Dyke has a more significant dry down than many of the other alternative process.

If you are experiencing a significant loss of image density, or if you wish to see highlights that have a bit more pop to them, consider changing a few things, like the paper you are using or the age of your sensitizer (fresh sensitizer is less desirable than a sensitizer that has aged for a few days). Try adding Tween 20 to aid the paper's ability to absorb the sensitizer more deeply, or better yet, using Liam's contrast control formula. You might also consider gelatin sizing the paper before coating. Again, if you are not using distilled, or demineralized, water for the first bath, you should consider adding a pinch of citric acid, or a squeeze of lemon, to this first wash.

The other side of this balanced sword is the addition of sodium carbonate to your sodium thiosulphate fixer formula. This is an option designed to

increase the alkalinity of the fixer and will help prevent "bleach- back" (hydrolysis and fading in the fix stage). The pH of your water and the effects of the chemistry on your printing should determine your use of adding citric acid to reduce alkalinity or adding sodium carbonate to increase alkalinity. Get some pH indicator paper to see what the pH of your water is to start with.

FIXING VAN DYKE

A 3% Sodium Thiosulphate Fixer Solution

30 g sodium thiosulphate
1,000 ml water
Add 2 g sodium carbonate to minimize the bleach-back effect of fix.

"Bleach-back" is a term that describes what happens to your print when it's attacked by the fixer and experiences rapid image deterioration. The sodium carbonate makes the solution slightly alkaline but will make the simplicity of removing iron salts from the paper a bit more complicated. It is an option and is not entirely necessary if your water is alkaline to begin with. Store your sodium thiosulphate fixer in any clean plastic chemical container. When you use a fixer this weak it will be necessary for you to change the solution every 8 to 10 prints. I recommend having a multiple-tray setup for the fixer and that you spread your total fixing time between 2 baths.

Fixing the Print

Pour a 3% sodium thiosulphate fixing solution into a clean tray and immerse the washed print for no more than 1 minute. Some of the artists working in Van Dyke prefer an extremely brief fixing time, and one who I know uses a 2% fix solution (20 g of sodium thiosulphate to 1,000 ml of water) and fixes for as little as 20 seconds . . . just to the point when the print turns darker and cooler. I am not entirely convinced a penalty does not come into play for this short a fixing time and am content recommending the 1-minute fixing time. It's important to remember that most of the problems that plague prints made in this process are due to inadequate washing.

As mentioned before, the use of a double-tray fixing setup, with separate 3% sodium thiosulphate solutions, will allow you to run a dozen average size prints before a fresh change of chemistry is necessary. During the fixing stage, the warm sepia-brown color of the print will change. Again, you may lament because that lovely romantic orange-brown pre-fix color might have been perfect for you, but you can always get some of it back through toning formulas, tea, coffee, watercolor, dyes, or combining it with another process such as gum bichromate or even a digital inkjet print on a photo rag paper with insoluble inks. Otherwise, you will get a much stronger and dense brown-black that will dry even darker than what you are looking at in the tray. As I've said before, the Van Dyke dry-down is not subtle.

Hypo Clearing Option

If you wish to accelerate the removal of the residual sodium thiosulphate that has permeated the fibers of your paper, you may use either a 50% dilution of a gelatin

Figure 21–10
Liz Lee, *Sun Prints, Beetle,* 2012 (Van Dyke and digital)
Liz Lee's *Sun Prints* combine digitally composed botanical backgrounds of insect environments as pigment prints. Maps identifying their location are overprinted in a Van Dyke contact printing process, and the combination print is then run through the inkjet printer a second time to display the insect as a mock-cyanotype. Finally, a statement is printed on transfer film and applied to the print and coated with varnish to create a surface reminiscent of traditional wax painting technique.
(Courtesy of the Artist)

silver paper-strength hypo-clearing agent or a 1% solution of sodium sulphite. In both cases, immerse your fixed print in the solution and agitate slowly for 1 minute.

Final Washes

The purpose of the final wash is to remove the last remnants of the sodium thiosulphate fixer from the print to prevent the image from fading in time. If you used the hypo-clearing bath you will give your print a freshwater final wash for 20 minutes. If you are not using a hypo-clearing bath, wash the print in slowly running water for 30–40 minutes. In both cases, immerse the prints you want to keep in a final distilled water soak for 5 minutes and then hang them on a clothesline to dry. I strongly recommend that all alternative process prints be line-dried versus rack-dried. It is far too easy, especially in a group situation, to encounter contaminated drying screens.

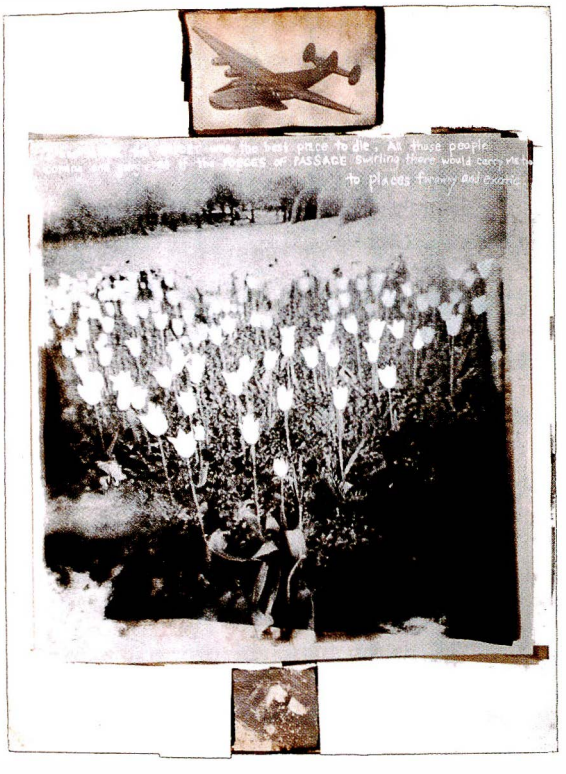


Figure 21–11
Stefanie London, *Untitled*, 1992 (Van Dyke and gum bichromate)
Stefanie, a student of mine at Harvard, and later a member of my faculty, is one of the most productive and innovative artists I've known. This is one of her Van Dyke and gum-gouache pieces. The text reads, "I used to think the airport was the best place to die. All those people coming and going, as if the forces of passage swirling there would carry me too . . . to places faraway and exotic."
(Courtesy of the Artist)

If you are unhappy with the image because the tonalities are too thin, save the image and try a Van Dyke with a palladium or gum bichromate overprinting combination technique. You might even want to consider combining your Van Dyke image with a digital inkjet image on good-quality rag stock.

If you feel that your contrast is too flat, try ironing the print or placing it in a dry mount press. This action will change the color of the image. Your other options to correct a weak-looking print are to start over or re-sensitize using Liam's contrast control formula and re-expose your image again on the same paper. You can also try a standard formula and process it with a first bath containing a 5%–10% potassium dichromate addition. If you feel that your darks are weak and your highlights are muddy, try gelatin sizing your paper prior to sensitizing or change papers. If that doesn't work, scan your negative into Photoshop, increase the density and contrast, make a new negative on Pictorico Ultra Premium OHP, and get back to work.

TONING THE VAN DYKE PRINT

A Pre-Fix Toning Process for Van Dyke

This is a toning process that can be used for both Van Dyke and kallitype, and it is employed *prior* to the fixing stage. This toner will help prevent bleach-back and will help, all other things considered, to make the print more archival. If you use this toner it is not necessary to add the alkaline sodium carbonate to your fixer.

TONER OPTIONS (BEFORE FIXING)

Gold Toner

To 1 liter of distilled water add 5 g of citric acid. To that solution, add either 5 ml of 5% gold chloride, 5 ml standard palladium solution Part C (the metal), or 5 ml of standard platinum solution Part C.

5 g citric acid
1,000 ml distilled water
5 ml 5% gold chloride

Following a first rinse wash, and prior to fixing, immerse the print in the toning solution and gently agitate the print until you like the color and tonal shift. This change is faster when the toner is fresh and takes longer

to realize as the toner is used and the noble metal salt in the toning bath is depleted. You will normally get 6–7 average size prints out of a liter of toning solution. Rather than re-make the entire solution, try replenishing the used volume with fresh noble metal. This is the same strategy that is commonly used in other toners such as Gold 231 gold ammonium thiocyanate toner, one of the tried and true standard toners in alternative process work.

Palladium Toner

2 g	sodium acetate
2 g	citric acid
400 ml	distilled water
30	drops of 20% palladium chloride

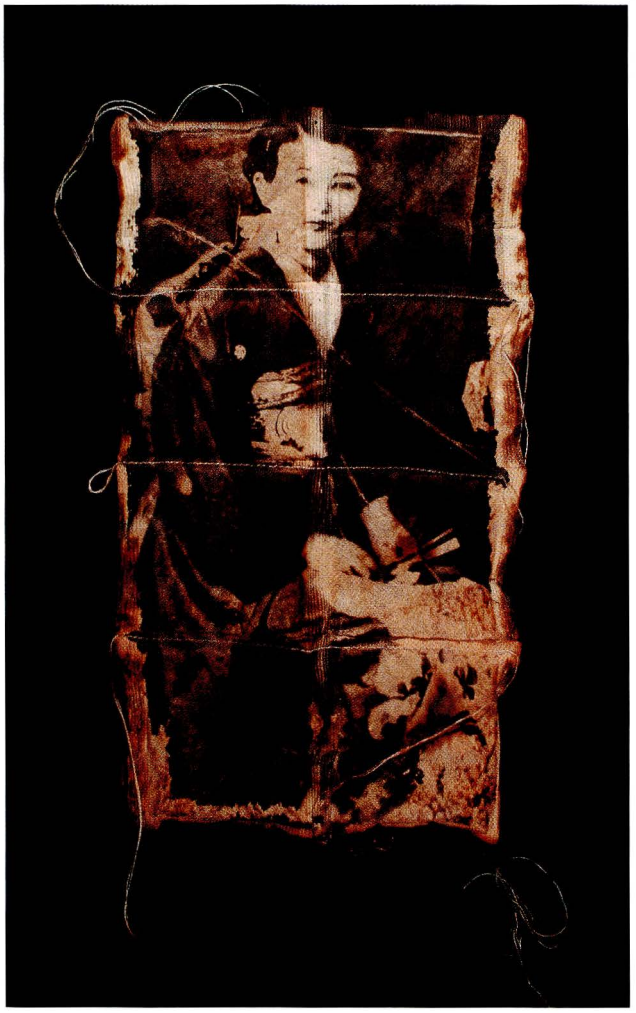


Figure 21–12

Erin Kawamata, *Tea test #1*, 2006 (VDB and Tea Bags)

This lovely, and innovative, Van Dyke piece was created by sewing together tea bags full of tea (tannin) and sensitizing them with VDB. In this example of Erin's work, the context and subject are in perfect harmony. *(Courtesy of the Artist)*

Gold or Palladium Toning Sequence

Sensitize and expose your kallitype print in the traditional manner and then go through the double-wash cycle beginning with the citric acid acidified distilled water. Next, mix the toner by combining the ingredients listed in the recipes just given.

Tone the print in either of the solutions until you like what you see. This could take up to 30 minutes and is always faster when the toner is fresh. Then, immerse the toned print in fresh running water for 5 minutes. When that rinse step is complete, immerse the print in your 3% sodium thiosulphate fixer for 1 minute. Then, immerse the print in a silver-gelatin-type hypo-clearing agent for 1 minute (a 1% sodium sulphite solution will work if you can't find standard hypo-clearing chemistry). Finally, wash the print for 30–40 minutes in running water, wash for 5 minutes in distilled water, and hang the print on a line to dry. Presto! A beautiful gold-toned Van Dyke in which the highlights are tending to cool grey blue and the shadows are heading to black.

Selenium

Although I have heard other Van Dyke practitioners discuss this toner as an option, I personally found that it has a very strong bleaching effect even in significant dilutions. The reason for this is that selenium toner is 30% ammonium thiosulphate, which is, as you know, a form of fixer. To use it, I recommend a dilution of perhaps 1:100 and a paper-strength hypo-clearing (sodium sulphite) mix in place of the water to neutralize the sodium thiosulphate. I also suggest using a warm solution to intensify the reaction in a shorter period of time. Selenium must be handled carefully, so please read the chemical section in the appendix for more information before you begin.

Blue Toner

Believe it or not, the standard cyanotype chemistry, along with a little acetic acid, makes a fine blue toner. It seems illogical to make a Van Dyke blue, but a split toning might be possible if you experiment with diluted concentrations. Simply mix the following.

20 ml	cyanotype Part A (ferric ammonium citrate)
24 ml	cyanotype Part B (potassium ferricyanide)
1200 ml	water
140 ml	28% acetic acid

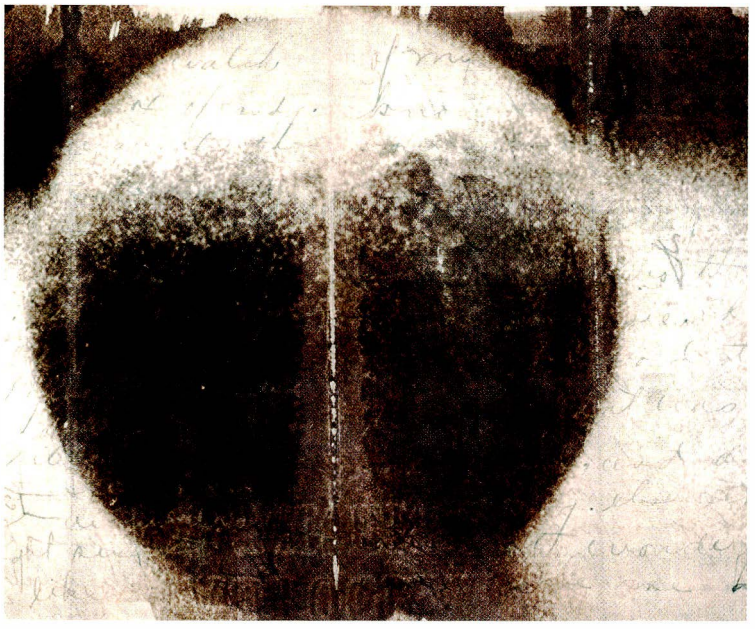


Figure 21–13
Sandra Johanson, *1 Ball on Letter*(Van Dyke)
Sandra writes, "*I am a collector of old things. A friend found letters from a long dead relative and the paper and penmanship was so beautiful, a long lost art. At the time I was working with Van Dyke, and enlarged negatives. This is an image of an old wooden ball, which paired nicely with the creases of the paper. I like the combination of the delicacy of the paper and writing and the solid strength of the ball. The ink reacted quite differently with the fixer, changed color, faded, it was unpredictable, but part of the fun. I really love that part of the process.*"
(Courtesy of the Artist)

To use this formula, presoak your print as you would in any photographic toning process and then immerse it in the blue toning solution. Agitate the tray until you are pleased with the results. Then, wash the print for 30–40 minutes.

For split tones with this formula, or to partially eliminate a bit of color from a too-blue print, mix up a solution of 5 g of borax with 1,000 ml of water and immerse the print until you begin to see the change. You can also use a pinch of sodium carbonate (another alkali) to a liter of water for the same effect. This formula can also be employed as a toner for kallitype prints if, for some reason, you want kallitypes to be blue. Try diluting the blue toning formula to see if a split can be negotiated with the Van Dyke print. Then again, if you want a semi-predictable split, try the B-V-D process.

THE BLUE-VAN-DYKE (B-V-D) PROCESS

In a workshop several years ago, after an afternoon of cyanotype frustration (the result of contaminated storage bottles), I tossed in the proverbial towel and, never allowing a complete failure to be anything but an opportunity for a new technique, suggested to the class that it was time to invent something new with the crap cyanotypes we had created. I can't remember if our cyanotypes were actually overexposed or simply too saturated with contaminated blue staining to be worth saving, but these were going to be our test prints.

Because the Van Dyke was the next process in the workshop's curriculum sequence, the sensitizer was already mixed and had aged the prerequisite 48 hours. I decided to use it to coat one of the very dark cyanotypes and see if anything would happen. Immediately, the visual cyanotype pigmentation broke down to a pale yellow brown. Remembering the account of Fox Talbot's surprise when he tried to re-sensitize a badly executed salted paper, I dried the newly re-coated paper and placed the negative slightly out of registration on the re-sensitized and dried paper. This wasn't difficult to do because the original cyanotype, having not been sized, didn't quite match in registration anyway. As it turned out, this slightly off-registration was one of the big reasons the experiment eventually worked.

The first test coating of Van Dyke was full strength, and the changes to the prints were not very interesting except for the off-registration parts. Those parts showed tinges of goldenrod yellow splitting with the blue of the cyanotype.

We then diluted the Van Dyke sensitizer by 50% with distilled water so that the brown would not completely dominate the cyan blue. This time, the split separation was truly pronounced and everyone in the workshop ran off to make horribly over-exposed cyanotypes so they could work with the new process for the rest of the day. This is what I've discovered about a workshop class . . . if you make a mistake, and if it's an attractive mistake, the mistake will be incorporated into

Figure 21–14
Dan Dakotas, *Taos Guadalupe*, Santa Fe, 2006 (VDB)
Dan, a legend in Kansas for his teaching and annual crop of spicy dill pickles, made this terrific Blue-Van-Dyke during one of my alternative process workshops in Santa Fe. The technique requires an over-exposed, processed, and aged cyanotype followed by a 50% diluted Van Dyke sensitizer with the negative slightly out of registration.
(Courtesy of the Artist)

the way the process is done from that point on. For the last decade or so I have intentionally made mistakes in demos (with the inexpensive chemistry) knowing that something good would happen that the students could adopt. This instills the idea of play in the process workflow. The students in this particular workshop quickly named the process *Cyan-O-Dyke*. This led to some class discussion regarding the political correctness of the innuendo, and the process was renamed Blue-Van-Dyke . . . or B-V-D in order to keep it a little edgy.

The B-V-D process is a weird and charming hybrid. When everything goes well, you will get a wonderfully split-toned image incorporating deep ultramarine blues that split with a variety of mid-tone earth colors that range from greens, grays, and blacks to golden yellows. At times, when the negative is not too high in contrast, the result is often a bas-relief-like effect. Several components appear to have a lot of impact on the success of the image. The first is the length of the original exposure, as the cyanotype must be over-exposed a lot. Another is the dilution and freshness of the Van Dyke sensitizer. The process does not perform well with full strength or old Van Dyke chemistry. The sensitizer must be cut with distilled water to at least 1:1, and the sensitizer must be fresh. I would recommend using Liam's contrast control sensitizer as the sensitizer for the B-V-D instead of the traditional formula, as contrast helps accentuate the effect of the split considerably. The negative also plays a large role because a great degree of linear delineation (versus mass), high contrast, texture, and energetic patterns always seem to make a better B-V-D than those negatives with a long continuous tonal scale.

A Few Final B-V-D Ideas

- Use a high-quality rag paper that can handle two separate processes, a lot of chemistry, and extended wash times. You may wish to pre-soak your paper in hot water, gelatin size, and perhaps harden the gelatin with formalin or glyoxal. This is especially important if you intend to do a gum print on the B-V-D print. Keep in mind that the best B-V-D splits occur when the negative and the first cyanotype image are slightly out of register. You can make this happen easily whether you gelatin size or not.
- If you underexpose the cyanotype and use a strong Van Dyke solution, all you will get is a solid color print that resembles a cyanotype after a strong tannic acid/sodium carbonate toning sequence. In other words, brownish with off-color highlights and bleached-out middle densities and detailed highlights.
- One different technique worth considering is to print the cyanotype step with a negative and then make the Van Dyke with a film positive of the same image. You will end up with a split-toned, tone-line separation. One more idea is to make a first cyanotype pass with one negative and then take a completely different negative and use it for the Van Dyke exposure. Play with this process, altering the chemical formulas of both sensitizers, knowing that you are going into uncharted process land.
- Lastly, if you find that you went too far with your Van Dyke portion of the printing experience, simply immerse the print in a tray of water with a little hydrogen peroxide and a good deal of your blue will return.

Figure 21–15
Ryan Wing, *Bicycle on the Lawn*, Oklahoma, 1998
Ryan made this B-V-D print while a student of mine at the Oklahoma Summer Arts Institute in 1998. This technique works best when the negative has a good deal of graphic linear detail and texture.
(Courtesy of the Artist)

GALINA MANIKOVA'S VAN DYKE ON PORCELAIN WORKFLOW

Residing and working in Norway, my friend Galina Manikova is acclaimed for her work placing images on impossible surfaces such as steel, glass, porcelain, and fabric, and in massive blocks of ice. In this description I will give you a brief overview of how she applies and prints her Van Dyke sensitizer on porcelain. This will give you a pretty good idea of her workflow, but to accomplish this task well you will first need to learn the Van Dyke process on a simpler substrate such as paper or fabric. Then you will need some knowledge of ceramic process, firing with a kiln, and casting. This section, however, should get you interested.

Preparing the Porcelain Form

To execute this technique you will require some liquid porcelain, Danish type, from the Royal Copenhagen porcelain factory (http://www.royalcopenhagen.com). The liquid porcelain is cast in a plaster form, dried, and fired twice. The first firing is to 900 °C (cone 06 or 07). The second firing, this time with a white matt glaze, is to 1280 °C (cone 9 or 10). It is important that you don't simply show up in a working ceramic studio and think that you're going to get straight into creating forms for your liquid porcelain and firing in a community kiln. You will need to get some experience, and my best advice is to register for a class or workshop in which you can become familiar with the materials and how they are used. This knowledge is especially important when using a group kiln because one exploding piece can destroy others in the kiln during a firing. Don't be intimidated; working with clay is an amazing amount of fun, but you need to know what you are doing.

Hardened Gelatin First Coat

Once the ceramic pieces that you intend to place your images on are complete, they are covered with a gelatin and formalin/glyoxal base that is made in the following manner.

- To 1 teaspoon of gelatin, add a small quantity of cold water, as little as it takes to allow the gelatin to bloom.
- After 10 minutes, dissolve the bloomed gelatin in a hot water bath by partially immersing the container holding the bloomed gelatin into a larger vessel containing hot water. This is the same setup we use for gum bichromate gelatin hardening. Once the gelatin is made more liquid by the heat, add 2 to 3 drops of 37% formaldehyde or substitute with the prepared glyoxal sold by Bostick & Sullivan. This, again, is familiar territory if you've prepared gum bichromate paper.
- Using a hairdryer, heat up the porcelain form that you are going to be applying your image to so that it's warm, preventing the gelatin from firming up too quickly . . . like a gelatin dessert

Figure 21–16
Betty Hahn, Dark Peony on Gold, (1982)
This is an example from alt pro legend Betty Hahn's abundant portfolio dealing with the potential of interdisciplinary alternative process techniques. Betty has long been one of the leading influences in the resurgent alternative process movement. *(Courtesy of the Artist)*

placed in a refrigerator. Then, using a foam brush, coat the porcelain object and let it dry overnight. Galina recommends that if you have the time, allow the seasoning and drying time to encompass a full month! This last ideal suggestion is an even better idea. The gelatin base needs to harden perfectly.

Applying the Gelatin Van Dyke Senstizer to Porcelain

A month later, after the drying time is complete, it is time to make up the gelatin and sensitizer mix that will allow you to place an image on the porcelain. To make the sensitizer, follow these steps.

- Add 2/3 the volume of Van Dyke sensitizer (ferric ammonium citrate, tartaric acid, silver nitrate, and water) to 1/3 the volume of gelatin prepared the same way you did before but this time *without* the formaldehyde or glyoxal hardener. This solution can be applied in a variety of ways but must be kept warm during the coating. Be sure that you are wearing nitrile or latex examination gloves and eyewear. You always need to protect your eyes and skin when using silver nitrate or glyoxal.
- Apply the gelatin and Van Dyke solution to the warmed porcelain form quickly and then place them in a dark environment to dry overnight.
- The next day, under safelight or low ambient light, tape your negative to the ceramic form with a transparent tape. If the form is flat, tape the negative down and cover it with a sheet of glass to create good compression. Your negative can be a traditional silver gelatin variety, a Pictorico Ultra Premium OHP digital film, a cliché verre on glass or transparent flexible acetate surface, a waxed paper negative, an acrylic lift transfer, or a photogram object. Use your imagination.

Exposing Van Dyke on Porcelain

At a distance of around 16" using a 300-watt bulb (Galina uses a 300-watt bulb from Osram, which is out of production but still available from Osram, a German firm represented in Norway), expose the coated sensitized ceramic object for 10 minutes. After exposure, wash it under very cold running water for about 3 hours. Allow the piece to dry completely and then expose the piece again, with the same light and distance, for 30 additional minutes.

End Game

You will notice that there is no sodium thiosulphate fixer used in this workflow following exposure. Galina reports no problems with this procedure, and this is likely due to the fact that the sensitizer is sitting on the surface of hardened gelatin and not residing in the fibers of a thick paper substrate. You may also begin to consider using other sensitizers in this workflow. Once again, go exploring and have fun.

Figure 21–17
Galina Manikova, *Porcstairs031* (*Flight of Stairs* Project), 2012
Residing and working in Norway, my friend Galina is internationally acclaimed for her skill in placing images on impossible surfaces such as steel, glass, porcelain, and fabric, and embedded in massive blocks of ice. There is a description in the text of this collaborative work with Israeli ceramicist Sara Ben Yosef, but please keep in mind that you will need some knowledge of ceramic process and materials, firing with a kiln, and casting to be safe and successful. This section, however, should get you interested. *(Courtesy of the Artist)*

POP: Printing-Out Paper

OVERVIEW & EXPECTATIONS

In this chapter I'll introduce you to the POP process, which is an abbreviation for printing-out paper. POP is a generic acronym first used by Ilford Limited in 1891. The term described a variety of products and techniques that shared similar chemical and working characteristics with albumen and salted paper including simplicity, flexibility, versatility, and the fact that the POP paper *prints out* without requiring a developer to yield a fully realized image.

Although POP commercially and chronologically succeeded salt and albumen in the alternative process timeline, it is significant in that it further democratized the medium of photography . . . allowing anyone, in any place, to make photographs easily with commercially prepared gelatin sensitized papers and very simple chemistry.

This chapter will provide you with the information you need to replicate the POP process as it was conceived by Peter Mawdsley (1874), William de W. Abney (1882), Johann Baptist Obernetter (Munich, 1884), and Raphael Eduard Julius Liesegang (Düsseldorf, 1886).

Figure 22–1

Christopher James, *Driver*, Delhi, India, 1994

Returning to India for the first time in 10 years with my toy plastic cameras. . . I found that the feast of images continued on.

(Courtesy of the Artist/Author)

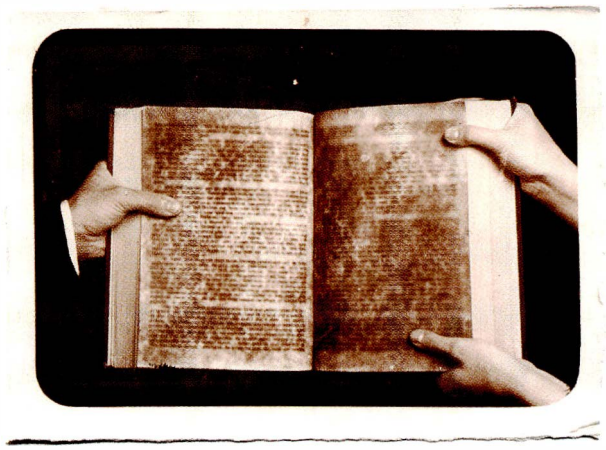
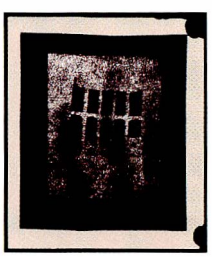


Figure 22–2
Dan Estabrook, *Untitled Book*, 1993 (POP)
This POP image is representative of the concepts that drive Dan's work. . . that of building a false history of anonymous photography and playing with the perceptions of nostalgia, melancholy, the space of loss, and original time. . . that space of time between us and that original image, calling attention to what might be missing and what we, in our time, project upon those images. It is within this space that Dan tells his own stories.
(Courtesy of the Artist)



A LITTLE HISTORY

In earlier chapters we toured the early history of alternative processes to see how the scientific and creative explorations of Schulze, Scheele, Hellot, and Fox Talbot took the new and evolving medium processes to the late 1800s. In this chapter we'll pick it up in 1873 with Peter Mawdsley's first *developed-out* (DOP) gelatin silver papers, which were not commercially available until 1885.

The first silver-gelatin-based printing-out papers were manufactured and made available to the German public by Johann Baptist Obernetter (1840–1887) in 1884. That same year, although some sources cite the year as 1886, Raphael Eduard Julius Liesegang began to manufacture a sophisticated collodion printing emulsion that he called *aristotype*, named by combining the Greek words *aristos* (best) and *typos* (type). The following year, Joseph Barker of London set up the production plant, Britannia Works, which a few years later was re-named Ilford Limited. In 1891, the term *POP* was first used on the boxes, wrapping, and text of Ilford's packaging and advertising.

POP papers were far less difficult for the amateur to work with than any commercially prepared printing papers, most specifically albumen. Much as albumen rose to popularity over less convenient imaging systems, POP papers gained acceptance due to the fact that their workflow and requirements were even more simplified. Ultimately, as has been the case throughout photographic history, the less demanding imaging system replaced commercially produced albumen papers in the marketplace. This didn't happen overnight, as the new POP paper was very similar to the albumen paper it was supplanting. Like albumen, it contained an excess of silver nitrate in a gelatin binder rather than an albumen binder. The printing speed of the two papers were similar, both printed out (more or less) to what they would look like during exposure, the processing workflows were nearly the same, and the contrast, coloration, and surface of the commercial papers were remarkably alike.

Unlike albumen, however, mass-market POP paper did not suffer from silver sulphide yellowing and fading (silver albumenate), which is produced by the chemical reaction of residual, undeveloped silver with sulphur-containing groups on albumen proteins. This malady affects 85% of albumen prints developed after 1860 and 95% of prints from the 1850s.

As previously mentioned, POP papers used gelatin as a binder. This natural protein, isolated from animal skins and bones, didn't exhibit stress and dryness cracks as easily as albumen, and it functioned as a protective colloid for the silver halide crystals, preventing silver salt crystals from growing too large. In a photographic context, the absence of gelatin as a binder for a silver halide results in crystals growing into a size far too large for a photographic emulsion.

By 1889, automated production of continuous roll collodion POP paper was underway when Dr. A. Kurtz began producing his Celloidin (meaning "pyroxylin" or "collodion") POP paper in Germany. That same year, in the United States, there were several POP operations already in business. Among them were the Jamestown,

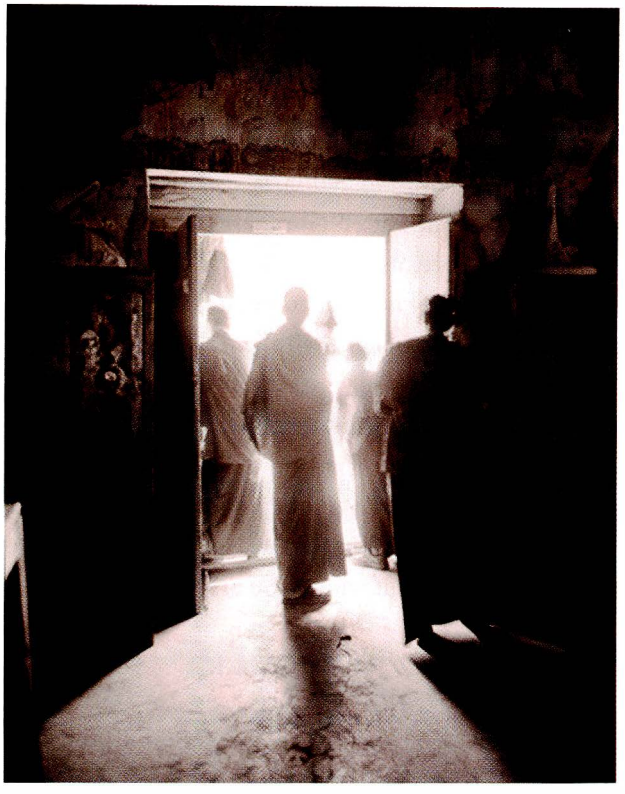


Figure 22–3
Linda Connor, *Monks Watching a Religious Festival*, Lamayuru Monastery, India, 1998
Recently, in an email exchange I was having with Linda, she wrote, *"Since the world has gone digital and left much of what we love about Photo in the dust... I have gone over to the dark side and I've been doing digital prints...thought still shooting film and have had some nice results printing on silk."* She continued, perhaps as a comparison, to write about the delicate magic of POP. . . a look that can still be achieved in the sibling processes of albumen, wet plate collodion, and silver bromide gelatin emulsions.
(Courtesy of the Artist)

New York, New York Aristotype Company, Kuhn Crystallograph in Missouri, and Western Collodion Paper Co. of Cedar Rapids, Iowa. Shortly thereafter, in 1892, George Eastman, the proverbial 900-pound gorilla in the living room in relation to these smaller operations, began manufacturing a POP paper called *Solio*. Eastman Kodak continued to produce this paper as *Studio Proof* until 1987 when it determined that the market had expired. It was wrong.

As the photographic medium entered the twentieth century there were several manufacturers supplying the POP demands of amateur and professional photographers, and the product could even be purchased in novelty party packs of pink and mauve papers to go along with the traditional burnt sienna. In the last several years, there has been a resurgent interest in commercially made POP papers with one example being Victor Petryakov's Alt Photo Products in Earlville, New York, and his collodio-chloride POP. We'll use this product as an example of the process later in the chapter.

HOW POP WORKS

POP papers are unique among commercially produced photographic papers in that they have several characteristics that not only make them perfect for contact printing large format film or digital negatives, including their exceedingly long tonal range, but also make them quite elementary in their technical demands. POP papers, of course, are UV sensitive, are contact printed, and require that you have a negative the same size as your final image. They feature a very slow speed emulsion that prints out, meaning you can examine your print's progress throughout the exposure. This concurrent evaluation of your image's progress, featuring a high probability of success, is one of the factors that make the process so appealing to both serious photographic artists and students, and is what allowed it to surpass albumen in the marketplace. Aside from the ease of evaluation, POP printing stock has a unique characteristic curve that results in a perfect combination of attributes. . . a delicate and smooth tonal structure with detailed shadows and soft highlights. . . like black-and-white film noir of the 40s. The POP paper features a self-masking attribute in the shadows, so more exposure yields reduced contrast. These tonal values can be further enhanced with an extensive menu of archival toning options incorporating gold, borax, platinum, and palladium.

In the POP process, UV light creates a printed-out image by decomposing the excess silver chloride and liberating decomposed *photolytic* silver in the sensitizer. The common light-sensitive silver chloride ingredient, in combination with the excess of soluble silver salts, is converted into metallic silver having a deep russet/chestnut brown color as it prints out. The silver salts in a POP emulsion are spread uniformly throughout the gelatin binder; in contrast, in the albumen

Figure 22–4
Linda Connor, *Benares*, 1979 (POP)
Having spent an important time in my life in Benares, India, I have lived with a reproduction of Linda's photograph of the ghats on my office wall ever since removing it from a magazine. Linda's work has been dedicated to the visual exploration of sacred spaces for over 35 years in countries such as Africa, Vietnam, Nepal, India, and Turkey. Linda writes, "*My primary concern as an artist is that the work operate not only as fact, but also as metaphor. To a certain extent, I'm working as a poet would, coaxing out layers of meanings.*"
(Courtesy of the Artist)

print, the silver salts are coated upon the surface of the prepared albumen. The unique reddish/russet-brown coloration of the POP print comes from this uniform dispersal of the silver salts and from the absorption of short spectrum wavelengths by the smallest particles of silver in the gelatin binder.

At this point, you are aware that the key attribute of the POP process is that the image is printed out during the exposure and that no post-exposure development is required in order to realize the image. The print's color, following exposure and prior to the toning and fixing bath stages, is a characteristic rusty plum in concert with a bronzed olive solarization in the darkest shadows. Unfortunately, you can't keep this coloration. With experimentation, however, it's possible to restore much of that color through multi-stage toning techniques.

When the POP exposure has been completed to your visual satisfaction, the print is washed in distilled water, in which a good portion of the unexposed silver is removed from the paper. If you elect to use running water from the tap during this prewash stage you will see a milky white residue form in the wash water that looks identical to what you see at the same stage in the salted paper and argyrotype processes. This milky residue is the excess unexposed silver nitrate reacting with the tap water to form insoluble silver chloride.

Using distilled water eliminates a fair degree of this white residue, as it doesn't contain the chlorine, or chloramine, that is often added to public water supplies. You can also begin with a distilled water bath and after 2–3 minutes switch out to running water for an additional 10–15 minutes. When the wash water runs clear, it is a sign that the excess silver has been washed from the print. At this point in the procedure, the image is unstable, but tonally rich, and you have to make a decision about where you are going next.

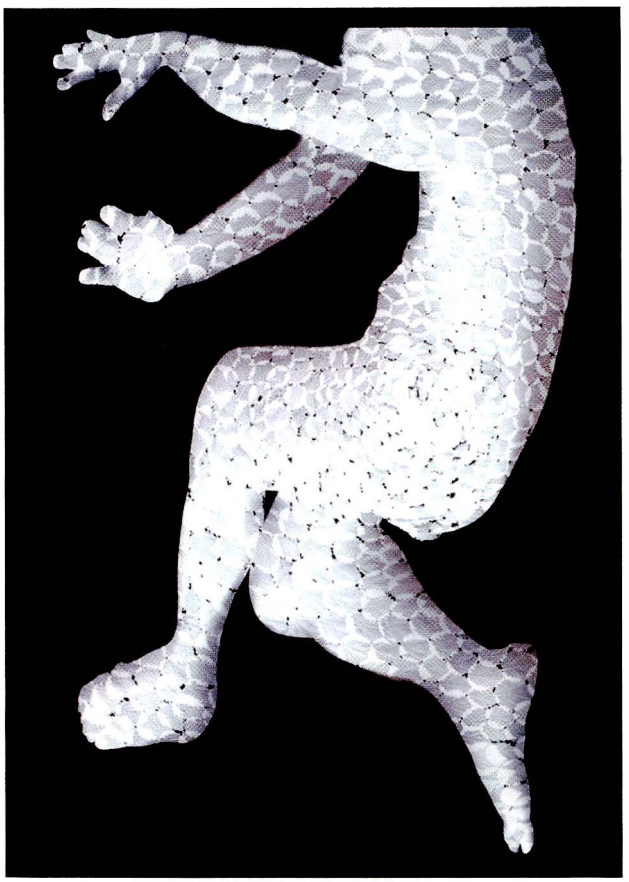


Figure 22–5
Martha Madigan, *Shiva*, 1995–96 (72" × 53" gold-toned POP image)
Martha Madigan made this double-exposure POP (image by initially creating the photogram of the body and then making a second exposure with a pattern of natural elements overlaying the white area created by the body during the first exposure. The POP print was then gold toned to create split coloration.
(Courtesy of the Artist and Jeffrey Fuller Fine Art, Philadelphia)

You have a choice between fixing the print immediately or toning it first and fixing it later. If you elect to fix the image directly after the first wash you will notice that a small percentage of your image's total density will be evident. After fixing in a standard 15% sodium thiosulphate fixing bath (150 g to 1000 ml of distilled water), the color of the print will change from its familiar plum red to a pleasant warm orange brown. I recommend that you add 2 g of sodium carbonate to every liter of the fixing bath to make the bath slightly alkaline. The print that is exposed and fixed without a toning stage is traditionally called a *proof* and looks exactly like the prints that you were given, if you are my age, during your senior year of high school so you could decide how your yearbook would remember you. They were not designed to last.

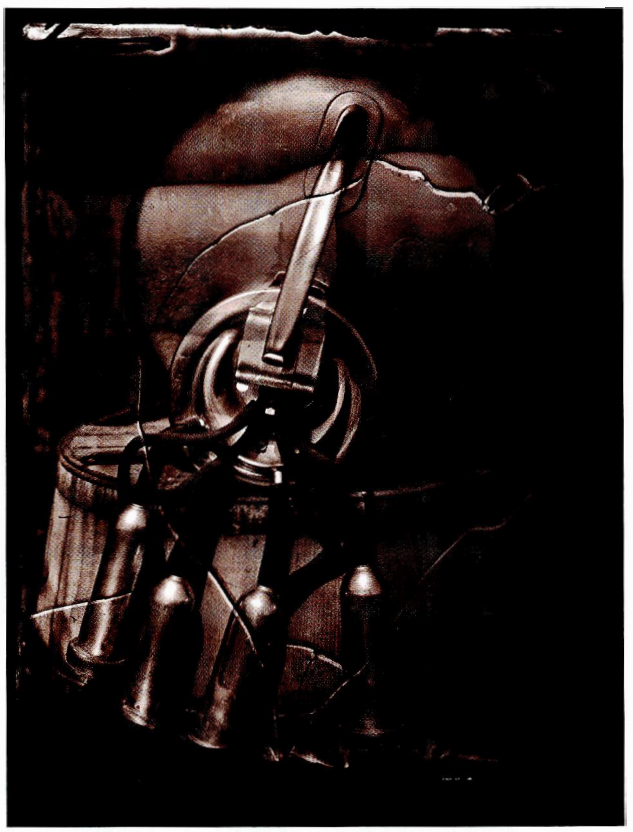


Figure 22–6
Margaret Adams, *Milking Machine*, 2006 (POP)
Margaret is a former alternative process workshop participant of mine and, what will probably come as a bit of a surprise to her students at the Corcoran College of Art & Design, the former lead singer in a punk rock band. Margaret has been a "lab rat" tester for my previous books and I am ever grateful.
(Courtesy of the Artist)

This form of POP print lacks a great deal of what the POP image can provide and will be a warm plum-orange-brown color. Simply for the pleasure of experiencing the diversity of colors available in the POP process I strongly recommend a toning stage prior to fixing and final washing.

HANDMADE POP EMULSIONS

POP emulsions, once mixed, have a short shelf life, so I will recommend that you make small batches and refrigerate what you do not use. Keep Parts A (salted gelatin) and B (silver) separate until you are prepared to make your POP paper. It is possible to make up a batch of POP paper, dry and age it thoroughly, and store it for a short time, but you run the risk of the *ripening* that results in an increase in the sensitivity of the emulsion. Unfortunately, it is accompanied by a companion increase in fog and a loss of contrast.

Here are two formulas to consider using for your homemade POP emulsion. The first is a recipe that I've worked with for a while and that is more intuitive and traditional in its makeup. The second is Liam Lawless's recipe from Judy Seigel's *The World Journal of Post-Factory Photography, #5*. This is quite a different formula in that it calls for far less gelatin than is normally recommended and a lot more silver nitrate. Liam's working formula is made by combining 2 parts gelatin–salt Part A, 2 parts distilled water, and 1 part silver nitrate in that sequence. We'll begin with Liam's formula.

The Liam Lawless POP Emulsion

Part A: Gelatin Salt Solution

23 g	Knox or similar cooking gelatin
5.5 g	citric acid
3.375 g	tri-sodium citrate/sodium citrate
1.125	sodium chloride
Distilled	water to make 200 ml

Mix the salted gelatin Part A in ambient light. Dissolve the sodium chloride, citric acid, and sodium citrate in 150 ml of distilled water in a very clean glass or plastic beaker. Sprinkle the gelatin over the surface and let the solution stand for 15 minutes. Sprinkling is important so that the gelatin does not clump together. You will notice that the

gelatin absorbs most of the water and sinks. Next, place the gelatin–salt beaker in a larger container, like a crock pot or six-pack-size beer cooler, containing hot water at about 140°F (gelatin melts at 104°F), and let it stand until it clears and is free of bubbles and ligand-like bits and pieces. Then add distilled water to bring the total volume up to 200 ml. You may elect to add 5 ml of 2% thymol in alcohol as a precaution against mold growth.

This emulsion has a good deal of contrast built into it. If you want a softer, less contrasty formula, increase the sodium chloride in the gelatin–salt Part A to 3.375 g. Everything else stays the same.

Part B: Silver Solution

18.22 g silver nitrate
Distilled water to make 100 ml

Mix the silver nitrate, Part B, in ambient light, and when finished, store in a very clean brown glass bottle in the dark.

When you are ready to coat paper, warm Parts A and B, and the distilled water to approximately 120°F before combining the working solution. It will take approximately 10–15 ml of emulsion to coat a stationary-sized sheet of paper. Place the gelatin–salt solution in a clean shot glass or ceramic saucer. Add distilled water to the gelatin–salt solution followed by the Part B silver. The solution will turn white. Stir it into solution with a small rod or brush, being sure to keep the solution from becoming cold. Coat your paper choice (Fabriano Classico is a good option) with a single-use foam brush and put the paper in a dark environment for 5–6 hours so that it may dry thoroughly. You may dry the paper for as long as 12 hours, but be cautious about doing this in high humidity as moisture may result in free silver staining the paper. Single coatings work fine depending upon the density of the paper. Do not dry the paper with heat. This prepared paper has a life of 24–36 hours before the first signs of spontaneous darkening show up.

A Traditional POP Emulsion Option

This formula has been a standard one for many folks for some time, and you will notice that it has a lot more gelatin than does Liam's recipe. It also uses proportionally less silver. My advice is to be free with your modifications to this recipe, reducing the gelatin proportions, increasing the silver content, and modifying the ammonium or sodium chloride to adjust your contrast.

POP Solution A

1 .5 g	ammonium chloride (sodium chloride is nearly identical)
5 g	sodium potassium tartrate
80 g	plain gelatin
750 ml	distilled water

POP Solution B

25 g	silver nitrate (insensitive to light until it is combined with salts)
10 g	citric acid (eliminates fog/increase in contrast)
250 ml	distilled water

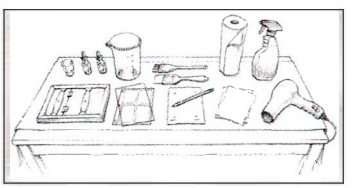


TABLE SETUP FOR POP

- A box of Alt Photo Products collodio-chloride POP paper. . . or your own handmade POP paper
- A pair of white cotton gloves if you're nervous
- Clean paper for the table surface coating area
- Pencil and paper for taking notes
- Contact-printing frame
- Film/Pictorico negative or photogram materials for contact printing

POP FORMULAS & WORKFLOW

Note: Adhere to the workflow that follows whether you are using a commercially prepared POP paper or paper that you have made by hand. The differences in success will

be dependent on a great many variables. This is especially true with handmade POP papers. Take superior notes of everything you see, and make your adjustments one at a time. This will take some time, so be sure to have fun learning.

Collodio-Chloride Aristotype Pre-Coated POP Paper

The following represents the working process using Victor Petryakov's Alt Photo Products collodio-chloride, aristotype, POP paper. This paper is an alternative to the discontinued Centennial POP. If you have used Centennial, you will notice that it is similar in appearance, gloss, speed, and contrast. The surface is a lot like the old Agfa PRN 111 silver–gelatin papers for those of you who remember the wet darkroom with great fondness. This collodion-based silver chloride emulsion is applied to baryta-coated rag paper in the United States. The shelf life of refrigerated paper is 6 months, and I recommend that your paper be exposed and processed within 30 days of receiving it and ordering another batch.

Figure 22–7
Victor Pertryakov, *Lament for the Beach*, 2009 (borax/gold toned on his own brand of collodion POP)
This image by Victor Pertryakov is made on a borax/gold-toned collodio-chloride paper that Victor makes and manufactures at his company, http:// www.altphotoproducts.com, in Earlville, New York. The collodion-based silver chloride emulsion, also known as aristotype, is applied to baryta-coated rag paper in the United States. The shelf life of refrigerated paper is six months, and it is recommended that it be exposed and processed within thirty days.
(Courtesy of the Artist)

Alt Photo Products collodio-chloride paper was developed through Mark Osterman's research of historic formulas in his work at the George Eastman House in Rochester, New York. Collodion printing papers were typically toned with gold chloride and have earned a reputation as the most archival of all silver halide photographic papers.

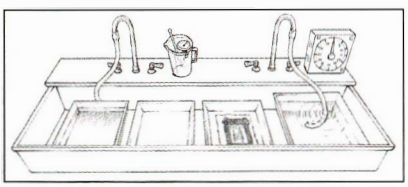
Be very careful when handling and storing POP paper because it does not appreciate high humidity or excessive handling. Be sure your hands are entirely free of moisture and chemistry before touching the paper. Do your best to limit your touching to the edges of the paper. If you cannot do this well, such as when working with a large piece of paper, I recommend a pair of the compulsively fresh *and* white photo gloves that curators and museum staff are so fond of wearing when looking at prints. Keep the paper tightly sealed in a plastic zip-lock bag and, if possible, at a temperature lower than 70°F. When you are not printing it is a good idea to store the paper in the refrigerator.

POP papers share characteristics and workflow with albumen and salted paper printing techniques. You can work with the paper in low, ambient, non-fluorescent light for limited periods of time. This same light will be appropriate for inspection of the print out during the exposure stage. Use a hinged-back contact frame for inspection and lightly overexpose your image to just past the point where you are happy with it. You're going to lose a bit of density in the fixer, but *you* will get most of it back during dry down.

When your exposure is complete you will have a plum-red to russet-colored image. This coloration will fluctuate depending on the time of day, relative humidity, and air temperature. Don't be concerned with these differences because the toning stages will change them anyway. Exposure times will vary, but begin testing with single minutes in mind, and depend heavily on visual inspection during the exposure. You should have the exposure times wired in for a particular negative after a few prints.

The negative that works best for this process is one that is quite contrasty and that has a long negative density range with strong shadows and highlights. A range of 1.5–2.0 will work very well. You can

use large-format contact or Pictorico Ultra Premium OHP digital inkjet film negatives with equal success. Collodion glass plate negatives print beautifully with POP as well. One more thing to know before the exposure: POP paper, under the right circumstances, will deposit silver nitrate on your negative. If you are anxious about your negative, and it is a particularly humid day, think about separating your negative from the POP paper with a thin and clean sheet of Mylar or put your negative into a Krystal seal envelope. Because of the silver nitrate, never touch your eyes while handling POP paper without taking time to thoroughly wash your hands first.



SINK SETUP FOR POP

Tray 1 Salted-distilled water for 2–4 minutes

Tray 2 Fresh water bath for 10–15 minutes

Tray 3 Toning baths (e.g., POP gold ammonium thiocyanate toner)

Tray 4 -A & 4-B Fixer—15% sodium thiosulphate (150 g sodium thiosulphate to 1000 ml distilled water. Add 2 g of sodium carbonate to this fixer to increase the bath's alkalinity. Make up 2 separate trays and split the total fixing time between them.

Tray 5 Final wash—running water

FIRST WASH

Salt Wash Bath

In the past I simply washed my exposed POP prints in a distilled water bath for 2–4 minutes and then moved them to a fresh running water bath for 10–15 more. For the past few years, I've been incorporating the same slightly acidic salt wash that I use for salted paper printing and albumen, in an effort to eliminate stain goblins and to facilitate a smoother toning process.

The first bath in the processing sequence consists of a slightly acidic salt bath whose purpose is to precipitate the free (or excess) silver by producing silver chloride. If you have no salt in this bath you will not be removing the free silver, and this will create problems with toning, as the gold will not adhere to the silver unless all of the free silver is eliminated. Following your exposure, immerse your print in the bath of salted water that has been made slightly acidic (lowering its pH) by the addition of citric acid.

10 g	citric acid (just a pinch)
30 g	kosher salt
1000 ml	distilled water

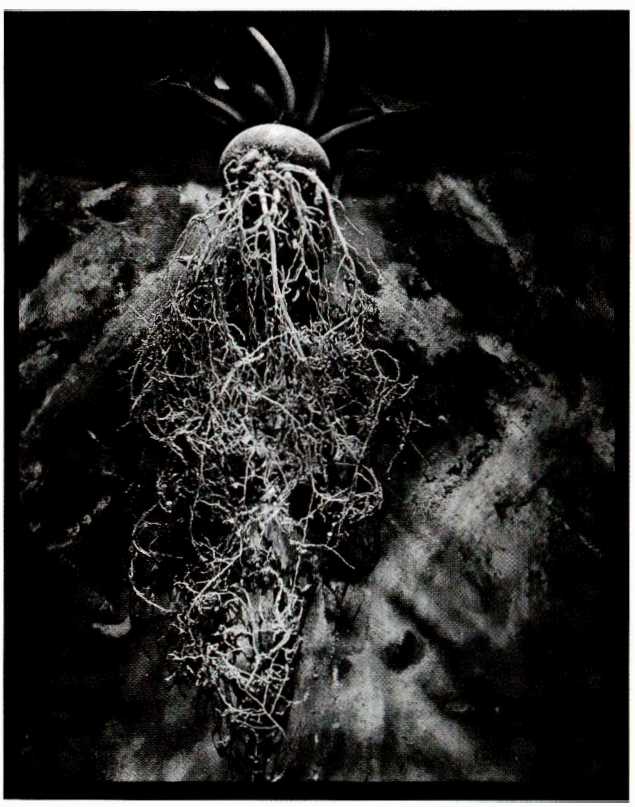


Figure 22–8
Olivia Parker, *Cyclamen*, 1980 (split-toned AZO)
For nearly four decades my friend Olivia Parker has made images that come to life from the genre of still life. She writes regarding the subject matter that means most to her, "*. . . the comfort of the table with food, or a vase of flowers, and the despair of the vanitas and memento mori with their reminders that life and death are inseparable. The images retain the formal shell of the expected, but have elements of the unexpected. This contact print is on Azo silver chloride paper, split toned with selenium. I like making visible aspects of objects that are often unseen.*"
(Courtesy of the Artist)

Immerse your print in this solution under low to moderate light, and agitate slowly for about 2–4 minutes. Following this step, move your print to a tray for a fresh running water bath for an additional 10–15 minutes. You will notice that the image will become lighter in the first wash but will retain the color. Later in the process, when you fix the image, you will see a decrease in density, and the color of the image will turn from russet red to brown. After a while the color will return to an orange/brown, and after drying much of the reduced density will be restored.

POP TONERS

The traditional step at this point in the POP process is to tone the print with one of several toning options. The most commonly used is a POP gold chloride–ammonium thiocyanate toner. The ingredients can be purchased as ingredients, in a partially prepared state (1% gold chloride and ammonium thiocyanate in separate solutions) or in monobath gold toner-fix combination. Again, these toners are used following your water wash to remove residual silver chloride and *before* the sodium thiosulphate fixer. Toners from both albumen and salted paper printing can be tried, and the following ones are the most common for POP.

Gold–Ammonium Thiocyanate Toner

This toner is available from several suppliers and can be purchased in two separate prepared solutions. Should you wish to make it yourself, this is the traditional formula that has been around for a long time.

Stock Solution A

10 g	ammonium thiocyanate
500 ml	distilled water at 120°F

Stir the 10 g of ammonium thiocyanate into 500 ml of distilled water. Once the solution is prepared, pour it into a glass bottle with a secure top and allow it to sit for 8–12 hours before use.

Stock Solution B

1 g	gold chloride
500 ml	distilled water at 70°F

Stir the single gram of gold chloride into 500 ml of distilled water at 70°F and pour the solution into a glass bottle with a top. This is the same percentage used as a supplement to platinum/palladium chemistry. If you buy the 1% gold chloride solution, a simple recipe is to mix 100 ml of it with 400 ml of distilled water to make a 500 ml volume of Stock B.

Note: A good idea for this part of the toner, as well as a simple way to prepare the gold-alkaline toners, is to purchase a prepared 1% gold chloride solution.

An even easier solution is to buy the POP gold–ammonium thiocyanate toner already mixed in two separate bottles from Bostick & Sullivan. In the kit you will find a bottle of A 2 % ammonium thiocyanate and a bottle of B 0.2 % gold chloride.

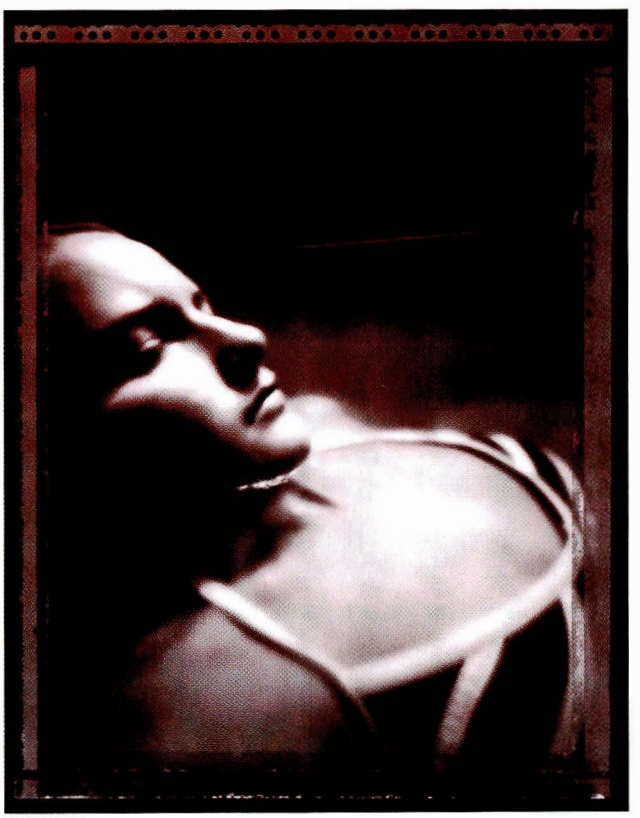


Figure 22–9
Christopher James, *Katie*, Oklahoma, 1999 (POP)
This is a pinhole image of Katie, one of my 1999 workshop students at the amazing Oklahoma Summer Arts Institute. . . quite possibly the best high-school-age arts workshop program on the planet. This POP print was contact printed and subsequently toned in a sequence of toners including platinum, gold, and selenium.
(Courtesy of the Artist/Author)

To Use: Mix A & B together in the following proportions.

50 ml	A (ammonium thiocyanate)
50 ml	B (gold chloride solution)
900 ml	distilled water

Toning will take 2–30 minutes and is entirely subjective. The first prints will tone quickly, and the time will increase for prints after the initial ones, as the gold is consumed in the process. A sepia-orange coloration will show after a minute. Do not be alarmed when it appears that the image is initially being destroyed in the toner. It begins its journey by fading your print. As the toning continues, the image will return and darken.

With agitation, as the toning time increases, the color will begin to cool, the highlights will turn light gray, and the shadows will intensify, often going to a rich and deep red. Color changes will continue to take place, but in general, shorter toning times result in warmer images while longer times provide cooler ones. If it appears that nothing is happening. . . punch up the toner by refreshing it with 50 ml of Part A and 50 ml of Part B. Do not add new distilled water or make up an entirely new batch of toner. When the toning is finished you can quickly rinse the print and head to the fixing tray.

Gold–Alkaline Toners (gray silver-sepia to pink)

There is another option available with gold toning that features the addition of one of several alkaline chemicals, such as borax, to the gold chloride, Part B, of the gold–thiocyanate toner formula. This alkaline formula provides a nice range of subtle color shifts from silver gray to sepia to pink. Again, the Stock B gold chloride for these alkaline toners is prepared by diluting 100 ml of the 1% gold chloride solution with 400 ml of distilled water.

Borax Toning

For sepia tones, add 4–5 g of borax to 900 ml of distilled or tap water. In this situation the water type doesn't matter a great deal. Next, add 30 ml of the Stock B gold chloride stock solution to the borax and water mix and enough water to make a working strength 1000 ml toning solution. You'll notice that the solution is yellow, but in a few minutes that tint should be gone and the formula will be ready to use. The toning time is completely subjective. Figure anywhere from 2 to 15 minutes, and keep in mind that shorter toning times will result in warmer tonalities. Also, a dry print is tonally cooler than a wet print.

Gold–Borax Albumen Toner Option

There is an alternative gold-borax toner that has traditionally been used for albumen and that you might want to experiment with. Dissolve 3 g of borax in 400 ml of distilled water and add 6 ml of a 1% gold chloride solution to the mix. Percentages of prepared gold chloride solution (1%–5% are most common) can be purchased in a prepared state from most chemical suppliers. Toning will take 5–15 minutes, at 70°F, depending on the tone you are seeking. Prepare this toning solution at least an hour before use and try to have it at room temperature. If you find the toning less than active, add, or replenish, with 6–10 ml of the 1% gold chloride solution.

Sodium Bicarbonate

This is another gold and alkali formula. For silvery gray tones, add 1 g of sodium bicarbonate to 900 ml of distilled water or water from the tap. Then add 30 ml of the gold chloride stock solution to the sodium bicarbonate and water mix and enough water to make a working 1000 ml toning solution. Again, toning time is subjective.

Sodium Bicarbonate–Borax Formula Options

The range of coloration in the combination of sodium bicarbonate and borax with the gold chloride stock is as variable as the proportions you elect to use. In general, your prints will take on hues of pink to sepia. To make a working toning solution add 1.5 g of borax and 3 g of sodium bicarbonate to 900 ml of distilled or tap water.

Stir the chemicals into solution and then add 30 ml of the stock gold chloride and enough water to make 1000 ml. Toning time is again subjective. More borax in proportion to the sodium bicarbonate in your formula will result in a toned print that is less pink and more of a silvery gray red. Again, in most cases shorter toning times result in warmer tonalities than do longer toning times. This is due to the gold in the formula.

Replenishment for Gold Toners

Gold is removed from the toning solution every time a print passes through it, as the toner is essentially gold-plating the silver. As a result, it is necessary to replenish the toner with several milliliters of gold chloride after every 8" × 10" print or equivalent. For the gold–ammonium thiocyanate toner add 7–10 ml of both the Part A and Part B solutions to the toning solution. For the gold alkaline toners, add 5–6 ml of the gold chloride stock after every 8" × 10" print or equivalent. If you are doing a lot of toning, such as in a workshop or class situation, it is less tedious to simply replenish the toner as described earlier. . . 50 ml of A and B into the old solution.

Figure 22–10
Christopher James, *Writing in Maine*, 1996 (POP)
This POP image was generated using a pinhole camera with Type 55 Polaroid P/N film. It was subsequently printed on Centennial POP paper. Sadly, both the Type 55 film and the paper are no longer being made. Stay tuned though; the New55 project may herald the new direct positive/negative film, and this book will help you make your own POP papers. *(Courtesy of the Artist/Author)*

Platinum Toner: Traditional Formula

You can create warm sepia-black neutral tones using the Part C from your platinum process chemistry. The formula is made like this.

Part A 7 g sodium chloride combined with 3 g alum in 500 ml distilled or tap water

Part B The 20%, Part C, platinum solution from the platinum process chemistry

Part C The lithium palladium chloride from the Ziatype process

The working solution is variable. You may opt to use Parts A and B only or to make a solution that combines Parts A, B, and C in a single toner. The number of drops

Figure 22–11
Martha Madigan, *Embodied #6*, 1995–96 (POP)
This is a terrific example of Martha's amazing control with POP. This solar photogram print is gold toned on printing-out paper and is 24" × 20" in size. *(Courtesy of the Artist and Jeffrey Fuller Fine Art, Philadelphia)*

of Part B, or Parts B and C with Part A, does determine print color, as will the time the print is left in the toner. Begin testing by adding anywhere from 2 to 10 drops of Part B to 500 ml of Part A. Immerse the print in the toner and time the toning until you like the color of the print.

For the second test, combine the same number of drops of Part B with the same amount of Part C and 500 ml of Part A. Tone your print for the same length of time and compare the results. This evaluation will give you a good platform for finding what works best for your intentions. Keep in mind that it is not a good idea to totally fall in love with your color or splits, as you still have both a fixing stage and a dry down to go through. Both of these last two stages will alter your colors to a degree.

POP Platinum Toner (*neutral black sepia*)

Bostick & Sullivan makes a prepared POP platinum toner using potassium chloroplatinite #3. The kit includes the following.

10 g citric acid
10 ml potassium chloroplatinite #3
1 empty 1000 ml plastic container for storage of the mixed solution

To make a POP platinum toning solution, measure out 10 g of citric acid on a gram scale and dissolve it in 1000 ml of room temperature distilled water. This will result in a 1% solution of citric acid. To this solution, add 7–15 drops of the potassium chloroplatinite #3. The more drops added to the citric acid solution the faster the toning. You may wish to add fewer drops to allow you to have time to adequately inspect your toning progress.

Note: Platinum toner does not have to be discarded after use. If you feel that its effectiveness and speed are not what they used to be, add 5–10 more drops of the potassium chloroplatinite #3.

To use this toner, overexpose your POP print by 15–20% and follow that with a 5-minute wash in distilled water. Then, place the print in a clean tray and immediately pour the platinum toner over its entire surface. Agitate the tray continuously during the toning process. The toner will make itself evident first in the deeper shadow areas of the print and then will work its way through the sequential tonal stages from dark to light. A shorter toning time results in a warmer print, while a longer toning period yields blacks and a cooler image. When you are content with the coloration, rinse the print for 5 minutes and proceed to the fixing stage.

Gold-Platinum POP Split Toner

You can achieve a nice gold-platinum split-toned POP print by partially gold toning the print (a very short toning time in the gold-thiocyanate toner), rinsing the print for 3–5 minutes, and then reimmersing it in the platinum toner until you like what you see. The darker values will be purple sepia in the shadows following the gold toner, while the highlights and lighter mid-tones will tone a cool blue black in the platinum. Always be sure to first tone with the gold because the citric acid in the platinum toner affects the gold toner in a negative way.

Gold-Platinum-Selenium POP Split Toner

This toning variation produces some intense results. My sequence begins with about 10–15 seconds in a fresh gold-ammonium thiocyanate toner. Then, I remove the print before it has a chance to thoroughly change and place it in a rinse for 2 minutes. After that I go directly to the platinum toner for 6–10 minutes. After the platinum toner, I wash the print for 5 minutes and then immerse it in a 30:1 selenium bath at room temperature for about 10 seconds and proceed to the final washing and fixing stages. The print takes on an extremely rich plum-red tonality in the shadows with sepia to neutral black tones in the middle grays. It's very easy to go too far with this toning process, as it gets away from you in a hurry. Selenium is a rather heavy metal, so removing it from the toner and placing it in water doesn't immediately end the toning process. . . take it out before it gets to where you want it to be. As always, when working with selenium, it is prudent to wear gloves or use tongs.

TONING AFTER FIXING

Lawless Gold-Thiourea Toner: After Double-Fix and Washing Cycles

Here is a postfixing toner from Liam Lawless that is notable for being effective, especially with darker tonal separation, as a toner following the fixing and washing stages. Its color is deep purple to purple black. With this gold-thiourea compound toner a dry print will fade upon entering the toning solution and will regain its tonal strength within a minute. After 2 minutes the print will convert to a russet to reddish brown. With extended toning, the coloration will change to purple brown and there will be a noticeable increase in maximum density. After 5 minutes the shadows will become black, but the mid-tones will begin to show signs of pink. The success of the toning is very subjective.

3 g thiourea
1 g vitric acid
0.5 g gold chloride
12 g tri-sodium citrate (optional pH buffer)
Distilled water to make 1000 ml
Add the gold chloride after all of the other ingredients have dissolved.

Wash the print completely following the fixer. With this gold toning formula it is necessary to return to the fix, following the first postfix wash, for a short immersion and then follow that second, and separate, fixer with another 15-minute wash. The reason for this is that toning changes some of the original silver in the

Figure 22–12
Linda Connor, *Monastery Roof,* Spiti, India, 1994
Linda's technique is as distinctive as her images. She uses an admittedly cumbersome 8" × 10" large-format camera, which allows her to achieve a remarkable clarity in her images. She frequently resorts to long exposures that permit the representation of time and movement. Her prints are created via direct contact of the negative on POP printing-out paper. In this process, the negative and paper are fitted carefully together and then the image is exposed through the sunlight in her garden. She then tones her images with gold chloride, which infuses the works with a rich patina reminiscent of the nineteenth-century photographic processes.
(Courtesy of the Artist)

image to silver chloride. You may proceed to the toning sequence or dry the print for toning at a later date.

Note: It is important to remember that cross contamination between toning and fixing baths is common, especially in a group lab and that yellow stains, most noticeable in the highlights, are the most direct sign of this problem.

FIXING THE POP PRINT

15% Sodium Thiosulphate Fixer Formula

150 g	sodium thiosulphate
1000 ml	distilled water
5 g	sodium carbonate (makes the fixer more alkaline—less fading in bath)
2 g	sodium sulphite (protects the print from sulphur damage)

* Make up 2 baths of 15% fixer and split the time between them.

If you elect to fix your print without toning, prior to the fixing stage, you will still notice that the color of the print's image will initially change to brown (which you probably won't be pleased with) but will return to an orange brown as fixing time increases. The reduction in density that you see in the fix will be restored during the dry down of the image after final wash. As mentioned earlier, if you wish to have different coloration then it is necessary to tone prior to the fixing stage.

To make a 15% sodium thiosulphate fixer simply dissolve 150 g of sodium thiosulphate into 1000 ml of distilled water. This fixer includes sodium carbonate to make the solution slightly alkaline. This alkalinity does several things including helping the fixer clear from the print more quickly and reducing the fading that occurs in the fixing stage. Once you are finished with your toning, give the print a quick rinse in clean running water and then move it directly into a fixing tray containing the 15% solution of sodium thiosulphate. Fix your print for 5 minutes in two separate 15% fixing baths.

You are probably wondering why, after a slew of processes with very dilute sodium thiosulphate fixing

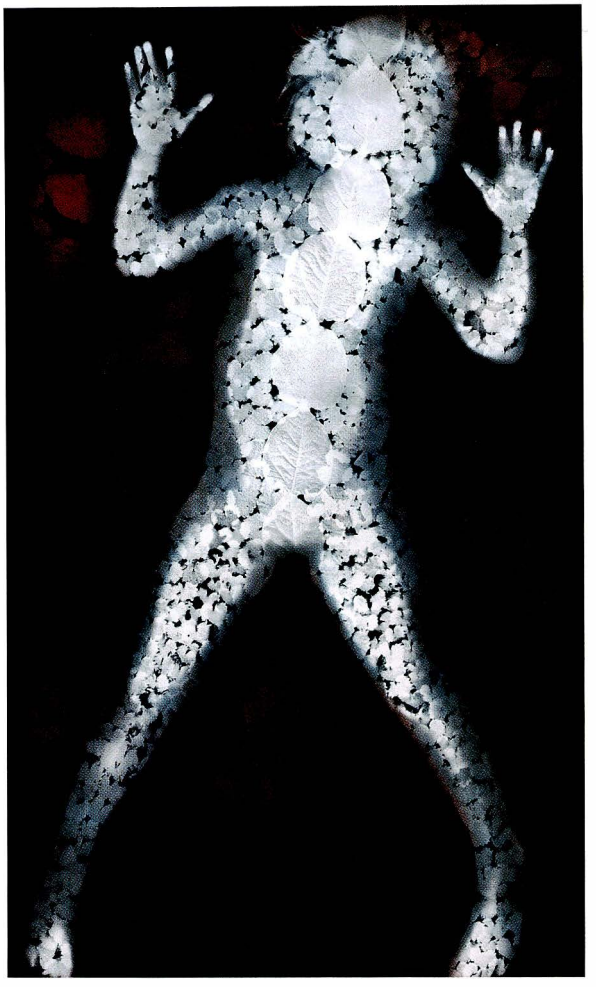


Figure 22–13
Martha Madigan, *Graciela-Growth-III*, (1993–2003)
Philadelphia artist Martha Madigan has been working in alternative processes for more than 30 years, and since 1981 she has focused on the POP process. Many of her images are mural-size works in which she makes complex multiple exposures in sunlight on a single sheet of POP paper.
(Courtesy of the Artist and Jeffrey Fuller Fine Art, Philadelphia)

times of a minute or two, we are now fixing with a 15% dilution for 5 minutes in two fixing baths for a total of 10 minutes. It is due to the fact that silver is embedded in the gelatin rather than in the easily accessible paper fibers. I know of many POP artists who play it safe with double fixing baths, and I recommend this same idea to you. Simply split your fixing time between the two trays. This is important. After 5 prints, a new 15% sodium thiosulphate bath should be made and moved to the Tray 1 position while the original Tray 1 goes to the Tray 2 position.

As an aside, if you wish to protect the gelatin with a hardener during the fixing and washing cycles, just

add 60–70 ml of Kodak Liquid Hardener to the total volume. This addition is not necessary so don't worry about it if you don't have any in the lab or if Kodak isn't making it any longer.

FINAL WASH

After the fixer, wash your prints well in clean, not too hot or cold, running water. If you are not intending to use a hypo-clearing bath then the recommended washing time is 40 minutes. If you do use a hypo-clearing bath, made up of 10 g of sodium sulphite to a 1000 ml of distilled water, you may cut the wash time to 15 minutes. After the prints are fully washed, hang them on a line, back to back, with clothespins at the top and bottom. This will keep them mostly flat until you locate a dry mounting press. You may also elect to lay them on drying screens, but I would avoid doing so in all communal lab situations, as those screens are almost always contaminated with chemistry.

Hand-Applied Emulsions

OVERVIEW & EXPECTATIONS

In the last several years, commercial silver gelatin paper, like silver gelatin film stock and cameras that shoot it, has been in decline due to the simplicity and ease of making and archiving images digitally. With this progress, something really beautiful has been lost, the total "fall in love forever" ritual of working under safelight in a traditional wet darkroom. What I intend in this chapter is to provide some options for you to have that experience and to ensure that you will always be able to have an additional choice in the creating of images using silver gelatin emulsions.

I'll begin by discussing commercially made, hand-applied, liquid emulsions; their idiosyncrasies; and how they can be adapted for use on alternative surfaces such as glass, metal, plastics, paper, wood . . . or any surface that enters your imagination. I'll provide information on how to make your own liquid emulsions and how to apply them to both dry and wet paper stock. Those of you on a budget will greatly appreciate this information, considering the cost per unit of commercially made emulsions.

The essential concept of this chapter is to make you aware of the commercial products presently available and the handmade liquid emulsion workflow as it applies to glass, paper, metal, and alternative substrates. My intention is to encourage you to experiment with the possibilities of applying emulsions and making images on an abundant menu of materials and media. As always, have fun, and welcome the oddities, as they may become your signature style one day.

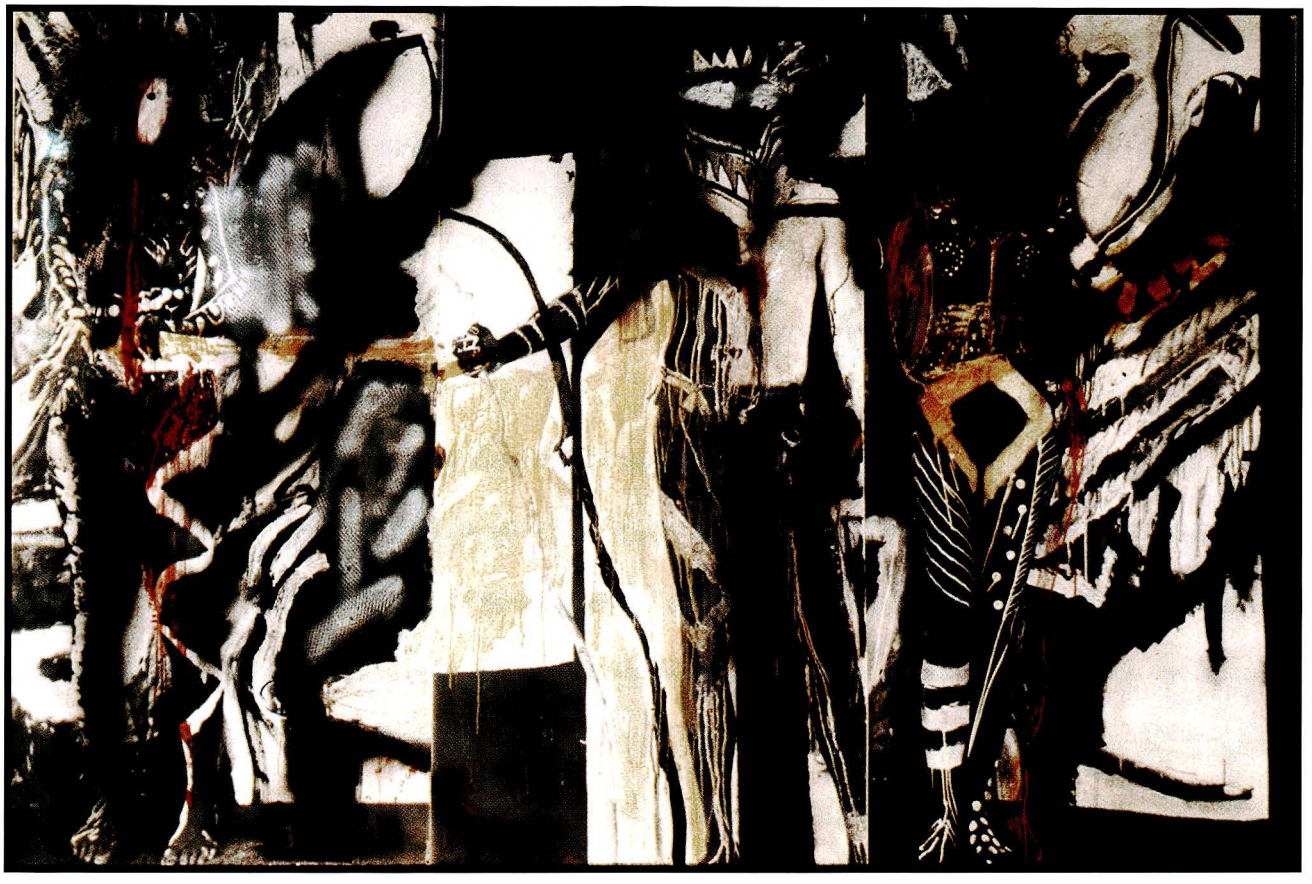


Figure 23–1

Charlene Knowlton, *Triptych,* 1984 (81" × 120" emulsion and oil paint on wood)

I first saw Charlene's work a few decades ago when she was making these huge tribal pieces out of a tiny garage space in Los Angeles … at least that is how my memory recalls it. As part of this memory there was an anecdote I heard that Charlene processed the 4' × 8' plywood panels with a mop and a garden hose. I want this to be true because it's interesting, so I never asked her. This piece is an 81" × 120" triptych on plywood, hand-applied emulsion, and oil painting, and it's been a favorite piece of mine from the first time I saw it 30 years ago.
(Courtesy of the Artist)

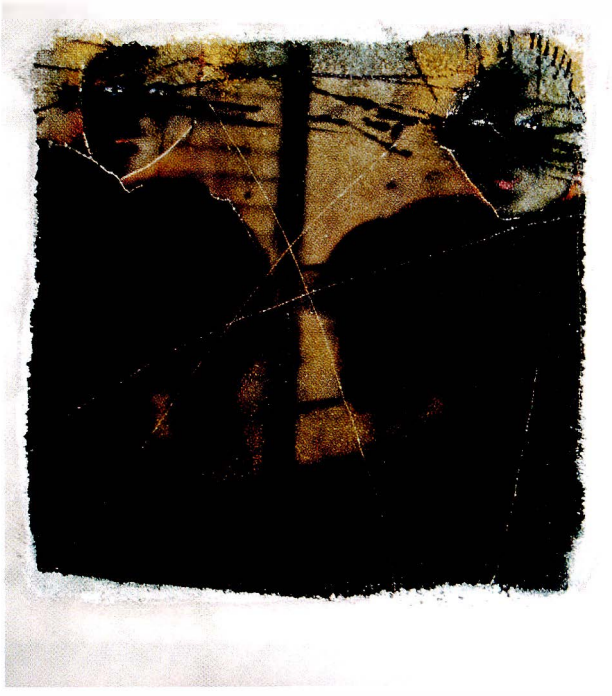


Figure 23–2
Christopher James, *Steel Twins on Acid,* 1996 (emulsion and paint on acid-etched steel)
This is another piece that is part of a larger body of work on steel plates that I do my best to destroy with acids and assorted tools. When satisfied with the substrate, I coat the etched surface with a colloidal emulsion for projection or contact printing. The plate is then subjected to more torture with power sanders, hammers, etching tools, oil paint, carbon, pastels, and toners.
(Courtesy of the Artist/Author)

COMMERCIAL EMULSIONS

Let's begin by focusing on several different commercially made emulsion types, including Rockland's Liquid Light and its superior companion emulsion, AG-Plus; Silverprint's SE-1; Rollei's (once called Cachet and then Maco) Black Magic set of multigrade emulsions and hardener; and Foma Fomaspeed Liquid Emulsion and hardener. The primary value of these commercially available emulsions is to provide photographers and visual artists with a continuous tone, blue-light-sensitive, silver halide emulsion that can be applied easily to almost any surface that will permit adhesion . . . and to encourage photographic integration and experimentation in a vast assortment of media.

Liquid hand-applied emulsions can be used alone or integrated with compatible partners such as drawing, painting, sculpture, printmaking, alternative process techniques, ceramics, artist's books, and transfers. These emulsions can also be applied to materials including plastic, paper, fabric, metal, stone, glass, and assorted basic food groups such as hard-boiled eggs, Twinkies, and toast. Personally, I feel these latter materials are at their respective best when used in combination with other media. Liquid hand-applied emulsions are materials with a sense of humor.

Rollei Black Magic Liquid Emulsion

Rollei's Black Magic Liquid Emulsion, and its related products' photographic catalogue, is made in Germany and comes in several tonal varieties of normal, hard, and variable contrasts. Among its best features are the following:

- High speed and high silver content, thus delivering short exposure times; works well with large format and has exceptionally high D-max
- A complete modular system with interchangeable components
- Three different emulsions: two graded and one variable-contrast emulsion
- RBM25 high edge sharpness and a cold image tone due to its silver bromide halides
- RBM33 variable contrast control and a neutral image tone due to its chlorobromide silver halides
- Long shelf life and excellent archival qualities due to adding a minimum quantity of a powerful fungicide and bactericide (phenol) for long-term conservation
- Black Magic additive RBM52 hardener that is free of formaldehyde and chromium potassium sulphate in its updated formula configuration
- RBM41 gelatin for surface preparation on nonporous substrates

Of all the commercially made emulsions, this is the one I personally use on metal surfaces and highly recommend for work on alternative materials . . . as long as the surface preparation has been well considered and executed. One of the primary reasons for my

enthusiasm, other than the emulsion's consistent quality, is the RBM52 Black Magic Liquid Hardener that when added to the developer eliminates the soft emulsion damage that generally occurs during normal processing with hand-applied emulsions.

Rollei also sells a gelatin base sub-coating, RBM41, for problem surfaces such as glass, metal, and absorbent materials. Black Magic Photo Gelatin comes in 250 ml bottles and is used in conjunction with Black Magic Liquid Hardener, a formaldehyde-free hardening agent that assists the emulsion in adhering to difficult surfaces. A sub-coating that is made for the emulsion is a bonus and should be explored if your work generally calls for a primer. These products offer high light sensitivity due to the silver content and are best with absorbent materials such as fabric, papers, or wood. If you want to prevent the emulsion from soaking into the base, a pre-coat with RBM41, pure photo gelatin, is advised. This is also called baryta solution, but without barium sulphate. For smooth and/or hard surfaces such as polished stone, glass, or metal, I recommend a pre-coat with RBM52 hardener in combination with RBM41 gelatin solution to improve adhesion.

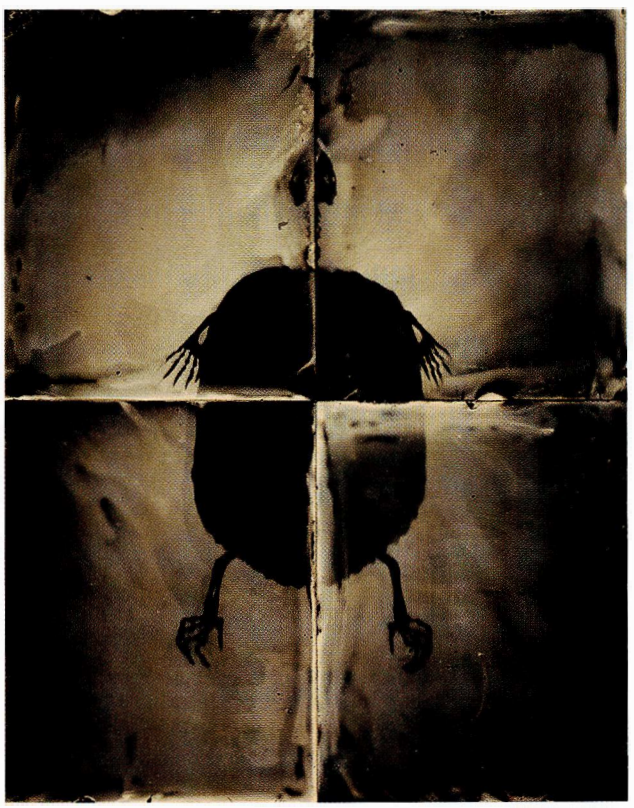


Figure 23–3
Jayne Hinds Bidaut (1999–2007), *Chrysemys Scripta Elegans—Turtle Skeleton*, 1999 (tintype)
The power of organic simplicity is how I describe Bidaut's work to those who are unfamiliar with it. There is a grace to these small and precious tributes on metal.
(Courtesy of the Artist)

Black Magic RBM52 Liquid Hardener: A Solution for Fragile Emulsions

Adding Black Magic RBM52 Liquid Hardener to the paper developer has proven to be a simple solution to the problem of a soft hand-applied emulsion breaking up or sliding off of the substrate it's printed on during the development and washing cycles. To use the hardener within the emulsion itself there are two steps to follow. The first is to make a stock hardening solution by mixing the hardener with distilled water in a 1:20 dilution. The second step is to then add the 1:20 hardening stock to the liquid emulsion using a ratio of 1:20. Make only the amount of emulsion with hardener that you intend to use immediately.

The hardener has an acidic pH of 3 and consists of 15%–20% of a glutaraldehyde sodium bisulphite compound, 1%–2% of 5-nitrobenzimidazole nitrate, and 12% acetic acid. The manufacturer recommends that the working hardener and developer solution is made by mixing the hardener to the developer in a 1:20 ratio, but I have found that an easier way to work with it is to simply add 2 capfuls of the hardener to a liter of Dektol developer mixed at 2:1. The hardener also works well with other liquid emulsion brands.

One additional benefit is that the addition of the hardener to the developer appears to increase the contrast of the image. Two other options with Black Magic Hardener are adding the hardener to the liquid emulsion itself or adding it, as mentioned earlier, to the RBM41 Black Magic Gelatin used for preparing non-porous metallic or glass substrates. Please refer to Black Magic's published literature regarding the creation of a baryta solution to improve adhesion. Here's the tech data in a nutshell.

How to Make a Baryta Solution

This may be carried out under normal lighting conditions. Warm up 1000 ml of tap water until it reaches approximately 180°F. Then completely dissolve 40 g of

RBM41 gelatin by continuous stirring until its consistency is smooth. To reduce surface tension you may add a few drops of wetting agent, like Tween 20, to your solution, which makes it easier to evenly coat hard materials. Coat your material directly afterward. To improve hardening and adhesion to the emulsion add 20–50 ml of RBM52 Black Magic hardener/gelatin additive to your solution. You may coat under normal lighting conditions as there is nothing light sensitive in this mix.

Silverprint SE-1 Liquid Emulsion

The SE-1 emulsion gets a strong recommendation from those who use it, as it has the sensitivity of a "normal" grade 2 silver gelatin paper, can be easily diluted for different substrates, has compatibility with a "subbing" solution available for non-porous/microporous surfaces such as glass, reacts well to toners, and has a warm black tonality. SE-1 also seems to be less prone to the fogging characteristics that are common in similar liquid emulsion formulas. For these reasons, Silverprint SE-1 emulsion has recently become a student favorite. Be sure to look at the Black Magic Liquid Hardener information given earlier for recommendations about using it with Silverprint SE-1. Adding the hardener to your print developer greatly assists in keeping the fragile emulsion on your paper from being compromised during the production process.

Rockland's Liquid Light & Ag-Plus Emulsions

Liquid Light has become a generic term, like Kleenex, and is often used to describe any hand-applied commercial emulsion. Additionally, this is the product most often experienced first by students and artists when working with this type of material simply because Liquid Light is what they ask for when shopping or researching. It is a simple black-and-white emulsion that is easy to use, quirky enough to teach you a lot about the foibles of liquid emulsions, and adequate for most intentions. Liquid Light, like other hand-applied emulsions, has a tendency to fog whenever safelight illumination is too close to the product or when freshly coated surfaces are exposed to it for too long a time. It often exhibits inconsistent behavior, although this might simply be due to the diverse working styles of individuals, the chemical alterations of the product itself over the years, and fewer people with traditional wet lab experience. I've been using it for over three decades, and the product's idiosyncrasies have taught me a great deal about dealing with the eccentricities of hand-applied emulsions. Due to its average quality, it is often the reason photographic artists decide to take the technical plunge into wet plate collodion.

Figure 23–4
Gary Emrich, *As in Titian Profane & Sacred*, 2004
Gary builds his images in the computer, puts them on videotape, and re-photographs them off of a 1955 Zenith TV. The TV lets him control contrast and brightness, which is often a problem with these emulsions. He ages his emulsions for years and believes that the best emulsions are like wine and cheese . . . left to ripen they will get better. Slate tiles, paint, brushes, and flagstone have many layers of alkyd white paint underneath. There is a lot of oil retouching after the materials are dry, and glass is the most stable of his substrates. Gary's artwork relies heavily on process, releasing him from traditional photographic perspective, scale, texture, materials, expectations, and preconceptions.
(Courtesy of the Artist)

Ag-Plus is Rockland's premium silver-gelatin emulsion, with higher sensitivity due to the fact that it has a greater content of silver in the formula when compared to Liquid Light . . . thus the name AG, the table of elements symbol for silver. It seems to work much better on non-porous surfaces, which is a major convenience if the emulsion is used in camera on metal or glass plates. Ag-Plus is also best to use when oversize prints are made at a considerable distance from an enlarger because it has a faster speed. Like Liquid Light, Ag-Plus emulsion is completely free of phenol fumes and is safe to use in any darkroom.

Foma Fomaspeed Liquid Emulsion & Hardener

Foma Fomaspeed Liquid Emulsion and Hardener is a commercial emulsion for use under red safelight in traditional wet darkroom conditions. The emulsion features medium contrast and high covering power, which allows you to achieve a broad range of halftones. For most common applications, especially on smooth surfaces, one layer of emulsion is sufficient for an application. One main advantage of this high-speed emulsion is its short exposure time, which enables large-size mural projection enlarging. With most developers, this emulsion produces a neutral to mildly warm image tone.

Fomaspeed emulsion may be spread on many different bases, including wood, textile, glass, china, ceramics, metals, leather, stone, concrete, and plaster. The photochemical inactivity of the base is important. If the required conditions cannot be met, the base substrate should be prepared with a water-resistant layer such as an epoxide resin varnish or a matte black or colored metallic weather-proofing paint.

Foma Hard Hardener is supplied with the emulsion. The hardener ensures good mechanical resistance of the layer spread and is recommended for all applications. The correct proportions are those supplied (15 ml with 1.0 kg of emulsion). Suitable hardeners can also be used (e.g., formaldehyde [1.0–5.0 ml of 10% solution per 1.0 kg of emulsion] or in combination with the same volume of chrome alum solution [10%]).

THE LIGHT FARM LOW TECH EMULSION #1

The Light Farm Low Tech Emulsion #1: Hershey's Tornado Emulsion

The following is a low-tech liquid emulsion that was generously given to me by the wonderful Denise Ross of the Light Farm. Her email address is editor@thelightfarm.com. Denise's web site is primarily dedicated to liquid emulsion and all of its variations. You can go see everything her site has to offer at http://www.thelightfarm.com.

Supplies & Chemistry Needed

- Hard bloom photographic-grade gelatin
- Silver nitrate
- Sodium chloride
- Potassium chloride
- Citric acid
- Ammonium bromide
- Potassium iodide

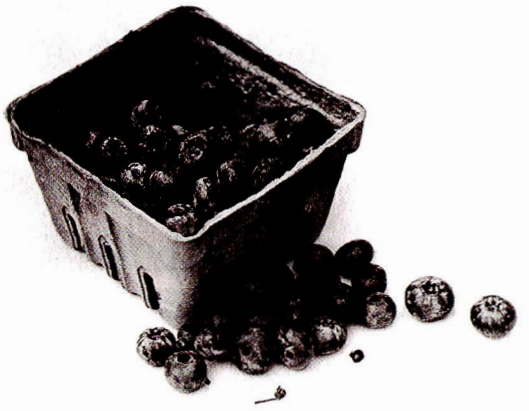


Figure 23–5
Denise Ross, *Blueberries*, 2013 (glass dry plate negative on handmade AgGel paper)
Probably the best complete resource for liquid emulsions is organized and nurtured by the charming and generous Denise Ross at her site, The Light Farm. Denise's web site is primarily dedicated to liquid emulsion and all of its variations. You can go see everything it has to offer at http://www.thelightfarm.com. Her email address is editor@thelightfarm.com. *(Courtesy of the Artist, Denise Ross)*

- Photoflo 600 (or Daniel Smith Acrylic Flow Reducer cut 2:1 with distilled water)
- Glyoxal (40% from Bostick & Sullivan)
- Everclear or similar (keep some in a small atomizer bottle for spritzing)
- Distilled water (keep some in the refrigerator)
- Scale accurate to at least 0.1 g and calibration weights
- 2 oz amber glass dropper bottles (3)
- Digital thermometers (2)
- Strainers: stainless steel tea and gold mesh coffee (2)
- Lightproof, waterproof canisters (2)
- Plastic spoons and forks
- Plastic condiment cups
- Plastic canning (wide mouth) funnel
- Small "rubber" (plastic or silicon) scraper
- 10 ml and 100 ml graduated cylinders are very handy, as are measuring cups or syringes marked in mls.
- Protective gloves and eyewear
- Old clothes or a mad scientist coat
- Hershey's Chocolate Milk Tornado Mixer ($49.00 on Amazon)
- Small plastic funnel and an electric drill with a bit to match the funnel neck size
- Monoject 412 curved-tip syringes
- Crockpot
- Buffet warming tray, or similar, referred to as "hot plate" in the recipe
- Tall French working glasses (21 oz. Luminarc) (2)
- Canning jars, 0.5-pint size, with lid rings (6)
- Several baby food jars
- Safelight (red or amber)

This liquid emulsion recipe, one that you can make at home in your lab, features a Hershey's Chocolate Milk Tornado Mixer, but you can improvise if that item is not readily available. Here's the recipe.

GEL A: 13 g gelatin/75 ml water

- Bloom (swell in water) for 1 hour, starting with cold distilled water.
- Melt to 110°F in a water bath kept at that constant temperature.

GEL B: 13 g gelatin/75 ml water (or 65 g if coating wet paper)

- Bloom gelatin for 1 hour starting with cold distilled water.

Note: As you assemble your equipment, do a dry run of measurements—table salt or sugar, tap water, and Knox gelatin are cheap test substitutes—to make sure the amounts required fit in your containers at each step.

Setup for Making the Emulsion

- Crockpot water bath at 125°F (Tip: Keep both crushed ice and very hot water close at hand to keep the temperature regulated.)
- Assembled Tornado Mixer (with small funnel firmly seated in a hole in the lid halfway between the edge and the center)
- Monoject 412 syringe(s). Pre-fill two of them.
- Baby food jars
- Plastic condiment cups to weigh out and hold dry chemicals
- Plastic spoons and forks . . . wash and rinse everything, even the plastic items straight out of the packaging
- Two 8 oz canning jars, plastic wrap, and jar lid bands
- Very hot water in a quart-size glass Pyrex measuring cup
- Atomizer bottle of Everclear alcohol (a lens cleaner bottle, washed with detergent and rinsed once with Everclear before filling) used for spritzing
- Lightproof canisters and heavy black plastic (if needed) for storing the emulsion in the refrigerator between stages

Pre-Weighed and Measured Chemicals

3.9 g sodium chloride in 12 ml distilled water
5.6 g silver nitrate in 20 ml of distilled water
0.5 g citric acid in 10 ml of distilled water
0.5 g potassium chloride
1.0 g citric acid, dry
0.7 g ammonium bromide

Chemical Preparation

- Dissolve the sodium chloride in 12 ml distilled water at room temperature.
- Dissolve the silver nitrate in 20 ml of distilled water at 104°F.
- Dissolve the citric acid in 10 ml of distilled water at 104°F.

Step 1 Pour the hot water into the assembled Hershey's Tornado Mixer and let it preheat a minute. Pour the water back into the original container.

Step 2 Strain melted Gel A through a tea strainer into the Tornado.

Step 3 Add in this order, with a whiz of the Tornado after each addition, the following: 0.7 g ammonium bromide, 1.0 g dry citric acid, sodium chloride solution, and potassium chloride.

Step 4 Combine the warm citric acid solution and the silver nitrate solution. Suck up about 10 ml into a syringe. Hold the rest at 104°F.

Step 5 **GO TO SAFELIGHT.**

Step 6 Touch the tip of the syringe to a clean paper towel and carefully shove the tip into the neck of the funnel in the lid of the Tornado . . . being careful to not depress the plunger.

Step 7 With one hand on the Tornado button and one hand on the syringe plunger, empty the syringe into the whirring emulsion. Start the Tornado just before emptying the syringe, and aim for about a 1-ml-per-second emptying rate. This is termed the "precipitation" or "emulsification" step.

Step 8 As quickly as possible, repeat the process by either refilling the first syringe or using a prefilled second syringe. There will probably be a little silver solution still left. If so, repeat a third time with whatever is left. It is important to use every drop of solution.

Step 9 Continue whirring with the Hershey's Tornado in short bursts for another minute.

Step 10 Pour the emulsion into the water bath container, making sure to get as much as possible with a scraper. Pour the pre-heated water back into the empty Tornado, replace the lid, and whirl a couple of seconds. Tip: If you skip this step, it will be very hard to clean the Tornado.

Step 11 Check the water bath temperature to make sure it's still at 125°F. Adjust the temperature with hot water or ice if necessary.

Step 12 Spritz the surface of the emulsion with 190-proof Everclear alcohol and gently stir the emulsion for 3 minutes with a plastic spoon. Check the water bath temperature to make sure it's still at 125°F.

Step 13 Fluff the bloomed Gel B with the tines of a plastic fork. Switch to a plastic spoon, and over the next 2 minutes incorporate Gel B into the emulsion. When it has all been added, stir an additional minute for 3 minutes total.

Note: Total times, in the heat and out, are emulsion variables. They are not hard and fast rules, but do take notes if your procedure varies so that you can calibrate cause and effect between makes.

Step 14 Divide the emulsion between two canning jars. Pour this through a stainless steel tea strainer. The tornado makes a frothy mix. You may need to press the emulsion through the strainer with a scraper. Try to divide the emulsion evenly. Place a double layer of plastic wrap over the top of each jar and secure with the lid ring. You don't want to use the metal lids that come with the jar. They will react unfavorably with the emulsion.

Step 15 Immediately refrigerate in lightproof canisters pre-chilled with a half inch of cold water. Every household goods store I've been in sells a version of a stainless canister with a snap-down plastic lid. Place several layers of cut up black plastic trash bags between the canister and the lid.

Adding Finals Before Coating

- Preheat crockpot water bath to 125°F.
- Preheat a water bath on the hot plate to 110°F.

Have ready:

- Dropper bottle of 1% potassium iodide (To make, mix 1 g potassium iodide with 100 g hot water)
- Dropper bottle of Photoflo
- Dropper bottle of glyoxal
- Coating tools and surfaces
- Precut paper and small pieces of adhesive tape (I tear off about 36 1-inch pieces and line them up on the clothesline over my sink.)
- Small jar of Everclear alcohol
- Strainers (tea and gold mesh coffee filters) and plastic canning funnel
- Hot distilled water
- Wash buckets (one with hot soapy water, one with hot clean water)
- A second cafe glass (or quart canning jar) sitting in a quart-size glass measuring cup or dish, with room temperature water as high as possible without making the cafe glass unstable

GO TO SAFELIGHT

Step 16 Melt one jar (1/2 batch) of emulsion. Remove the jar from the lightproof container and place it in a 104°F water bath. Have the water level at about the height of the top of the emulsion. Stick a thermometer through the plastic wrap into the emulsion. When the temperature of the emulsion hits about 100°F, remove the plastic wrap and gently stir with a clean plastic spoon until the emulsion is 107°F.

Step 17 Strain the melted emulsion through a stainless steel tea strainer into the cafe glass in the crockpot. Keep the water bath temperature at 123°F. While constantly stirring with a plastic spoon, add 15 drops of 1% potassium iodide solution at about a drop per second, and stir 1 minute. In the same manner, add 12 drops of Photoflo 600 and stir 1 minute. Add 15 drops of glyoxal, and then spritz the surface of the emulsion with Everclear alcohol. Remove the glass from the water bath and wipe the outside dry. Pour this solution into the second cafe glass filtered through a stack of two or three gold mesh coffee filters (the type that Mr. Coffee products use). Spritz with Everclear 190-proof alcohol. Set the second cafe glass with the filtered emulsion into a pot of hot water.

Step 18 Begin coating, making sure that your emulsion remains warm and liquid. A little experience with your workflow will quickly help you determine your temperature parameters.

The First Coating Pass Will Tell You Two Things

1. Is the emulsion cool enough? If the coating is too warm it will go on too thin and you'll be able to see the dull paper through the shiny emulsion. Just wait a couple of minutes, give the emulsion a gentle stir with a clean plastic spoon, and try again. Mark this first sheet because it's not wasted. It can be cut into test strips when you start printing.
2. Is the surfactant right? If you see air bubbles or spots (repellency indicators) add another drop of Photoflo 600 and gently stir.

Final Emulsion Tips

- Tiny bubbles, often in a cluster, indicate that you probably added air during the emulsion take-up. Have an atomizer bottle of Everclear close at hand and immediately spritz the bubble patch from about 4 inches away. The bubbles should disappear. If they remain, don't try again. After the emulsion starts to set, Everclear can leave its own marks on the surface. Make note of the location of the defect and avoid printing on that area.
- Keep a black permanent marker close at hand. Right after coating, the surface of the emulsion is shiny and any and all defects are plainly visible. It is a simple matter to make a mark along the uncoated edge of the paper to guide your printing.
- After the paper is dry and you start to stack the sheets for storage in a paper safe (or light-proof bag), triage the sheets. Start with the "ugly" ones on top. These will be your test strips, and you'll soon value them. They eliminate the stress of cutting up perfect sheets for testing.

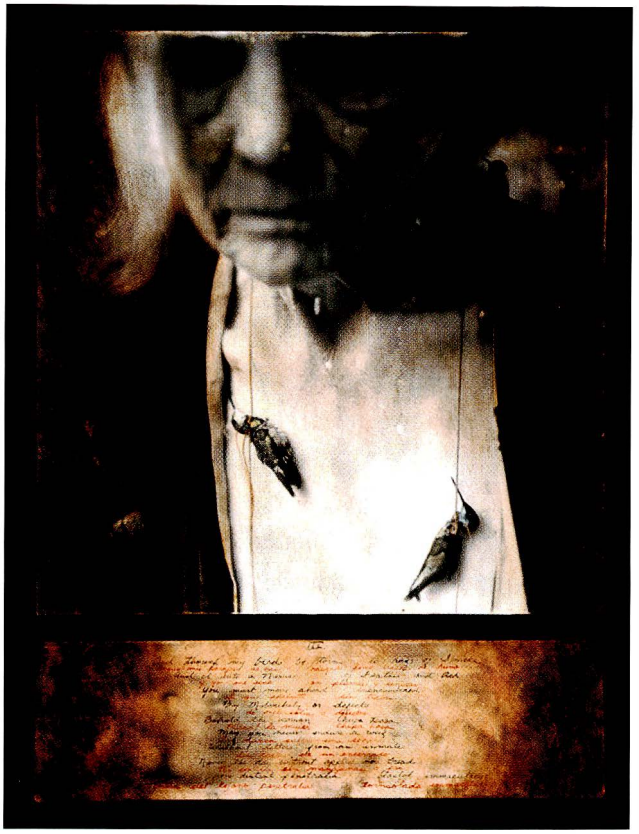


Figure 23–6
Deborah Luster, *Rosesucker Retablos III*, 1997
This liquid emulsion on aluminum with oil paint is a wonderful example of the organic richness found in Deborah's work. The piece was created with Silverprint liquid emulsion on aluminum panels and hand painted with oils. The image is from Deborah's *Rosesucker Retablos* portfolio, which was initially published in *Conjunctions: 32* accompanying the poetry of C.D. Wright with translations by Gabriel Bernal Granados. *(Courtesy of the Artist)*

- One defect that doesn't show up until printing is "slugs." If you see them, you'll recognize them. Good straining and filtering all but eliminates this problem.

THE WORKING PROCESS

Paper Preparation

One of the common complaints heard when discussing commercial liquid emulsions is the inconsistent nature of the product. Granted, most of these problems are easily dealt with simply by paying close attention to the manufacturer's printed documentation and to surface preparation. One of the easiest solutions to fuzzy images is to seal the pores in your paper with a gelatin bichromate-hardening step that will provide a flat and sealed surface for the emulsion to lie upon rather than the paper itself. This action results in a less porous and slightly glossier surface, leading to more resolved blacks and less streaking in the coating, and it helps in keeping the emulsion on the paper during the processing stages.

One example of this surface preparation is to prepare a porous surface substrate, like paper, with a traditional gum bichromate gelatin-glyoxal sizing, without using pigment in the formula. This means mixing a solution of 1:1 gum arabic and saturated potassium dichromate or ammonium dichromate (your "light trigger") and applying it where you intend to place your image. All you need to do at this point is expose the coating to UV light for 10 minutes and water process the paper for 20 minutes. Follow this water wash with a second exposure to UV light for 5–10 minutes. The paper can be flattened in a dry mount press following the drying stage. The surface will have a light tan color, and this color will take the place of white in your liquid emulsion image unless you decide to clear it in a 1% potassium metabisulphite bath to clear it a bit more to white paper color. Now you have a gelatin-hardened surface, like an albumen coating, that can be used as a substrate for liquid emulsions.

Working Under Safelight

It is important to remember that all commercial liquid emulsions are susceptible to fogging both while you are working with the emulsions and while you are preparing to make images. It's easy to forget that in traditional darkroom printing (likely to become an alternative process in the near future) you are simply opening your box of paper, placing a sheet of paper in a printing easel, exposing it for a short burst of seconds, and moving directly to the processing chemistry. It's different with hand-applied emulsions in that you are going to be applying your light-sensitive emulsions to a substrate, which takes time and patience, drying it, generally aging it for 24–48 hours if you want decent contrast in your image, and then going to the final exposure and processing stages. Knowing this, and being aware of the possible fogging dangers from staying too long under safelight conditions, it is important to reduce the time or intensity of the safelight illumination in your darkroom.

Figure 23–7
Mari Gardner, *Ostrich Egg*, 1999
Mari Gardner created this ostrich egg with liquid emulsion image, in sculptural motif, piece while a student of mine in Boston. Like most all of Mari's work since, it is conceptualized with the intention of showing both life and death in an organic and evolving state. Mari's work once used Plexiglas-encased deceased life forms (her skunk, logs, and mud sculpture made her a living legend at the Art Institute of Boston), as well as living vegetation such as the moss growing on top of her sculpture. *(Courtesy of the Artist)*

Move yourself, the working area, or the lights, to a location that you would call light safe. I recommend coating some paper with your emulsion and performing a series of timed exposures to only the safelight and then processing the pieces of paper to see when it begins to show signs of grey fogging. The easiest way to do this test is to coat an entire sheet of paper, dry it, place it where you will be doing most of your darkroom work, and lay quarters on the paper in a grid, with each quarter representing a specific time interval. Begin your test and remove one quarter at a time from the paper, being sure to write on the paper the exposure time from when the opaque quarter was removed. After all the quarters are accounted for, process the paper and then look for the first sign of grey fogging in the quarter's circles. Now you will now know how much time you have to work safely under safelight in your workspace with the emulsion you are using. You may try putting your safelight on a dimmer switch (not all will be compatible with this solution). A simple way to lower the intensity of the safelight in a small space is to place a yellow towel over the safelight glass.

Basic Workflow

Begin the printmaking sequence by placing the sealed bottle of liquid emulsion into a large beaker of very hot water and wait for the emulsion to become warm and fluid. The emulsion will gel and get too thick to flow evenly as it cools, and it's essential that the solution stays warm for an even application of the emulsion. This warming step should take about 10–20 minutes, and it is where you will keep your sealed bottle of emulsion between coatings.

If you intend to expose immediately after your coating is dry, begin to set up your chemistry in the darkroom sink. This setup is identical to paper chemistry in a traditional wet lab, but it is usually a good idea to omit the stop bath and go directly to the fixer. Some workers employ a water bath in the stop bath's place to act as an intermediate step between the developer and the fixer and to make the fixer last a bit longer.

To your developer, add 2 capfuls of the *hardener* supplied with your emulsion. This will help keep your soft emulsion from being scarred during processing. Use a non-rapid fix. Rapid fixers can occasionally have a less than positive effect on the emulsion. Instead, use a regular sodium thiosulphate fixer like Kodak's Kodafix or prepare your own by making a weak solution as you have done with several of the processes in this book. An example would be a relatively weak 15% sodium thiosulphate made by dissolving 150 g of sodium thiosulphate in 1000 ml of distilled water. Add 2 g of sodium carbonate to this fixer solution to increase the bath's alkalinity. Make up two separate trays and split the total fixing time of 10 minutes between them.

If you are working with paper, lay it down on a clean and dry surface, such as a sheet of ¼" to 3/8" white or black Lucite that is larger than your paper, and tape the corners with blue painter's tape to keep the paper flat. Surfaces that are not normally flat, like eggs, rocks, or cupcakes, will have to be positioned with stability to allow you to apply the emulsion.

One of my techniques for keeping a substrate warm, be it paper, metal, or a similarly conductive material, is to lay my Lucite sheet, with the paper substrate attached, down on a tray filled with very hot water. The tray is, of course, smaller than the Lucite, so it sits on the edges of the tray suspended over the steaming hot water. This warms the Lucite, and subsequently, the paper, glass, or metal, keeping the warmed emulsion that is about to be applied warm for a longer period of time before it cools and sets up.

When you are all set up, pour a small quantity of the warmed emulsion on the paper's surface. On paper, a brush or a Puddle Pusher is ideal. For brush application I like using a 2"–4" synthetic Richeson or a soft watercolor fan brush. In both of these cases it is imperative to rinse your brushes in hot water so that the emulsion doesn't set up in the hairs of the brush. Foam brushes are easy to get, inexpensive, and easy to throw away after a single application. However, I'm not a fan of how much emulsion they absorb, or the texture they leave if you take too long to coat. In a pinch, you can also use your fingers. This works surprisingly well as long as the emulsion and the substrate stay warm.

For a rod or Puddle Pusher application your set up is the same except you are going to lay your emulsion down in a single, or double, pass with the rod. Your technique will be the same as with other processes that incorporate the glass rod or Puddle Pusher, except that you will be dealing with a thicker solution. The trick is to elevate the Puddle Pusher bar by wrapping some frictionless tape, like aluminum slide masking tape, a few times around the tube's ends. Unlike when you use this application tool to apply a liquid sensitizer such as a platinum palladium drop-count, you are not trying to drive the solution into the paper's fibers. In this instance, you are first pouring a small amount of emulsion along the edge of the Puddle Pusher and then, moving the rod back and forth in the solution to get an even amount along the width of your coating rod and print area, pulling the Puddle Pusher down the length of the paper, leaving behind a slightly elevated and even coating of rapidly cooling emulsion.

After your substrate is prepared and dry, you're going to work in a similar manner to any established wet lab workflow with the exception of your exposure times, which will in most cases range from 15 seconds to several minutes, depending upon the product you're using. If you project the negative in a slide mount from a slide projector, the exposure will be as short as a few seconds. This will, of course, depend on the distance between the projector and the coated paper and the type of liquid emulsion you are using. For instance, AG-Plus will be faster than Liquid Light. The slide projector is the best way to expose large mural pieces in a short time, and a wonderful example of this is seen in the work of Charlene Knowlton's 1984 Triptych in which she coated 4' × 8' sheets of plywood and then followed the processing up with applications of paint . . . a perfect integration of two mediums.

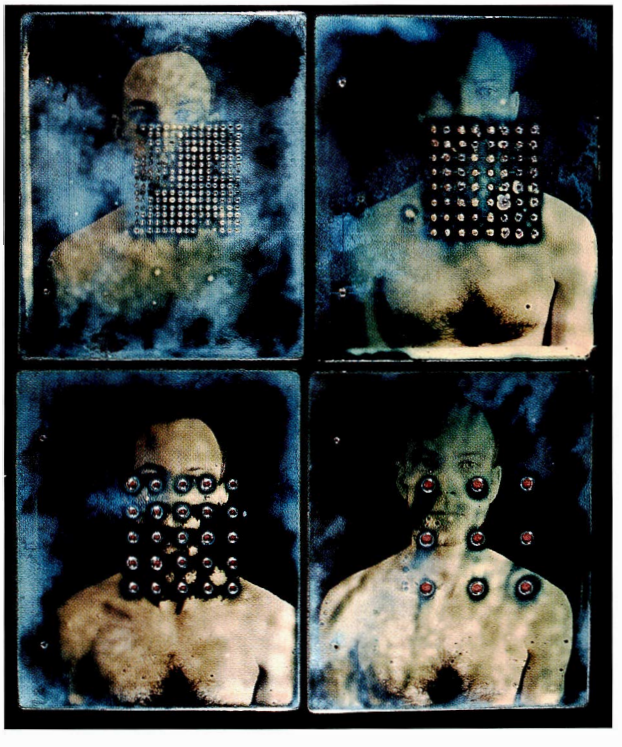


Figure 23–8
Scott McMahon, *Emulation of Self*, 2004
Scott's *Emulation of Self* tintype was printed on four separate black-enameled copper plates, each plate measuring around 6" × 5". For this work, Scott used a Luminos emulsion, but that product is no longer made. A suitable alternative would be Silverprint or Rollie's Maco's Black Magic Liquid Emulsion with hardener.
(Courtesy of the Artist)

After fixing and washing your image, consider toning and split toning it. Most toners have an effect, and they are a bit different than what you might be used to with paper. With that in mind, try selectively painting the toners on the image. Stay loose and enjoy learning from the failures and occasional successes. The failures, meaning they were not what you were expecting, are potentially great substrates for applications of other materials and additional emulsion coatings.

EMULSION ON GLASS, CERAMIC, & NON-POROUS SUBSTRATES

One of the great pleasures of working with liquid emulsions is seeing how many different surfaces you can get an image to print on. Of course, each surface or substrate will present a new challenge to you, but that's what makes this particular category in the sphere of alt pro so much fun. There is a good deal of information in this book providing detailed information on surface preparation, so I'll just touch on a few of the points now and if the ideas interest you, then you can investigate the prep and application techniques further in the chapters dealing with Cyanotype Variations, Wet Plate Collodion, POP, Paper, Gum Bichromate, Alternative Negative, and Dichromate Options.

If you intend to use a liquid emulsion on glass, metal, or a similar non-porous substrate, you need to take a different approach to your surface preparation than when you are working on paper or something like wood or eggshells. There is a simple solution to working on metal, so we'll deal with glass first and get to metal shortly. The glass substrate is prepared by thoroughly cleaning what you intend to print on, whether you are making a negative or a faux ambrotype . . . essentially a tintype on glass that is backed with a blackened coating or fabric to present itself as a positive image. (Please see the Wet Collodion chapter for a lot more information on this topic.)

Start with a piece of clear or dark glass cut to size so that it either fits your plate holder or your projection requirements. Once your glass is cut to size, file the edges with a handheld sharpening stone, a plumber's pre-soldering abrasion tape, or a medium mill file to prevent any inadvertent cutting of your fingers on the sharp edges. Put on a pair of gardening gloves before you begin. To take the sharpness away, place the file at a 45° angle on the edge of the glass and draw the file away from you several times. Repeat this step on all eight of the sharp edges.

The glass must be totally free of any solvent, grease, and debris or the emulsion will not adhere to the glass effectively and will likely slide off during processing. A traditional glass cleaner is *rottenstone,* a fine, grit-like material that can be purchased at stores, or web sites, that sell furniture-finishing supplies. It is an ultra-fine gray powder, and mixing it with equal parts of powder, water, and alcohol produces a good glass-cleaning solution. You can also make up a bottle of calcium carbonate, or "whiting," to accomplish the same purpose. Personally, I prefer the whiting to the rottenstone. Here's the formula . . ..

Whiting Formula for Glass Cleaning

This is a very good calcium carbonate/whiting formula for cleaning glass. Mix it and store it in a small bottle like the culinary arts drizzle bottles that sous chefs use to make their sauces look exotic on your plate.

80 g	of whiting
100 ml	of water
20 ml	grain alcohol

Place your sheet of glass in a glass-cleaning vise or on a piece of rubberized shelf liner, or just hold it firmly in your hand while wearing a gardening glove. Apply the whiting solution to the glass liberally, and with one piece of cloth or cotton pad, vigorously cover the entire plate and wipe rapidly in a swirling motion until you hear a squeaking sound. Take a fresh piece of cloth or cotton pad and continue to buff the surface, removing any and all whiting residue and lint from the glass. To verify if your plate is cleaned properly, breathe on the glass and check to see if there are streaks showing in the breath mist condensation. If there are, continue cleaning. A 4" × 5" sheet shouldn't take more than a minute or two.

Last Step with Bon Ami

Once your glass plates have been cleaned, you may want to make them ultra-perfect. The best way to accomplish this is to put your cleaned plates in a dishwasher and

add some Bon Ami to the detergent holder instead of dishwasher detergent. Run a short cycle and you'll be in perfect shape to apply an emulsion without too many problems. If, by chance, you still are having issues with your emulsion adhering to the glass, try taking the albumen white of an egg, stir it into froth, and apply it with a cotton swab to the edges, and slightly over the top of your glass plate. It will dry quite rapidly and will give your emulsion something to hook on to so that it will stay on the plate without running off.

Glass Pre-Coating Options

Glass preparation can also be accomplished with gelatin-glyoxal applications, followed by UV-hardened gum arabic and bichromate applications, or with the commercially available Black Magic Photo Gelatin and Hardener combination that is often employed as a primer for difficult surfaces. The Black Magic Gelatin is especially effective on glass and similar non-porous surfaces. As well, when this product is used on fabrics it saves on emulsion use by limiting the absorption of the sensitizer in the material.

Once your glass is thoroughly pristine and dry, you can begin to feel confident that the multiple gelatin-glyoxal solutions to come will adhere to the surface. When ready, lay the glass sheet on top of a smaller tray filled with hot water in order to heat the glass from below to a constant warm temperature. This prevents the gelatin from setting up too quickly after you pour it on. Now pour a warm gelatin-glyoxal mix over the piece of warmed glass. It will be important to apply the warmed gelatin solution several times so that you have multiple thin layers rather than a single thick coating. Be very careful and move slowly, as you don't want bubbles in the gelatin. Dry the glass well between applications.

You will be layering on three successive coatings of warm gelatin and glyoxal. This standard sizing-hardening solution is made of 28 g of Knox food gelatin from the supermarket and 1000 ml of distilled water. Please refer to the preparation instructions for gelatin-glyoxal sizing and hardening in the Gum Bichromate chapter before making up a solution. This is the difficult part of preparing your plate. Unless you have exceptional coating skills, don't try to gelatin-glyoxal size your plate with a single coat.

Once the glass and gelatin-glyoxal solution are warm and ready, apply three very thin and delicate coatings . . . air-drying well between each one. Pour the warm solution into the middle of the warmed glass surface and gracefully move the glass plate around until the coating is smooth. If you are a good wet plate collodion practitioner, this part will be a lot easier for you. Do not mix up more solution than is necessary to coat the glass plate a single time. A new mix should be made for each of the three separate coatings. One good trick is to angle the glass so that the small amount of excess gelatin and glyoxal runs off into a separate tray. Once that step is done, lay the glass on a level surface and allow it to dry. Then repeat the process until you have three coatings.

Gelatin Coating Option with Separate Glyoxal Bath

Another coating option is to apply a standard gelatin solution of 28 g gelatin to 1000 ml of water. Pour, or spray, the gelatin on the glass plate and allow it to thoroughly dry. Following the dry stage, immerse the glass in a separate bath of prepared 40% glyoxal (available in a prepared solution from Bostick & Sullivan) that you have set up outdoors or in a supremely well-ventilated space. The immersion time is very brief, and once the print is removed from the glyoxal, allow it to dry completely in a clean space that is not in your living area.

After drying the plate, repeat the gelatin-to-glyoxal bath sequence two more times. When using this method you will have to coat and dry your plate 6 times (3 gelatin coats and 3 glyoxal hardener coats). For safety, throughout this process be sure that you wear nitrile safety gloves, eye protection, and an apron, and be sure that you have fresh air or superior ventilation. Also, don't forget that glyoxal outgasses for about a day on paper and less, I suppose, on glass. Nonetheless, dry your plates away from where you eat and sleep.

What you are seeking is a smooth surface without bubbles, unless that is the effect you are looking for. The purpose of the gelatin is to allow the glass surface to accept a liquid sensitizer without running off or beading . . . like water on wax. Once you are ready to apply your liquid emulsion you may want to

consider adding a bit of prepared gelatin to your sensitizer, as this will assist in the sensitizer adhering to the gelatin–/glyoxal-prepared surface. The emulsion itself should adhere just fine at this point, but if you are having issues with adhesion, it is another option to think about.

Printing on Glass

When printing, use small apertures to avoid fogging potential. When working with glass it is a good idea to place a sheet of non-reflective black velvet under the glass plate to avoid back-splash reflection of the projected light. When processing, use slightly chilled chemistry and agitate very gently throughout the developing and washing process. If your chemistry is too warm, place a can of cold, unopened soda, or ice, in a plastic storage bag and place it in the solution. This causes a quick chilling and does not dilute the solution.

Exposing Glass Plates in the Developer

Another method of exposing and processing a glass plate image at the same time is to expose it while it is immersed in a tray of paper developer. This lessens the chance of damaging the emulsion during the working process. In the darkroom, under very low red safelight, take a dry tray and place a piece of paper, mat board, or frosted glass that is of the same size and thickness as your coated glass under the enlarger to focus the projected image. Remove the focusing material from the tray and replace it with your coated glass. Pour cool developer over the glass in the tray until it just covers the upper exposed surface. If you fill the tray too deeply with developer, the fluid will refract the light from the enlarger. Turn on your enlarger and make the exposure.

You will be able to observe your image developing during the exposure, and I recommend allowing for extended development by occasionally turning off your enlarger and observing the changes that are taking place under safelight conditions. When you're satisfied, gently remove the exposed glass from the tray of developer and place it in a cool water bath. Try to keep the glass in a flat position during the transfer to lessen the chances of the image sliding around. Then fix and wash gently in the normal manner. If you find that your emulsion is having a difficult time remaining on the glass, especially if you haven't gelatin/glyoxal hardened it, then you will want to add 2 capfuls of Black Magic's Liquid Hardener to every 1000 ml of your paper developer.

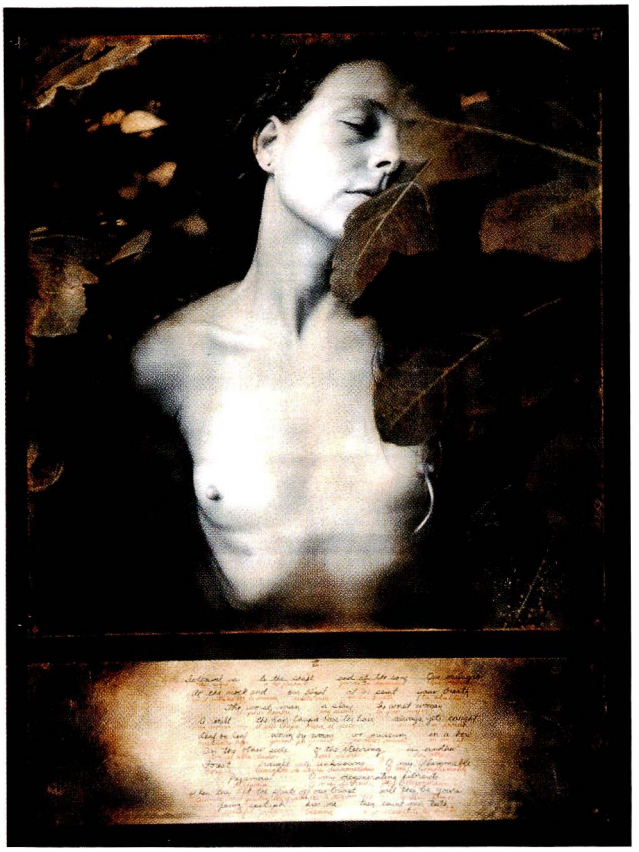


Figure 23–9
Deborah Luster, *Rosesucker Retablos, VI*, 1977 (emulsion on aluminum w/oil)
This is a mysterious and poetic work by Deborah Luster, an artist whom I had the pleasure of teaching in a workshop many years ago. I am delighted to relate that she is a current Visiting Artist/Scholar in my MFA in Photography program at Lesley University College of Art and Design. *(Courtesy of the Artist)*

LIQUID EMULSIONS ON METAL

Prepared Black Metal Sheets, Cut to Size, with a Film Laminate

Metal is much easier to use, especially if you are interested in making contemporary tintypes with liquid emulsions. By far the most elementary way to begin is to order some cut-to-order black aluminum metal plates from Bostick & Sullivan, Lund Photographics,

or Main Trophy Supply. The plates, identical to the ones you purchase for wet plate collodion tintypes, are ready to go, and all you'll have to do is peel back the protective film on the perfectly clean blackened plate and apply your emulsion. Plates come in black or chocolate brown and are in assorted thicknesses. They can be pre-cut to fit in camera or used in projection. If you are going to make a lot of plates, or are working with an assortment of cameras and plate sizes, you should invest in a plate cutter (about $300) and a large box of 20" × 24" blanks. Main Trophy is the best source for the plate cutter.

Alternative Metal Preparation for Liquid Emulsions

This is very simple. Many times you will want to work with metallic substrates that aren't clean and shiny . . . like what you might find in a junkyard or town dump. You might also come across aluminum flashing in a hardware store, or steel plates in a roofing company, and get an inspiration to make something amazing with your find. In these cases you still have to prepare the surface so that the liquid emulsion can adhere to it and stay on the substrate during the processing stages. The best solution to this situation is to use a readily available matte black or clear Rust-Oleum spray- or brush-applied paint for an excellent surface preparation. If you are using raw aluminum flashing, clean the plates well with borax powder, soap and water, and/or Everclear 190-proof alcohol before coating with the Rust-Oleum. Once the paint has been applied and dry, I like to give the surface a gentle buffing with very fine #00000 steel wool to act as "teeth" for the emulsion to come.

Working with Liquid Emulsions on Metal

Since graduate school at RISD in the early 70s, I have been working with the application of liquid emulsions on metal substrates such as stainless steel, aluminum, and copper in combination with acids, inks, paints, and anything else that comes to mind. One of the best sources for these plates is an industrial or commercial roofing company; most of the time such a company can cut the plates to your required size specifications with very impressive, room-size snipping machines. The plates are available in a variety of thicknesses and sizes including long industrial-size rolls and very heavy 4' × 8' sheets. After trimming to size in the factory, the edges of the plates must be filed down, and it is necessary to degrease the metallic surface, as the majority of industrial metal sheeting has a thin oily coating to prevent corrosion prior to its sale. Steel roofing material, painted and ready to use in a variety of colors, comes at a reasonable cost, and a few years ago I bought a 4' × 10' sheet for about $50. The cutting costs will always be extra unless you are friends with the owner and you are allowed to use the trimming machines on your own.

Figure 23–10
***Two Women Fencing*, 1885 (tintype)**
This is one of my favorite art history photographs . . . I like it almost as much as the daguerreotype of the blind man holding the headless cat earlier in this book. What is so cool about tintypes is that they were so simple and inexpensive to make that people thought nothing of playing while they made pictures . . . a far cry from the serious nature of portrait painting and daguerreotypes. *(Courtesy of George Eastman House, International Museum of Photography and Film)*

Materials You May Need

- Liquid photographic emulsion including Rollei Black Magic Emulsion, Rockland Liquid Light or AG Plus, Silverprint SE-1, Foma, or one that is handmade
- Black Magic RBM52 Hardener (helps adhesion and can be added to emulsion or developer)
- Black Magic Gelatin for odd and difficult surfaces
- Anodized aluminum or steel plates (prepared or unprepared)
- A can of gloss spray polyurethane for surface preparation
- Rust-Oleum in matte black or any other color you wish
- A safelight environment like a darkroom or closet with a tiny red light
- Traditional paper chemistry in trays or spray bottles (no stop bath)
- Distilled water for developer mix
- Hot plate, double boiler and electric kettle (for heating emulsion)
- Plastic trays
- A tray for hot water that is smaller than the plate, for keeping the plate warm during coating . . . prevents the emulsion from gelling too quickly
- Glass cleaner/degreaser and soft cloth for cleaning metal
- Everclear 190-proof alcohol for cleaning (do not drink this ever!)
- Hairdryer
- Film transparency for printing traditional silver gelatin or Pictorico Ultra Premium OHP inkjet transparency, or positives/negatives in slide mounts from projector
- Contact-printing frame if contact printing; an enlarger, slide projector, or digital projector for projection
- Paper safe or light-proof storage box for drying sensitized plates

The Working Process

After degreasing and cleaning your metal surfaces, you may decide to inflict almost any kind of distress or mayhem that comes to mind including my favorites . . . acid etches, power sanding, painting, hammer blows, fire, and so on until you get a surface texture and look that suits your intentions. If you want a pristine surface, simply degrease and then lightly buff the surface with circular strokes using a very-fine-grade steel wool. This technique leaves a lovely sand-washed, silk-like surface. You can also take your plate to a granite grave marker business and ask them to sandblast your plates . . . metal or glass.

You can also add color to a metallic surface with Rust-Oleum spray paints . . . especially if you do not want your highlights to look like the base metal surface. If you want the original metal, use clear polyurethane in multiple very light applications. Be sure to keep the plate warm when doing this, and consider a fine steel wool buffing in between coatings once each coating is fully dry. You can also substitute white, or any other color for that matter, in place of clear polyurethane, and your options are only limited by your imagination. Be sure that the surface is bone dry between applications. The polyurethane, metallic paint, and steel wool buffing will aid in keeping your emulsion on the metal during the processing stages.

Note: Liquid emulsions form a chemical bond with polyurethane and alkyd (meaning synthetic polyester resin) paints. I've had a lot of success prepping my plates with Rust-Oleum spray. I recommend that you do a very light finish coat with gloss polyurethane over any colored spray paint.

In the Lab

OK . . . you are now in a safelight environment and the light level is low and full of promise as it always is when you go into a wet darkroom. When you're ready to coat, fill your tray, which is smaller than the plate you are coating, with very hot water. Place the metal plate on top of the hot water tray and it will warm up. This action will allow you the time to smooth the emulsion at your own pace. Liquid emulsions tend to set and gel immediately, showing a rather uneven surface, if applied to a cold substrate.

Heat up the liquid emulsion, leaving it in the original bottle with the top on, in a large beaker, a crock pot, or a small beer cooler filled with hot water. When it is at least 110°F, pour approximately what you will need to make a thin coating on the top edge or center of your metal plate. You can brush it on with a synthetic Richeson, foam, watercolor, or hake-type brush, or simply spread the emulsion with your fingers. You can also use a glass rod or Puddle Pusher for a totally smooth and even application. Feathers work well, or simply pick up the plate and roll it around in the air to make your coverage smooth and even.

If you decide to roll the plate around, you will notice that the emulsion is gelling in uneven layers as it cools. Just put it back on top of the hot water tray until the emulsion warms up again. After your coating is done it is important to age the plate in a totally dark environment. Personally, I like to age my emulsion for at least 24–48 hours to ensure a tonally rich image. In the meantime, prepare additional plates and metal test strips for the following day and consult the Basic Workflow section from earlier in this chapter. If you are having issues with air bubbles in your emulsion, try the following process.

Sweet Cream Emulsion: How to Avoid Bubbles in Coating

Bubbles are often a problem. Here is a way to avoid them.

Step 1 Warm the surface that you are intending to make an image on. You can use a dry mount press, or hot water tray technique, for flat and thin objects or a hairdryer for three-dimensional ones.

Step 2 Make up a formula of the following:
60 ml emulsion
7 ml distilled water
1 ml heavy sweet cream

Mix the ingredients together at 110°F slowly, and carefully pour the solution on the surface and rotate the object using a technique similar to coating a wet collodion plate. Please see that chapter for an illustration and instructions.

Liquid emulsions on metal are a challenge, and doing them leaves the creative doors wide open to a vast array of post-image abuse and adornment such as paint, acid, cutting, welding, and the like. The good news . . . if you don't like the results you can always go get a power sander and grind the image off the plate and start again.

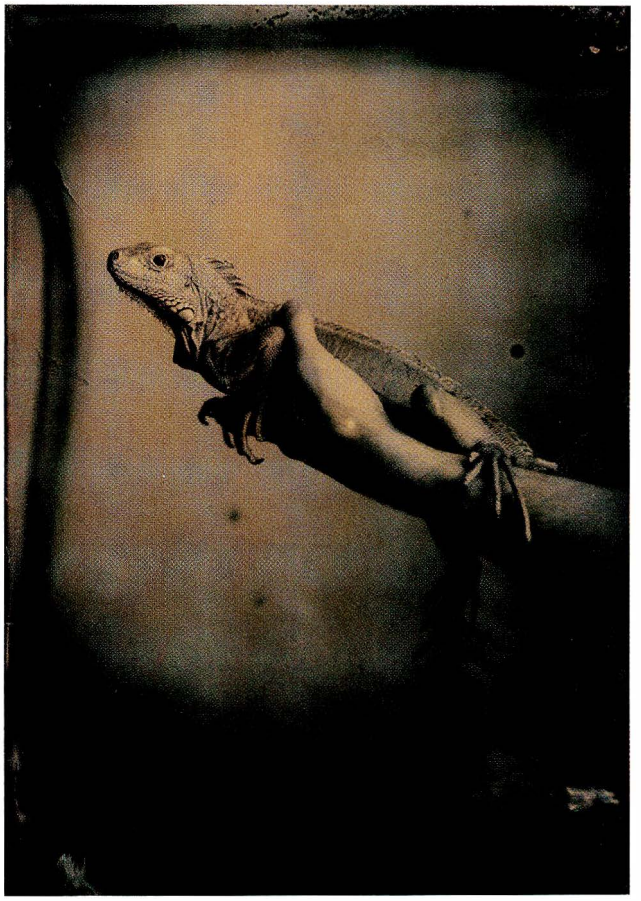


Figure 23–11
Jayne Hinds Bidaut, *Green Iguana, Held In Hand*, 1998–2007
At the time, Lizzie was a 2-year-old, 5-foot-long male iguana who was a casualty of the pet trade and was living with Jayne. Lizzie is a sweet guy, and he visits schools to help educate kids about the environment. According to Jayne, Lizzie has had a big impact upon her work and has taught her many things. Jayne never had a desire to live with an iguana before she took him in, but now she cannot imagine her life without him. Lizzie does not live in a cage, and he travels with her wherever she goes. *(Courtesy of the Artist)*

A CONTEMPORARY DRY PLATE TINTYPE PROCESS

First, if you are really interested in doing this process in the original wet collodion technique, I recommend that you head directly to the Wet Collodion chapter and consider producing your tintypes in the original

chemistry and syntax . . . where the true mystery and beauty of that process can come to life. The faux tintype of the following contemporary technique is performed with a commercially made silver gelatin emulsion that varies quite a bit between brands and is a facsimile of collodion.

The Rockland Colloid Company (http://www.rockaloid.com) makes a Tintype Parlor Kit that claims to have everything you need to make tintypes. It comes with the necessary materials for creating five tintypes, including your tests.

Metal Plates and AG-Plus

I use Rockland plates simply because I haven't had success with any other metal plates, including spray painted aluminum flashing. I found the propellant in the spray paint reacted with and darkened the emulsion, and often the spray paint would constrict with temperature changes and then crack and fall off the surface of the plate. I have also experimented with black trophy plates, traditionally used on trophies and plaques; the surface is not porous and will not hold the emulsion. Coating the surface of the trophy plate with a brush-on oil-based polyurethane does allow the emulsion to adhere to the plate, but not nearly as well as it does with Rockland's plates.

Humidity and Ag-Plus

Humidity will cause the emulsion, after processing, to discolor, turn magenta, and often darken to the point where you will lose your image. Make sure the emulsion is 100% bone dry before printing. After coating the metal plate let the emulsion dry for a minimum of 2 days in a paper safe. If it is humid the plates need longer to dry; I suggest waiting a week to ensure your plates are dry and that no humidity is being retained in the emulsion. If the emulsion does not completely dry before exposure the image may be completely lost over time.

Processing the Plate—Developer

The developer made by Rockland, once mixed into a working solution, will weaken after two weeks. Measure out small amounts of the raw chemistry and mix a little at a time rather than mixing the entire developer batch at once.

Place the exposed plate in a tray of Rockland's tintype developer and agitate constantly for 1–5 minutes. During this time you should see the plate turn entirely black, and then an image should slowly appear. If an image does not appear during this time, and the plate remains black, the problem is that it was underexposed.

Another thing to be aware of regarding developer . . . despite Rockland's directions that say you can put multiple plates through a tray of developer, you can actually only put one plate through a tray of developer before you have exhausted it.

Fixer and Wash

For fixer, use Sprint Rapid Fixer with an alum hardener added. The instructions for fixing time provided by Rockland should be ignored. Fix the plate for 10 minutes and then wash in cold running water for 10 minutes. If any thick white areas of emulsion are present you can lengthen the fixing time and they will slowly disappear. Fixing and washing the plate for less than these recommended times may result in plate discoloration and fading.

Trouble Shooting for Ag-Plus Tintypes

- If your images are silvery, dark, and metallic following development, your developer tray is contaminated from repeated use and inadequate washing between the development of multiple plates. If you see this problem, replace your developer tray.
- If the emulsion has small cracks or a reticulated look after the plate is completely processed, there is not enough hardener in the fixer. Simply add more hardener.
- If the emulsion is soft and slides off the plate during the development, Rockland has sent plates that were either not properly degreased or you are applying the emulsion to the back of the plate. Clean the plate with borax and warm water, flip it over, and try again.

As an alternative to Rockland's kit, especially when your intention is to make more than a few tintypes, I am including the following technique using Black Magic Liquid Emulsion and Hardener. You can use a variety of commercial liquid emulsions, such as Rockland's Ag-Plus or Silverprint SE-1, to prepare

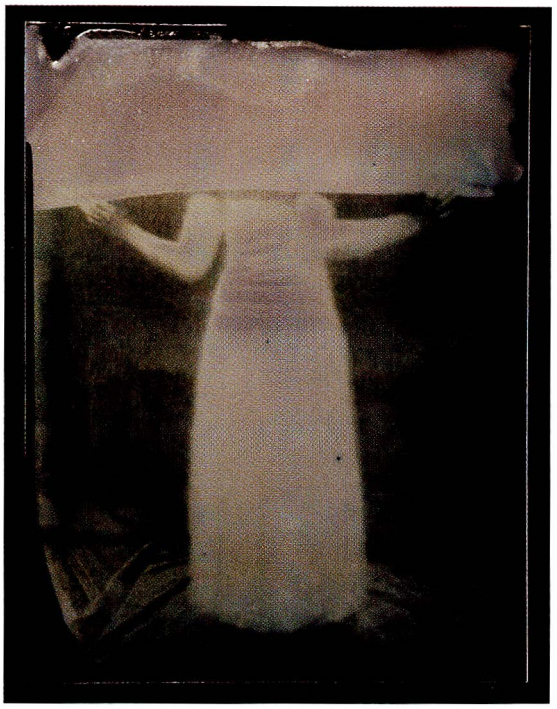


Figure 23–12
Jess Somers, *To Pretend Thinness*, 2009
Jess Somers, a former student in my MFA program at Lesley University and now a colleague, has quite a few images in this book due to the eclectic nature of her studio practice and a first rate imagination. This piece is an example of her work with hand-applied emulsions and is part of a series in which she made a plate a day for a very long time. *(Courtesy of the Artist)*

your own plates, but in my experience, Black Magic's Liquid Emulsion, in combination with its RBM52 Liquid Hardener, works as well as any of the alternatives, with the exception of making your own collodion emulsion.

THE METAL PLATE

The first thing you need to decide is what kind of metal substrate will best suit your intentions. Thin sheets of metal can be obtained quickly, and inexpensively, at a building or roofing supply company, and all you will need to do is clean them thoroughly and prepare their surfaces so that they will hold an emulsion. These are a few alternatives to consider.

Anodized Aluminum Sheeting

Anodized glossy black aluminum is perfect for both this technique and for collodion tintypes. The company Lawrence & Frederick makes a superior anodized aluminum sheeting on a roll in matte or glossy white, and it is a product that can be modified with additional applications of paint.

Metal Roofing Substrates

You may have noticed, especially in areas that get a lot of snow, that more and more buildings are sporting metal roof surfaces. This new metal solution is a far cry from the tin roofs of the past, and these roofs are extremely durable and come in a variety of finishes. Recently I had to repair a section of my studio roof that was too flat for the slate that covered the majority of the barn. I looked into this metal roofing option and, after handling the samples, thought it would make a terrific substrate for tintypes. If you want to give it a try go to a local roofer and ask for some scraps to run a few tests on. Here are the types available at the present time.

- **Steel** is the most common industrial-grade metal roofing used today. It is heavier and sturdier than the aluminum that is primarily used for residential property. Manufacturers offer a number of durable coatings and finishes that protect steel from corrosion. The roofing material is zinc-coated and then sealed with an epoxy primer that will provide you with emulsion adhesion. That is followed with a baked-on colored acrylic top coating for added protection. Ask for steel, as it's already painted with the baked-on color. My roofer says he'll cut it up for me and that I can buy it for $1.00 to $1.50 per square foot.
- **Aluminum** is extremely lightweight and is the material most often used in residential metal roofing.
- **Copper** roofing, in shingles or sheets, will last as long as the house is standing. Copper will not rust, has no "finish" to scratch or peel, is soft enough to easily tool and shape, and weathers naturally to a beautiful verdigris patina. Copper is also very expensive.

Baked Copper Enamel Plates

If you have access to a kiln, you could try your hand at preparing baked enameled glass on copper plates. The enameled copper plate is made by applying a dusting of powdered glass on a piece of copper and firing it to a glass surface in the kiln.

An enameled plate often varies in thickness, forcing the emulsion to settle unevenly, creating variations in tone and, in some cases, abstracting the image entirely. Scott McMahon's ceramic-fired plates for his work with liquid emulsions have luminosity that the spray-painted plates entirely lack. For me, they feel more like ambrotypes in that the liquid emulsion rests upon the glassy ceramic surface. Scott relates that the baked enamel plates are quite different from plate to plate. You might end up with thicker areas or dips in the surface and firing ceramic debris that might have been loose in the kiln. It's nearly impossible to get really consistent results, so each plate or substrate is unique . . . and this is always good.

Japanned Lacquer Plate Preparation

You may elect to use Japanned lacquer to blacken your plates. Developed over the last 7,000 years, *urushi* or Japanese lacquer is made with toxic sap, powdered metals, bits of shell, and months or years of patient labor. Cultivated from the lacquer tree (*Toxicodendron vernicifluum*), a relative of poison oak, lacquer is extremely durable and resistant to moisture, and it has an incomparable natural gloss. Unlike polyurethane spray paint, or shellac, a Japanese lacquer contains no resins for hardening purposes and polymerizes in high humidity to form a hard, water-resistant film. It may be painted, carved, and molded, lending itself to a wide range of artistic expressions.

Prepared Aluminum Plates with Protective Laminate

This is really the easiest solution. As mentioned often in this book, you are able to purchase cut-to-order sheets of black aluminum from Main Trophy Supply, Bostick & Sullivan, Lawrence & Frederick, or Lund Photographics that are identical to the ones you would order for wet plate collodion tintypes. These plates are super-clean, and the only preparation you need to perform is to peel back the protective laminate film on the blackened plate and apply your emulsion.

Supplies You May Need and Sink Setup for Contemporary Tintype

- Liquid photographic emulsion (Black Magic Emulsion, Silverprint SE-1, Fomaspeed, Light Farm Hershey's Tornado Emulsion, etc.)
- Liquid Hardener additive (Rollei Black Magic RBM52, Foma Hardener, etc.)
- Blackened plates (commercial laminated film aluminum plates, matte spray-painted anodized aluminum, japanned plates, ceramic enameled plates, steel or aluminum metal roofing material, etc.)
- Tintype developer (commercial or homemade, positive or reversal for contemporary tintype)
- Distilled water for developer
- Fixer—Kodak powdered fixer or sodium thiosulphate fixer
- Hot plate, electric kettle, large beaker with hot water, beer cooler with hot water, and crock pot for hot water and constant temperature (for heating emulsion)
- Plastic or Pyrex glass trays
- Glass cleaner, whiting solution, Everclear alcohol, and soft cloth (for cleaning enameled or glass plates)

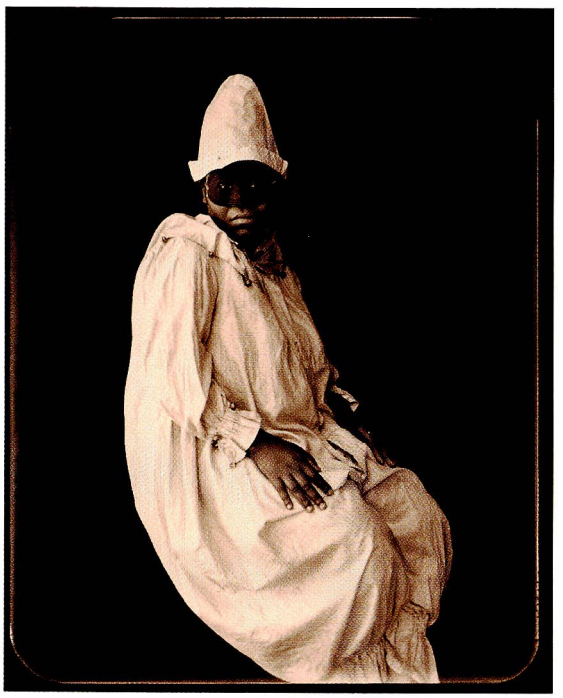


Figure 23–13
Deborah Luster, *St Gabriel, Halloween*, 2000 (from the portfolio *One Big Self*)
Deborah Luster's work centers on bringing forth the real person in her photographs. These images are rich and complex and often feature a great deal of handwork and alternative techniques. The image, originally in tinted color, is Silverprint liquid emulsion on aluminum. The subject is Prisoner #298170, from New Orleans, born in 1968 and serving a 7-year sentence at the Louisiana Correctional Institute for Women. She works in the chair plant. *(Courtesy of the Artist)*

- Paper safe
- Positive transparency for printing tintypes (film positive, Pictorico Ultra Premium OHP digital inkjet film or slides)
- Film or plate holder if shooting in-camera black plate contemporary tintypes
- Contact-printing frame if contact printing to an alternative light source
- High-quality varnish (e.g., sandarac varnish, spray polyurethane, or Renaissance Wax) for protecting the surface of a finished plate

Film Positive

For projection, you will need a silver gelatin film or digital inkjet film positive. To produce a reasonable contemporary faux tintype, it is necessary to have a positive film image with strong contrast and distinctive tonal separation. The positive film image can then be projected from a slide projector and exposed using an enlarger or in a contact printer under a blue light source.

You may also expose the sensitized tintype plates directly, as you would sheet film, in a large-format lens-dependent or pinhole camera. This process is time consuming but immensely gratifying . . . especially if you are making your own emulsions.

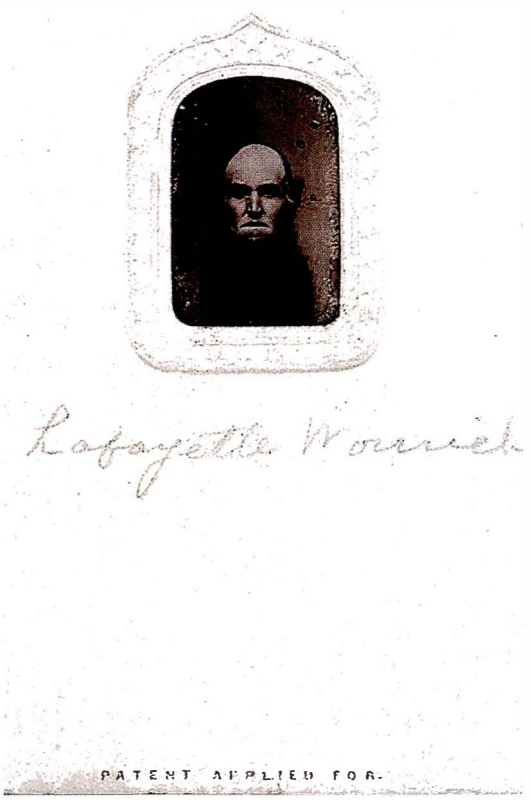


Figure 23–14
Little Gem Tintype of Lafayette Warwick, 1850s
A little gem tintype measuring ½" × ¾" and set into an embossed card. *(Courtesy of the Author)*

THE WORKING PROCESS FOR CONTEMPORARY TINTYPE

Making the Digital Film Positive

Size the image at 300 ppi to the print dimensions you want on the finished plate. Make the positive transparency a bit darker and more contrasty than a perfect black-and-white print using your curve adjustment tool. Check your levels and print out the image in color or grayscale on Pictorico Ultra Premium OHP inkjet film. You can easily use the positive in a contact printer, which remedies the lack of a view camera or darkroom setup with an enlarger.

In this example you are starting with a grayscale mode digital file, and your intention is to prepare it for contact printing or projection on a blackened metal plate. In these very abbreviated and simple instructions I'm describing how to get a black-and-white positive with no extra bells and whistles . . . such as built-in colored filtration for contrast. For that technique, please refer to the gum bichromate chapter in the section dealing with making a CMYK color separation as a way enhancing the contrast ability of the image.

Step 1 Open up your image in Photoshop and work with it until it meets your expectations and intentions. This is the time for you to change the contrast levels and play around with the tonalities so that they give you the very best chance for a successful plate.

Step 2 Go to Image > Rotate Canvas > Flip your image horizontally. This will place the ink side of the Pictorico film directly against the emulsion on the plate, giving you the best detail. This is different than working with wet plate collodion contact printing, in which the emulsion is still tacky.

original digital image | positive image for contact printing in safelight conditions | tintype

Figure 23–15

Mary Dorsey Wanless, *Self Portrait*, 2009 (digital to tintype sequence)

This is a sequential example by my friend, former workshop student, and professor at Washburn U., Mary Dorsey Wanless, that illustrates the transition from a color digital image film positive or slide, which is then projected on a hand-applied emulsion using an enlarger or projector. Average exposure time is anywhere from 30 seconds to 3 minutes.

(Courtesy of the Artist)

Step 3 Print the file on Pictorico OHP Ultra Premium at Highest Quality. I use a Photo Rag profile setting and generally print out 2–4 copies at a time in case I want to tape them together in registration to increase the chances of getting a strong separation of shadows and highlights.

Step 4 Let the Pictorico dry thoroughly before using. If it gets scratched . . . make another one. This is the beauty of making digital negatives . . . if they get destroyed, there are no tears or loud noises in the lab; you simply make a new positive.

Remember, make a slightly contrasty **positive** film. If the film looks good up against a white piece of paper then it will probably work fine. With this dry plate tintype method, the longer you expose, the lighter your finished image will be.

Chemistry Setup

Set up your processing chemistry as you would for other hand-applied emulsion techniques (i.e., developer with a liquid hardener and Kodafix or a weak sodium thiosulphate fixing solution).

I recommend that you buy the bulk developer and hardening fixer packages from one of the emulsion, gelatin, and hardener suppliers such as Rockland Colloid, Black Magic, SE-1, or Foma and mix your chemistry by the gallon. You will be changing your developer every plate or two (the fixer lasts slightly longer) so it's worth it to make up the bulk chemistry rather than scrimp with the small package supplied by Rockland.

Use the developer supplied by Rockland for paper. For contemporary tintypes, use the Rockland Reversal Developer first and then move on with experimentations.

The fixer is less of a mystery. Use Rockland's hardening fix or Sprint Fix with Alum Hardener (add 50 ml of hardener to every 1000 ml of paper fix). Shake the fix well before each use.

A sodium sulphite hypo clearing bath, or a hypo clearing agent is an option if you are in a hurry but is not really necessary with plates, as they lack the fiber absorbtion of paper and thus need less washing time.

Set up three trays and a running water cold water wash so the emulsion doesn't get damaged. Tray 1 is for the developer and should be approximately the same size as the plate so you don't have to use too much developer. You will usually change your developer for each plate. Tray 2 is for the hardening fix. Tray 3 is a cold water wash. You can add a hypo clearing agent after the fix for paper, but it isn't really necessary for metal plates.

Cleaning and Plate Preparation

As always, begin by cleaning your plate's surface with great care. See the plate cleaning and preparation sections throughout this chapter and in the Wet Plate Collodion chapter.

Coating the Plate with Warm Emulsion

When you are ready to begin your work in the lab, warm (don't boil) the liquid emulsion in its sealed plastic container in hot water at about 100°F for about 15–20 minutes. While you are doing this, put your work area in safelight mode.

Warm up your plate before pouring on the warmed sensitized emulsion. Methods of keeping your plate warm include a hot plate at a very low setting, around 115°F, or placing the plate over a smaller tray of hot water and letting the resulting steam warm the underside of the plate. As always, if you are using an electric appliance, such as a hot plate, do not use it near a sink or trays of water. When the plate is sufficiently warm, pour a puddle of emulsion on the top edge or center of the plate and spread it around the plate's surface with your fingers or a foam or synthetic brush or Puddle Pusher. Please see the suggestions for emulsion coating earlier in the chapter. Pick up the warm plate, with the warm emulsion on it, and rotate it around slowly, letting the emulsion spread evenly over the plate surface as it cools off.

Pouring, Drying, and Waiting 24–48 Hours

Once your plate is nicely coated, the best thing to do is place it in a totally dark environment, like a paper safe or a secure cabinet drawer with an opaque liner, and leave it alone for 24–48 hours. You want your plate to be bone dry before exposure. Blow drying works for a demonstration when time is short. If you must blow dry the emulsion due to time considerations, aim the heat at the underside of the plate until the emulsion sets up and then go to a medium heat setting for the emulsion itself.

After the plate is dry you may load it into a pinhole camera or plate holder, equipped for a view camera,

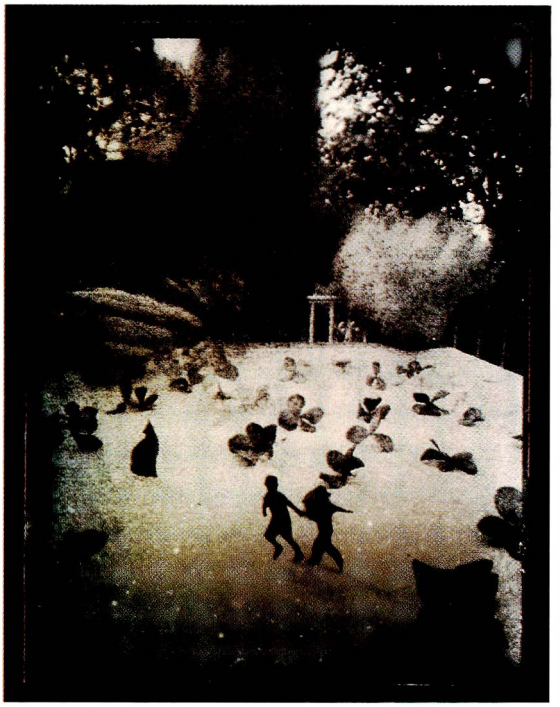


Figure 23–16
Jess Somers, *Flowers in the Desert*, 2009 (pinhole liquid emulsion for 15 minutes)
This piece by Jess Somers is an example of using a hand-applied emulsion as the light-sensitive receiver inside a pinhole camera. Exposure time for this image was 15 minutes.
(Courtesy of the Artist)

for an exposure or use it in a contact-printing frame with the film *positive*. For the best results in tonality and contrast, I like to let the plate age for 24–48 hours.

EXPOSURE RECOMMENDATIONS

Exposure on Blackened Plates

You're going to have to adjust to the way you think about the exposure. This is a reversal process, and you are either projecting or contact printing using a positive film on a blackened plate or you are shooting in-camera. If the image on your plate is too light then you need to be thinking about giving it less exposure time. If the image is too dark, increase the exposure time. You must make test strips to determine your exposure. Try exposing your plates in a pinhole or zone plate camera . . . this works quite well. Pinhole camera exposures, in bright sun, with a 1.5 focal distance, run between 45 seconds and several minutes. Jess Somers's *Flowers in the Desert*

was a 15-minute exposure . . . which is fine because this isn't a wet plate process in which the emulsion has to stay wet to be effective.

As mentioned previously, several different light sources can be employed. Whatever type of light you elect to use, do a bit of testing first before committing your carefully prepared plates. If you use an enlarger, expose the plate, using a film positive like a test strip, at 10-second intervals. Remember, a tintype exposure is similar to direct negative-to-negative film, like the no-longer-manufactured Kodak SO-132. The more exposure you give, the lighter that area will be in the final image. Slide transparencies are good sources for film positives, as are orthochromatic duplicating negatives and black-and-white reversal films.

If you opt for a view camera exposure, place your camera on a tripod and make an exposure using the sun as the light source. A sunny day starting time for tests might be f/5.6 for 0.5 second. The proper exposure should show a nice balance between highlights and shadows. If your plate is flat and lacks highlight detail then you might wish to consider increasing your exposure. If your plate is too light, with little contrast, you should decrease the exposure. You may wish to use filters to enhance the contrast.

Exposure In-Camera for Pinhole Tintypes

This is a perfect opportunity for you to try exposing your blackened plates in a handmade, custom pinhole, or zone plate camera, as the exposure will be a positive, just as it is when you load your pinhole with a piece of conventional photographic paper. Zone plates are much faster than conventional single pinhole cameras, and I recommend that you go to the pinhole chapter to read about them and to get information on resources such as where to buy zone plates or zone plate cameras.

Jess Somers, an ardent tintypist and recent graduate of my MFA in Photography program at the College of Art and Design at Lesley University, sent this exposure suggestion along for both traditional view camera and pinhole exposures: "*I've had a bit of consistency with exposure on the pinhole tintypes using this method: using my reflective meter (set at ISO 4) through a blue piece of acetate, meter off of a grey card and then add between 2 and 3 stops to the reading.*"

An example: Set your meter, with a blue acetate covering the sensor, to ISO 4 at *f* 128, metered off a gray card or your own skin in shadow. Add 5 stops of exposure to the reading so that if you get an initial reading of *f*128 @ 1 minute, your 5 stop adjustment will be *f* 128 @ 32 minutes.

Exposure Recommendations

Thin and consistent emulsion coating applications have shorter exposure times than thick coatings. Here are a few "ballpark" recommendations for beginning your exposure experiments.

- **In-Camera** (4" × 5") exposures in hazy open sun: *f* 8 at 1 sec
- **In-Camera** (4" × 5") deep shade/backlit: *f* 8 at 6 seconds
- **Pinhole Camera**: Exposures, in a pinhole camera, usually run for 8–15 minutes in open shade. A zone-plate-equipped camera will yield a similar look as the pinhole but is much faster. You'll know if you need additional time if your image is too dark. Longer exposures will often result in a bit more detail. Pinhole exposure will be dependent on your pinhole design, so be patient and zero in on what works best for your camera.
- **Projecting a film positive, or slide, from a condenser or diffusion enlarger**: Set your enlarger lens aperture to wide open. You are going to have to do some exposure strip tests with your equipment and the emulsion you are using. With a diffusion enlarger, start your testing by exposing for 3 minutes. With a condenser enlarger, begin your tests by exposing for 30 seconds. These are suggestions for beginning exposures to determine where to begin zeroing in on the perfect plate. Remember, the freshness of your emulsion, the age of your enlarger bulb, and the karma that surrounds you that day will influence your results.
- **Contact frame printing with a film positive**: Cover the printing frame glass with several sheets of vellum, or better yet, Pictorico OHP, as a filter and expose in open sun/shade for 0.5–1 second. You can also successfully use a UV exposure box. If you want the highlights brighter, increase the time slightly, but

remember that there is a point at which an increase in exposure will result in dull shadow details.

- **Contact printing with a paper positive inkjet print:** You can contact print using an inkjet print positive, which means that there is a whole new world of opportunity open to you via copy machine and Photoshop. Print out on an inkjet positive on a matte paper and load your contact-printing frame with it, a sheet of vellum or unused Pictorico, and the emulsion-coated plate. Make test strips and figure out a workflow and exposure time for the inkjet print and your liquid emulsion. If you find that the image is a little fuzzy, consider oiling the paper to get more transparency or using a much thinner image stock . . . like Bienfang 360.

Contemporary Tintype Processing

First, a few brief words regarding Rockland Colloid's http://www.rockaloid.com AG-Plus Emulsion, Tintype Reversal Developer, and Kodak Fix as a processing strategy. Rockland has a Tintype Parlor Kit that includes everything for a beginner . . . but is only good for a few plates that may, or may not, fit in your large-format camera without modifications to the plate holder. I've recommended using Black Magic Emulsion and Hardener combination available from http://www.freestylephoto.biz, but as well as this product works on other surfaces, it doesn't, in my experience, seem to have the sticking-to-the-metal-plate abilities that Ag-Plus has.

Ag-Plus and Reversal Developer for Plates

Ag-Plus (meaning it has more silver in the formula than does Rockland's Liquid Light) emulsion is used for normal negative-to-positive prints on paper as well as tintypes. In normal use, the Ag-Plus emulsion is coated on a light-colored material such as paper and exposed and developed in a standard paper developer like Dektol. However, for tintypes, the same emulsion is used with a special tintype reversal developer. Coated on black material and developed in tintype developer, the end product gives a positive-to-positive print through the illusion of reversed tonalities.

Mix the Ag-Plus reversal developer and your fixer the day before you intend to use it. The developer doesn't age well and can result in dull and dark plates. Store it in as small a bottle as you can for less oxidation potential. The developer will last up to 2 weeks.

You can use a manufacturer's developer or the developers mentioned below. Your darkroom needs to be very dark . . . much darker than it is for conventional silver gelatin printing due to the amount of time that your sensitized plate has been collecting fragments of light since you began working with it. Don't be alarmed by the way the image looks during the developer stage. The plate, if you can see it well, may look a little flat. In fact, sometimes it doesn't appear that you have an image at all or that the image has been fogged. Let the plate sit in the developer as you agitate the tray very gently for 2–3 minutes.

Additional Developers

- **Developer #1**

  Mix up a tray of Dektol paper developer 1:10 at least 24 hours in advance of processing. To this developer, add a capful of liquid hardener, from one of the manufacturers in this chapter, to prevent your delicate emulsion from being damaged in the processing stages. The hardener is optional, but I always recommend it. Use the developer at room temperature and develop your exposed plates in extremely low red or amber safelight conditions for 2.5–3 minutes . . . or longer if the developer is older.

- **Developer #2**

  Developer #2 works pretty well but has its own idiosyncrasies that need to be tamed. It has proven to be a particularly good developer to use on glass, so I am including it here in case you want to give it a try. Begin by mixing up a Dektol developer solution of 1 part Dektol to 2 parts water. Then add a small amount of exhausted fixer diluted with water 1:2. I would like to be more specific about the amount of fixer, but that will depend on how exhausted it is. Age the solution for 24 hours before using. This developer is really inexact but fun to try. I've had friends that cultivated their exhausted fixer so that it was almost always consistent.

Here are two other developers that were played with in the spirit of experimentation. Neither was perfect all of the time, but they resulted in laboratory fun. Test #1 is a mono-bath formula in which the developing and fixing was done at the same time in the same tray. The second, Test #2, is an alternative contemporary tintype developer.

Test #1—Developer-Fixer Mono-Bath Ferrotypes

21 g hydroquinone
78 g sodium sulphite
56 g sodium carbonate
170 g sodium thiosulphate hypo crystals
70 ml liquid ammonia
Water to make 900 mls

In this test formula, we developed and fixed the plate at the same time in a mono-bath solution and then washed the plate. Back in the day, photographers used to add a little silver nitrate to get the development activated, and this is still a fairly common technique in wet plate collodion processing . . . to add a shot glass of silver nitrate to your ferrous sulphate developer. Brightening was also being done with a diluted potassium cyanide fix, as in wet plate collodion processing, followed by a wash. However . . . because potassium cyanide is extremely dangerous, I will warn you that using it without proper instruction and training is not a good idea and you should not use it even if you can find a source for the chemical. Please read the section on potassium cyanide in the Wet Plate Collodion chapter if you plan to use this chemical. If you do use it, be sure to have a lot of 3% hydrogen peroxide on hand to neutralize any accident you may have, such as touching your skin. In the end, we got this formula to work, but it was consistently dull and lacked contrast . . . problems that could certainly be rectified with more testing.

Test #2—Developer for Liquid Emulsion Ferrotypes

920 ml warm water
186 g sodium carbonate
93 g sodium sulphite
14 g hydroquinone
6.5 g potassium bromide
29 ml hypo solution (15%)

This is a tray developer for processing liquid emulsion plates. Add the ingredients in this order, making sure that each once dissolves before you add the next. Let the solution stand for several days undisturbed and then decant the clear liquid off the top, leaving the sediment behind. It gets better the more it's used because it collects some silver from the plates that have been processed in it. You could, of course, add a little silver nitrate to the formula in the first place to save time. Fill a shot glass with the developer solution and flow it across the plate as you would when processing a wet collodion plate.

We found that this formula produced really sweet-looking negatives on the plate, indicating the potential for using negatives instead of positives for contact frame and projection exposures. However, in our brief period of testing, the traditional 15% fixer was too powerful for this emulsion.

Again, set up three trays and a running water cold water wash so the emulsion doesn't get damaged. Tray #1 is for the developer and should be approximately the same size as the plate so you don't have to use too much developer. You will usually change developer every two plates. Tray #2 is for the hardening fix. Tray #3 is a cold water wash.

Expose your plate. You may have to use test strips to find the correct time. Use more exposure time if the image is too dark.

Pour a small amount of reversal developer over your exposed plate. Develop your plate with gentle and constant agitation for 2+ minutes. The plate will turn from white to black and then begin to show the image as development continues. Usually, 2–3 minutes is sufficient. If you continue to see the image emerging, develop a bit longer. If you notice the emulsion getting cloudy, dump it and start fresh. It will leave a cloudy film on your plate that is permanent if you think about it too long.

You will notice that the image is a *negative*, which makes sense because you used a film positive to contact print it. Increasing your development time does not result in increased density, and that is significant because there is exhausted fixer in the developer.

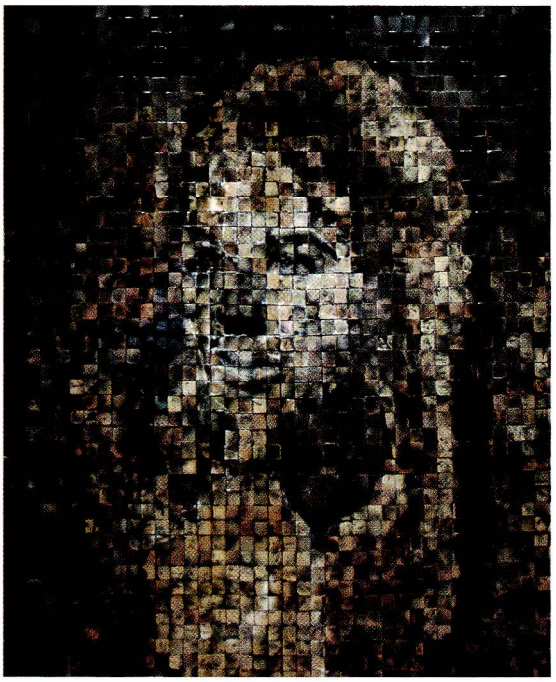


Figure 23–17
Mary Dorsey Wanless, *Diminished*, 2010 (6' × 8' tintype mural)
This 6-foot by 8-foot modular piece, made up of 1764 2-inch square tintypes, continues Mary's personal exploration into the aging process. This work is a contrast between the young and the old. The base image is a picture of Mary as a young woman, made up of pieces selected by tonal values to make up the image of the face. She writes, *"The individual squares are parts of my aging body that have been physically altered over time: eyes that cannot see, ears that cannot hear, breasts that cannot produce milk. These body parts are still parts of me and make up my whole as I age, but have a diminished capacity. They still make up my identity, yet function in a different way over decades of living." (Courtesy of the Artist)*

Negative quality at this stage is judged by how clean the white areas of the image are. Gently rock the tray during development. During development you may notice portions of the image are very dark—don't worry about it.

Fixing and Hypo Clearing Stages

Move your plate directly from the developer to the fix. Fix for 2–3 minutes or until the milky quality of the image has cleared away. At this point, the image will take on the appearance of a positive due to its underexposed nature and its dark negative background space. If you fix too long, the plates become very dark. If you wash with water between the developer and fix, the plate will become cloudy. Hypo clear for 1 minute, wash the plate for 10 minutes, and then let it sit flat to dry.

Tintype Shadow Intensification

Since the dry plate tintype is a reversal process, the shadows can be intensified in much the same way that one would intensify highlights on a silver gelatin print . . . by slightly dissolving the thinnest areas of emulsion on the plate. These thinnest areas exist in the shadows. The thinning of the emulsion will reveal the dark aluminum plate underneath, giving the shadows the illusion of more density. This does sacrifice some detail in those shadow areas.

This step is done after the final wash. Dissolve approximately 2 teaspoons of dry potassium ferricyanide in 1 liter of water. Place this solution in a tray and have a second tray of water nearby. Place your tintype in the potassium ferricyanide solution and watch closely for the first signs of the shadows becoming darker. At this point immediately remove the tintype plate from the solution and place it in the water tray to continue the intensification. Follow the intensification illusion with a 2-minute running water wash. If the intensification happens too rapidly and you lose too much of your image then your solution is too strong and you will need to use less potassium ferricyanide. If there appears to be no change in the image then the solution is too weak. Add small amounts of potassium ferricyanide at a time until you begin to see the shadows darken. This intensification can also be done selectively by painting the potassium ferricyanide into the specific shadow areas you are most interested in. Have running water nearby to wash the intensifying solution off your plate as you work so you do not dissolve too much of your image in the process.

Closing Thoughts

Working with liquid emulsions is a lot of fun and certainly opens the doors to an abundant buffet of integrated media opportunities. That said, if you really want to make tintypes, learn the wet plate collodion process, as there is no comparison to how beautiful the results of that technique are compared to the contemporary kit tintype. What the liquid emulsion experience excels at is providing you with a base on which to experiment, and it is often one of the first alt pro techniques that any of us experience.

The Alternative Negative

OVERVIEW & EXPECTATIONS

We will begin with a little magical realism in the form of an excerpt from Tiphaigne de la Roche's *Giphantie,* written in 1760. In his poetic vision you will see his imagination conceive the miracle of modern photography nearly eighty years before it was officially described to the scientific societies in France and England. I'll also provide A Little History regarding the curious individual and scientific connections associated with the evolution of the photographic negative.

A good deal has changed in the world of photography since the first edition of this book in 2001. The biggest change has been the very real attrition of traditional silver gelatin photographic materials. In the second edition of this book, in 2007, I wrote about a small consumer alert notice that had been accompanying more than a few films and papers from our favorite manufacturers . . . completely unhinging many of my friends who immediately ran off to appliance stores to buy giant freezers in which they planned to store paper and film to last the remainder of their lives. The notice read: ***NOTICE OF DISCONTINUANCE—Digital techniques have substantially decreased the demand for Commercial Inter-negative Film; therefore, this film will be discontinued when inventories run out.***

In this third edition, 6 years later, there are even fewer silver gelatin films to discuss, or many compelling reasons to do so, since there is little guarantee that those brands still being produced will continue to enjoy that privilege when this book is released. I am still in mourning for Kodak's SO-132, that lovely single-stage direct duplicating film, as well as the film stock that everyone in alt pro truly misses, Polaroid's Type 55 Positive/Negative Duplicating film (which used Kodak's SO-139 in the pod package). This film ensured a perfect contact negative experience. I am down to two boxes of this treasured material and will bring it out for my summer workshop students to use until the last sheet has been exposed. On the bright side, all is not lost . . . I'm going to introduce you to a potential replacement for Type 55 called New55 FILM. That news is very optimistic and exciting.

Figure 24–1

Malin Sjoberg, *Botanical IV,* 2012 (photogenic drawing)

My former student, Malin Sjoberg, is a friend and gifted alternative process artist. She created this piece as part of a botanical study of plants from Fox Talbot's garden which Talbot had collected during his travels in the Mediterranean. The colors are rendered by stabilizing them in salt solutions of chloride, bromide and iodide rather than fixing in hypo. Malin writes, *"I don't care that the images are fugitive and will eventually disappear, because the colours one gets are so beautiful."*

(Courtesy of the Artist)

Figure 24–2
Christopher James, *Pilar*, Mexico, 2005 (Type 55 negative & POP positive)
This pairing illustrates a Type 55 negative that was contact printed on a POP silver chloride paper in sunlight. It is an image of my friend Pilar, one of the best cooks in Mexico.
(Courtesy of the Artist/Author)

Fortunately, recent digital technologies, including substrates and inks, are getting better and better, and the ease of producing the perfect digital contact negative, in a variety of sizes, on a product such as Pictorico Ultra Premium OHP inkjet film, is making lamenters into believers. Information on this terrific product can be found in nearly every chapter in this new edition.

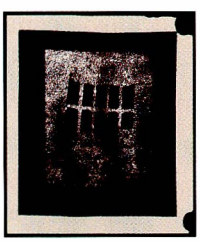
In this chapter I'm going to write about some basic things you need to know about film and how this knowledge will relate to your work with digital negative workflow. This will lead into a section on how to make digital negatives and positives for alt process contact printing, how to hit a curve, curve adjustments, basic math (don't be afraid), and recommendations for complete books on this particular subject. This section is designed and produced to be an introduction to complex technical issues surrounding negative production.

Most of the silver gelatin film stocks that I referenced a few years ago have now been discontinued, so I'll briefly write about a few that remain and how to work with them so that they can be controlled for your alternative process needs. One of these techniques is Dave Soemarko's LC-1 and LC-1B development process for creating continuous tone negatives with graphic arts ortho litho films, such as Arista's Ortho Litho 2.0. For those who are darkroom challenged, but are not yet equipped to deal with the complexities and nuances of the digital world, I will discuss making handmade negatives from photogram materials, using acrylic lifts, and creating cliché verre negatives on glass, acetate, or plastic substrates. We'll touch upon pinhole-camera-generated paper and film negatives and transparent films produced on a copy machine.

A significant technical achievement in this chapter is the contribution made by my friend

Mark Osterman, a process historian for the George Eastman House, International Museum of Photography, in Rochester, New York. Mark's developmental research in the area of dry plate emulsions (2006–2014) is detailed in his paper, *Making, Coating and Processing a Simple Silver Bromide Gelatin Emulsion.* As Mark writes in his introduction, "*If silver gelatin technology is important to the reader, this chapter, updated from the previous edition, is the starting point for learning how to make your own black and white negative plates, films and photographic paper. Mind you, these are the very basics, but if you follow the directions it's possible to make your own dry plate glass negatives capable of extraordinary resolution.*"

If you are anxious about chemistry and scientific complexity then you will appreciate that I have done my best to make this chapter uncomplicated. There are plenty of books on the market that revel in technicalities, and they're all listed here and in the bibliography. There are a few reasons I am going to take a different tack and make this chapter simple. First, specific references to products will likely be irrelevant to readers in a few years due to the speed of change in photography. Secondly, the purpose of this chapter on the negative is to open up a conversation regarding the first stage of what you'll need to make an alternative process image in print or plate form. For me, and this has always been my philosophy of teaching, you need to fall in love before you learn to kiss well . . . and falling in love should be easy. I am a believer in the proposition that technique follows the realization of need and that you will know when you need more. At that moment, the knowledge will be important to you. But first, as always, a little history.



A LITTLE HISTORY

Imaginative intellectuals, artists, and writers throughout history have been seduced by the romantic concept of a mirror that forever captures the image that it reflects . . . like Narcissus's image in the water. The Roman poet Publius Papinius Statius (40–96 CE) expressed this sentiment within his five-volume epic *Silvae. Silva*, the singular form of *Silvae*, meaning "of the forest," was used to describe a poet's work that was composed without formal structure and often in a moment of intense creative inspiration. The poems were dedicated to a wealthy patron and later revised to fit more stringent and formal standards.

One of my favorite examples of inspirational poetic premonitions is Charles Francois Tiphaigne de la Roche's *Giphantie,* written in Paris in 1760. In the following excerpt from his writing, de la Roche describes the imminent miracle of photography and an important aspect of the daguerreotype . . . eighty years prior to the medium's official coming-out party to the scientific societies in France and England! It is extraordinary how perfect it is in its detail.

A Vision from 1760: Tiphaigne de la Roche's *Giphantie*

"*That window, that vast horizon, those black clouds, that raging sea, are all but a picture. You know that the rays of light, reflected from different bodies, form a picture, and paint the image reflected on all polished surfaces, for instance, on the retina of the eye, on water, and on glass. The elementary spirits have sought to fix these fleeting images; they have composed a subtle matter, very viscous and quick to harden and dry, by means of which a picture is formed in the twinkling of an eye. They coat a piece of glass with this matter, and hold it in front of the objects they wish to paint. The first effect of this canvas is similar to that of a mirror; one sees there all objects near and far, the image of which light can transmit. But what a glass cannot do, the canvas by means of its viscous matter, retains the images. The mirror represents the objects faithfully but retains them not; our canvas shows them with the same exactness and retains them all. This impression of the image is instantaneous, and the canvas is immediately carried away into some dark place. An hour later the impression is dry, and you have a picture the more valuable in that it cannot be imitated by art or destroyed by time . . . . The correctness of the drawing, the truth of the expression, the*

Figure 24–3
Christopher James, *Double Strike/Atlantic*, 1981
This image is a small gift from the picture spirits. The negative was shot with a Diana plastic camera that I had modified with a Kershaw 450 shutter so that I could have a choice of *shudder* speeds.
(Courtesy of the Artist/Author)

stronger or weaker strokes, the gradation of shades, the rules of perspective, all these we leave to nature, who with a sure and never erring hand, draws upon our canvasses images which deceive the eye."

Angelo Sala to George Eastman

In 1614, Angelo Sala, an Italian Calvinist who had fled from Italy to avoid religious persecution, and who is incidentally credited with discovering that the herb St. John's Wort could help alleviate periods of anxiety and depression, documented experiments in which he noticed that silver nitrate inexplicably turned darker when exposed to sunlight. Presumably at the same time, he observed that silver nitrate in a water solution would also stain paper, or fingers, black if exposed to light.

Shortly thereafter, in 1664, the Irish scientist Robert Boyle (1627–1691) noted the influence of light on gold chloride that had come into contact with his skin, which resulted in a purple discoloration. He also observed that a silver chloride compound reacted to light by turning from light to dark. Boyle, unfortunately, thought that foul air in his lab had caused the reaction and didn't pursue an alternative explanation . . . that ultraviolet (UV) light was responsible for the changes. Boyle, by the way, was the gent who authored Boyle's Law (1662), the most important physical law of SCUBA diving: *as ambient pressure increases, volume decreases, and vice versa.* This describes what happens to the air in your tank, and lungs, as you go deeper and return to the surface. Boyle was also a founder of the Royal Society where, in 1839, Talbot eventually had his (please forgive me) day in the sun describing his practical photographic discoveries, which ironically included the sensitivity of silver chloride to UV light.

The legend goes that in the latter part of the 1700s, Josiah Wedgwood (1730–1795) was asked by Catherine the Great of Russia (1729–1796) to produce a porcelain service with her exact likeness on it in the Wedgwood porcelain factory. Sounds like a simple enough request except that photography hadn't been invented yet. Josiah Wedgwood was certainly the guy to ask, as he had industrialized the ceramics industry. As a note of interest, Charles Darwin was Josiah's grandson. One other odd connection worth relating . . . Josiah hired Joseph Priestly, the gentleman who discovered carbon dioxide and co-discovered oxygen, to tutor his son, Thomas, in chemistry.

In 1802, Thomas Wedgwood, Josiah's son, and his dear friend, Sir Humphry Davy (1778–1829), made what might have been the first *photogram.* Wedgwood was familiar with Heinrich Schulze and Carl Wilhelm Scheele's experiments with the light-sensitive properties of silver salts, in which alphabet letters were cut from paper, arranged into words, and wrapped around jars full of silver nitrate–impregnated gypsum (hydrated calcium sulphate). Armed with this knowledge, Wedgwood and Davy commenced coating paper, glass, and strips of white leather with solutions of silver nitrate. They then lay stencils on the substrate surfaces in sunlight. During the exposures, the silver salt sensitizer turned gray, purple brown, and eventually, black.

By the mid 1800s, artists were employing photogram techniques with both creative and practical scientific intentions. Notable at this time were

Herschel's flower extract *anthotypes*, Anna Atkins's cyanotype studies of algae, Mongo Ponton's potassium dichromate *shadowgraphs*, and William Henry Fox Talbot's *photogenic drawings* on salted paper.

In March 1851, Frederick Scott Archer (1813–1857) altered the landscape of photography forever. Prior to the 1850s, the primary photographic options available, providing you didn't want your images to be botanical studies rendered in cyanotype blue, were daguerreotypes and variants of wet or dry waxed or oiled paper negatives. The daguerreotype was known for its precious detail and elegant presentation, as well as the length of time it took to make a plate and its uniqueness as a one-of-a-kind product. The calotype image existed on paper and was reproducible, but the image quality was inferior because of the contact paper negative required to make a print. It was necessary for light to pass through the paper negative's fibers in order to make a positive print on paper. The desirable solution to these limited options would be a single imaging system that could be simultaneously reproducible, finely detailed, and fast enough to record un-posed and actual life.

Figure 24–4
William Henry Fox Talbot, *Photogenic Drawing of Feathers Lace & Leaves*, 1839
Silver iodide sensitized writing paper *photogram*.
(Photography Collection / Harry Ransom Center / The University of Texas at Austin)

In 1832, the French chemist Henri Bracannot (1780–1855), who is little known for his contributions to the development of photography with the discoveries of gallic and pyrogallic acid, observed that nitric acid, when subjected to starch or wood fibers, produced a combustible material that he called *xyloïdine*. This material was the forerunner of collodion and nitrocellulose, and could now be referenced as the first creation of a polymer in a chemistry lab.

Soon after, in 1845–1846, the German–Swiss chemist Christian Frederick Schönbein (1799–1868) discovered nitrated cotton (guncotton) by accident as he cleaned up a lab spill of concentrated nitric acid with a handy kitchen apron. According to the story, this cleanup action resulted in the commingling of the apron's cotton fibers with the nitric, and possibly sulphuric, acids. He then hung the chemically infused apron on the stove door to dry, whereupon the heat from the stove promptly instigated an explosive flash. Naturally this got a lot of attention as a potential addition to the arsenal of war, and Schönbein's formula of 1-part cotton immersed in 15-parts of a 1:1 solution of nitric and sulphuric acids for 2 minutes, followed by a cold water wash and a slow drying of the acid-free rinsed fibers at 100°F was greatly imitated. Ironically, a year later in 1847, a young medical student in Boston by the name of John Parker Maynard formulated a durable, skin-like medical dressing from the guncotton dissolved in ether and alcohol called *collodion,* which could be used to treat wounds from Schönbein's explosives. In 1850, Gustave Le Gray (of dry waxed paper negative fame) offered up the idea that Parker Maynard's collodion solution could be applied to photographic purposes because it was the near-perfect vehicle for holding a sensitizer in solution on transparent glass.

In March 1851, shortly after Le Gray's revelation went public, Frederick Scott Archer described an application of salted (iodized) collodion on sheets of glass for the purpose of making glass plate negatives. Archer detailed a process in which potassium iodide was combined with a solution of diluted collodion and

Figure 24–5
Fred Church, *George Eastman Aboard the S.S. Gallia with a Kodak #2*, 1890
The beauty of George Eastman's Kodak system was that it eliminated the psychological barriers of the technical and allowed the amateur to make photographs without the need of chemistry or darkroom. Eastman's motto, "You press the button, we do the rest" transformed photography by establishing a comprehensive photo-finishing industry that was accessible to everyone.
(Courtesy of George Eastman House, International Museum of Photography and Film)

then applied to a glass plate, which was then immersed in a silver nitrate bath, resulting in a light-sensitive layer of silver iodide.

This sensitized glass plate was then exposed in a camera immediately after being withdrawn from the silver nitrate, developed in multiple solutions of pyrogallic acid (thanks to Bracannot), and fixed in a mild sodium thiosulphate fixing bath (thanks to Herschel). The advantages were immediately evident. This new technique resulted in a sharp and reproducible glass substrate negative that was far more light sensitive than any process to date, especially in its wet state, permitting exposure times in seconds rather than minutes. This increased exposure speed allowed the subject of a portrait to exhibit a bit of candid behavior. It was also democratically priced, being a fraction of the cost of the daguerreotype. Incidentally, shortly after Archer published his experiments, enterprising photographers realized that an underexposed wet collodion negative, when laid on a dark background and viewed in reflective light, appeared as a positive. This visual phenomenon led directly to the even more democratically available ambrotype and tintype processes.

In 1871, an Englishman by the name of Dr. Richard Leach Maddox (1816–1902) produced the first successful silver bromide (rather than silver iodide) dry plate emulsion. With this process it was possible to make a negative on a glass plate at any time—not just when the plate was wet with the sensitized collodion emulsion. This meant that it wasn't necessary to take your darkroom with you when you went out for a day of making pictures or that you were forever tied to your studio. Maddox's patent-free achievement was described in an issue of the *British Almanac,* a reader of which was a young man named George Eastman (1854–1932), whose occupation at the time was coating and developing wet plate collodion glass plates.

George Eastman had a revelation. He theorized that if photographers could be guided to a dry plate system of making photographic negatives, their cameras could be smaller and processing negatives would be less cumbersome and complicated. He also surmised that image development could wait until the end of the shooting experience, rather than having to be done immediately following the exposure. He set to work on the inspiration in 1877, and in 1879 was granted a patent for his dry plate system. This was followed, in 1884–1885, by his brilliant idea of creating the world's first commercially produced flexible roll film system.

In this discovery, Eastman utilized very thin and flexible celluloid as the substrate for his emulsion. Celluloid was invented in 1861 and originally consisted of pyroxlene (a.k.a. guncotton) with naphtha, amyl acetate, oil, and camphor. As had been the case with the majority of photographic discoveries, the original seed for the idea belonged to another. The concept of using celluloid as a support for a sensitized emulsion had first occurred to a gentleman by the name of John Carbutt, a man most remembered for his stereographs, made while in the employ of the Union Pacific Railroad (*Glimpses of the Great West, 1864–1867*).

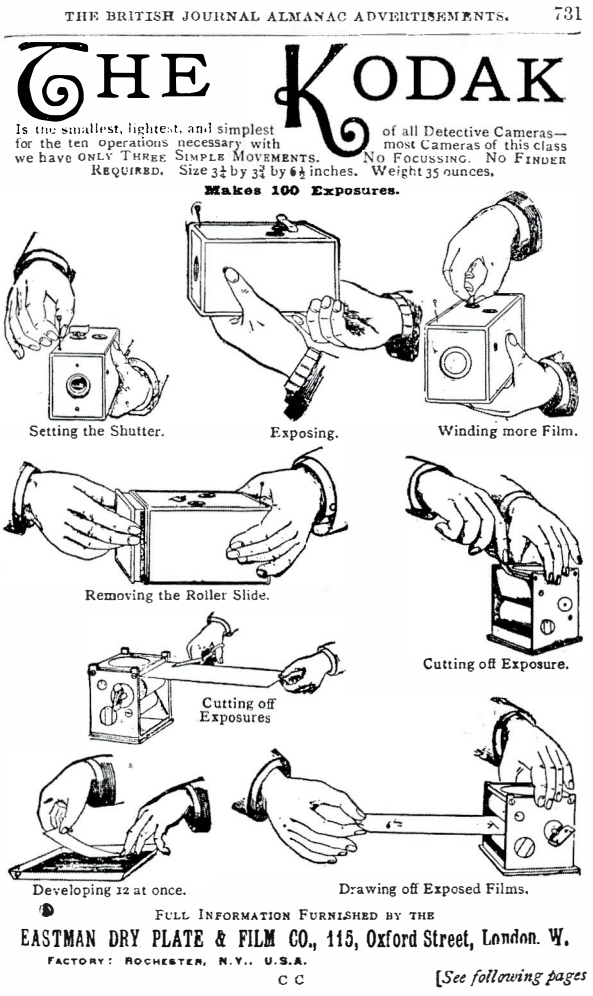


Figure 24–6

Advertisement for the Kodak #1, *British Journal Photo Almanac*, 1890

(Courtesy of George Eastman House, International Museum of Photography and Film)

In 1888, Eastman began to manufacture the Kodak 1A camera, loaded it with a roll of flexible film able to record 100 images, and sold it for under $25.00. The owner of the camera would expose the film and promptly send the camera back to the Kodak company in Rochester, New York, with the exposed film still inside. In a very Netflix kind of idea, the photographer would get a freshly loaded camera (not necessarily the same one that was sent in with the exposed film) and two small circular images of each exposure. The beauty of Eastman's Kodak system was that it eliminated the psychological barriers of the complex photographic system and allowed the amateur to make photographs without the need for technical instruction, chemistry, or darkroom. Eastman's idea revolutionized the medium of photography by creating a complete photo-finishing industry that was defined by its advertising motto "You press the button, we do the rest."

As an aside, there is a good story that the word *Kodak* was invented by a group of linguists and language experts at the request of George Eastman. Legend has it that Eastman wanted a name for his company that had no meaning, or similar spelling, in any language on Earth. The one that the language experts came up with was *Kodak,* and the rest was history.

A GOOD MOMENT TO EXPLAIN A FEW THINGS

Let me make this simple in a visual way because it is as important to understand what you are looking at when making a traditional silver gelatin or digital negative. I want you to imagine yourself standing on a white sand beach in full moonlight. The lunar glow is illuminating your body, and the odds are excellent that there is a shadow of you nearby. That shadow, against a field of white sand, is the equivalent of a negative of you in the moonlight, and the best way to describe it is to begin with the concept of a photogram.

In the early 1900s, the photogram re-emerged from the crude light-sensitive tests of Talbot, Hershel, Bayard, and Atkins in the mid-1800s. German painter and printmaker Christian Schad used torn paper and fabric as photogram source material, under glass, on silver gelatin photographic paper, to make negative light-marking images that Tristan Tzara, the leader of the Zurich Dadaists, called *Schadographs.* Schad, a principal member of the Cubist movement, inspired by Paul Cézanne and adapted by Pablo Picasso and Georges Braque, used photography to address the same issues being explored in contemporary Cubist painting, namely the illustration of the emotional force of three-dimensional objects, seen two-dimensionally, from many vantage points of place and time at once. Examples of the graphic power of a photogram can be seen in the work of Lucia and László Moholy-Nagy, Alexander Rodchenko, Georgy Kepes, and Man Ray.

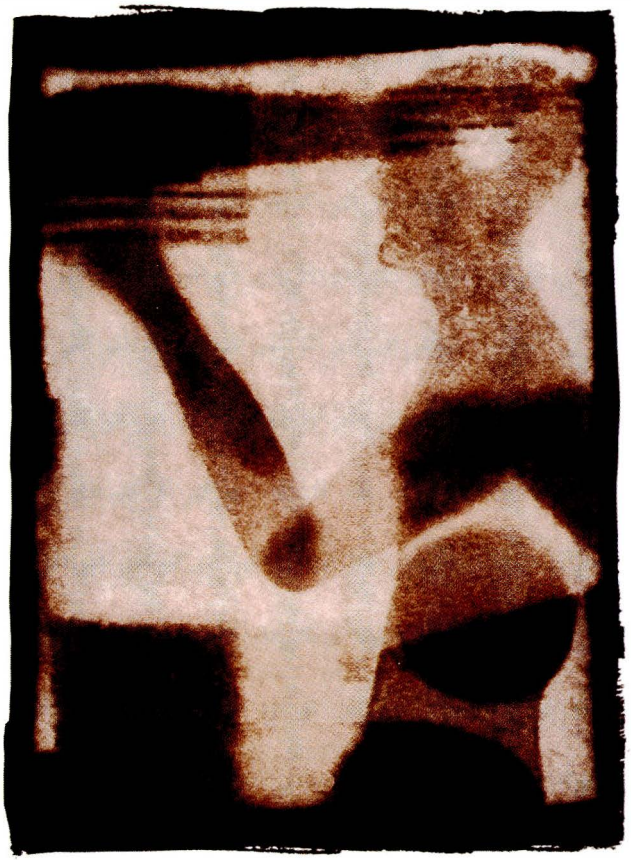


Figure 24–7
Paul Karabinis, *Contemplating the Noisy Confusion*, 2008 (salted photogram)
Paul, a great teacher, mentor, and artist, writes, "*I've always seen my work as a kind of hybrid printmaking that relies upon light sensitive materials rather than etching acids and inks. It's not that I'm trying to deny that the work is photographic, but I am more interested in that broader territory of how a photograph can be made, how it can look, and how it might function as a picture. Mostly, I'm just trying to make pictures that work with alt processes and don't fall into that trap of pictorialism and nostalgia.*" I couldn't have expressed it better. *(Courtesy of the Artist)*

The word *photogram* is used to describe the result of exposing a layer, or layers, of transparent, translucent, or opaque objects directly upon a photosensitive receptor such as a sensitizer applied to paper or a sensitized emulsion on a substrate of some type, including paper, metal, or glass. The objects placed against the sensitized substrate work like a negative, blocking or allowing light to reach the sensitizer in proportion to the degree of exposure to that light and the respective densities of the objects. The most transparent layers allow the greatest exposure, whereas the least transparent ones prevent exposure. A photogram on paper is only different from a negative because it is a one-of-a-kind image-making event and the result is a reverse, or negative, of the subjects and objects.

Negatives have visible zones of density that describe the amount of light that affects the silver, which is subsequently developed on the film. This works the same way with digital exposure except that there is no film, silver, or development involved, and the negative is realized by inverting the positive digital image within a software program. Back to film . . . clear or thin areas of the negative have the least exposed and developed silver and are primarily dependent on development. Dark and dense areas of the film have a great deal of exposed and developed silver and are most dependent on exposure. The center of this equation is an 18% gray (average film density of around 0.745) that is relative to any exposure made according to a light meter's standardized 18% gray, Zone 5, recommendation to its user.

The recommended development times assigned to films are important to you in that the longer the film is developed, the greater the contrast result will be for that particular film. When your film is being processed and *pushed* beyond a normal development time, the areas that have received the least exposure (your shadows) will not darken to the same degree as the more exposed areas of the film (your highlights). Up to a point, the extended development's effect on the highlight areas of the negative will create an ever-increasing comparative contrast with the shadow areas.

A basic rule of thumb: for more contrast in your negatives, underexpose and overdevelop (push) the film. Pushing the film means to develop the film so that the contrast is greater than it would be if the film were to be processed for a normal time. For less contrast, overexpose and underdevelop (pull) the film. Pulling means to develop the film so that the contrast is reduced relative to what the contrast would be if the film were developed for a normal time. After development, the resulting negative will exhibit a menu of tonal values that many large-format photographers refer to as zones. In a negative, these zones are given calibrated equivalent values with assigned numbers that can be applied to the lightest low-density shadows and the darkest high-density highlights of the negative. Density equals degrees of transparency in this context. When all of these assigned

values and numbers are stirred together you begin to encounter assorted theories about the *Zone System* . . . and just thank your lucky stars we will not be investigating that subject in this book.

For your information, the ability of a normal photographic paper to render highlight densities is maximized in the vicinity of a 1.2 average negative density range reading in the negative. In platinum/palladium (Pt/Pd) printing, the process has the ability to render a much greater range of densities in the negative, thus the compelling need to have a negative to match the almost linear curve of a perfect platinum negative. It is possible for the Pt/Pd processes to render highlight densities in the negative beyond an average negative density reading of 2.0.

What Is Average Negative Density?

Let's say that you're reading the directions for Pt/Pd printing and you come across some information that asks you to work with a negative that has a negative density range of **1.5**. The majority of readers will say "OK" and read on, hoping for the best . . . unless that number is one that they have looked into before or they have a little experience with densitometers and parametric curves.

- The number **1.5** comes from measuring, with a densitometer, the value for the thinnest shadow with detail and giving it a number. Let's say that the number you calibrate in that specific area is **0.35**.
- The next thing you would do is measure the value of the densest highlight with detail. Let's say this new calibrated number has a value of **1.85**.
- To find the average negative density of this film all that you have to do is subtract the thinnest shadow number from the densest highlight number. In this convenient example you will come up with the number that was recommended to you for the process (**1.85 – 0.35 = 1.5**).

When working in non-silver and alternative processes it is necessary to create a negative, or a positive, that will match the size of your finished print and one that can be contact printed in direct sun or with a UV mechanical light source. Most photographic artists have an occasional or constant desire to make big and impressive images. Being able to produce enlarged duplicate negatives from existing smaller film or digital image sources permits carrying around a small camera and eventually making large enough negatives for alternative process contact printing. What was once the exclusive domain of dedicated large-format film photographers, or inter-negative-savvy lab-rats, is now available for anyone making images . . . especially those working with high-end digital cameras or telephones with high megapixel capture capacity. Better still, digital photography makes the construction of a personal calibrated average negative density system easily within your grasp.

One other reason for enlarging your negatives is that in the real world, your original negative will rarely have the correct tonal values for a particular process. As an example, a negative made for Pt/Pd printing will make you happy if it exhibits a healthy contrast and an average negative density of 1.5–1.7 . . . which would be appropriate for printing in a traditional wet darkroom on a silver gelatin paper with a contrast filter grade of 0. In a second example, gum bichromate prints often require a CMYK negative set of the same image, in perfect registration. They also often require that each negative has a different average negative density. Making a set of enlarged duplicate film negatives is an option for some ambitious "gummists," while others simply alter their exposure times or pigment to sensitizer ratios using a single negative source. With Adobe's Photoshop, making a CMYK negative set on Pictorico Ultra Premium OHP digital film requires only a few dedicated clicks in a sequence and your printer will provide the rest. Please see the instructions for this workflow in the Gum Bichromate chapter. We'll get to more of this further along in the chapter where I'll give you a nice menu of options for making negative sources.

Negative Density Ranges

For each alternative process, slightly different negative requirements will be required to yield the best results. Platinum and palladium negatives, for instance, enjoy a long sloping tonal scale between shadows and highlight density. The ideal negative in this case is one with pronounced contrast and average negative density in

the neighborhood of a 1.5–1.7. In general, the following combinations of paper grades and density ranges offer a good starting place, assuming you've spent some time in a darkroom.

An average negative density in the vicinity of 1.5 is suited to a grade 0 silver gelatin paper. An average negative density range of 1.3 works well for a grade 1, an average of 1.1 on a grade 2, a 0.90 on a grade 3, a 0.70 on a grade 4, and an average negative density of 0.60 (or less) on a high contrast grade 5. Of course, any of these approximate recommendations will only be relevant depending on what you intend to make with your negatives, and the intentions of each individual artist will always come first when determining exposure and development relationships of both interpositive and negative stages.

In multiple-stage duplication, whatever black-and-white films that are still in production when you read this can be processed in ortho A & B high-contrast developers for a graphic look. For more continuous tonalities and a longer tonal scale, consider Soemarko's LC-1 and LC-1B formulas in this chapter. If you are chemically astute, you may modify existing developers or make up your own. Many of the ortho lith film types can be processed in film developers such as HC-110 dilution-B, or D-76, for 4–5 minutes alone, or in combination with conventional paper developers. Freestyle (http://www.freestylephoto.biz) sells a solution called Clayton Extended Plus Developer, a low-contrast developer for both film and paper that provides extended latitude for processing high-contrast films and papers. Clayton Extended Plus can be successful in giving a longer tonal scale with ortho lith films through dilution strengths in the 1:15 range. If you get into this, I recommend that you experiment with as many combinations of film and developer as you can find and ask other artists for their personal recommendations and preferences.

Figure 24–8

Christopher James, *Rachel w/Wings,* Maine, 1995

This piece was made during a cyanotype on fabric mural project workshop. I made the image with a Lensless Camera Co. pinhole camera fitted with a Polaroid 4" × 5" back and Polaroid Type 55 Positive/Negative Film. The Type 55 negative was then used to demonstrate the palladium process. *(Courtesy of the Artist/Author)*

THE DIGITAL NEGATIVE

A Basic Intro to Making Digital Negatives/Positives

Let me begin by making this as simple as I am able. It's getting more complicated to work exclusively with your favorite silver gelatin film stock, and unless you are shooting wet plate collodion or dry plate emulsions in-camera, you are likely finding your options narrowing. To compound the problem, most of you reading this are personally invested in the handmade print and are dependent upon a contact negative or positive the same size as your finished print to do your alternative process work. The perfect option at the moment is for you to learn how to make and produce your contact negatives on a digitally compatible film stock, such as Pictorico Ultra Premium OHP, using pigment-based inks. This solution is faster, less expensive to archive, more flexible, and less precious. It can also be used as a contact source or in the enlarger, and it can be endlessly modified to your intentions and process. Additionally, making digital negatives allows you to create custom profiles and process-specific curves, separations for gum bichromate and printmaking purposes, and multiple test negatives to determine

the best densities for your process. Digital negatives also enable you to construct digital image negatives and positives for hand-applied emulsions and to make masks for multiple exposure printing. Additionally, you don't need to stress about ruining your best negatives with silver nitrate sensitizers on a hot and humid day. You can make any mistake you want while experimenting, and if the film is damaged, just print out another film and get back to work.

The ability of the digital negative to customize densities and curves, to match the peculiarities and requirements of the processes you are performing, to put it simply, is a terrific improvement over the wet lab. An example would be a Pt/Pd contact negative that requires a long and gently sloping toe and shoulder curve for delicately separated highlight and shadow details. By digitally creating a steeper curve, and dictating the D-min (minimum density) and D-max (maximum density) of the negative, you are able to create a negative that is far easier to print and that can be instantly modified to a different state by simply returning to Photoshop and generating another version of it. This is especially convenient if you want to use the same image in several different processes, each with its own unique curve requirements. As well, inkjet negative production allows you to add a colored layer that can mimic a filter such as the UV screening pyro development tint, greatly improving your technical flexibility. This convenient control well exceeds the learning speed limits one can master in a traditional darkroom environment, which will always remain dependent on how well everything went during the original shoot and subsequent chemical development. Essentially, there are three steps to begin learning how to teach yourself to make a fine digital negative.

Step 1 Start with a digital image, like a RAW file from a digital camera, or one that has been converted into a digital file through a digital scanning process. This scanning stage can be done professionally by simply going to your local camera store, as these stores are now in the business of servicing digital photography needs, instead of processing and printing. Your local store is likely to have a scanner that is far superior to one that you would generally purchase for home use.

Step 2 Once you have the file in hand, it's time to put it into Photoshop and begin creating the negative you want to work with for the process you have in mind. It's a simple matter to invert the image from the positive you've been working on to the negative for the particular process you intend.

You may want to add a specific curve profile for each individual process you intend to print in. These curves are readily available on the Internet, and many paper and ink manufacturers have them available as free downloads from their web sites. Most people I know are happy making their own, but if that idea makes your brain itch, you can find sample curves for alternative processes using a simple Internet search. Just for fun I am going to give you some basic, non-scientific, "How to Hit the Curve" information very shortly.

Step 3 Output the work to provide a contact negative for contact printing . . . *unless you need a film positive,* as in the case of wet plate collodion projection or contact printing and anthotypes. This output can be achieved quite simply with Pictorico Ultra Premium OHP film and a decent quality inkjet printer, such as an affordable Epson 3880, with water-resistant Epson K-3 ink sets. I'll chart out the step-by-step workflow for this later in the chapter.

How to Hit a Curve: A Brief Conversation About Curves

Here are the remnants of a conversation I had with my former MFA student, and friend, Cotton Miller . . . it may help put the beginning of this section in perspective.

Me: Cotton . . . when you make a curve profile, do you begin by making the best image you can in Photoshop as a positive and then invert it to make the best negative for the process? And is that the moment when you save the curve profile?

Cotton: Start with a step wedge. Invert and Print that without a curve. Build the curve based off of the difference in tones from input to output. The curve specific to the process is added when the image is a positive . . . before the image is inverted.

Me: Um . . . do I look puzzled at the moment?

Cotton: Another way to do this is to invert the image with no curve and then print the negative. Then, print the image in whichever process you are using. Once you see the results, begin to use curves to start correcting the negative by setting highlight and shadow points, simply by choosing the tones according to what printed well in the alt pro print. What did not print well might be easily fixed with a curve adjustment.

I know that may sound confusing, but it's pretty intuitive. All of this should be based off of a standard print time, which is the minimum amount of exposure to print through the Pictorico. I can't tell you how many prints I see that don't have D-max. They have a relative D-max, in that it's relative to the other tones being blocked by the Pictorico. This is very obvious when people apply brush strokes that extend beyond the Pictorico, and they look way darker because there is no Pictorico filtration blocking light.

Me: That helps . . . I think I'll begin explaining it that way. What I'm trying to do right now is explain the very basics of what a curve is, how to intuitively construct one, and how to capture it so that it can be used in subsequent working sessions. I don't want the explanation to be longer than a page or two. Perhaps show a sequence of images that show what the curve adjustment looks like in each step. I've got a rather detailed workflow in the gum bichromate chapter about CMYK negative separations and additional detail workflow from Tony (Gonzalez). This one needs to be a raw basic tutorial for someone who wants to give it a shot but doesn't know very much and would be happy if it could work intuitively rather than as an equation. Does that make sense?

Cotton: Yes it does. Would you like me to elaborate on setting a white and black point?

Me: Not at the moment thanks....

Curve Adjustments

The curves adjustment dialogue box, found in the Menu > Image > Adjustments sequence, is one of the most useful tools in Photoshop . . . especially if you intend to make your contact negatives digitally in Photoshop and print them out on Pictorico. Curve adjustments are pretty simple. The box is set up like a grid . . . and when you open it you will see a

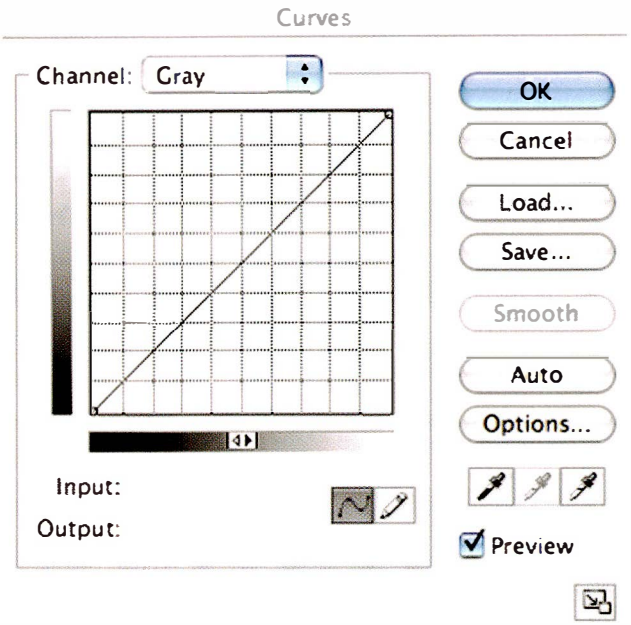


Figure 24–9
Curve Adjustment Dialogue Box
(Source: Adobe® Photoshop®)

straight line running diagonally from the lower-left corner to the upper-right corner. The lower point on the line on the grid represents the dark end of the image. The higher point on the line on the grid represents the light end of the image.

If you take the upper-right-corner point of the diagonal line and make the diagonal steeper by moving the point along the top to the left, you will increase image contrast by making the highest values brighter and the medium values lighter. If you take that same point in the top-right-corner and move it down, you will make the line less steep, and simultaneously decrease image contrast, making the medium values flatter and your highlights less bright. Be conservative when moving the extreme top and bottom of this diagonal line.

You can place, and lock, any point on the diagonal curve adjustment line by simply clicking on any point along the line. By doing so, you prevent any tonality changes in the original image at that specific point in the existing tonalities. The easiest way to lock in a point or tonality on the line is to place your cursor on any value in your image that you want to change or preserve. Then simply press the Command button and click on the mouse . . . this action will lock that point on the line.

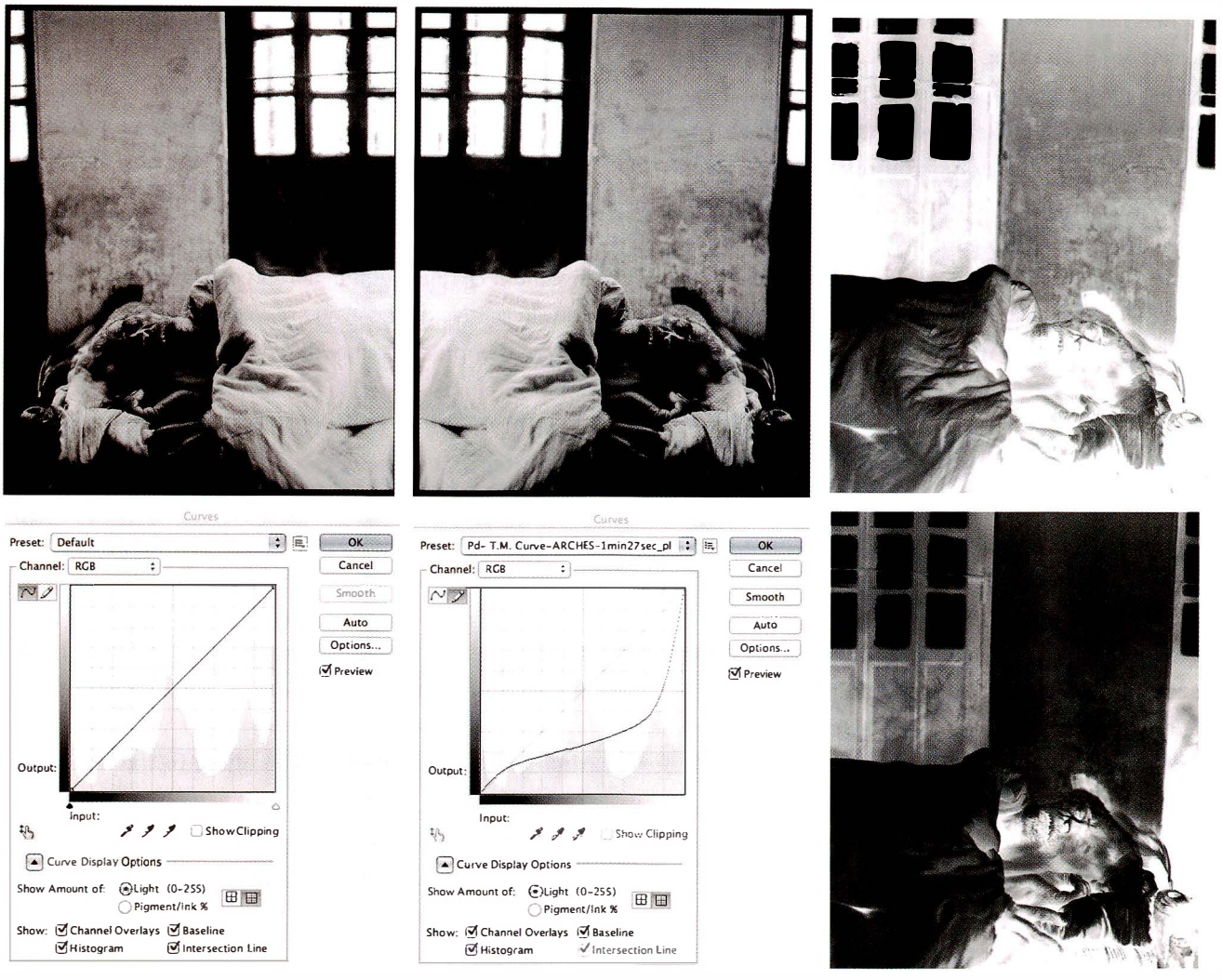


Figure 24–10

***Dying Man* Applied Curve Adjustment Sequence**

This is an illustration of one of my photographs as it transitions through a series of steps leading to the most optimum contact negative for a particular technique. This example shows a custom palladium curve, created by Tommy Matthews, intended for a print on Arches Platine.

(Courtesy of Author/Artist)

Here's how it might work. If you place, and lock, a point on the middle of the diagonal line and draw it up toward the upper-left corner, making a smooth and bow-shaped arc, you will increase the overall luminosity in all values except for extreme white and black ends, where the line is locked automatically. If you drag the locked point in the other direction, the opposite happens and luminosity decreases uniformly across the image. Now, if you find a value in your image that you don't want to change while you adjust the curve, lock that value as described and it won't change no matter what you do. This is a good way to preserve delicate shadow details that would be lost with a total brightening or darkening adjustment of the entire image.

If you just want more contrast in your image, lock in the middle point on the grid and then find the lightest tonality with detail and lock that point . . . then move it diagonally left a little bit and you'll see a brightening of the higher tonalities. Then lock in a point on the lower part of the diagonal where you have shadow detail and pull that diagonally down to the right. Again, just a slight adjustment. What you have created is a modified "S" curve on the line and an increase in the contrast of the image on the screen. Click the Preview option in the Curve Adjustment box and you'll see the difference of before and after. If you like it, do a Save As and label it as that image with a contrast adjustment.

Keep in mind that the best negative for most alt pro work is one with a long average negative density range of at least 1.7. This is dependent on the process, of course. Some techniques, like salted paper or albumen, will require a more dense and contrasty contact negative. Mike Ware advises extending from base + fog (0.2) to a D-max of 2.0 or more for his New Cyanotype process. This density is achieved with silver gelatin film by "over-developing" the negative as much as 70%–80%.

If you are making digital film negatives you can apply the same concept to your image saturation/exposure/output. If you process your negatives using what looks like a nice negative in a traditional wet darkroom, you will probably end up with negatives that are too flat and thin. They will block up under the influence of strong UV light and generally be flat and uninteresting. What you are seeking here is density and contrast that will give you a strong image during an exposure that may be as long as 20 minutes in direct sunlight . . . think about it. *Bulletproof* is a word that we often use to describe a negative that will print well.

Making an Adjustment Curve

Once you get a good-looking negative for the process you want to work in, save the adjustment curve and label it as that particular processes curve. Place it in your Curves folder, which is found by going to the Photoshop application > Presets, Curves, as you can see in the Curve Profile Capture illustration.

Here's one way to learn how to make an adjustment curve intuitively. First, make a great positive that you really like on every level you can think of. Do your best to simply make your adjustments with Levels and Curves, and try to stay away from the seductive siren songs of the Filter options. Once you have produced the best positive on the screen that you can, *invert* the positive to a negative with no curve profile adjustment.

Print out that negative version on Pictorico Ultra Premium OHP inkjet film and proceed to make a print in the alternative process you are working in. Be aware that different printers produce different levels of excellence on inkjet film, with Epson being the best in my experience.

After making the best alt pro print that you can from that first negative output, paying close attention to highlight and shadow details that you are printing out with the step wedges, go back to your file in Photoshop and begin adjusting your negative in your Curves Adjustment box, which you will find easily in the Images menu. Determine the tonal changes in the negative based upon what printed well, or did not.

This is an intuitive exercise and will take some time, but it will be worth the effort in the end when you will have a *preset* curve profile to apply to all subsequent contact negatives for that particular process.

All of your test prints should be at the same exposure time. It's best to use a UV-exposure unit, instead of the sun, for a day-long series of tests with the goal of determining the minimum amount of exposure needed to achieve D-max, the darkest possible value in the print, which is equivalent to the sensitized outside border of an alt process image with a brush-applied sensitizer. Once you have your personal curve, you will

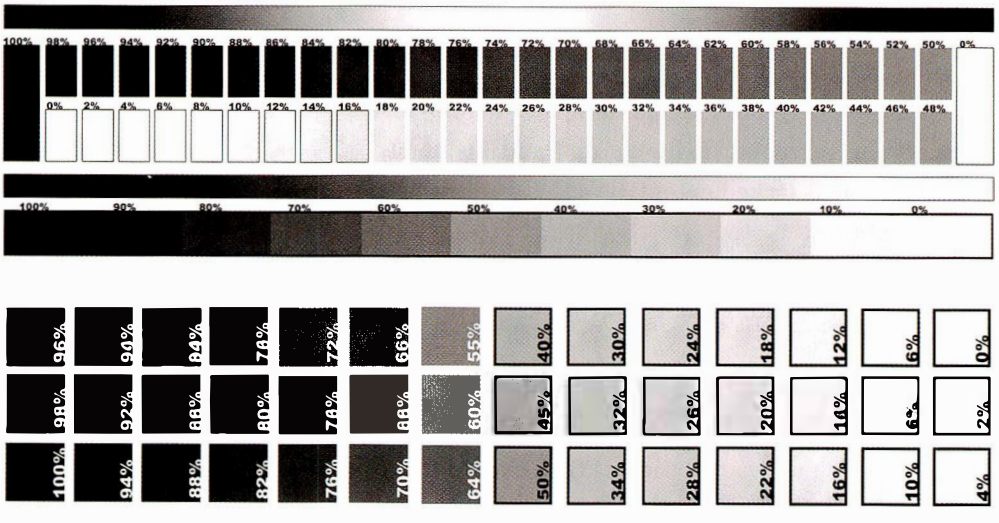


Figure 24–11
Step Wedge
This is an illustration of a common step-wedge that can be printed at any time in the workflow to inform you of your UV light intensity, chemistry, possible exposure times, and a myriad of other useful bits of information. I often print one of these on the same paper I'm printing a test exposure to see how close I am to realizing all of the possible tonalities.
(Courtesy of Cotton Miller)

want to save it and place it in the special Curves folder mentioned earlier so that you can access it when applying curve adjustments in Photoshop.

Saving a Curve Profile (PS CS6)

Step 1 Go to Image > Adjustment > Curves, and in the Curves Panel, click on the tiny Curve Options in the upper-right corner of the Curve Panel, and then click Save Preset. You'll notice that there is a Preset option there as well, which is for all of your saved or collected Curve Adjustment profiles . . . the file suffix is normally *.acv* unless it is an Action step.

Step 2 Navigate to Applications > Photoshop > Presets > Curves, and name the .acv curve that you have just created. Later you can name it more specifically when you know what process, exposure time, and light source you will use.

Step 3 Once you click OK, the curve profile should show up in the curve presets drop-down menu in both the curve adjustment and curve adjustment layers. This is the little square box in between the Preset drop-down menu and the OK box at the top of the Curve graph box. Simple.

A FEW WORDS ABOUT TECHNICAL STUFF

If you are like many people I know, what you want is a "magic-bullet" solution to the problem of how to use your favorite negative in many different processes without having to negotiate a complex set of technical instructions on how to make a digital negative. If this fits you, then I'll try to make the task a simple one. If, on the other hand, you want to be a master of the digital negative universe, I will send you in the direction of some very good books on the subject, and after some time, you will be very good at it.

I am constantly humbled by what I do not know and am forever asking how-to questions of my students. It is not my intention to try to tell you how the digital world works . . . I'll leave that to the experts who are increasingly represented by young men and women who got their first phones, tablets, *phablets* (telephones that are large enough to be tablets), and computers as baby presents. In the meantime, there are a few issues, directly related to alternative processes, in which I can offer to simplify your life rather than complicate it.

Some Basic Digital Needs

You will need a computer with a large hard drive for software applications and archiving. It should probably be an Apple computer because that company services artists and designers rather than the business world. The monitor for this computer should be large enough for you to see what you're doing, and it should be a Retina display that is better than your own perceptual ability. I have done all of my work on a MacBook Pro for a decade and am happy. If you are really digitally serious, you might want to invest in a companion monitor of sufficient size. You can connect them and use the laptop for tools and the larger monitor for the images.

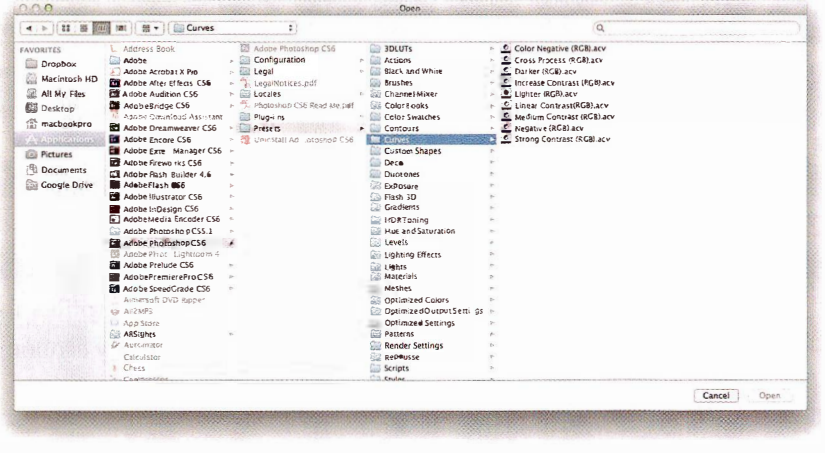


Figure 24–12
Curve Profile Capture #3
A screenshot of what you will be looking for when determining how to save, and where to store, your custom curve profile presets. *(Source: Adobe® Photoshop®)*

Figure 24–13
Christophe Engel, *Untitled Ships 091201*, 2009 (digital)
This extraordinary digital image is one by Christophe Engel that he made of Singapore Harbor in 2009. I responded to this image immediately as it reminded me of the abstract expressionist power of some of Cy Twombly's paintings from the late 1960s and early 1970s.
(Courtesy of the Artist)

Load up with as much storage as you can afford. You might consider a hard drive with over 250 GB to be a good place to begin. You will also need a minimum of 8 GB of RAM (random access memory) to work on large files. The bottom line regarding RAM is to have as much as possible. A good rule of thumb: allocate enough RAM to accommodate four times the size of your largest file and you should be OK. Obviously, file size is dictated by the physical size of the image. Other factors include whether it's a 8- or 16-bit per channel file, the number of layers, masks, alpha channels, how complex the image is, and a host of other things you will learn as you go. Photoshop will use as much RAM as you dedicate to an image while you're working on it and then it will begin using free hard drive space. If you make a 16-bit scan of a 6" × 4.5" negative, at 2500 ppi, the file size will be around 321 MB. Photoshop will need close to 1.3 GB to edit this file. You get the concept here . . . load up on the RAM when you buy a computer.

This is serious. You need a back-up hard drive for storing all your images. You must have one of these, and it should be large enough to store an unlimited number of images in various stages of completion. It is critical that you get on a schedule for backing up. When I'm working daily, I back up daily. Otherwise, I back up every Sunday morning while having coffee, toast, and playing vicious backgammon and cribbage games with my lovely wife Rebecca.

You will need a good printer. I won't waste a lot of time being diplomatic here. I have used Epson printers for years and have zero complaints or problems with them . . . as long as you use them on a regular basis. My choice for an upscale home lab printer, the Epson 3880 with its K3 Ultrachrome ink sets, with superior profiles and print management system, is about as perfect as you can get for the investment. I have no doubt that within a very short period, in fact by the time you read this, my perfect 3880 will have been replaced by newer printing technology that will be even better and probably less expensive. The cost of ink sets drives this particular train.

There are other issues to consider, of course: the environment you work in, the paper that you use (Hahnemühle photo rag is my favorite), your color calibration tools and software, the curve profiles for specific third party papers and films, and any economical bulk ink feed systems, like Jon Cone's at http://www.inkjetmall.com.

Basic Math and Associated Reading Recommendations

The image you scan into Photoshop will be made up of pixels rather than grains of silver. In order to achieve a continuous tonal range in the final negative, the tonal scale, from black to white, is assigned a possibly endless buffet of separate levels of pixels and tonalities. Each one of the pixels and levels consists of individual triggers, and each trigger is either *on* or *off* and *black* or *white*. When the triggers are activated, each pixel will have an impressive number of separate on or off switches that will determine whether an on or off switch will print a black or a white dot. That means that each separate pixel is capable, in black and white, of looking like gray when next to another pixel. There is no actual gray dot, just the illusion of gray dots due to the relationship of black and white dots.

Note: In RGB (red-green-blue) mode the pixel is generated by a numeric value (0–255) indicating a level of brightness for the red, green, and blue components. A pixel with a numeric value of (R) 255 (G) 255 (B) 0 would have fully saturated red and green values but no blue values (in this case yellow would be the resulting color). This is an entirely different discussion and one that you can have later with a more comprehensive digital tech book.

If your intention is to enlarge that 4″ × 5″ negative to a 16″ × 20″ negative, you will have to scan your original negative at four times your intended printer resolution. A 4″ × 5″ black-and-white negative scanned at 1200 ppi for printing a 16″ × 20″ at 300 ppi (pixels per inch) image is mathematically figured out like this:

- 4″ (*neg. dimension*) × 4 = 16″ (*new neg. size*) × 300 ppi = 4,800 pixels
- 5″ (*neg. dimension*) × 4 = 20″ (*new neg. size*) × 300 ppi = 6,000 pixels
- 4,800 × 6,000 = 28,800,000 pixels (*16″ × 20″ negative*)

One of the constraints when working with alternative printing processes is that the print cannot be larger than the negative because the prints are made by contact. If a larger print is desired, then you need to make a larger negative. This is accomplished by creating a copy negative in the darkroom (now a problem, as many of the films that were exceptionally good for this task are no longer made) or by producing a digital negative on a computer using digital imaging software. The latter is by far an easier solution to the problem.

An understanding of resolution is important. You will also need to have a working comprehension of the relationship between a negative's density and Photoshop's histogram for that negative. The histogram is a graphic representation of the density range within a negative and is essentially a densitometric map of the image that looks like a mountain range at twilight. Photoshop's Levels and Curves commands can alter the histogram to change the appearance of your image. It's important to have a working knowledge of those commands as well. That's about it.

There are many excellent books written on how to make your way in the world with Photoshop by your side. Many of these books give good and basic information on these and other digital topics, and I absolutely recommend that you purchase one and use it. In particular, study the chapters relating to resolution, the histogram, levels, and curves. As well, I recommend buying only what you can comprehend so that you don't get overly frustrated. The following are among my favorites.

- **George DeWolfe**, *George DeWolfe's Digital Photography Fine Print Workshop* (McGraw-Hill Osborne Media, 2006).
- **Dick Arentz**, *Platinum & Palladium Printing*, second edition (Focal Press, Elsevier, 2005).
- **Mike Wooldridge and Linda Wooldridge**, *Teach Yourself Visually Photoshop CS6* (2012).
- **John Paul Caponigro**, *Adobe Photoshop Master Class: John Paul Caponigro*, second edition (Adobe Press, 2003).
- **Dan Burkholder**, *Making Digital Negatives for Contact Printing*, second edition (Bladed Iris Press).

Figure 24–14
Dan Burkholder, *Flatiron in Spring*, New York, 1997
Dan writes, *"I print this as Pigment-Over-Platinum in which I combine digitally applied color pigments with hand-coated platinum. This image works beautifully for the POP process with the transition from the subtle color to the rich platinum blacks being particularly enchanting (for me anyway). This image is printed as a 9" × 13.5" print on Bergger Cot320 paper. In gallery talks and other presentations I describe this as my 'homage to Steichen' image. I was trying to capture the same luxurious aquamarine color he used in his gum-over-platinum image."*
(Courtesy of the Artist)

- **Jeff Schewe**, *The Digital Print: Preparing Images in Lightroom and Photoshop for Printing* (Peachpit Press, 2013).
- **Steve Weinrebe**, *Adobe Photoshop & the Art of Photography* (Cengage Learning, 2008).
- **Janet Ashford and John Odum**, *Start with a Scan*, second edition (Peachpit Press, 2000).

ALTERNATIVE PROCESS INKJET FILM NEGATIVES

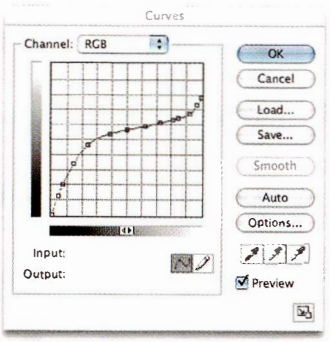
Creating a UV Color Filter for Contact Negatives

Pictorico Ultra Premium OHP comes in two forms. One is the basic sheet film, which is relatively clear, like acetate, and holds a respectable amount of ink. There is a new Pictorico OHP Ultra Premium inkjet film that comes on a roll, and in sheet packages, and accepts a bit more ink than other inkjet films I have experimented with . . . allowing for greater densities where it matters, in the highlights. It has a translucent white base coloration, and I often use it as a plain filter sheet when exposing in a UV-exposure unit to simulate shade exposure. Pictorico OHP is coated with a fine layer of ceramic dust that allows a formidable amount of ink to be printed on it without streaking or settling on the film as a puddle.

The following is a simple workflow for assigning a color filtration to Pictorico Ultra Premium OHP. This is a variation of several similar digital negative workflows, some of them far more complicated in their approach to this topic than what you are about to learn. If you follow these steps, your negative will print with a reddish-yellow cast. You may decide to go in other filtration directions such as duplicating the greenish-tan cast of a pyro developed sheet film, and it's a relatively simple matter to alter the instructions to match that chromatic tonality. These colors block and filter UV light and will assist your ability to attain a longer tonal scale in your final printed image versus printing with a monochromatic negative. My friend David Stinchcomb fine-tuned this workflow. It works well for many processes and is surprisingly simple and easy to learn.

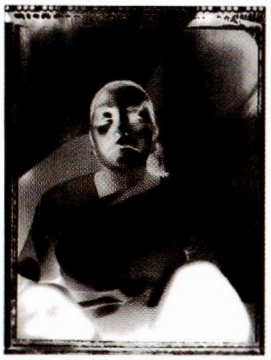
Before creating the color mask you may want to make some quick adjustments to the Adobe Photoshop Color Management Settings, found in the Edit Dialogue menu. You should be in the RGB mode with color management turned off. If color management isn't turned off, Photoshop will do strange things to the color mask. The easiest way to do this is to go into Photoshop's "Edit Color" settings and, under working spaces, choose Colormatch RGB. Then go down to "color management policies" and make sure they are all turned off. Then save the settings under a title that you will recognize for future use with digital negatives . . . you can load this setting every time you make digital negatives.

Grayscale to RGB

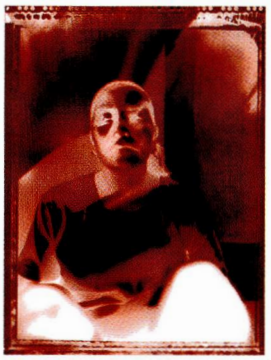


Ziatype Custom Curve Profile

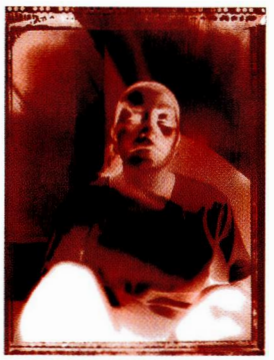
Positive with Custom Curve Applied



Inverted w/ Custom Curve



Inverted w/ Color Layer Applied



Flipped For Contact Printing

Figure 24–15
***Pilar*, Mexico, Curve & Color Layer Sequence**
This sequence illustrates the steps I might make when transitioning my negative of Pilar from grayscale, through a custom adjustment curve profile for Ziatype, followed by an inverted step and color layer application for contrast control. *(Courtesy of Artist/Author)*

If changing your Photoshop Color Management settings is a little too much adjusting for you, then don't worry too much about it. I keep my settings simple with Adobe RGB (1998) and let Photoshop determine the colors. Everyone works a bit differently, depending on his or her basic knowledge, process goals, and intentions. What works for you is what you should be doing.

In this example you are starting with a lack-and-white (grayscale) file, and your intention is to prepare it for contact printing with a Pt/Pd digital contact negative. You will be assigning a custom curve profile to the image and then laying a color layer on the image to assist in enhancing the quality of the image.

Step 1 Open up your image in Photoshop and work with it until it meets your expectations and intentions.

Step 2 If you are in Grayscale, go to Image, then to Mode, and click > RGB.

Step 3 Go to Image, to Adjustments, to Curves, and click Load.

Step 4 Find the correct curve profile, in your Curves Profile folder in the Photoshop Preset folder, for the process you will be working in and click Load to apply the curve.

Note: It's necessary to do this step before you invert the image. The reason is that when applying a color layer, it has a different effect on the tonal scale if you apply the curve to the positive as opposed to applying it to the negative. This is different than when you are making an adjustment curve and applying the preset curve to the negative.

Step 5 Go to Image, to Adjustments, and click Invert to make the negative.

Step 6 Select Layer from the menu.

Step 7 Choose New Fill Layer and click Solid Color.

Step 8 Name this new layer if you feel like it.

Step 9 In the Mode box, select Color.

Step 10 Keep the opacity at 100%.

Step 11 Click OK.

Step 12 You are now in the Color Picker window.

Step 13 Look for the CMYK boxes in the lower-right quadrant of that window.

Step 14 Change the following CMYK numbers to **(C)** 0, **(M)** 55, **(Y)** 55, **(K)** 0.

Step 15 You will now be looking at a deep orange-red version of your file.

Step 16 Go to Image, to Rotate Canvas, and flip your image horizontally.

Step 17 Print the file on Pictorico Ultra Premium OHP at Highest Quality.

Step 18 Let the Pictorico dry thoroughly before using. If it gets scratched . . . make another negative. This is the beauty of making digital negatives . . . if one gets destroyed it's easy to make a new one.

MAKING DIGITAL NEGATIVE SEPARATIONS

Simple Workflow in Photoshop: Gum Bichromate Example

Gum bichromate artists have always had to accomplish a few tedious tasks before getting to the fun parts of the process with all the colors and splashing around their trays out in the sunshine. Along with paper sizing, making CMYK negative separations was one of my least favorite things to do for a day in the studio. In the beginning you could shoot the separations in camera or move to the darkroom with an existing negative and do your separations there with an assortment of film types, filters, and projections. Then along came digital imaging, Adobe Photoshop, and Pictorico Ultra Premium OHP, and everything got a whole lot less complicated . . . sort of.

A dozen years ago, in the first edition of this book, I was wicked. . . sorry, I was born and raised in Boston . . . impressed with Photoshop v.5 and by the fact that I could make CMYK separations from a black-and-white source in 26 easy steps . . . I called it the "speedy, non-fussy version" at the time because it didn't involve filters and multiple exposures in the darkroom. In the second edition I wrote, "Now I'm using Photoshop CS2. Next month I'll probably be using Photoshop CS3." Well, now I'm using Photoshop CS6 and upgrading again if CS6 stops doing what I need it to do. No matter, the fact is that with CS2, CS3, CS4, CS5, or whatever, I can describe for you how to go from a black-and-white grayscale to a CMYK, or from an RGB (red-green-blue) source to CMY (cyan-magenta-yellow), or from a color mode to grayscale, without making it too difficult. Best of all, it is fast and simple . . . even for the technical neophyte.

The following sequences are a good start. They are absolutely *not* the last word in making digital separations on Pictorico Ultra Premium OHP film or the most sophisticated way to go from grayscale to RGB to CMYK or back to grayscale. They are, however, designed for play and simplicity and offer you the opportunity to

Figure 24–16
Tony Gonzalez, *Loralee & Margo Sitting*, (3-Color Gum)
It isn't always critical to have a set of CMYK separations to make a beautiful gum bichromate exposure. Tony Gonzalez, who is a professor at Queens College in New York, has a terrific workflow that utilizes cyan, magenta, and yellow CMY negatives that are made on Pictorico OHP inkjet film. Tony's technique is pretty flawless, detailed in the Gum Bichromate chapter, and worth emulating if you are seeking a realistic rendition of life in a gum print. *(Courtesy of the Artist)*

make digital negatives and separation sets that will do what you need them to do . . . give you a digital negative to contact print with an alt process technique.

These particular workflows are the ones that I've been working on with the help of several friends: Tony Gonzalez in New York; xtine Burrough in California (you should read her books on this subject), and Cotton Miller in Texas. Their brains don't melt when they think about digital things, and they were a great help in getting much of this information into a simple and easy-to-follow workflow. What I ended up doing was taking their good advice and in some cases condensing it even more so that someone with the most rudimentary Photoshop skills could make serviceable digital negatives. As with any alternative syntax in any medium, individuals will adjust the steps in any process to suit their individual needs. Again, these are only workflow recommendations, but they do work well and will certainly get you started.

I want to emphasize something here . . . the separation directions I am offering here are simple workflows designed for those who just want to have an easy and adequate way to generate their digital negatives quickly.

Grayscale to RGB to CMYK Separations: Gum Bichromate for Output on Pictorico Ultra Premium OHP in Photoshop

In this example, duplicated in the Gum Bichromate chapter, I made a wet collodion plate of Alicia, who was a participant in one of my annual wet plate collodion summer workshops at the Santa Fe Photographic Workshops. A month later I was teaching a gum bichromate workshop at the Center for Photography in Woodstock, New York, and decided to use a wet plate collodion plate as an example for a very simple gum bichromate separation workflow. This example serves as part of the concept of making your own negative separations from an existing image and printing them out on Pictorico.

I began this gum separation sequence by taking one of my recent wet plate collodion plates (grayscale) and scanning it into Photoshop as an RGB file so that I could play around with it a little before making my gum separations in CMYK. I then made coloration adjustments using a few of Photoshop's tools such as Levels, Curves, Hue & Saturation, and Color Balance before printing it out on Pictorico Ultra Premium OHP digital film.

Step 1 Scan the image into Photoshop and save it as an RGB file.

Step 2 Begin by opening your image file and working on it in Photoshop until it meets your expectations. Save it with a label that will indicate that it is specifically for a particular process or set of CMYK negatives you are making.

Step 3 If you are creating a CMYK set, go to Menu Bar, to Image, then to Mode, and click CMYK. If for a negative, go to Mode and click Grayscale. Sometimes, if I am going to add a simple color tint to the negative, such as a pyro-like brown green, I will return to Mode and click RGB. This allows me to create a tint and gives the film a bit more ink.

Step 4 Go to Image, then to Adjustments, and click Invert. This will give you a negative.

Note: You have an option at this point in the process. You may often be creating a negative that is really "punchy" and that shows a great deal of contrast . . . as in a gum negative. This is where you will go to Image, then to Adjustment, and then click Curves. In curves, set the center point on the diagonal line and then make an "S" curve out of that diagonal line until your contrast level pleases you. This is really elementary stuff and not an academic exercise in scientific perfection . . . that will come later. This is about play and learning.

Step 5 If you are going to create a CMYK set of negatives, go to the information palette that is probably already on your screen . . . it's the one indicating Layers, Channels, and Paths. Click Channels and then look for the tiny arrow pointer in the upper-right corner of the palette box you just opened. Click Split Channels and Presto! . . . Photoshop will automatically create four separate, distinct CMYK negative separations for you. If you are simply making an RGB negative, there is

Figure 24–17
Christopher James, *Alicia*, New Mexico, Negative Separations for Gum Bichromate, 2012
This grid is repeated from Chapter 18. Top Left: Original wet plate collodion. Top Middle: RGB interpretation from scan of wetplate and adjusted for subjective intent in Photoshop. Top Right: After conversion to CMYK, and separated into channels, this is the cyan channel. Bottom Left: Magenta channel. Bottom Middle: Yellow channel. Bottom Right: Black channel.
(Courtesy of the Artist/Author)

no need to go through this step other than to see what your other options look like and to satisfy your learning curiosity. I will admit that I often create multiple versions of the same negative, at the same time, and place them in registration for a UV contact exposure in order to add density and specific color filtration to the negative. Again, play around with this and figure out what works for you.

Step 6 For each of these negatives . . . go to File and then to Save As. Name your negative whatever you need in order to remember it. I name my sets by the title of the image, its date, and what I will be using the negative with when it comes time to print. With a CMYK set I will definitely add the CMYK designation.

Step 7 Go to Image, then to Adjustments, and click Levels and adjust the levels manually . . . bringing the left and right adjustment markers to the extreme ends of the levels histogram. Do this for each of your separations. Keep in mind that you are making a unique set of negatives here and that you can adjust the contrast of these negatives using levels or curves to suit your needs. This will make sense once you begin using the negatives or positives for UV exposures.

Step 8 Go to Image, to Canvas Size, and give yourself a black or gray border to use for registration marks, pin holes, or other miscellaneous marks that will be your guide for gum registration. You can apply registration marks automatically with your printer in Print With Preview.

Step 10 Print out the CMYK negative separations using Pictorico Ultra Premium OHP inkjet film.

MAKING, COATING, AND PROCESSING A SIMPLE SILVER BROMIDE GELATIN EMULSION

Authors Note: At this point in the chapter I would like to introduce a significant technical contribution to this book, researched and written by my friend Mark Osterman. Mark is the process historian for the George Eastman House, International Museum of Photography, in Rochester, New York, and for the last 7 years he and his research team have been investigating the area of contemporary dry

plate emulsions. This work is detailed in full in the following section, which includes complete instructions for making, applying and processing your own silver bromide gelatin emulsion. Given the rapid disappearance of traditional silver gelatin films and papers, this is a unique opportunity for a reader with a sense of adventure and a lot of confidence to experience the richness of a handmade film negative and print. As an aside, I often compare silver bromide gelatin film to digital in the same way I am aware of the difference between film and video projection. The contrast of feeling between the two is tangible for me . . . one seems to reflect with the precision of its perfection, while the other feels more human, washing over my experience of the visual offerings. Granted, digital imaging generation is making great leaps toward commensurate film quality, but I doubt it will ever be, for me, as beautiful and as atmospheric as a film-generated image. I am most grateful to Mark for allowing his research on making, coating, and processing a simple silver bromide gelatin emulsion to be included in the book, and I know that you will find it compelling.

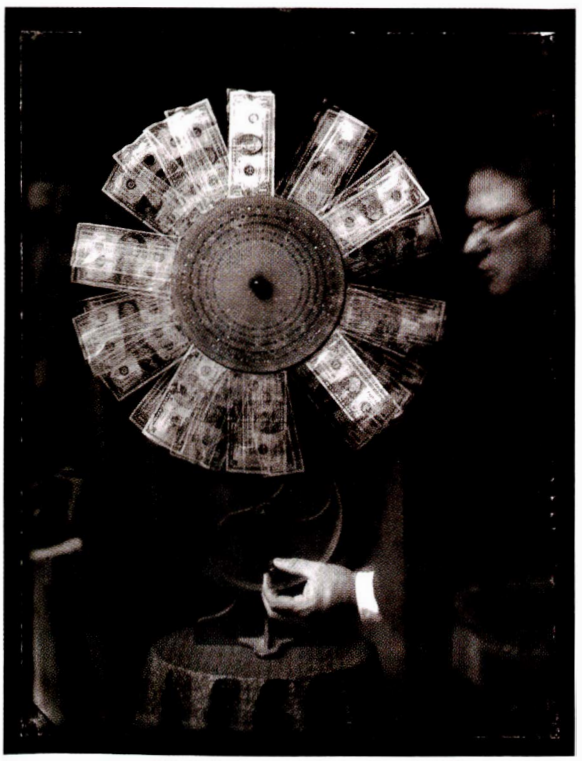


Figure 24–18
Mark Osterman, *Turning the Tip*, 2007 (print from dry plate silver gelatin negative)
My friend Mark is the process historian for the George Eastman House, International Museum of Photography, in Rochester, New York, and is one of the most knowledgeable artist/scientists I know. For the last 7 years, as more traditional photographic materials disappear from the marketplace, Mark and his research team have been investigating the area of contemporary dry plate emulsions. Mark's research in this area is important and is generously shared to you, in his own words, in this chapter.
(Courtesy of the Artist & The Howard Greenberg Gallery)

Making, Coating, and Processing a Simple Silver Bromide Gelatin Emulsion

Copyright 2006, 2014, Mark Osterman, Process Historian

George Eastman House, International Museum of Photography, Rochester, NY

Since the previous edition of *The Book of Alternative Photographic Processes: 2nd Edition* the film industry has become much smaller. There are even fewer companies making photographic films and papers and it's unlikely that a revival will breathe life into an industry that is gradually being made obsolete. If silver gelatin technology is important to the reader, this chapter, updated from the previous edition, is the starting point for learning how to make your own black-and-white negative plates, films, and photographic paper. Mind you, these are the very basics, but if you follow the directions, it's possible to make your own dry plate glass negatives capable of extraordinary resolution.

Some History

By the 1870s, there were three major variants of the wet-plate collodion process: preserved (or moist) collodion, dry collodion, and collodion emulsion. Unlike the former two, collodion emulsion relied on actually adding silver nitrate to the halides in the collodion binder *before* it was applied to paper or plates. The basic concept that evolved from making collodion-based emulsions was the beginning of emulsion photographic technology for the next 150 years.

The use of gelatin as a photographic binder was suggested by several people but the first experiments with making silver halide emulsions with gelatin were conducted as early as 1853 by Marc Gaudin.

His emulsion, which he called *Photogene*, was based on the combination of iodide and silver and was not successful. It was not until January 17, 1868 that W.H. Harrison published the first serious article on gelatin dry plates in the *British Journal of Photography*. Though imperfect, Harrison's work helped to create new interest in the possibilities of the process, particularly in England.

In 1871 Dr. Richard Leach Maddox introduced the idea that gelatin emulsions should be based on silver bromide, rather than silver iodide; which is the basis of modern gelatin emulsions for development. Improvements, such as washing the emulsion (J. Johnson 1873) and ripening by heat to increase sensitivity (C.E. Bennett, 1874), were major contributions to the evolution of the medium. By 1877 gelatin technology was advanced enough to produce commercially manufactured plates, though many professional photographers were not yet ready to make the transition from the wet plate collodion process. Gelatin emulsion plates were being manufactured in factories on both sides of the Atlantic by 1880 and being used by both amateurs and professionals alike.

Like the daguerreotype, albumen on glass and collodion processes that preceded them, all gelatin emulsions begin as sensitive only to blue and violet light. However, depending on the procedure, early gelatin emulsion plates could be made to be from two to ten times more sensitive than the typical collodion negative. The sensitivity of many of these early gelatin plates was even expressed numerically by how many times faster they were compared to a wet plate.

Making gelatin emulsions in the early 1880s was not particularly difficult, once the basic concepts were understood. Hand coating these early plates was also very easy since the emulsion could be applied to glass plates under red light. Today, an individual can, without expensive equipment, make a similar emulsion that is perfectly suited for hand coating plates for negatives and positive transparencies.

The purest gelatin of the mid-ninteenth century was probably not so different than good quality food grade gelatin available today. It was, and is still processed from the hides, connective tissues, bones and hooves of cattle and pigs. By the 1880s, when gelatin emulsions were becoming popular, the purity of gelatin was understood as beneficial. As the speed and spectral sensitivity of emulsions was increased, the purity of this bovine gelatin became more of an issue and photographic grade gelatin was improved. Photographic grade gelatin was, and still is, much purer than the food grade variant. As chemical based photography is phased out, better grades of gelatin will still be available because they are used in other industries.

Basic Theories of Emulsion Making

It's difficult to know just how much information to include in a basic set of instructions but the following will give the beginner a good start. Though it's technically a **suspension**, the end product of this technique has become known as an **emulsion**. The goal is to produce a liquid that suspends the precipitated silver halide particles and keeps them from falling to the bottom of the beaker.

The eleven basic steps of making a simple washed silver bromide emulsion are as follows:

1. Add gelatin to distilled water.
2. Allow the gelatin to swell with water.
3. Melt the gelatin by heat.
4. Add bromide and iodide to the hot gelatin solution.
5. Add silver nitrate solution to the gelatin / bromide solution to make a light sensitive emulsion and maintain heat for prescribed time to ripen.
6. Add "reserve" to the emulsion and reheat.
7. Pour hot emulsion into chilling dish.
8. Chill the emulsion.
9. Noodle the chilled emulsion.
10. Wash and drain the noodled emulsion in ice water.
11. Remelt and add finals.

Understanding Gelatin

Gelatin falls under the classification of colloids. The basis of this classification was established by Scottish scientist Thomas Graham in 1861. It states that certain

substances in a liquid state, such as swollen gelatin or albumen, will not pass through an animal membrane; essentially a very fine filter used for dialysis.

There are good reasons why gelatin replaced collodion as a photographic binder. When gelatin is placed in cold water, it swells. Swollen gelatin melts in hot water, but sets to a firm jelly when chilled. When the jelly dries it is very hard, yet it can be swollen in cold water and melted again. Silver halides can easily be suspended in hot gelatin and they remain in suspension after the gelatin dries and returns to its original volume. Gelatin emulsions can be chemically hardened to resist melting in warm solutions, making it possible to produce plates, films, and papers that can be processed in solutions of a wide range of temperature. Finally, gelatin actually acts as a sensitizer, allowing the possibility of much higher sensitivity than possible with any other process.

There were three basic forms of processed gelatin available in the late nineteenth century; glue, food grade, and photographic [technical] grade. Glue is not suitable for photographic emulsions. It is possible to use some food grade gelatin provided that it is of reasonable purity, though photographic grade should always be a first choice. Poor quality food grade gelatins may contain other organic compounds that will cause non-image fogging.

Start by making your first emulsions with photographic grade and once you can make clean working plates, try other sources. When using food grade gelatin, it's possible that you will need to add more than the formula requires to achieve the same setting characteristics as the photographic grade. This is not a problem as additional gelatin can be added at any time as required to set into a firm jelly at room temperature.

Gelatins are occasionally assigned a bloom rating which is important for knowing the setting potential of your emulsion. In the nineteenth century, gelatins were offered as simply hard or soft. It was common to use the lower bloom (soft gelatin) for the first melt and the higher 250 bloom (hard gelatin) for the reserve gelatin added after ripening. This small percentage of softer gelatin in an emulsion allowed the film to be penetrated by the chemicals more easily. Gelatins of different bloom ratings are not so easy to find in the higher grades available today. Don't worry; it's not really necessary to use more than one type of gelatin in basic emulsion making.

Relationship of Silver to Halides

The emulsion described in this chapter is a silver bromo-iodide variety. The bromide in this type of emulsion is always in excess to the iodide, and the total halides must always be in excess to the silver. This is also why the silver nitrate solution is always added to the gelatin bromide solution rather than the other way around. The excess bromide to silver ratio is important when adding the silver as it prevents potential fogging in the finished emulsion. The emulsion would be much more sensitive if the silver was in excess, but non-image fogging would be the result. So, the restraining action of a slight excess of bromide is considered beneficial even if it produces a less sensitive basic emulsion.

When looking at the formula however, it would appear that the weight of silver nitrate is actually heavier than the total weight of the halides. It is not. This is because to accurately compare the ratio of silver to halides (bromide + iodide) one must convert the gram weights of the silver and halides to the molecular weight of those compounds being used.* This depth of understanding is only necessary if you are formulating your own emulsion formula or substituting one halide for another. This formula is tested and has the correct silver to bromide ratio.

Sensitivity of Gelatin Emulsions

The speed by which you combine the silver solution with the gelatin bromide solution (called the *precipitation step* or *the addition*) has much to do with the sensitivity and resolution potential of the final emulsion. There are several ways to control this particular variable. These include:

1. The quantity and bloom of gelatin in the gelatin bromide solution
2. Speed of agitation when combining the silver with the gelatin bromide

* A metaphor might be that the sweetening power of a sugar substitute might be stronger than plain sugar. Equal amounts of these two sweeteners will have a very different effect. Therefore, it will take less weight of the substitute to have the same effect as sugar because of its greater sweetness.

3. Where the silver is added; under the surface or upon the surface
4. The opening of the orifice on your syringe and how quickly the silver streams or drips from the orifice. *The slower the silver is introduced, the larger the silver halide grain size and the more sensitive the emulsion.* The reverse is also true; so the faster you introduce the silver, the smaller the silver halide and the less sensitive the emulsion.

When making your first gelatin emulsions, sensitivity is much less important than making a clean, fog free plate with a good range of tones. An incredibly slow, fine-grained emulsion is made by literally pouring the silver solution from a beaker, into the gelatin halide solution in a continuous stream while stirring. A much more sensitive emulsion is made by adding the silver, drop by drop, over a longer addition time.

Ripening and Digestion; Its Effect on Gelatin Emulsions

Once the silver solution has been added to the gelatin bromide solution, the sensitivity can be increased several different ways. The first is by a process called *ripening*. The hot emulsion is kept at a constant temperature for a prescribed length of time to promote the growth of larger silver halide particles upon the nucleus of already established silver halide grains. These larger grains are more sensitive to light than the initial smaller particles formed when first adding the silver. The hotter the temperature of the emulsion and the longer the ripening period, the larger the silver halide grains will become. After ripening, *reserve gelatin* is added to the emulsion. Once the reserve gelatin is added and integrated into the emulsion, it may also be subjected to an *additional heat ripening* or another treatment called chemical *digestion*.

Figure 24–19
Nick Brandreth, *Downtown, The Exchange Wall*, 2013
Nick is a member of Mark Osterman's dry plate emulsion research team, and his photographic participation and testing has been instrumental in the development of this technique.
(Courtesy of the Artist)

Chemical digestion evolved from simply more heat ripening to be a chemical treatment with ammonia, sulphur or other additives. It is ripening however, which continues to increase the sensitivity *every time a gelatin emulsion is reheated.* If an emulsion is reheated too many times, or at too high a temperature, it will eventually break down the gelatin to release compounds that produce non-image fogging. Reheating the emulsion also causes the gelatin to lose its setting characteristics which are *absolutely crucial for successful coating* and subsequent processing. This is why the reader should never melt the entire stock of emulsion when planning to only use a small portion. Always scoop out only what you actually need to melt for a coating session and return the bulk container to the refrigerator.

Washed Emulsions

When silver nitrate is mixed with a bromide and/or iodide, silver nitrate reacts with the halides creating a new compound of light-sensitive silver bromo and/or iodide. In a process called *double decomposition*, a nitrate by-product is also formed. Generally the iodide reference is dropped in discussion since bromide is the dominant halide. So, this expression of double decomposition might be expressed as:

Silver Nitrate + Potassium bromide = Silver Bromide + Potassium Nitrate

When making developed-out silver bromide emulsions, the resulting water-soluble potassium nitrate should be washed away or it will crystallize on the surface of your coated plates. These nitrates are not a problem when coating printing papers however, because the paper base absorbs them. But washing is

an absolute necessity when coating plates or film with emulsion. You can actually coat with an unwashed emulsion and then wash the plates, but it is easier to simply wash the entire emulsion. The first step in washing away this unwanted nitrate in the emulsion is called *noodling*.

Chilling & Noodling

Potassium nitrate is washed out of the emulsion by first allowing the hot emulsion to chill to a still jelly in a refrigerator. Once chilled, the firm emulsion is put into a noodle press and extruded into gelatin noodles. In the ninteenth century this was done by cutting the emulsion into shreds with a silver fork or squeezing it through the small openings of a cloth mesh as used for making hooked rugs. These thin noodles give the emulsion a greater surface area that aids in releasing the water soluble potassium nitrate when they are washed in very cold water. The diameter of the noodle dictates the washing time. After washing the noodles they are drained of excess water and remelted leaving behind only light sensitive silver bromo-iodide in a gelatin binder.

Noodle washing was eventually replaced by dialysis and later, the application of special washing gelatins that precipitated the emulsion so that the potassium nitrate could be siphoned off the top of the emulsion. For the amateur emulsion maker however, old-fashioned noodle washing is still the easiest approach.

Making the Silver Bromide Emulsion: Formula #MO-1880

The following instructions are based on a typical early 1880s formula for making about 300–315 ml of a slow gelatin bromo-iodide emulsion for landscape or portrait work. You can make this emulsion more sensitive by adding the silver solution slower, combined with ripening and digesting the emulsion longer. However, it's better for the novice to start with slow, clean working emulsions. Walk before you run.

Equipment and Materials Needed

Much of this equipment can be used for other historic photographic processes. The hot plate/stirrer, for example, is one of those pieces of equipment that is a great help for mixing all sorts of things. Pyrex glass beakers in assorted sizes are essential in every historic process darkroom. The crock pot and potato ricer or noodle press are specific however to gelatin emulsion making, an activity very similar to cooking.

1. Safety glasses or goggles
2. Latex gloves
3. An accurate gram scale (0.01-25 g)
4. Pyrex "tempered glass" laboratory beakers; one 500 ml & two 300 ml size
5. 1 ½ quart Pyrex "tempered glass" loaf baking dish for chilling
6. A heat source*
7. Thermometer (digital thermometers are cheap and perfect for emulsion making particularly when they have a built-in alarm)
8. A 3 quart [about 3 liters] glazed ceramic or stainless steel mixing bowl
9. Stainless steel wire mesh drainer big enough to rest in the opening of the aforesaid mixing bowl
10. Small brown ceramic cheese crock with wire locking ceramic lid or an old 35mm stainless steel developing tank
11. A 1 square foot of black plastic sheeting (must be opaque)
12. A 1 gallon bag made of black plastic sheeting (must be opaque)
13. A 60 ml plastic syringe with removable stainless 18 gauge needle
14. Heavy duty stainless steel potato ricer or compression noodler**
15. Refrigerator (a small dormitory type is perfect or use your household refrigerator) and ice cube tray

* You can use a sauce pan on a hot plate or the crock pot (also listed) for precipitating and ripening the emulsion, but a laboratory hot plate with magnetic stirrer is perfect for emulsion making and well worth the expense. You can purchase them second hand on the Internet from online auctions.

** The best noodler we have used was purchased from China on eBay as a screw type press for making Asian noodles. Before this we always used a heavy-duty stainless steel potato ricer which works fine.

16. Electric crock pot with at least two temperature settings
17. A 25" square piece of sheer white nylon or polyester cloth (for washing and draining noodles)
18. Piece of strong cotton string
19. Stainless steel spoon
20. Glass or stainless stirring rod
21. Deep red safe light
22. Darkroom timer with sweep second hand
23. 1" strip of foam core long enough to cover the 500 ml beaker

Materials

The quantities listed below are for making one batch of approximately 300 ml emulsion. Naturally it is a better plan to buy larger amounts any time you buy these materials, as they are generally less expensive when purchased in quantity.

1. 1 liter distilled water
2. 10.5 g potassium bromide
3. 0.4 g potassium iodide
4. 12 g silver nitrate crystals
5. 21 g gelatin (start with photographic grade)
6. 5 g chrome alum (added as needed)
7. 0.065 g thymol
8. 5 ml 95% grain alcohol

Caution: Safety goggles and latex gloves should always be worn when handling silver nitrate to prevent possible eye injury and indelible stains on skin.

The Procedure

Very important: take the time to read and visualize all of the following steps before you attempt to make the emulsion. Failures in making emulsions are usually the result of substituting materials, taking shortcuts or not fully understanding the directions. You may want to practice step 6 with plain water to feel comfortable with the technique. Try to spray 40 ml from the syringe in a continuous stream within one minute. Preparing all the materials and equipment prior to working under safelight conditions always makes the procedure much easier to perform.

In Daylight

Step 1 Put 3 g photographic grade gelatin into a 500 ml Pyrex glass beaker with 85 ml distilled water. Allow at least fifteen minutes for the gelatin to become fully swollen and easily flattened (or squished) between the fingers. This is called the "first melt" gelatin.

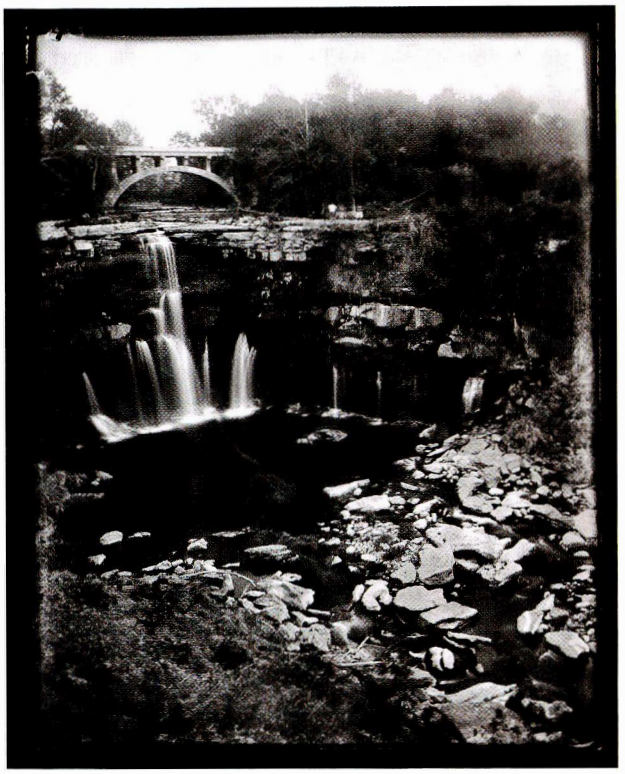


Figure 24–20
Nick Brandreth, *Buttermilk Falls*, 2013
Here's another example of Nick's excellent work with Mark Osterman's dry plate emulsion. The plate is of Buttermilk Falls, which takes its name from the foaming cascade into Buttermilk Creek as it flows down the valley side toward Cayuga Lake.
(Courtesy of the Artist)

Step 2 Put 18 g photographic grade gelatin into a 300 ml beaker with about 80 ml *cold* distilled water; or enough to just cover the gelatin. Allow this gelatin to absorb enough water to make it soft as tested between the fingers. This is called the "reserve" gelatin which will be drained of excess water and then added to the emulsion after the first melt.

Step 3 Dissolve the swollen first-melt gelatin by placing the beaker in a hot water bath such as a small saucepan with just enough water to the level of the gelatin solution. You may also use a hot plate stirrer *as long as the solution is kept in motion with the magnetic stirrer*. In either

case, keep the gelatin solution moving so that you see a slight vortex bringing the surface fluids down into in the center. Place the 1" strip of foam core across the top of the beaker and push the probe of your thermometer through until the end is in the middle of the gelatin solution. Try to maintain the temperature of the gelatin solution around 120° F. [49°C].

Step 4 Put 10.5 g potassium bromide and 0.4 g potassium iodide in the first melt gelatin and stir the solution until the halides are fully dissolved.

Step 5 Prepare the silver solution by dissolving 12 g silver nitrate in a 300 ml Pyrex glass beaker with 85 ml distilled water. Heat this silver solution to around 120° F [49°C]. and draw half of this solution [42.5 ml] into the syringe with the needle tip removed. Reattach the tip after the silver is drawn.

Under Safe Light

Every operation after this point should be done under medium dark red safe light. A Kodak #1A safe light filter is perfect for this type of work. *Wear safety goggles to protect your eyes from stray silver nitrate solution.*

Step 6 ***Precipitation*** Slowly squirt the heated silver solution at a rate of 42.5 ml per minute in a continuous stream *with the tip just below the surface of the gelatin halide solution* while you stir it continuously (this is where a hot plate stirrer comes in handy). Refill the syringe [this should take about 20–30 seconds] and continue until all the silver solution has been added to the gelatin-halide solution. As you combine the silver with the gelatin-halide solution you will see the two clear liquids change into a milky looking silver bromo-iodide emulsion.

Addition Tip: When making more sensitive emulsions that require slower additions you can be more accurate if you use a musician's metronome to keep you on track as you gently and continuously push the plunger of the syringe. Try to make the plunger pass a ml marking on the syringe on every third or fourth click of the metronome. You can set your own rhythm on the shaft of the metronome to as slow as you want.

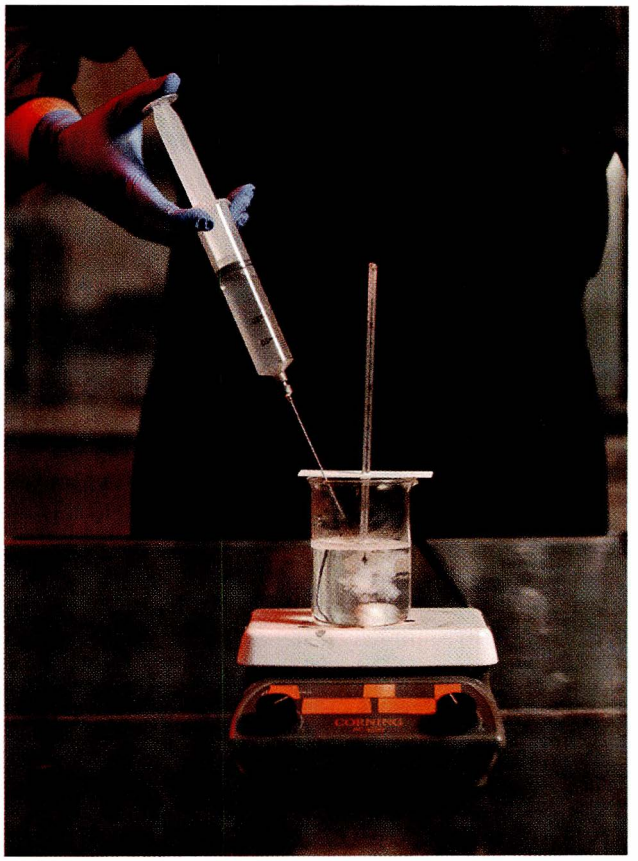


Figure 24–21
Precipitation
Squirting silver nitrate solution into the hot gelatin and bromide solution. This is the point at which a photographic emulsion is actually formed. As you combine the silver with the gelatin-halide solution you will see the two clear liquids change into a milky-looking silver bromo-iodide emulsion. *Note: This step is performed under safelight. It was photographed under normal lights for illustration only.*
(Courtesy of Mark Osterman)

Step 7 ***1st Ripening*** After all the silver has been added, ripen the emulsion by maintaining the temperature of the emulsion at around 120° F for 15 minutes with constant gentle stirring. Be accurate with time and temperature!

Step 8 ***Adding Reserve Gelatin & 2nd Ripening*** While the emulsion is ripening, begin draining any excess water from the reserve gelatin you mixed earlier. Too much water in the reserve gelatin can cause weak, thin images. When ripening is complete, add the entire reserve gelatin to the emulsion and stir until the new

gelatin is completely dissolved. When you first add the reserve gelatin the temperature of the emulsion will fall. It will take some time to bring the temperature of the emulsion back to 120° F. Once the emulsion has reached 120° F maintain this temperature for about 5 minutes with gentle agitation to further ripen.

Step 9 ***Chilling*** Pour the hot emulsion into the shallow glass Pyrex loaf dish and carefully slide this into the black plastic bag. Secure the opening of the bag so that no light can fog the emulsion. Place the bagged emulsion in the refrigerator for about two hours or until completely set to a stiff jelly. The reason a shallow dish is used for chilling the emulsion is so that it will set the gelatin to a stiff jelly faster and more evenly than if left in the beaker. You can speed up the process by chilling the Pyrex dish with some ice water.

Caution: In the following steps it is advisable to wear latex gloves; not because of potential silver stains, but to prevent contamination of the emulsion from chemicals that might be on your hands.

Step 10 Under red safe light remove the emulsion from the refrigerator and pull the dish from the bag. The emulsion will look white under the safe light (it is actually bright yellow). Scoop out the firm jelled emulsion with the stainless steel spoon and put it into the noodler.

Step 11 ***Noodling & Washing*** Place the 25" square sheer white nylon or polyester fabric in the stainless steel wire drainer and lay the drainer in the mixing bowl. Squeeze the ricer to extrude emulsion noodles that will fall into the center of the fabric. When the emulsion is completely noodled into the fabric, gather the edges of the cloth and secure the bag of noodles with cotton string. Fill the three quart [about 3 liters] mixing bowl with very cold tap water** (add a few ice cubes) and move the noodle filled fabric under the water with your hands for about five minutes. Let the noodles soak for five more without agitation. Change the water two more times and wash the noodles as before.

[The quantity of water doesn't have to be exact, but should be near this volume. Failure to wash the noodles as directed will produce a less sens itive emulsion because this step also removes some excess potassium bromide which acts as a restrainer if it remains.]

Step 12 ***Remelt & Finals*** Empty the water from the washbowl and place the strainer in the bowl. Twist and squeeze the bag as hard as you can to drain the washed emulsion noodles. Place the bag in the strainer and open the bag to expose the noodles. Allow the noodles to continue draining for at least 15 minutes; longer draining is even better. It is important to remove as much excess water as possible because too much water will dilute the emulsion causing weak, thin images.

Carefully scrape up all the noodles and place them in a clean 500 ml Pyrex beaker. Remelt the emulsion using the electric crock pot or a small sauce pan of water at around 120° F and add "finals." The finals listed below are alcohol to aid in coating and thymol, to prevent bacteria growth. Remember that gelatin is the perfect medium for growing bacteria. *Thymol* is only really needed if you plan to store the emulsion in a refrigerator for more than a few weeks.

D-min D-max Test: *To determine if you have made the emulsion correctly*

Before adding any finals and storing your emulsion in the refrigerator or coating plates, it is very instructive to test the minimum and maximum density potential of your emulsion. This is very easy. All you need is an eyedropper and two 4 × 5" sheets of chemically clean 100% cotton blotting paper. Place several drops of hot emulsion on each blotter and let them dry in a dark place. Expose one set of drops to daylight but not the other. Then process both test sheets in the same developer, stop and fixing solutions for the same times as you would your plates. *See processing section.* You

** This is based on chlorinated tap water found in most American city water systems. If you are using tap water without chlorine or distilled water for washing your emulsion add a pinch of sea salt [sodium chloride with no added iodine] to the water.

should see fairly clear dots in the unexposed sheet [D-min] and very black dots in the exposed sheet [D-max] if you made the emulsion correctly.

Finals

5 ml	95% grain alcohol
0.07 g	thymol [one tiny crystal is generally enough]

When the finals are added and fully incorporated into the emulsion pour the entire contents into a brown ceramic cheese crock, carefully cover the opening with a piece of black opaque plastic and secure the ceramic lid with the wire spring. Another storage option is an old stainless steel 35mm developing tank. Developing tanks can be covered with the same opaque black plastic material and secured with a rubber band. Place the emulsion in the refrigerator for future use. Remove only what's needed when coating a batch of plates by scooping out the chilled emulsion with a stainless steel spoon. The stock emulsion will last many months if thymol is added; it's kept cool and protected from white light.

Doctors

Doctors are additives introduced into small batches of the emulsion just prior to coating plates, film, or papers. The only doctor that *might be needed* in this emulsion is *chrome alum*. If you are working in a hot climate, where your solutions are warmer than 68° F, you should consider using chrome alum as a hardener. Unhardened emulsions will eventually dissolve in chemicals that are 70° F and warmer.

Most of the early emulsion formulas *do not* include chrome alum and if you work in a temperate climate or in an air conditioned workspace you may not need a hardener in your emulsion. It's best to make your first emulsion without any chrome alum hardener if possible.

If you do choose to use chrome alum, add the solution drop by drop while stirring the emulsion or the emulsion will instantly seize into a solid lump. Too strong a chrome alum doctor will prevent the gelatin from absorbing the processing chemicals resulting in thin images and prolonged developing times.

The hardening effect of chrome alum also continues long after the emulsion has dried on the surface of the plate, so it's best to use the plates within a week or so to keep development time short. There is no way to include the absolute correct amount because the characteristics of each source of gelatin are going to be different. The quantity of chrome alum may need to be decreased or increased as needed. *Make only as much chrome alum solution as you will need as it goes bad quickly.*

Chrome Alum Doctor: add 0.6 ml of a 5% chrome alum solution (1.25 g chrome alum into 25 ml distilled water) for every 100 ml emulsion just prior to coating your plates.

Coating Glass Plates with Gelatin Emulsions

Coating glass plates with gelatin emulsions is a little different than working with a solvent based binder such as collodion, which relies on evaporation for the coating to set to a firm film. Gelatin emulsions must be heated to a liquid form, and once applied to the glass support, be able to set back into a firm jelly at an average room temperature. This so called *set time or setting time*, is governed by the ambient temperature of the room, the bloom and percent of gelatin and the quantity of chrome alum added to the emulsion.

Shortening the setting time was almost always done by quickly lowering the temperature of the emulsion. The most common approach was to level a piece of polished marble or thick glass and place the warm coated plates upon the surface until the emulsion cooled and became firm. The setting of gelatin emulsions on paper supports was generally accomplished by chilled air.

The earliest commercially made gelatin dry plates were coated by pouring the emulsion by hand. An 1884 account of the coating operation at the Cramer Dry Plate Works in St. Louis was described as "eight busy men, with pitchers of emulsion on one side, a pile of glass on the other . . . and in front of them, a peculiar leveling stand." –*Philadelphia Photographer*, Jan 1884, p 11

The following instructions are based on the techniques of the early 1880s, before the invention of cascade or slit coating and continuous belt chilling chambers. This system of hand coating with a chilling table is not difficult to master and enables one person to make dozens of plates

in one sitting. The only real limitation is the capacity of the drying box and supply of cleaned plates.

Equipment and Materials Needed

1. Glass cutter
2. Cork backed straightedge
3. Small sharpening (whet) stone
4. A 2" wide natural bristle paint brush
5. A Soft natural hair make up brush
6. Two wood plate racks
7. Clear type liquid dish detergent
8. Glass beaker or old stainless steel film developing tank
9. Electric crock pot with at least two temperature settings
10. A small ceramic tea pot, antique invalid cup or small glass beaker with a lip
11. An electric laboratory hot plate
12. Deep red safe light
13. Paper towels
14. Two 1′×1′ marble tiles or ¼ glass plates
15. A small spirit level
16. Two wood leveling stands
17. A drying box

Cutting & Cleaning Glass Plates

Window glass is good enough for hand coated photographic plates. Make sure you purchase these from a framing supply house in unopened boxes. The plates should be interleaved with paper to prevent surface scratches. If you have never cut glass before, pay a visit to a stained glass shop, purchase the best glass cutter you can afford and ask for a demonstration.

Cut the glass to the desired size and never lay the plate surface down on anything or it will become scratched. Place the plate upright against a wall or in a wood rack. It is extremely important to remove the razor sharp burr on all the edges on both sides with a small hand sharpening stone. Dust off the powdered glass dust with a stiff natural brush. This is also a good time to check if the plates fit your holders *before you coat them with emulsion.*

Apply a drop of clear dish washing detergent to each side of the glass and rub every surface thoroughly with your fingers. Wash the plate completely under warm running water. Be sure to rinse your hands carefully along with the glass plate. Keep washing in running warm water until the water sheets off evenly. Only handle the washed plate by the tips of the corners and place the plate upright in a rack to dry.

Figure 24–22
Pouring the Plate
Coating glass plates with gelatin emulsions is a little different than working with a solvent-based binder such as collodion that relies on evaporation for the coating to set to a firm film. Gelatin emulsions must be heated to a liquid form, and once applied to the glass support, must be able to set back into a firm jelly at an average room temperature. Once the emulsion is coated, distributed, and drained, the plate is then placed on a leveled chilling table to "set" the gelatin. *Note: This step is performed under safelight. It was photographed under normal lights for illustration only.*
(Courtesy of Mark Osterman)

Heating and Pouring the Emulsion *(under red safe light)*

The directions are based on coating a standard 4 × 5" plate. The whole coating procedure requires very little time; less than ten seconds for this size plate from the initial pour to placing the plate on the chilling table. It is similar to coating collodion plates, though not exactly. *Naturally all of the following is performed under red safe light conditions.* Before you turn off the white lights, level your chilling tables using the spirit level.

I have always used an antique invalid pouring cup to apply gelatin emulsions to glass because they pour from the bottom, subduing the formation of bubbles. In the ninteenth century, the most common tool was a small child's toy tea pot. If you use a tea pot, be sure it doesn't have a built in ceramic filter, which would actually create bubbles.

Naturally, you can simply use a small glass lab beaker. In the beginning it's very instructive to use the following technique. Keep the main volume of emulsion in a larger beaker in a hot water bath at the correct temperature. Pour a measured amount from this into a smaller pouring beaker and apply to the plate immediately. You will need to pour 15 ml emulsion from the larger beaker into the smaller pouring beaker. After coating you will drain the excess emulsion from opposite corners of the plate and back into the smaller beaker. The 4 × 5" plate should end up with between 4–5 ml of emulsion on the surface. Pour the excess back into the hot emulsion to remelt.

Step 1 Remove the emulsion from the refrigerator. Scoop out enough cold gelatin emulsion for several plates and place this in a glass beaker or stainless steel developing tank. Put the tank containing the emulsion in a heated crock pot and with enough water to keep the emulsion warm without having the container float or flip over. Heat the emulsion to between 95° F and 105° F. The actual temperature will depend on the pouring qualities of each batch of emulsion.

Step 2 When the emulsion is thoroughly liquefied, pour it through a coffee filter into the pouring cup or stock beaker. Allow some time for the emulsion to settle so that the bubbles rise to the top and pop. If using the smaller beaker for coating, pour 15 ml into this from the heated stock beaker. If bubbles are a problem add a few drops of alcohol to the emulsion.

Step 3 Slightly heat the plate of glass by placing it on the surface of a warm laboratory hot plate or food warming tray covered with two layers of paper towels. The plates should be very warm, but not too hot to handle. While the plate is still warm hold it horizontally in the left hand with the fingertips spread and supporting the back of the plate. Do not touch the outer edges of the plate or the emulsion will travel down your fingers. Give the plate a quick dusting with the make-up brush.

Step 4 Holding the pouring cup in the right hand, pour all of the 15 ml emulsion onto the center on the plate. Keep the plate level so that the creamy emulsion forms a perfect circle and allow it to spread across the plate. If you have a level plate, all you have to do is be patient. If the plate is too cold, the emulsion will stop flowing.

Step 5 Gently tilt the plate if needed so that the emulsion flows progressively to all four corners *without going over to the back side.* Once the plate is completely covered, tip the lower right hand corner of the plate to let some of the emulsion flow off one corner and back into the pouring cup. Immediately afterwards pour some of the excess off from the upper left hand corner [opposite the first corner from which you drained into the pouring cup].

Each corner from which you poured the excess will drip a small amount of emulsion that rolls to the back of the plate. Do not worry about this, it is typical of hand coated gelatin plates and this artifact can be seen on historic examples. Any emulsion on the back of the plate can be removed with a razor blade after the emulsion is dry or after the negative is processed.

Step 6 Gently give the plate a rocking motion for a second so that the emulsion redistributes

evenly on the entire surface. Immediately place the plate on the leveled chilling slab leaving a slight lip to hang over the edge of the slab for subsequent removal. The emulsion should still be warm and still fluid enough to level itself on the surface of the plate before it begins to set to a firm even coating.

Step 7 As the gelatin begins to set up you may see some dimples on the surface. Move the plate to a new section of the chilling table until the emulsion is firm enough to place upright on a rack in the drying box. You can test the firmness of the emulsion by touching one corner with your finger, though with experience you'll eventually have a sense when they're ready to be removed from the slab without touching the surface.

The slower gelatin plates are dried the better. Fast drying can cause concentric ridges in the surface of the emulsion. Make sure the drying box is absolutely light tight but fitted with adequate ventilation. Collect the dry coated plates the next day and place them in a light proof box interleaved with clean paper until needed.

This emulsion is slow by modern standards and only sensitive to blue and violet light. Depending on the batch of gelatin, how careful you were when adding the silver, the duration of ripening and washing you may assume an ISO rating of between 2 and 5 based on this formula and procedure.

Processing Gelatin Emulsion Plates

The earliest developers used for gelatin emulsion plates were based on either *ferrous oxalate or pyrogallic acid*, known simply as *pyro*. Unlike the calotype, albumen negative or collodion processes that preceded gelatin technology, all of the developing agents for processing gelatin emulsions were used in an *alkaline* state. Ferrous oxalate was one of the first developers used for gelatin plates, though it fell from favor by the end of the century. Pyro was introduced in the 1850s to develop collodion and paper negatives and has continued to attract devotees well into the twenty-first century for development of silver based film stock. Pyro development produces warm brown silver deposits with a slight yellow stain.

By the 1890s, *hydroquinone* and *metol* based developers were being offered by photographic suppliers. Metol developers produced cool, blue-black silver deposits and developed very quickly though with little density. Hydroquinone development resulted in warm black silver deposits that developed slowly with greater density potential than metol. By the late ninteenth century, most photographers chose either pyrogallic acid or a combination of metol and hydroquinone, simply called "MQ."

A typical developer formula for processing gelatin emulsions has the following elements; the *reduction agent* (pyro or metol/hydroquinone), an alkaline *accelerator* (ammonia or sodium carbonate), a *restrainer* (usually potassium bromide), and a *preservative* such as sodium sulphite. Increasing the sulphite will also make a more active developer. By knowing the function of these components, a photographer can tweak the formula to suit specific needs and correct exposure problems to some degree.

Because this emulsion is only sensitive to blue and violet, development is most easily done in a white tray so that the progress of development can be easily viewed by red or amber safe light. This is an advantage because the effect of over or under exposure can be seen during development. The knowledgeable photographer therefore has the opportunity to adjust the developer as needed to produce the best possible results. It was typical in the ninteenth and early twentieth century for the photographer to have small dropper bottles of accelerator (ammonia) and restrainer (potassium bromide) solutions at the ready near the processing sink to make adjustments to the developer as necessary.

Processing the Negative (under red *safe light)*

The exposed plate is placed, emulsion side up, into a light colored tray containing more than enough developer to cover the plate. The developer should be used at a temperature of around 65–68° F. It is necessary to rock the tray frequently during development so that fresh developer is always in contact with the emulsion.

When developing by inspection, the most common mistake is to stop development too soon. The

Figure 24–23
Nick Brandreth, *Upper Falls, Letchworth Park, 2*, 2013
Here is another outstanding and dramatic image from Nick Brandreth shooting with the dry plate emulsions created by Mark Osterman and his working group. The shot is of the Upper Falls at Letchworth Park, one of three major waterfalls on the Genesee River.
(Courtesy of the Artist)

maximum density areas of a negative always look much darker when working under safe light.

It will be necessary to lift the plate from the tray and inspect the progress by looking through the plate, illuminated from behind by the safe light. Assigning a development time of around 15 minutes at 68° F is a good starting point for testing your plates. An average, properly exposed landscape negative develops gradually with the sky visible first, followed by architecture and eventually well lighted foliage. Overexposure will result in the image coming up faster including even the darkest areas of the subject. Development can be carried out longer, but this is usually a sign of underexposure and all you will achieve is high contrast.

Once development is judged to be complete, stop the action of the developer with a dilute acetic acid wash for at least a minute. You can use glacial acetic acid, commercial indicator stop bath or even vinegar, but it should test around pH 4. Fix the negative in a tray of fresh sodium thiosulphite or commercial fixing agent for at least five minutes with occasional agitation. Wash the plate in several changes of fresh water or running water for at least 20 minutes. A 1950s–1970s vintage hard rubber processing tank with stainless steel hangers is a great tool for washing glass plates. After washing place the plates on a drying rack in a dust free place.

Troubleshooting

- **Peeling Problems:** On occasion, you may have problems with an unhardened emulsion [without chrome alum] lifting from the edges of the plate; an effect called "*frilling*." This usually happens if water is used instead of an acid stop bath after development. The developer is alkaline and swells the emulsion to as much as 10 times its volume. Plain water will remove the developer but the emulsion may swell even more and then detach. Actually, some people might like the effect for aesthetic reasons. Assuming the glass support was properly cleaned, the temperature of the developer was not too hot and an acid stop is used, this shouldn't happen. If you still have problems, a simple 2% alum hardening bath after development is usually enough to prevent frilling. If frilling is a persistent problem, precoat your glass plates with a 2% subbing solution of hard gelatin containing 1/2% chrome alum using the same method described for coating with the emulsion.
- **Image does not appear or takes too long to develop:** The plate was either underexposed or the emulsion was too hard due to the addition of excessive chrome alum. A presoak in 70° F water for about five minutes will usually soften *a hardened emulsion* enough for development. You may also add a drop or two of glycerin to the pre-soak. Adding a few drops of ammonia to the developer will also help, though excessive ammonia will soften the gelatin too much, causing frilling and fog.
- **Fog:** There will always be some degree of fog present in gelatin emulsions. Too much fog can be a problem. This emulsion, when made as described is generally very clear. The most common causes of fogging are:

1. Poor quality gelatin
2. Heating the emulsion at too high a temperature and/or for too long
3. Reheating an emulsion [take only what you need to reheat for a coating session]

4. Preexposure of the emulsion or the coated plate to white light
5. Faulty safe light
6. Light leaks in the camera or plate holder
7. Over exposure
8. Too warm or too active a developer

If the shadows cast by the plate holder on the edges of negative are clear, the problem is always overexposure in the camera.

- **Thin, weak negatives:** These are negatives that may display a proper amount of visual information in both shadow and highlight areas, but have very little density. It is common for the beginner to produce thin images. This is usually the result of not following the directions carefully or substituting materials when making the emulsion. Once an emulsion is properly made the other common causes of thin images are overexposure combined with underdevelopment. Using cold or dilute developer, not developing long enough or with enough agitation will result in weak, thin images. Excess water in the emulsion from not draining the reserve gelatin or the washed noodles effectively is a common cause of weak, thin images.
- **Too much contrast:** High contrast is the result of underexposure and over development. If there is no shadow detail despite prolonged development, it is a clear sign of underexposure. Always remember that visual information in negatives is controlled by exposure and density potential is gained by development.

Formulae

Developer Manipulation

You can use any modern print developer such as Kodak Dektol for processing plates coated with this emulsion. Begin by using it 1:1 for overcast lighting conditions or dilute 1:2 or 1:3 if you feel the maximum highlight density is too strong. You may also make your own MQ (metol/hydroquinone) style developer. Kodak D-49 [below] was originally formulated for processing bromide prints though it can be used stock or diluted for negatives made with ordinary blue-sensitive emulsions.

Kodak D-19 also included here is a much more active developer that is good for making stronger negatives for albumen printing or similar printing out processes that require a negative with more density. D-19 should not be diluted. If this is too strong for your purposes use either the D-49 in various dilutions or Dektol 1:2.

When making an alkaline developer the ingredients should always be added to hot distilled [or deionized] water in the order listed and each ingredient fully dissolved before the next is added.

D-49 Developer

500 ml	distilled water (around 120° F)
3.1 g	metol
45 g	sodium sulphite
11 g	hydroquinone
45 g	sodium carbonate
2.1 g	potassium bromide

Room temperature distilled water added to make a total 1,000 ml

Kodak D-19

500 ml	distilled water (around 120° F)
2.2 g	metol
96 g	sodium sulphite
8.8 g	hydroquinone
48 g	sodium carbonate
5 g	potassium bromide

Room temperature distilled water added to make a total 1,000 ml

As with all MQ developers, metol and hydroquinone are the active developing (reduction) agents. Potassium bromide is the restrainer. Sodium carbonate is the accelerator. Sodium sulphite, the preservative, may also be increased to make the developer more active. If you want more density than extended development will provide you may raise the pH a little which will make the gelatin swell more. This is most easily done by adding drops of household ammonia.

A good starting point is about 4 drops in 100 ml developer. Pour the developer from the developing tray into a glass beaker, add the ammonia to the developer solution, and then pour the developer back into

the tray. Raising the pH with sodium carbonate will also make the gelatin soften and more permeable so that the developer can be more effective. Be conservative, too much will cause the emulsion to fog, lift from the glass and cause frilling.

Decreasing the potassium bromide restrainer in the formula will also cause the developer to work faster, though by doing this there is always a chance of causing fog. Tweaking the developer formula as needed eventually becomes intuitive.

Sodium Thiosulphate Fixer (working solution)

1,000 ml	tap water
150 g	sodium thiosulphite

Appendix

There are three things you will need to construct before coating gelatin emulsion plates; a plate rack, a wood leveling stand for a chilling table, and a plate drying box.

Photographic Plate Racks

Vintage plate racks can be purchased at antique shops and on internet auctions, though availability is uncertain. You can make a nice rack by drilling pairs of holes into the top of a wooden board and fitting a series of wood dowels. The size plate you wish to coat will dictate the size of the materials.

Leveling Stands for a Marble Chilling Table

The chilling table is generally made from a smooth sheet of marble. These can be purchased at a home improvement or bath and tile shop. Larger marble table tops can occasionally be found at flea markets or antique shops. In either case, you will need to make sure the chilling table is level before it is used for setting the emulsion on your plates. This is done with a leveling stand, which is essentially a short adjustable tripod, with wide, flat top.

Materials

2 - 8" × 8" pieces of 3/4" birch plywood
6 - 1 1/2" × 5/16" bolts
6 - 5/16" nuts
6 - ¼" flat washers
6 - 5/16" coupler nuts

Drill three 5/16" holes through the plywood. Countersink the holes so that the heads of the bolts sit below the surface of the plywood when installed. Install the bolts and attach the washers and nuts to the bolts on the underside of the plywood. Thread the coupler nuts on the end of each bolt. The coupler nuts allow adjustment of the leveling stand from below. The marble (or glass) chilling plate rests upon the leveling stand to complete the chilling table. A small spirit level is placed on the marble surface to establish perfect level.

Plate Drying Box

In time you may want to make a sturdy wood box with filtered ventilation, but for your first experiments a cardboard drying box is easy to make and will do the job very well. You will need one, good quality, corrugated cardboard box and a couple extra sheets of the same weight cardboard for constructing the ventilated light trap. The size of the box is dictated by the size of the plates on a plate rack and the quantity you wish to coat in one session. While any tape will work, I have found that the old fashioned water soluble gummed paper backed tape (available at art supply stores) never fails over time.

Simply put, the box must allow adequate ventilation without exposure to white light. Holes must be cut into either end of the box and then fitted with a light trap. Make sure you have a good fitting top to cover the box. You can test it for light leaks by putting a lamp in the box and turning off the room lights. Finally, it doesn't hurt to have a piece of black cloth to cover the box for extra protection.

Further Reading

The ninteenth century photographic journals are a great wealth of gelatin emulsion technology, particularly for the individual making and coating their own emulsions on paper and glass. English language publications include the *Photographic News*, *British Journal of Photography*, *British Journal Almanac*, *Philadelphia Photographer*, *American Annual of*

Photography and Photographic Times Almanac, and *Anthony's Photographic Bulletin.*

The following out-of-print texts should be sought by every emulsion enthusiast. Some are available online as reprints. The more common titles are often quoted like scripture by old school emulsion makers.

The Practical Working of the Gelatin Emulsion Process, Captain W. De W. Abney, Piper & Carter, 5 Castle Street, Holborn, E.C. London, 1880

Modern Dry Plates or Emulsion Photography, Dr. J.M. Eder, E. & H. T. Anthony & Co., No. 591, Broadway, NY 1881 (English edition)

Wilson's Photographics, E.L. Wilson, No. 853 Broadway, NY, 1881

*The Photographic Negative,*W.H. Burbank, Scovill Manf. Co., NY, 1888

Photographic Emulsions, Their Preparation and Coating on Glass, Celluloid and Paper, Experimentally and on the Large Scale, E.J. Wall, American Photographic Publishing Co., Baker, 1929

Photographic Emulsion Technique, T. Thorne Baker, American Photographic Publishing Co., Boston, 1948

Photographic Emulsion Chemistry, G.F. Duffin, Focal Press, London & NY, 1966

Silver Gelatin: A User's Guide to Liquid Photographic Emulsion, Martin Reed & Sarah Jones, Argentum/Aurum Press, 25 Bedford Ave., London, 1995

Finally, there is the Internet, where you will find a huge amount of information posted by individuals with a wide range of experience. In most cases however, you will be better served to read the original texts and evolve though your own personal experience. Many people dispensing advice in forums give the impression that they have much more experience than they really do. While they mean to be helpful, the information often supplied by enthusiastic posters is generally not backed up by practical application or may be out of context. As more people begin to actually work with emulsions we will see more reliable and helpful advice.

Sources of Supply

Please refer to the Resources section in the Appendix of this book for businesses that carry many of the chemicals used in alternative and historic photographic processes.

NEW55 P/N TYPE FILM

New55 FILM

Here's what I wrote in 2007 . . . If you want to have a really great time making photographs, let me recommend that you treat yourself to a box of Polaroid Type 55 Positive/Negative 4 × 5 instant film. This ingenious film can be

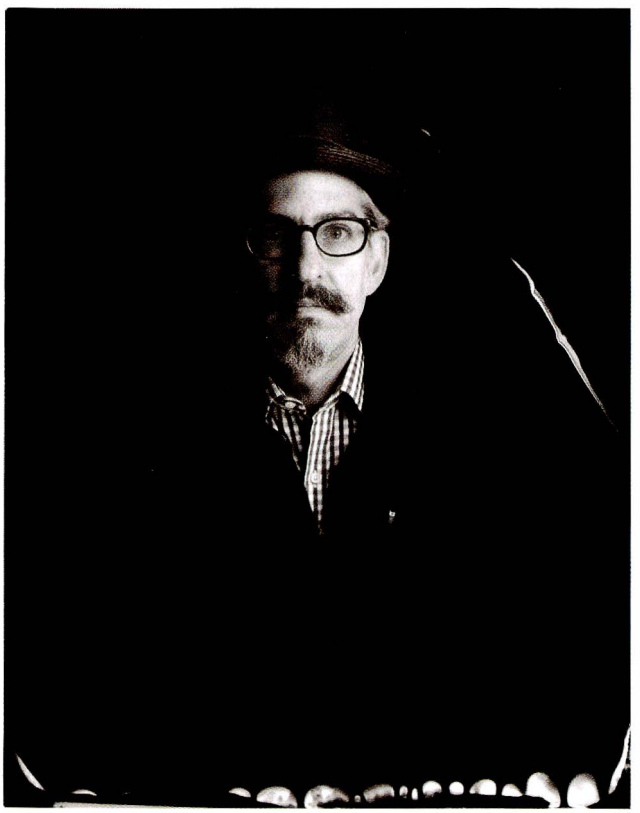


Figure 24–24
Bob Crowley, *Sam Hiser on NEW55,* 2011 (Tri-X version)
Since February 2008, when Polaroid announced that it would cease production of Type 55 P/N film, Soundwave Research Laboratories, in Ashland, Massachusetts, has been working to produce a replacement. Now, after a long and concentrated effort, it has manufactured a modest production of film that is very similar to Polaroid's Type 55 P/N. Bob Crowley has documented the project's progress in his blog called New55 FILM, which can be found at http://www.new55project.com. This is a portrait of Sam Hiser, a candidate in my MFA in Photography program at Lesley University College of Art and Design, and a member of the New55 team, made with New55 film.
(Courtesy of the Artist, Robert J. Crowley)

shot in either a conventional 4 × 5 camera or in a pinhole camera that accepts a 4 × 5 Polaroid back. Polaroid Type 55 P/N yields both a positive print and a very serviceable, grainless negative. For alternative process photographers, shooting with pinhole cameras and with a limited amount of studio time to spare, it is a perfect film.

In 2008, Polaroid stopped producing Type 55 P/N and the world went dark. Just kidding . . . but it was a serious blow to hundreds of alternative process artists and, I would venture to say, thousands of editorial, architectural, and commercial photographers around the world. The discontinuance of this wonderful product, along with the end of the grand buffet of silver gelatin films, also affected the makers of 4" × 5" pinhole cameras that were so successfully connected to the manual 4" × 5" Polaroid backs. Making a shot with Type 55 P/N in your pinhole camera, processing the film in 25 seconds, clearing it in sodium sulphite, hanging it to dry, and using it as a near perfect contact negative 30 minutes later was a pure delight.

With Polaroid Type 55 P/N you had the choice of achieving a great negative for printing in the darkroom with an enlarger or contact printing in an alternative process. You could also simply make a nice positive print, as both the negative and the positive were produced within the single-exposure film and chemistry pod. It was rare to have both the negative and the positive come out well simultaneously, and with negatives made for alt pro intentions, my advice was to use the positive as a way of evaluating the composition and context of your image and to then focus all of your attention on making the best negative for the process. The lighter and more pathetic the positive, the richer and more resolved the negative. You simply had to adjust the exposure to fit the process. The Type 55 P/N film negatives could be cleared successfully in standard hypo clearing baths or in a simple sodium sulphite bath of a tablespoon or two to a liter of water. The negatives cleared quickly and were then washed in regular tap water for permanence in minutes. When I worked with Type 55 P/N away from the studio I filled a plastic food storage container with a sodium sulphiteclearing bath for transporting the negatives and waited until I returned to the studio to water rinse and hang to dry. On occasion, when working at the beach, I would simply use ocean water.

The film was much loved due to its ability to allow instantaneous adjustments to exposure evaluations, and it resulted in instant gratification for the student. Its flaws and artifacts were appreciated in the same way the flaws in wet plate collodion are, and they signaled the use of that material to those who could recognize it. The negatives were actually better than satisfactory for any process, and the very nature of the film's immediacy greatly accelerated a learning curve for anyone learning to shoot contact negatives for alternative process printing. I really loved this film.

That was then . . . and this is now.

This may well be a very big deal. For the first time since February 2008, when Polaroid announced that it would cease production of Type 55 P/N film, Soundwave Research Laboratories, in Ashland,

Figure 24–25
Polly Chandler, *Untitled*, (New55 FILM)
I've been a great fan of Polly's work from the moment I saw it years ago. To the point, it's a thrill to see her involved as a testing artist for New55 so that her mysterious and provocative work will continue without interruption. Polly wrote recently, *"There's a difference in the New55 and Polaroid Type 55, but it's in the same league and that is more than exciting to me."*
(Courtesy of the Artist, Polly Chandler)

Massachusetts, has been working to produce a replacement. Now, after a long and concentrated effort the company has manufactured a modest production of film that is very similar to Polaroid's Type 55 P/N. Bob Crowley has documented the project's progress in his blog called New55 FILM, which can be found at http://www.new55project.com.

New55 FILM utilizes the same film holder that was used with Polaroid Type 55 P/N and seems to share many of the same characteristics. While a commercial product is a little way off, I can tell you that what has been done by Bob Crowley and his team to date is a major accomplishment. New55 is a 4" × 5" black-and-white instant film that produces a tonally superb negative along with a positive print. It improves on the discontinued Polaroid Type 55 P/N through a lower parts count, and this produces the benefit of generating less *Polatrash* . . . the term we somewhat affectionately used to describe all of the paper, metal strips, and brown separating tissue that had to be thrown out with every shot. As well, there is an additional major improvement to the old Polaroid as the positive and negative expose evenly, rather than two stops apart like the Polaroid Type 55.

Handling is quite similar, though the new project is *not* a duplication of the Polaroid classic. New55 FILM works in the same 545 Polaroid Land Film Holder, which is available in great numbers on eBay. The New55 FILM negative requires a fixing step to clear the gunk, although the traditional sodium sulphite bath is optional.

Exposure characteristics are undefined as of now because some flexibility remains in final component selection. Most of the existing off-the-shelf sheet films possessing cubic-grain emulsions, such as Efke 25, Shanghai 100, Kodak Tri-X (320TXP), Fomapan 200, Adox CHS II, or Ilford HP5 Plus, will work reasonably well with the diffusion transfer reversal process while giving a decent to excellent negative. Old Type 55 used Kodak's "SO-139" (alas, my all-time favorite single-stage duplicating film until it went out of production), which was a fine-grain Panatomic X. The print receiver sheet and developer reagent for New55 FILM, during experimentation, have been provided by 20 × 24 Studio, which also manufactured the developer pods.

It is one thing to read a vague, long-expired patent, quite another to duplicate the results on a lab bench. What is planned presently is the assembling of a new work group locally, in Europe, and in the Far East. Past vendor quotes, sales projections, and new suppliers need to be revisited, and technical drawings need revision. Fundraising efforts, such as a Kickstarter campaign on the Internet, also need to be prepared. If the New55 FILM project is successful with Kickstarter this spring (2014), there will be sufficient funds to finalize the component specifications, bring in an engineer, and collect the assembly machinery under the roof of Bob Crowley's *skunkworks* at Soundwave Research Lab in Ashland, Massachusetts. Here, the first production run of New55 FILM would be finished and shipped to artists and large-format photography enthusiasts worldwide. If the fundraiser falls short, the developers will wrap up the technical knowledge into some sort of open source format and schedule a couple of handmade New55 workshops.

Said New55 FILM's founder, Bob Crowley, *"The initial motivation wasn't anything glamorous: I just noticed that The Impossible Project said they were not going to work on 4 × 5, and so I said, on Twitter, that I would look into it. The gamut of my inventions runs through all things that detect something such as heat, radio and light waves, or sound. In this case, lightwaves through a lens appealed to my inventor's instinct, along with the knowledge that a new era was opening up in materials science and nanotechnology—which is plainly evident in the diffusion transfer reversal ("DTR") process that Andre Rott and Edith Weyde invented for Agfa just after World War II. Like any project, New55 started with researching patents and papers, buying the important books that exist in any field, and contacting people with knowledge who are willing to talk. After establishing a basic understanding of the technology, I set out to locate the pieces: industrial resources, vendors and others who could supply the materials—often materials that nobody has made for a long time."*

In the meantime, the developers have a product that works and are getting close to being able to clean up the process, so this New55 FILM will be closer to realization. I will add that asking them for free samples right now will only slow things down . . . be patient and keep your fingers crossed.

SEVERAL SIMPLE ALTERNATIVE NEGATIVE OPTIONS

The Cliché Verre

In French, *cliché* means "negative" in relation to photography, and *verre* means "glass," and *cliché verre* is a term describing a handmade negative on a transparent base of glass, Plexiglas, or acetate. It is usually created by applying liquid resists, such as paint, syrup, asphaltum, varnish, oils, soot, or ink, to the transparent substrate. The artist works on the glass with the assorted paints and resists, and the resulting "negative" is then contact printed, or exposed via projection, to a photosensitive substrate such as a sensitized paper, a photo polymer plate (for work in printmaking), or a traditional silver gelatin paper. As you have likely figured out by now, the painted areas filter the light to make the image. The degrees of transparency in the various resists allow light to pass through according to density; less resist equals more exposure and vice versa. In a printmaking context this is very similar to mono-printing but with light instead of paint.

Figure 24–26
Jean Babtiste Camille Corot, *Corot par lui-meme* (self portrait), 1858
Corot, a well-known painter, etched into the emulsion of completely exposed, glass albumen plates and used them as negatives for photographic prints of his drawings.
(Courtesy of Detroit Arts Institute Museum / The Bridgeman Art Library)

The cliché verre was reinvented by Adalbert Cuvelier in 1853 and used by artists to make reproducible plates for their drawings. Among the most notable in this group of artists was Jean Baptiste Camille Corot (1796–1875), who used bichromates and colloids and made his cliché verre prints on glass using pure albumen as his sizing agent. This was a really fine concept, putting photographic syntax in the hands of a painter. In the middle of his career, Corot made colloidal etchings by coating glass plates with wet sensitized collodion emulsion. The plate was then exposed to light, which darkened it entirely. Corot then etched into the darkened emulsion and, when finished, contact printed the plate to a piece of sensitized paper for a paper print.

In the nineteenth century, artists who were disciples of the Barbizon School of landscape painting coated sheets of glass with hard and soft etching grounds (similar to asphaltum or pitch) or with black soot by burning a tallow candle closely to the underside of glass plates. In both examples, the dark opaque coating was then etched, scratched, and drawn into with traditional etching tools, brushes, and fingers. The result was essentially a graphic negative with the remaining ground on the plate functioning as a light-resistant mask. The etched lines and areas in the ground allowed light to pass to a bichromated colloidal emulsion underneath the plate, resulting in an image on paper. For a quick idea of how this works, take a piece of glass, or an acetate sheet film, and play on it with paint, inks, and resists. Then, with a pin, nail, razorblade, comb, etching needle, or pencil, scratch away portions of the resist. When you're done, use the glass or acetate as a contact negative with a conventional silver gelatin paper and you'll get the idea immediately.

Additionally, this technique is a terrific way to include text in your imagery. Simply create the text on your computer, print it out on acetate, and use it as a cliché verre layer during your exposures.

Figure 24–27
Tim Butler, *Family Farm Project*
This image is from former student Tim Butler's series on the demise of the family farm in America. To make the image, Tim went out and photographed the farm. Later, he rigged up a projector powered by a car battery and projected his images on the farm itself.
(Courtesy of Tim Butler)

The Paper Negative

It is possible to use a paper negative for contact printing, but fine detail should not be one of your high priorities. Paper negatives are the result of loading conventional printing papers into a pinhole or large-format camera. The paper negatives, if exposed on an RC (resin coated/plastic) paper, for instance, will often produce excellent images when contact printed with an alternative process or with another piece of conventional printing paper.

When using a paper negative with an alternative process you must be prepared for fairly long exposure times. Successful images are generally quite soft and "painterly" due to the obfuscation of the light through the paper substrate.

Should you wish to approximate Talbot's calotype paper negative experiments, consider making a paper negative from a film positive on a piece of writing paper or vellum and then soaking this paper negative in olive oil and wiping it dry. The olive oil will make the paper more translucent and will give you a better shot at a readable and successful final image. Of course, you could also just go to the Calotype chapter and make one as Talbot did. You may also wish to consider using an inkjet paper negative by *inverting* your image and using the paper print as your negative. Again, consider oiling or waxing the inkjet print, but be sure you are making the print with ink that is moisture resistant like Epson's K3 Ultrachrome inks.

Projection

The use of light projection, through either a positive or negative transparency, is another option when dealing with film as the primary transmitter of an image. I think of both variations as alternative image making, adhering to my long-held belief that any creative process that makes use of light to leave its mark can be thought of as photography.

Negative or positive projections can be used in installations and performances. A projection from a slide or digital projector can be a versatile tool in printing large images coated with hand-applied liquid emulsion or contact printed wet plate collodion plates. Superimposing these negative projections, in conjunction with other media, can also allow for the creation of entirely new perspectives of content and intention. Although *positive* transparency projection is not a negative source in the way we have previously been dealing with film, it offers a wide range of possibilities to the alternative artist.

The Copy Machine

Most commercial copy services are capable of producing an enlarged duplicate film positive of whatever flat 2-D source you give to them. The quality is generally

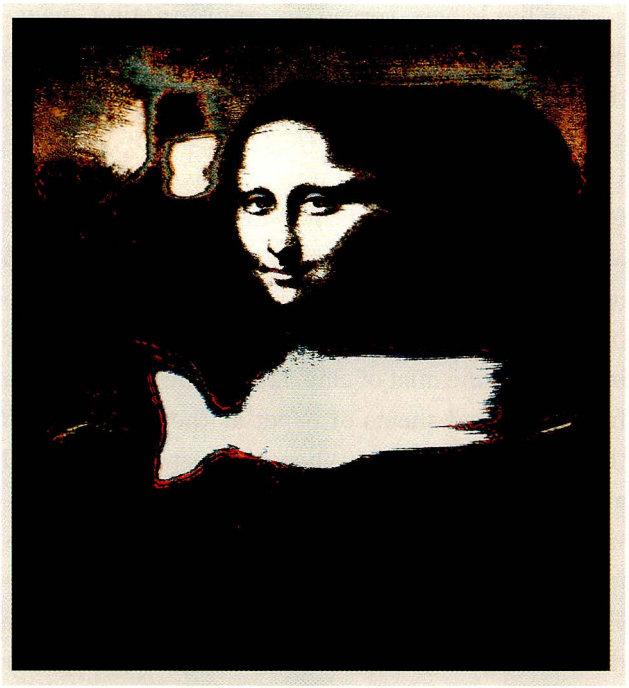


Figure 24–28
Christopher James, *Mona & The Whale,* 2014 (copy machine, digital negative, palladium & gum bichromate)
This is an example of using the attributes of a photocopier as a camera. The detail of da Vinci's *Mona Lisa* was placed on a copy machine, and when the light went in one direction, Mona and the art history textbook went in another … resulting in the moving impression. The resulting print was then photographed, and an enlarged negative was made on a direct duplicating film. Now I would just place it in Photoshop and generate contact negatives for any process I had in mind.
(Courtesy of the Artist/Author)

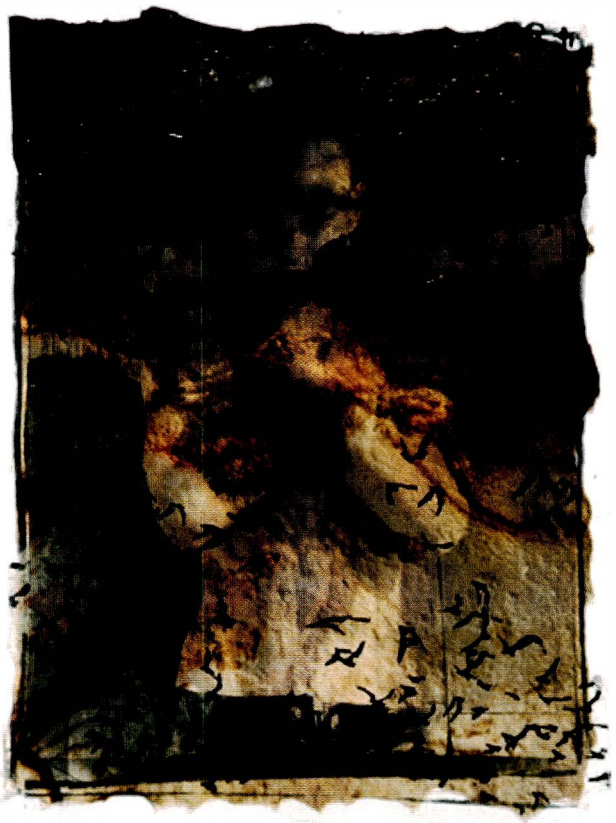


Figure 24–29
Bina Altera, *13th Hour Montage,* 1996
This is a nice example of Bina Altera's emulsion lift montages that are always dense with graphic complexity and surprises.
(Courtesy of the Artist)

inferior, but that particular look may be exactly what you are searching for, as the machine has its own unique syntax. There is no question that there is a funkyness to copy machine negatives, just as there is for FAX transmissions of images, that is truly original and beautiful to a particular eye.

The Desktop Printer

Desktop scanners and printers are now so sophisticated that there really is no drop off in quality between what you can generate at home and what you can pay an arm and a leg for at a service bureau . . . really. Printers and scanners are more affordable than ever, and why shouldn't they be considering the cost of premium ink sets? If you actually priced out ink by volume in a cartridge it would probably cost about $10,000 a gallon. I have no actual proof of this inflammatory claim, but I do know of some people at an art school in the south who broke apart some ink cartridges, weighed and measured the liquid contents, and extrapolated a cost basis for the ink. It's probably close to being true. No matter, it's only money and it's our art were talking about here, right?

I used to produce all of my digital negative work with custom ink sets from Jon Cone at http://www.inkjetmall.com in conjunction with his efficient and outstanding out-of-printer feeding systems. In the last two years I've been adding to my digital "toolbox" and now produce equally comparative digital negatives on an Epson 3880 with K3 ink sets (K3 stands for three blacks in the ink set) and Pictorico Ultra Premium OHP inkjet film using a Hahnemühle/Photo Rag printing profile.

ACRYLIC LIFT TRANSPARENCIES FROM PRINTED SOURCES

To appropriate and create a unique positive or negative from an existing printed source, try creating a translucent acrylic lift to use as a *positive–negative* . . . meaning the lift will feature a positive image identical to the original magazine page and will yield a negative image on the substrate. Of course, you can change this outcome by making a digital scan of the positive and printing out a flat duplicate as a negative . . . more on this in a minute. Not only is it a great deal of fun, but it's also simple, inexpensive, infinitely flexible, and one-of-a-kind. The materials you'll need consist of a bottle of acrylic gloss medium, a little dishwashing soap, a tray with warm water, and a stack of magazines for inspiration.

Once your acrylic positives are made, you can use them directly as a positive contact source to get a negative print in almost all of the processes featured in this book. You can also use the acrylic positives as the image source for a tintype or ambrotype positive-negative to produce a positive image on glass or metal. You also have the option of scanning the acrylic positive on a scanner and downloading the scan into Photoshop, inverting it to a negative, and printing it out on Pictorico Ultra Premium OHP for a very utilitarian negative. The possibilities are only limited by your imagination.

You'll be best served by appropriating magazine reproductions printed on *clay-coated* paper, the type that you would find in magazines such as *Vanity Fair*, *New York Times Magazine*, and *Vogue* that use high-quality inks and paper stock. Once lifted, you may utilize the procured pictures and text as conventional and distorted images and montage or collage source material. Clay coating, in this description, is an ink-printing process in which a fine mist of clay dust or talc is sprayed on freshly printed sheets of paper as they run through the printing presses. When the paper is printed and automatically stacked, the dust coating prevents the newly printed sheets of paper from sticking together.

Another image source that is less common, but one that allows you to use your own images, is the laser transfer copy print. When making copies, ask that your black-and-white images be copied in color formatting because this will give you additional layers, beyond a single black, of thermographic dyes to transfer. You can make lifts from these in much the same manner. You can add to this graphic menu by breaking down the printed dyes, placed face down against a transfer support, with marker solvents applied to the rear of the paper print.

Basic Materials for Acrylic Lifts

- High-quality printed magazines

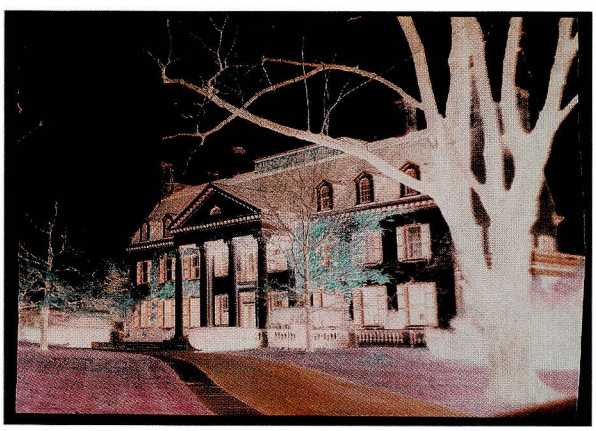


Figure 24–30

Jo Babcock, *VW Van Camera*, George Eastman House

San Francisco photographer Jo Babcock has made a career out of constructing pinhole cameras out of an object and then making a related pinhole photograph with it. This portrait of the George Eastman House is one of his most notable combinations.

(Courtesy of Jon Zax for Jo's VW Van Camera & Jo Babcock for Eastman House)

- Acrylic gloss gel medium
- A clean and dry coating surface such as a glass or Plexiglas
- Brush—foam, synthetic, or watercolor type
- Hot water in a tray with a little detergent
- Hairdryer

The Technique

With a foam brush, apply a thin and even coating of acrylic gloss medium over the magazine image you wish to make an acrylic lift from. You may choose to use the entire page or simply an isolated image or text block. Brush the first coat in a single direction and dry it completely, front and back, with a hairdryer. Once dry, recoat the image in the opposite direction with the acrylic gloss medium. Repeat this sequence until you have 4–5 thin coats.

Applying thick coatings, or coating on medium that has not dried completely or on top of a previous application before the acrylic medium has begun to "set up," will result in a milky translucent image. Work with some speed, and don't stress about making the coatings perfectly smooth . . . they will get smooth on their own. Once you have successfully completed this part of the process, it will be time to separate the ink-acrylic graphic from the paper support by immersing the entire coated page in a tray of hot and soapy water. This action will eventually cause the paper support to break down and will leave you with the ink image supported in the flexible and transparent acrylic skin. If you get impatient, you can gently rub the paper support with your fingertips or a paintbrush. The positive acrylic image will appear cloudy at first but will dry fairly clear if you haven't over-brushed in the coating steps.

Once you have removed all of the paper from the image, the acrylic *image-skin* can be applied directly to paper, wood, or glass with a thin wash of the same acrylic medium or a diluted white glue wash, say 3 parts white glue to 1 part water. You can nail it, staple it, stretch it, or cut it into shapes. The dried lift can also be used immediately as a contact positive for any alternative process, and it can be, as mentioned, scanned and worked upon in Photoshop, montaged, collaged, digitized, remade on acetate, and played with as you see fit.

As you might expect, the *positive* acrylic image, printed as a contact film, will yield a *negative* print. To make a positive print image it is necessary to make an inverted film or acetate inter-negative.

A QUICK TIP OF THE HAT TO IN-CAMERA FILMS

Shooting large-format negatives in-camera is still one of the best options for generating the perfect conventional negative. I mentioned in the earlier edition of this book that digital technology would soon challenge silver gelatin film as a preferred negative source. Well, that day has come earlier than I had imagined . . . and it isn't as bad as I had imagined. The expense of buying, processing, and archiving traditional film has been greatly reduced, which is good. On the downside, because it is so easy to make more negatives, the issue of quality control through editing has been compromised. In the meantime, a few conventional black-and-white films are still being made and used by those hearty folk who are hanging on to the romance of the wet darkroom. Check the web sites of B&H Photo and Freestyle Photo for the latest on what is out of production and what can still be purchased.

Conventional standards for exposure and processing in silver gelatin printing are not the same when applied to alternative processes, as the average negative density would be inappropriate for a silver gelatin paper with anything but a 0-grade filter . . . meaning your negative has a ton of contrast and is what we would call *bulletproof* in its exposed silver density . . . those areas that will be your strongest highlights. This single subject, that of film and its relationship to alternative process image making, could easily take an entire book, as you will discover if you go looking for one on the topic. I personally don't have the deep interest, page space, or time to devote to this theme so I will offer some resources. Fair warning: it is easy to get drawn into the realm of compulsive technique, and the history of alternative

Figure 24–31
Binh Danh, *The Leaf Effect: Study for Metamorphosis #2*, 2006 (Chlorophyll print, butterfly specimen and resin)
Binh Danh makes his images by directly printing directly on plant leaves through the natural process of photosynthesis. By placing a negative in contact with a living leaf and then exposing it to sunlight for several weeks, the image literally becomes part of the leaf. Danh then permanently "fixes" the image by casting it in resin.
(Courtesy of the Artist and The Haines Gallery)

processes is full of individuals who made stunningly beautiful prints that were, in the end, devoid of life, imagination, and inspiration.

GRAPHIC ARTS FILMS

Ilford Ortho Plus

Ilford Ortho Plus is still in production and is known primarily as a copy film for both continuous tone and line copying. It is orthochromatic (sensitive to blue and green light) and can be handled briefly under dark red safelights. Ilford Ortho Plus allows you to fine-tune the contrast by the choice of developer, the exposure given, and the development time, and it is possible to achieve an accurate reproduction of most black-and-white originals, or to maintain a clean background in copies of combined line and continuous tone art. The characteristic curve of ORTHO Plus copy film has been optimized to ensure precise tonal accuracy of original art and is different from conventional films, which often yield a flat result when used for copying.

For two-stage positive to negative production, Ilford Ortho Plus is high-quality, two-step, continuous tone (or high contrast) film with fine grain. The film is a student favorite because of its low cost, quality, and simplicity. In the *positive* first-stage Ilford Ortho Plus can be exposed for highlights and developed for shadows in a conventional paper developer for 2–4 minutes. In the second stage *negative* you will be exposing for shadow details and developing for highlights. If your shadow density looks good but the highlights lack substance, simply increase the type or strength of your developer, and vice versa. This film behaves like FP4 and can be developed under safelight conditions. Ilford Ortho Plus comes in sheet sizes from 4" × 5" to 10" × 12" and can be developed in ID-11 normally for 6 minutes or 11 minutes for high contrast. You may also use Microphen, which can be developed at 4 minutes for normal development or 7 minutes for high contrast.

Processing Ilford Ortho Plus

Ilford Microphen Developer is a fine grain developer recommended for obtaining the maximum film speed with films that can be push processed. It is optimized for use at the faster end of the exposure range. Grain size is reduced, and grain clumping is prevented because of the low alkalinity of the developer.

The majority of developers that can yield an increase in film speed usually produce a corresponding increase in grain size. Microphen, however, has been specially formulated to overcome this disadvantage and, therefore, has a high speed-to-grain ratio. That is, there is a speed increase while maintaining the type of grain associated with a standard developer. A speed increase can be achieved with many films, and meter settings up to EI 3200/36 can be used with ILFORD HP5 Plus film.

Microphen is supplied as a powder and shows exceptional consistency in performance throughout its working life. It is made up to a stock solution for normal

tank and tray use and can be further diluted 1 + 1 or 1 + 3 for users who prefer to use fresh solution each time.

Arista Ortho Litho 2.0

One of the most popular products in the marketplace was a regular supply of graphic arts films such as the now out of production Arista APHS Premium Halftone Supreme Ortho Litho film, a quality graphic arts film that was a replacement for every art student's favorite, Kodak Kodalith Type III Ortho Litho film. After a multi-year absence there is a new and reliable ortho film available from Freestyle called Arista Ortho Litho 2.0.

Arista Ortho Litho 2.0 has very similar specifications to the previous Arista-II Ortho Litho film but with more contrast. This is a film to be used for high-contrast and continuous tone output. For higher contrast negatives, of subjects such as line text or monochromatic line drawing, use this film with Arista A&B Lith developer or any standard lith developer. For a continuous tone it is recommended to use with LegacyPro Select Soft Powder paper developer or any other standard powder paper developer. To reduce contrast in the film, you may want to double dilute the paper developer to get continuous tone results. There is also Dave Soemarko's LC-1 and LC-1B processing formula for very high quality continuous tone negative reproduction. For more on this, keep reading.

Arista Ortho Litho 2.0 is available in small formats up to 20" × 24" sheets and in 24" × 100' rolls and will not rapidly exhaust or foul your developer.

Processing Arista Ortho Litho 2.0

Arista black and white chemicals were created to compliment a superior line of photographic chemicals for the graphic arts industry. For a continuous tone, develop with LegacyPro Select Soft paper developer. For high-contrast negatives, develop with Arista Powder A & B Lith Developer, a two-part, non-corrosive economical developer specifically designed for use with Arista Ortho 2.0. If you happen to have any Arista II Ortho Litho, Arista APHS Halftone Supreme, or Kodalith films in the freezer, the same developer will work with those now out of production films. It is also specially formulated for use in lith printing processes of standard B&W photographic papers. A single packet of the developer powder will make two 1-gallon solutions. When used in the lith printing process your developing time,

Figure 24–32
Charmaine Craig, *Family Portrait*, 1990
Charmaine Craig created this work, a family portrait, when she was a student of mine at Harvard University. She writes, "*This piece is intended to evoke my relationship with my mother, who, in Burma of the 1960s, was a beauty queen, an actress, and a leader of the Karen people in their struggle to survive the military dictatorship.*" *(Courtesy of the Artist)*

dilution, and temperature will vary based on your desired result.

For lith printing, mix 1 part A & B Lith Developer working solution with 14 parts water. For lith processing of film, mix A & B in equal proportions.

SOEMARKO'S LC-1 & LC-1B LOW-CONTRAST DEVELOPER FORMULAS FOR CONTINUOUS TONE ORTHO LITH FILM

To be perfectly clear, it's not a simple task to dial in specific density and adjust for the contrast when making an enlarged duplicate inter-positive on a high-contrast film. The traditional controls of exposure, development time, and developer dilution fall shorter still when the requirement is placed on an inherently high-contrast product such as an ortho lith film. Traditionally, an artist who wanted a continuous tone lith film would attempt to trick the film into providing a longer tonal scale by processing it in a standard Dektol paper developer in the 1:4 to 1:10 dilution range. Others would make esoteric mixtures of combined paper and film developers in an effort to control the tonal scale and still be able to use this inexpensive film, which was a staple in the graphic arts and printing industry and a favorite amongst art students everywhere because it was cheap, big, and easy to get and had funky high-contrast characteristics. Also, the problems with it were somewhat predictable. They included the following:

- High-contrast (density) and loss of highlight or shadow separation (low density)
- Inconsistent densities between test strips and final positive and negative film
- An uneven or mottled appearance throughout the tonal scale
- The need to constantly refresh the developer to maintain consistency

Dave Soemarko's self-assigned task was to develop a working technique in which he could fully control the inter-positive in making an enlarged duplicate negative. The beauty of Soemarko's formula is that it allows the artist to get that low-contrast inter-positive needed for the final negative step in an orderly and consistent manner. His LC-1 inter-positive technique also allows you to use lith film and develop it so that it has a very long tonal scale from toe to shoulder.

The following is going to document the LC-1 and LC-1B techniques using some out-of-production ortho lith films. I asked Dave Soemarko if he felt that it was going to be an issue applying his formulas to processing the few ortho films that remained on the market and he replied, *"Nothing has changed on my LC-1 and LC-1B developer formula. I do not know for sure specific similarities or differences between Arista Ortho Litho 2.0 and Ilford or Kodak. They all work similarly, but Arista used to have two versions of their litho film, one is higher in contrast and more expensive. The other one was slightly lower in contrast and cheaper. Since we want to use it for continuous tone instead of high-contrast screening work, the lower contrast is actually better. I am not sure about Litho 2.0, but if there are still two versions, the lower-contrast one should be preferred. One can probably just use LC-1B unless one wants to really play with the contrast. In that case one would use LC-1."*

Note: Again, although I am referencing Arista APH and APHS film, both of which are out of production, you will be able to approximate the same results using the Arista Ortho Lith 2.0.

Being able to use lith film is a bonus because it comes in a wide array of sheet sizes and rolls, and it is also affordable, even on a student's budget. The film in the first test is Arista Premium Halftone Supreme (APHS). In a more recent test, Soemarko worked with Arista Premium Halftone (APH), which is less expensive than APHS but yields similar (some think better) results. The APH test is described at the conclusion of this section.

Dave goes into a lot of detail in Judy Seigel's *Post-Factory Photography Journal* describing his entire investigation and how he arrived at his formulas. If you're interested in seeing how his mind works, I refer to that specific issue, #2 (available in well-stocked

arts-centric bookshops like the Strand in New York City). Following is a description of the salient points of the process. LC-1 is made from two stock solutions and water, and it is manipulated to suit the particular stage of the process you're dealing with, interpositive or negative.

The Standard LC-1 Formula

Stock A

750 ml distilled water (125°F)
3.0 g metol
60 g sodium sulphite
3.0 g hydroquinone
Distilled cold water to make 1 liter

Stock B

10 g sodium bisulphite
Distilled cold water to make 1 liter

Once the separate stock solutions have been made they are mixed together in equal or unequal amounts and diluted with additional water to make a 10-part formula. An example of this would be a 2:1:7 formula or 2 parts Stock A, 1 part Stock B, and 7 parts water.

In a developer with a stronger alkalinity such as Dektol, which contains sodium carbonate, the processing speed is faster. The contrast of values is greater, and this combination results in accelerated exhaustion of the developer, which, in turn, leads to uneven development.

With Soemarko's LC-1 formula and a mix of the preceding 2:1:7 solution, Dave made multiple tests with the same exposure and development and found that each negative was nearly identical to the other! There was no mottling, or uneven values, proving that the development was well controlled. He presoaked his film for 3 minutes and processed for 5–7 minutes and achieved a gradation of 21 steps. The inter-positive was low in contrast, indicating that he could place all of the tonal separation in the original negative into the inter-positive and go for the higher-contrast positive in the negative stage by extending his development time. The low contrast of the inter-positive is a great help in avoiding compressed values when making the negative.

For a second example with the same negative, Dave changed his formula to 2:2:6, a proportional mix that indicated an increase in the sodium bisulphite portion of the formula. Because sodium bisulphite is an acid, the contrast is reduced. In his test, the inter-positive development was slower and the toe-to-shoulder curve was nearly linear. If you find unevenness in your developed film, simply add more of the Stock A to your 10-part formula. Density will increase with this change. If you wish to maintain the same low contrast, you will need to add more of Stock B.

The Rule: *The more acid, or bisulphite, in the formula, the less active the developer, and less contrast in the film. The reverse of this rule is also true.*

An example of this modification to the 10-part formula is indicated in the following way. You have a formula of 2:2:6, giving you the contrast you desire but showing unevenness in the film. You would want to compensate for this, so you would change the formula to 4:4:2. This new proportion eliminates the unevenness but may give you too much contrast for the inter-positive. An additional modification to a 4:5:1 formula, with a little extra bisulphite, makes a less active developer and reduces the contrast, providing the correct results. For almost any inter-positive on ortho lith film, a formula of 2:1:7 or 2:2:6 is going to give you good results with a 5-minute development time. Many users find that a formula dilution of 2:3:5 will give a linear response for a longer exposure range, which can be very useful for in-camera use of lith film.

The principle is the same for making both the inter-positive and the final negative. In the inter-positive, a low-density range is sought as a way of adjusting the overall density levels of the negative and having both the top and bottom end of the scale usable.

In the final inter-positive negative stage, the tonal range is attached to the process, and you will likely want to use a formula indicating a stronger developer or a LC-1 formula of 2:0:8 with a 6-minute development.

The two-stock LC-1 formula is particularly useful if you are testing a different high-contrast lith film. Once

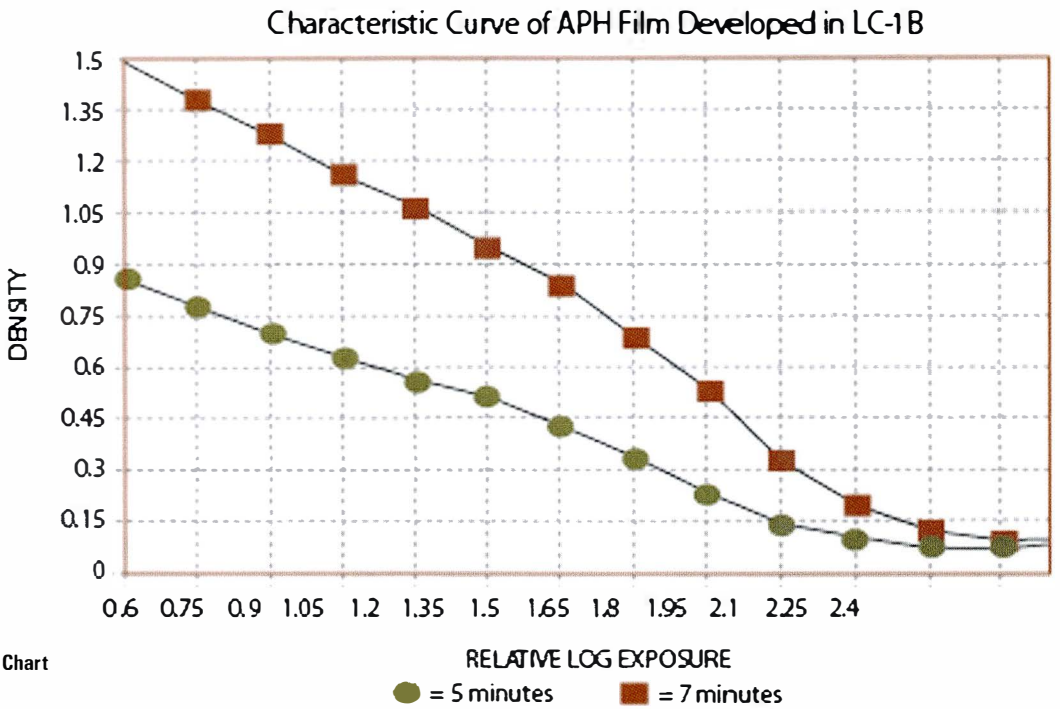


Figure 24–33
Soemarko APH Curve LC-1B Chart
(Courtesy of the Artist)

you have worked out the combination and dilution that works best for your film type, it is simple to combine the Stock A and Stock B parts and then dilute them with water before use. Combining Stocks A and B makes the solution less alkaline and extends its storage life.

Figure 24–24 shows the characteristic curves for Arista APH ortho lith film developed with the LC-1B formula at 68°F with continuous agitation for 5- and 7-minute development times. Note that the film can be developed for linear characteristics or the more typical S-curve characteristic. By closely monitoring the exposure and development, you are able to place the tonalities in the negative to the desired section of the characteristic curve.

LC-1-B Low-Contrast Formula for Arista Ortho Lith Film for Both Inter-Positive and Negative Production

750 ml	distilled water (125°F)
4 g	metol
80 g	sodium sulphite
4 g	hydroquinone
20 g	sodium bisulphite

Distilled cold water to make 1 liter of stock solution

To use: Dilute between 1:5 and 1:10. Develop film between 5 and 10 minutes at 75°F. The LC-1B is similar to an LC-1 dilution of 2:3:5 but with more sulphite and bisulphite added in proportion.

FOMAPAN R100—B & W REVERSAL FILM

Fomapan R100 is a panchromatic sensitized black-and-white reversal film intended for taking black-and-white transparencies and/or making movies. It is distinguished by very fine grain, high resolving power and sharpness, and higher contrast. Fomapan R100 is a true BW reversal film and is a perfect replacement for Agfa Scala. Best yet, it can be developed in standard black-and-white chemistry. However, as of this writing, individual home processing kits for slide production are not available.

The spectral sensitization of Fomapan R100 is designed for translating color tonalities into an accurate grayscale when exposed in daylight and simultaneously making full use of the film speed when exposed in artificial light. Due to a very efficient anti-halation layer, situated between the base and emulsion layers,

the film features very good resolving power and high contour sharpness. The anti-halation layer will decolorize during processing.

PYRO

If you are extremely compulsive about your negatives, you can become a disciple of the *Cult of Pyro*. By joining, you will become a *pyro-maniac* and may indulge yourself in the wondrous world of Pyro developers.

Essentially, Pyro chemistry provides the user with a very long tonal scale negative that is a favorite of platinum/palladium printers. When an exposed piece of film is developed in one of the Pyro formulas, the negative's sensitive silver halide reduction to a metallic state is not all that is taking place. The silver being reduced to its metallic state not only forms a negative but also delivers a greenish-yellow, sometimes tan, stain that functions like a sunscreen or tanning agent, hardening the gelatin into a microscopic bas-relief. This yellow-green Pyro stain works as a filter to UV light and allows films like high-contrast ortho lith to yield a long and very smooth tonal gradation curve. For more on the complicated subject of Pyro . . . and to join the cult, I suggest investigating Gordon Hutchings's *The Book of Pyro*, published by Bitter Dog Press.

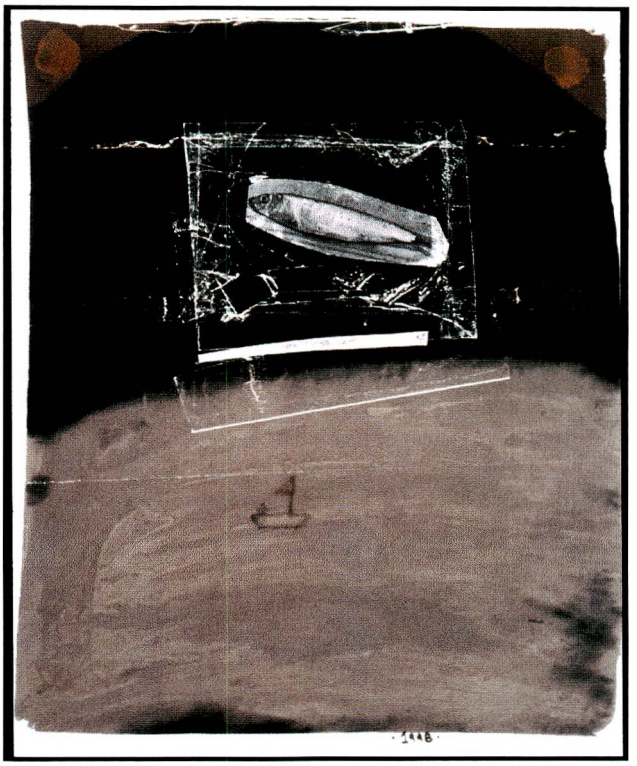


Figure 24–34
Pablo Ortiz Monasterio, *Comida*, 1998
I first saw Pablo's *Comida* during his visiting artist lecture at the Art Institute of Boston. It was a bit of a surprise, as my knowledge of his work was limited to his impressive documentary projects in Mexico City. *Comida* was created by constructing a montage of films and incorporating toners in post-print manipulation.
(Courtesy of the Artist)

Digital Imagining

OVERVIEW & EXPECTATIONS

So . . . many of you may ask as you launch into this chapter, "What is *digital imagining*, why is it here, and why is this chapter not dedicated to demonstrating how to accomplish alternative image-making tasks like all of the other chapters?" Good questions. For some time I've been trying to find the right place in the book to have a discussion about the influence of digital imaging upon photography. In the time I've been considering the question, the discussion has changed. No longer is the conversation about how digital imaging is changing photography, but how digital imaging artists are actively inventing *alternatives* to digital imaging's own accepted standards and syntax.

I see digital imaging, in still image representation specifically, describing the phenomenon of digital capture where the device, essentially a very sophisticated light meter, takes measurements of reflected and collected light on command. After the human desire to initiate the act of making the picture, and the necessary measurements of reflected light, all the rest of it, from the download to the output, is simply a matter of processing data. As my friend Fionnbharr Ó Súilleabháin wrote recently, it is no different from the sequence of operations in seismic processing or the interpretation of oil-well logging data.

Digital technology has improved to the point that its software and machine-made output are critiqued and contextualized with most of the same standards that have been in place since Stieglitz and friends set the critical bar for handmade photography in the early 1900s. Digital imagery doesn't have a unique critical language, such as painting, because, in truth, it is simply an alternative to traditional photographic practice. In this context, the history of binary code and digital adaptation is the core of the digital process, and once established, it's possible to have a dialogue about its "alternative" directions.

Throughout the book, individual processes are presented as an alternative path to the way photography has been practiced for the last century with silver gelatin films and papers. For the most part, the techniques featured represent a return to the beginning, in essence, an alternative to the last hundred years of practice which were, themselves, alternatives in the way images were reproduced.

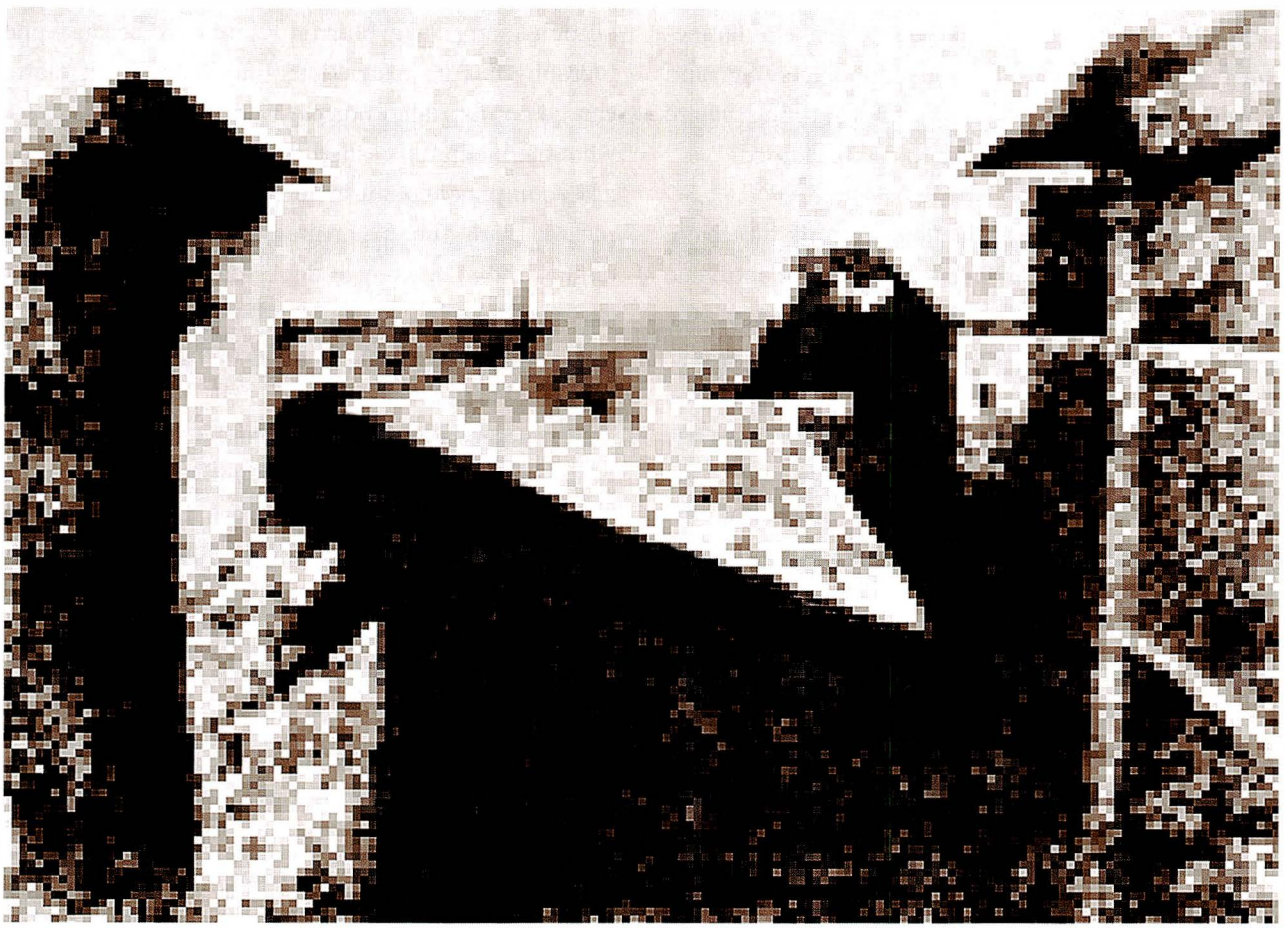


Figure 25–1

Christopher James, *Niépce Grab Shot at Le Gras*, 2007

I was putting together a lecture for one of my seminars and decided that it might be interesting to produce a conceptual example of the "very first and most recent" photograph at the same time. In this case, Niépce's view through his studio window at le Gras in 1826 and my postmodern appropriation of it at 5 pixels per inch and printed digitally in the form of a 40" × 60" piezograph on Hahnemühle photo rag.

(Courtesy of the Artist/Author)

With that as my thesis, I want to add to the conversation that digital imaging is simply an alternative form of photography and that the term *digital imagining* identifies the engine of this chapter. In this context, the digitally based themes of signals of information and performance, the monitor, the print, and the art are alternative incarnations of traditional digital imaging, which I flippantly describe as being a *mushy democracy* due to the near universal dependence upon software and hardware to make an impression.

This chapter is not about *how to* but *what is* . . . and *why*. I have chosen to write about how it all began and what it means in a contemporary critical context. This conversation will change, of course, but for now I intend to make a bridge from the nineteenth to the twenty-first century, where the digital negative can be part of the scaffolding. I also want to make a distinction between photography and digital imaging, and between digital imaging and digital imagining, where the *new photography* is currently being defined.

Let's begin. . ..

As I wrote in the introduction, from its inception, photography has never been a single, identifiable technology or process. Throughout its evolution, the medium has been a slowly moving glacier of change, adaptation, and obsolescence followed closely, and often concurrently, by another body of knowledge influenced by science, industry, technology, aesthetics, and cultural taste. I equate it to what remains from the changes to the monolithic rocks you come upon in the forest . . . evidence of the glacier's history as its recognizable mass melts and transforms. Each of these process transformations, the great majority of them overlapping, has ushered in an ever-greater democratization of photographic image making, public adoption, and adaptation. Each of these cycles has had the same family name regardless of how odd the offspring appeared . . . and they have always shared the genus and photographic DNA . . . that of making marks with light.

At its very core, photography is the name of the desire to make pictures. In 1829, Louis Daguerre penned a letter to Nicephore Niépce, stating, "I am burning with desire to see your experiments from nature." Not a thing has changed since that sentence was written but the way in which that itch of desire, to make and look at photographs, is scratched. In the last several years, the photo-partisan bickering between the digital and silver gelatin film disciples has occasionally achieved a level of mutual disrespect at which the new scarlet letter "A" might stand for *analog*.

Consider the non-confrontational concept that photography is one thing and digital imaging is quite another. In the recent past, when photography concerned itself with media, such as painting, sculpture, and performance, it was almost always to document those other studio practices. A wingman, if you will, for the more established and sophisticated arts. Since the mid-1990s, when digital and Internet photography began to seep into and influence media, such as painting, sculpture, printmaking, and video, the exclusive distinctions between those forms of expression have become increasingly blurred . . . more so because photography has no restrictions on what subject matter can be appropriated nor clear and defined rules as to what the medium is called once photography becomes a key component of the creative process. This has really messed with the departmental distinctions in academia, and at one recent departmental meeting I suggested that the photography program be abandoned as a separate entity and instead become a requirement of every department in the university.

In the midst of this photographic and digital revolution, there is the unlimited potential of incorporating all of it under the umbrella of alternative photographic practice. The romance of the traditional studio in a funky marriage with the accelerating changes in digital technologies has led to possibly the most exciting time in the arts in a century.

From my perspective, photography was significantly responsible for setting painters free and redefining the critical definition of both painting and painter. It is equally plausible that digital imaging may ultimately be responsible for freeing the medium, and more specifically the meaning, of photography in a similar manner. In a sense, permitting the embrace of those rare moments of serendipity and feeding the hunger for the accident that has given photographic artists new ways of expressing the realities they choose to capture on sensitized film, glass, metal, and paper.

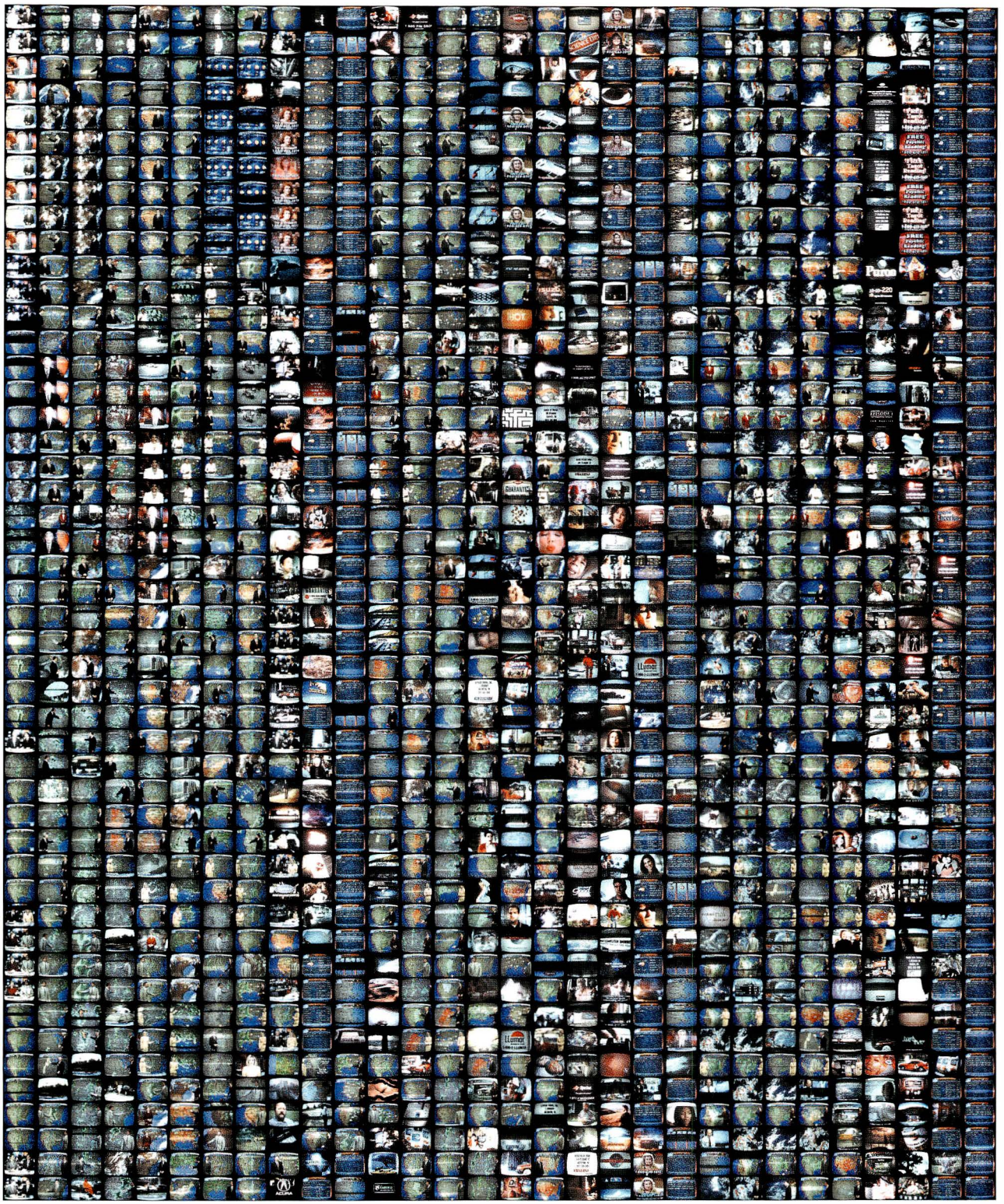


Figure 25–2

Matt Belanger, *The Weather Channel*, 06-22-1999

This is one of Matt's large-scale TV pieces digitally documenting popular culture and the regimented order and content of television programming . . . in this case an hour-long document of the Weather Channel.

(Courtesy of the Artist)

Oddly, this declared freedom may turn out to be a reciprocating event in which digital imaging will then be free from the obligation of behaving like an alternative to photography and able to reinvent itself as an alternative to digital imaging. Think about it . . . it's possible that what photography did for painting, digital imaging will do for photography . . . and photography will then do, in turn, for digital imaging. Kumbaya. . . .

I've learned a lot. In an early edition of this book I wrote, "*I am a relative neophyte tourist to this new planet in the universe of art. In fact, even a decade ago I had resolutely expressed a nagging distrust of the computer, not only as an art-making tool, but also as a device that you would consider letting into the house. Then I realized I couldn't communicate without email and am now convinced that the photography programs of the very near future will be obsolete if their wet labs are not digitally integrated.*"

So much else has changed in my digital world since then. In the past dozen years I have taken to carrying my life around on a laptop. All of my files from the College of Art and Design at Lesley University are in my computer instead of taking up space in cabinets in my office. I conduct my entire banking and business life online, my images are all catalogued and realized in binary code, and when I lecture, my presentations are constructed with digital software, like Keynote, and delivered with a digital projector or over the Internet. All of my music is now digital, and I buy it online. I have text conversations with my lifelong friend, Craig Stevens, in Savannah while we watch the Red Sox play at Fenway Park on TV in different states, and the only people I send an actual letter, with a stamp on it, to are the few dinosaur friends who have managed to avoid using email and college admissions offices that still insist that recommendations be on paper. This technology has also put an end to the definition of "weekend" when you were allowed to rest.

At the College of Art and Design at Lesley University, when I was the chair of the BFA program, I added digital offerings to the curriculum each semester, and the number of students with outstanding Photoshop skills increased with each incoming freshman class. Most of our current students, as is the case everywhere now, are actively creating work digitally in black-and-white and color, using inter-disciplinary mixes of still and moving imagery programs, switching out of camera apps on their telephones like a child going through a box of chocolates. They are also making their contact negatives on ceramic-dust-coated films for alternative process printing in the sun. And all of this is exciting and inspirational as young artists seek unique ways to stand apart from the crowd.

As much as I have become dependent on the digital world, I am cautious that all it would take is one sizeable solar storm, such as the solar event in 1859, and 17 hours and 40 minutes later a great many hard drives on the receiving end of that solar flare would instantly become door stops.

It's true, I have embraced the dry-darkroom of digital imaging and have become quite expert at printing beautiful Piezo prints, using carbon pigment-based inks on rag paper stocks and making perfectly serviceable alternative process negatives on Pictorico Ultra Premium OHP inkjet film. However, and here is where the language may become provocative, I am greatly disturbed by what I refer to as the "mushy democracy" of digital imaging . . . a term I've used to describe when equipment and software allow for perfect execution and output and when it takes very little time, compared to the past, to become a competent image maker. I see the genre becoming one in which everyone may be technically *good* and the criteria for excellence is undefined. When you tell someone he or she is a superb printer, does it mean that person has the judgment and skillset to evaluate in the real or metaphorical darkness . . . or is he or she simply good at clicking "print"? As we all become as *good* as our software and hardware, there is a danger of heading backward as an exclusive medium . . . to the days of the salon, when being *good* technically was all that was necessary to be a *good* photographer.

Yet at the same time I am seeing a resurgent passion for the alternative process image, as well as the alternative digital expression, and I am getting emails from students and artists from around the world who are using their digital imaging skills to produce powerful visual statements in which context, syntax, and content are front and center and in harmony with their handmade print intentions. They are using the

best and most distinctive attributes of digital technologies to produce contact negatives and mixed discipline prints that are unique and actively breaking new ground in the arts. This is a very positive outcome due to digital influences and bodes well for the health of the handmade print.

There are many digital artists whose work I greatly admire. Some create from their camera-made images, while others appropriate and recreate from the inspirations they discover in the course of their day-to-day lives. There are many, like myself, who love the handmade photographic image but now realize that many of the technical tar pits, the laborious tasks that consume creative time and energy, could be filled in with the assistance of digital technology, such as instantly produced CMYK separations for gum bichromate printing. This is a fine idea and a wonderfully efficient syntax.

These separations, which once took an exceedingly long time in the lab, can now be accomplished with a few clicks of the mouse in a curve dialogue box in Photoshop, and they can be printed out at very high resolution on inkjet film. It is significant that the first edition detailed a 26-step sequence for making CMYK inkjet separations for gum bichromate contact negatives. In this new edition I can tell you how to do the same thing in a few very simple steps . . . changing the mode to CMYK and clicking Channels.

Additionally, near-weekly advances in optical and printing technology now permit digital film reproduction that is capable of exceeding the best of traditional

Figure 25–3

Jerry Uelsmann, *Water Angel*, 1992, and *Threshold*, 1999

Jerry Uelsmann's working style can be compared to that of a concertmaster thoroughly engaged in the music he is conducting. *Water Angel* is a perfect example of his ability to create multiple layers of imagery on a single sheet of silver gelatin paper with multiple enlargers, negatives, and extraordinary skill. In a recent email to me, Jerry wrote, "*I'm still in the dark ... room! The water angel image has only been done as a silver gelatin print ... I assume after I go to the great darkroom in the sky it might be done in ink jet.*" To make a point about the process of the artist, I asked Jerry to make a piece using Photoshop and was not the least bit surprised that the image he made continued to exemplify his personal vision.

(Courtesy of the Artist)

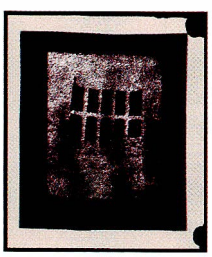
silver gelatin negative output. And for dessert, I can mimic pyro-developed film coloration with color layers and then assign functioning "curves" for individual alternative processes.

I have done my best to make these topics understandable and to refrain from the usual maze of digital tech-talk. If I have learned one thing from the first and second editions' version of this chapter, it is to be very concise about "why" one might be using digital technologies for negatives and prints, and to discuss specific software and hardware as little as possible. I will not spend much time telling you about individual programs because their lifespan is so brief . . . on average they will live about 18 months before you must invest in a new version. In an alternative process book it is a bit ironic to be concerned with being out of date before the book comes out. Besides, there are a host of books now on the market that deal with digital photography more thoroughly than I could hope to do in this book . . . I'll tell you which ones I think are best.

Figure 25–4
Doug Prince, *Floating Rose*, 1978 (Plexiglas boxed images)
I first experienced Doug's box constructions in Lee Witkin's gallery decades ago. His photo-sculptures are three-dimensional images, constructed of plastics and film, approximately 5" × 5" × 2.5" inches in dimension. The images are printed on graphic arts film, which is supported between panels of clear plastic at various depths within the box structure. The boxes are then viewed by transmitted light from the rear of the sculpture.
(Courtesy of the Artist)

During my brief history of learning and teaching in the digital world I have discovered that most authors and teachers assume too much prior knowledge on the part of their readers and students. They fall victim to the trap of *what* and *how* and often fail to address the most relevant part of the equation for a young digital artist . . . *why*? The reason is simple really . . . the knowledge required is profoundly dense, and the pathway from the *noun* in your imagination to the *verb* in your imaging software is often a mysterious detour, all but eliminating everything but immediate technical considerations. Sophisticated software programs, as you all know, are quite content to sit on your monitor screen, mocking your ignorance, until you provide the key that completes the action or avoids the digital transgression. This is the sort of thing that causes rational, and intelligent, people to have irrational and pointless conversations with their electronic devices.

With that in mind, I have attempted to make this chapter entertaining and as simple as possible . . . and to go light on information that could make whatever I write obsolete in a few months. The heart of this chapter is an essay that I have been considering about the digital arts . . . it's the engine for this chapter. If you are less than comfortable traveling in the digital world, this chapter should make you feel a little better about the trip. As always, have fun and be an artistic revolutionary . . . for the times, they are a changing. But first . . . A Little History to function as the core foundation of digital imagining.



A LITTLE HISTORY

Jacquard's Loom, Vaucanson's Duck, & Engelbart's Mouse

In 1984, a year after Apple had introduced *Lisa I*, its first interactive graphical user interface computer-operating system, I was watching a loom weaver working in Varanasi, India, creating a tapestry that he would likely make many times throughout his life. A thick stack of linked and battered cards, with an abstract pattern of punched holes, was suspended above him

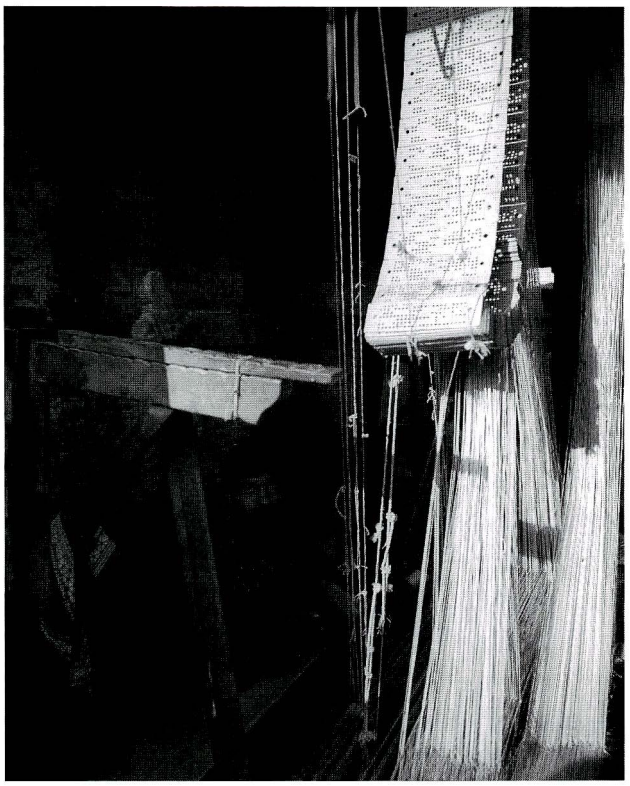


Figure 25–5
Christopher James, *Loom*, Benares, India, 1985
In 1984 I was watching a loom weaver in Benares (Varanasi), India, create a tapestry that he would likely make repeatedly throughout his life. A thick stack of linked and battered cards, with an abstract pattern of punched holes, provided the answer to the question "How does the color and design of a fabric remain the same from generation to generation?" These cards were similar to those found in the early room-sized computers . . . the ones with the typed warning "Do not fold, spindle, or mutilate."
(Courtesy of the Artist/Author)

and answered the question "How does the color and design of a fabric or rug remain identical from generation to generation?" The cards his loom was relying on for the design were similar to those found in the early days of room-sized computers, the ones with the standard text warning *Do not fold, spindle, or mutilate.*

The well-worn cards were integrated into the operation of the weaver's loom and determined which *shed* would rise in a particular pattern sequence and which would not. The shed's position controlled which of the vertical warp strands of the rug in progress were back or forward in relation to the horizontal *weft* strands that the weaver was sliding his shuttle through. The rows of fibers, stacked one upon the other, produced the patterns and organized the colors within the fabric. They essentially controlled a very efficient coded binary on/off system.

The evolution of the computer is as complex as the computer itself, but several individuals were particularly important in its development, and they are the ones that we'll focus upon now. We'll begin with Jacques de Vaucanson (1709–1782), whose creative genius was legendary in Europe in the 1700s. Vaucanson was known for his *automatons* . . . fiendishly complicated mechanical devices that mimicked actual life. Vaucanson referred to his projects as *anatomie mouvante* or moving anatomy. Among his creations were a life-size tambourine, a flute-playing shepherd, and an extraordinary device created in 1738 that he called *Le Canard Digérateur* or Digesting Duck.

Vaucanson's duck consisted of over 1,000 intricate parts and was able to wag its tail, eat, digest, and eventually defecate a mixture of breadcrumbs and green dye that was a perfect replica of real duck poop. This stunning scientific curiosity was accomplished through a tubular digestive tract made of a milky rubber tree sap called *caoutchouc* that Vaucanson himself had actually discovered in South America in 1731. He subsequently designed a machine to convert the sap into the duck's digestive tubing. As an aside, if you're interested in how this reality might play out in a science fiction novel, pick up a copy of Phillip Dick's *Do Androids Dream of Electric Sheep*, the inspiration for director Ridley Scott's magnificent 1982 film, *Blade Runner*.

The genius of Vaucanson was well regarded during his lifetime, and the general finance comptroller, Philibert Orry, invited him to apply his odd talents to revolutionizing the troubled French silk industry. In response, Vaucanson invented the first automated loom (1745) and then improved it by controlling the automation of the system. His machine, coincidentally, was regulated by a punch card system similar to the one I saw in India, making it possible to repeat designs through a form of automation rather than memory or passed-down tradition. As a bonus, anyone could learn to use it without a great deal of training.

A relatively short time later, Joseph-Marie Jacquard (1752–1834) improved the concept and created a simplified automatic loom (1801), inspired in

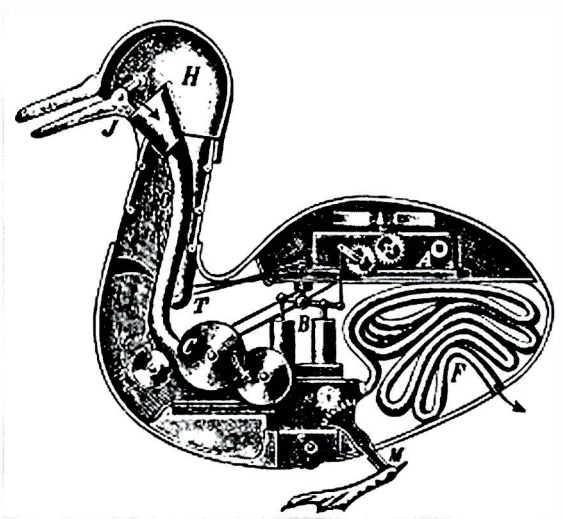


Figure 25–6
Le Canard Digérateur, *Vaucanson's Duck*, c.1730
Vaucanson was the inventor of the first automated loom in 1745, but he was better known for his *anatomie mouvante*. Among his creations, besides a life-size tambourine and a flute-playing shepherd, was an extraordinary device he called the *Digesting Duck*. Vaucanson's duck consisted of over 1,000 intricate parts and was able to wag its tail, eat a fish, digest it, and eventually poop on the lawn just like a real duck. This feat was accomplished through a digestive tract made of a rubber material called *caoutchouc* that Vaucanson himself had actually discovered in South America in 1731.
(Courtesy of the Artist)

part by earlier inventions by the Frenchmen Basile Bouchon (1725), Jean Falcon (1728), and Vaucanson. Jacquard's loom remodeled the weaving industry in France through a *linked* sequence of punch cards. In Jacquard's loom, each hole in the punch cards corresponded to a hook called a *bolus*. The bolus hook raised or lowered a harness that directed and supported the warp thread so that the weft would lie above or below it. This alternating sequence allowed the pattern to be realized in the final fabric design.

Although Jacquard actually invented his loom in 1790, he decided to keep it a secret due to the social turmoil of the French Revolution (1789–1799). When things quieted down a little, Jacquard was asked to demonstrate his machine to the French government. Seeing the value in mass standardization with the new loom, the government gave Jacquard an annual stipend and declared that his invention was now public property. Unfortunately for Jacquard, his loom was so efficient and simple to use that it resulted in his looms, and reportedly Jacquard himself, being beaten up by angry traditional silk weavers who saw their way of life being altered by the influx of automation . . . does this sound familiar?

Mr. Babbage Lived on Cabbage

Jacquard's automated weaving innovations ultimately led to the steam-driven punch card systems of Charles Babbage's (1791–1871) *Difference* and *Analytical Engine* calculators. Babbage was a devilishly brilliant and complex man who immersed himself in invention, philosophy, politics, statistical analysis, and industrial systems. In a curious "two ships in the night" coincidence . . . he was also Sir John Herschel's roommate when they were young students at Cambridge.

His inventions, and creations, included the sweeping cowcatcher adaptation to the front of railroad steam locomotives, standardized postal rates for the British "Penny Post," occulting lighthouse illumination (a system for distinguishing one lighthouse from another), the concept of submarine navigation (1818), colored lighting for the theater, the ophthalmoscope, and his never constructed, but infamous, Analytical Engine—the very first computer. The English humorist E. Clerihew Bentley (1875–1956), the inventor of the *clerihew*, an irregular form of humorous biographical verse, composed this little piece in Babbage's honor:

Mr. Babbage
Lived entirely on cabbage.
He used his head, rather than his thumbs
In inventing his machine for doing sums.

Babbage would have been a strange person to have as a neighbor. He was, as Max Byrd wrote in his book, *Shooting the Sun* (2004), "one of those irascible and colorful eccentrics that the damp, unweeded, garden of England seems to throw up in endless profusion."

There's more . . . Babbage was enthralled by fire and once had himself baked in an oven set at over 250°F . . . apparently without appreciable harm to his person. As well, Babbage detested musical sounds. His public condemnation of that form of expression, coupled with his curmudgeonly and incessantly cranky behavior, incited his neighbors to torment him with full brass band ensembles outside his home, to throw dead cats at his

Figure 25–7
Ada Lovelace
Ada Lovelace was the lovely daughter of the poet Lord Byron, but her passion took the form of mathematics rather than rhyme or verse, as she applied her poetic side by bathing numbers in metaphorical images from deep in her imagination. Ada described a programmable *engine* that could compose complex music, generate and modify graphics, and calculate information, of scientific nature, faster than the human brain. I like to speculate that she, with Babbage's influence, realized the prospect of digital imaging in the early 1830s . . . before there was photography! *(Courtesy of the Artist)*

front door, and to organize large groups of children to follow him through the streets, making shrieking sounds on tin whistles. Curiously, while Babbage embodied each of these socially unpleasant characteristics, he simultaneously managed to gain the adoring attention of the allegedly most beautiful women of her time . . . Lord Byron's daughter, the dazzling Ada Lovelace.

Ada Lovelace and the Analytical Engine

Augusta Ada Lovelace (1815–1852) was the ravishing daughter of the scoundrel and romantic poet, Lord Byron, whose life featured an infamous history of love affairs, debts, and living well beyond his means. He was described by one of his lovers, Lady Caroline Lamb, as "mad, bad, and dangerous to know."

Ada was named after Byron's half-sister . . . with whom Byron had had a very poorly considered affair shortly after Ada's birth. In response, Ada's mother opted for a metaphorical retaliation and banished her husband from the family home while simultaneously forbidding Ada to be involved with poetry from that point on. All of this was in an effort to prevent Ada from being like her outcast father. This solution worked for a short time, but Ada was renowned as an aristocratic and gifted thinker, with a volatile and seductive temperament, and she was unable to escape her inherited sensitivities. Instead of poetry, her passion was mathematics, a science that she adapted to her proclivities by bathing all numerical symbols in poetically equivalent images. In essence, she romanticized numbers.

In 1833, at the age of eighteen, the enchanting Ms. Lovelace was introduced to the eccentric and brilliant Babbage. Seduced with the poetics of his Analytical Engine and complex persona, she immersed herself in the study of advanced mathematics. In short order, Ada became so adept at the discipline that she was given the task of interpreting Babbage's overly complicated dissertations on his monstrously complicated engines. Her copious notes of Babbage's original manuscripts, adapted from both Babbage and the Italian mathematician Menabrea, tripled the content of Babbage's original 1843 thesis. In her "Notes" Lovelace wrote, "We may say most aptly that the Analytical Engine weaves algebraical patterns just as the Jacquard loom weaves flowers and leaves." Pretty interesting, don't you think?

More to the point of this historical narrative, Lovelace added her own visions of what the Babbage analytical engines could lead to. She described a programmable engine that could compose complex music, generate and modify graphics, and calculate information of a scientific nature . . . far faster than the human brain. Lovelace then suggested to Babbage that his Analytical Engine could be programmed to calculate Bernoulli numbers. Her inspiration is considered as evidence of the first example of a written computerized program, and it is relevant to note that in 1979 the U.S. Department of Defense named a computer program "Ada" to honor her contributions to computer science. One last bit of interesting information before leaving the love affair between Ada and Charles . . . Ada was addicted to gambling on horse races and managed to convince Babbage to construct an enormously complex set of calculations and tables so that she could experience a little success betting on horse races. There is no evidence that the horses performed in her favor.

As an aside, a former student of mine, Matt Belanger, produced an interactive work called *Ada's Shop* in 2011. Pedestrians passing by the windows of the Mid-Manhattan Library at 455 Fifth Avenue in New York City from December 1, 2010 to January 2, 2011 could call a number from their mobile phones to hear excerpts from Ada Lovelace's conversations

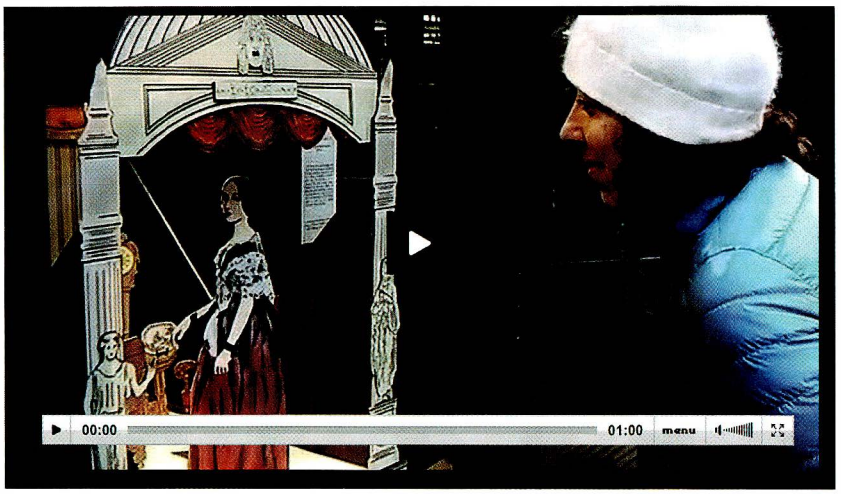


Figure 25–8
Matt Belanger, *Ada's Shop*, 2011 (interactive digital installation)
Ada's Shop was an interactive work inspired by Ada Lovelace. Pedestrians passing by the windows of the Mid-Manhattan Library at 455 Fifth Avenue in New York City from December 1, 2010 to January 2, 2011 could call a number from their mobile phones to hear excerpts from Lovelace's conversations with Charles Babbage as motorized paper figures moved in the window. Ada's Shop was produced with Marianne Petit. For more information visit http://www.matthewbelanger.net/adas-shop.
(Courtesy of the Artist)

with Babbage as motorized paper figures moved in the window. *Ada's Shop* was produced with Marianne Petit, and here is a link to see it in action: http://www.matthewbelanger.net/adas-shop.

Boolean Algebra

The most common attribution for the first "digital matrix" is English mathematician George Boole (1815–1864), who, in 1847, developed a concept of symbolic logic known as Boolean algebra. In 1854 Boole published the whole of his intellectual process in a book entitled *An Investigation of the Laws of Thought on Which Are Founded the Mathematical Theories of Logic and Probabilities*. Boole's thesis argued that all logic could be rendered in terms of mathematical rather than philosophical standards. He proposed that *symbols* could be substituted for principles and objects and that these objects could be divided into classes, each of which would have a specific property. These properties would then be designated as either being "on" or being "off." This is the magic behind the effectiveness of computing as we know and use it presently in our relationships with the web, email, word processing, and digital design. It is the representative of 1 and 0 binary logic, the same as found in the common Jacquard loom punch cards, and is identical to the scheme that determines how a computer works.

Figure 25–9
Douglas Engelbart's Very First Mouse, Late 60s
In 1945, Douglas Engelbart picked up an issue of the *Atlantic* and read Vannevar Bush's article, *As We May Think*. This inspired him to consider the critical importance of *augmenting* intellectual capacity through the creation of a technological system that would be both interactive and uncomplicated. Taking on the challenge of Bush's vision, Engelbart invented the concept of *windows* on a desktop, and just for good measure, he invented the mouse to move the windows around. In 1968, Engelbart unveiled his entire system in what author Steven Levy referred to as "the mother of all demos."
(Courtesy of Apic/Getty Images)

Hollerith's Counter

In 1882 Herman Hollerith (1860–1929) became interested in the work of Jacquard, Babbage, and Lovelace . . . specifically, he was interested in how Jacquard's punch card automation might be adapted to a census calculating machine that would work in much the same manner as did Babbage's proposals for his Difference and Analytical Engines. Hollerith's first system utilized paper tape and pins that would penetrate the paper, thus creating an electrical contact. This was the first instance of a carded system that would activate an electrical impulse that would, in turn, activate a mechanical counter. In 1890, Hollerith engaged a fledgling company, by the name of Pratt and Whitney,

to manufacture a punch card machine that could be used like a typewriter. This machine, employed in the 1890 census, was so efficient that the projected counting time of two years took only three months. In 1896, Hollerith founded a company called the Tabulating Machine Company to market his new census counter. After a few more mergers he eventually went into business with Thomas Watson, and together they created a company they named International Business Machines . . . IBM.

Vannevar Bush & Engelbart's Mouse

In 1945, Vannevar Bush, Director of the Office of Scientific Research and Development, which had coordinated the activities of over 6,000 American scientists in the application of science to warfare, wrote an essay in *The Atlantic* magazine titled "As We May Think." The essay asked a logical question: after the collective effort they had expended in developing an atomic bomb, what was the next big idea that scientists could collectively invest in with unbridled enthusiasm? He then described the answer to the question . . . essentially the computer system that I am using right this minute to write these words, check my email, and watch the weather radar of a snowstorm that matches what I am seeing outside my studio window here in Dublin, New Hampshire, this afternoon.

That same year, a young naval radio technician named Douglas Engelbart was passing time in a library in the Philippines while awaiting his orders to return to home to America. He picked up that issue of *The Atlantic* and read Vannevar Bush's article (http://www.theatlantic.com/doc/194507/bush). Then he began to think of the critical importance of *augmenting* humankind's intellectual capacity through the creation of a technological system that would be both interactive and uncomplicated. Taking on the challenge of Bush's vision, Engelbart came up with the concept of *windows* on a desktop. Just for good measure, he invented the mouse to move the windows around.

In 1968, Engelbart unveiled his entire system in what Steven Levy referred to in his terrific book, *Insanely Great*, as "the mother of all demos." Engelbart's breakthrough immediately caught the attention of the military, which didn't quite comprehend his intentions of shared and efficient peaceful knowledge. Instead, it saw the potential for more efficient warfare. Engelbart and his team of scientists soon found themselves without space to work in, or advocates to support that work, and closed up shop.

In 1970, a few miles away from Engelbart's laboratory, the Palo Alto Research Center (PARC) got under way courtesy of the Xerox Corporation. This was a seminal moment in what is often referred to as the golden age of computer evolution. It was in this California complex, filled with beanbag chairs, hippies,

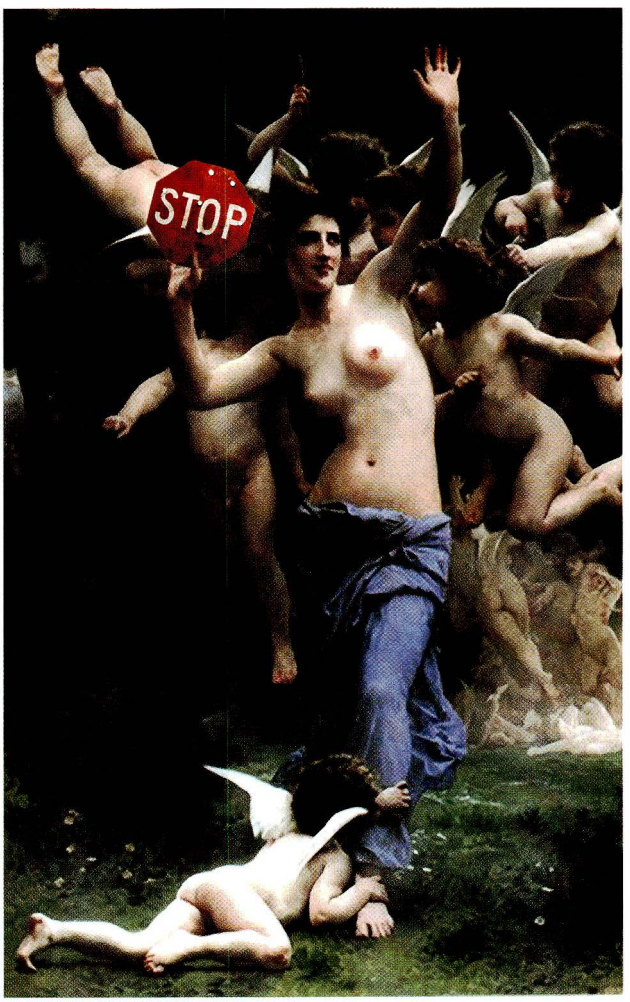


Figure 25–10
Christopher James, *Renaissance Crossing Guard*, 2010
In 2010 I was sitting in a required faculty meeting, realizing that we had little hope of making anything happen. I was working on a presentation and looking at a picture of this Bouguereau (*Invading Cupid's Realm*, 1892) and decided to editorialize the moment!
(Courtesy of the Artist/Author)

and the most brilliant geeks in the universe, that everything changed for good. Among the scientists was a newly anointed legend by the name of Ivan Sutherland, author of a 1963 M.I.T. Doctoral Thesis titled *Sketchpad: A Man-Machine Graphical Interface Communication System.* Sutherland produced Sketchpad on a room-sized computer with a twentieth of the power of the first Macintosh II.

Using a light pen and his Sketchpad program, Sutherland demonstrated real-time interactive computer-aided design (CAD) drawing, making figures and manipulating them on the screen. This was the first computer-aided image-generation system that could be changed by the user. Steven Levy wrote a great description of Sutherland's achievement: ". . . Sketchpad was absurdly ahead of its time. It's as if the designer of the first automobile had created a 1967 Corvette."

THE DIGITAL ARTS: A THIRD EDITION PERSPECTIVE

The Soft Democracy

For the foreseeable future, the digital arts will likely be an odd waiting room in which the thrills and options of the new tools are not enough, or perhaps all too much, for artistic work to consistently stimulate interest as a legitimate form of creative expression . . . where the uniqueness of an artist's vision is not compromised, excused, or instantly identified by the software or hardware that is used to make the work. The reality of "needing" to have the latest and greatest upgrades every year creates an expensive and financially difficult environment for younger artists who are operantly and culturally tuned-in to this moment in the digital evolution.

The medium, and what is created with it, is increasingly homogenized by its tools and syntax and is, in great part, responsible for the current democracy of digital imaging, in which photography has increasingly been reduced to a condiment in the grand social networking buffet. This raises issues for further discussion (for example, the distinction between pictures and photographs, like tourists and travelers, where experiences and images are packaged rather than earned). Setting this aside for the moment, I want to approach this segment from several separate but contemporaneously evolving perspectives and digital art forms . . . here's what I've been thinking about lately.

THE SIGNAL: INFORMATION & PERFORMANCE

The first thing to consider in a discussion of the digital arts is the *signal* . . . the free transmission of electronic information and the World Wide Web itself. In this new cosmos, the artist works independently as a solo act or forms a collaborative creative

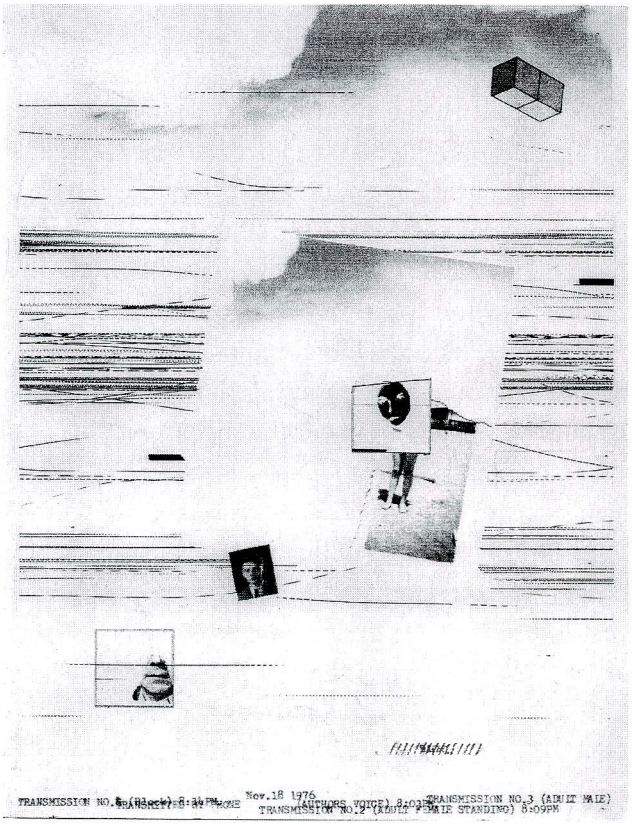


Figure 25–11
William Larson, *FAX 1*, 11-18-76
William began working with the FAX back in 1969, recognizing its ability to render a photographic image in electronic code that was suitable for transmission by telephone—in essence, transforming the image into sound by assigning a different audio tone to the gray values of the photograph. Perhaps, more profoundly, William realized that it transformed the image into a mediated electronic state in which it was compatible with other electronically encoded information.
(Courtesy of the Artist)

relationship with others . . . who often might not be aware of the collaboration, to express and influence ideas and perceptions . . . and sometimes just to have fun. I see this room in the genre as being divided into two separate parts: the signal itself and the influence, or underlying meaning, of the communication via that signal.

The Signal: Information

On a basic level, it is the physical signal that carries the information that is critical to the expression and interpretation. This transmission had its birth in the mid-1800s through the inspiration of Alexander Bain's crude facsimile machine that was subsequently improved upon in 1860 by Giovanni Casselli, an Italian priest who invented a working machine he called the Pantelegraph.

To use a Pantelegraph, the operator would draw, or write, with fat-infused ink on a sheet of tin. The tin was then placed on a plate that was charged with an electric current while in contact with a transmitter that was connected to a telegraph wire. A stylus would pass over the fatty ink, and the electric current, unable to penetrate to the charged electronic plate through the fatty ink drawing areas, would transmit what could not be transmitted (the fatty ink) to the other end of the telegraph line, where the image was received on chemically treated paper . . . thus making an electronic picture of the thing itself.

Perhaps the first artist to think about rendering a photographic image using electronically coded signals was William Larson. He reasoned that the FAX machine's ability to translate images from sound signals over a telephone line would produce images in values of gray. More importantly, according to Larson in correspondence, "it transformed the image into a mediated electronic state where it was compatible with other electronically encoded information."

When Larson began this work he considered how photography might be used within an electronic system able to translate everything it was given into a FAX code/signal, from a song to a picture in a family album . . . and how visually this was, in essence, a montage of signals that could be reconstructed as a complete visual entity. By using the available FAX technology of 1969, Larson may have created the first electronically constructed photographic montages that were critiqued with the same critical concerns of a traditional photograph.

In recent years, the ability of artists to pan for raw digital signals from diverse sources such as museum collections, surveillance videos, and the never-ending debris of social media, has provided a distinctly new way to work with photographic imagery that is not dissimilar to what William was thinking about with the FAX machine . . . where everything was considered signals to be decoded . . . like an electronic curiosity cabinet. In a recent talk at the College of Art and Design at Lesley University, our MFA Visiting Artist/Scholar, Lyle Rexer, related that his current students, unlike those from the past, were far more interested in images that could be collected, used, and reinterpreted than in image subjects that could be found, photographed, and put on a wall. This is a very important perspective on recent changes in photographic practice and philosophy. As Daniel Rubenstein provocatively wrote in '*Towards Photographic Education*' (*Photographies*) in 2009, *"The resignation of photography education in the face of digital culture crippled it and proved its irrelevance to everyone beside itself."* Rubenstein suggests that if the digital moment in the medium's history is approached conceptually, rather than technologically, that it will present photographic educators with

Figure 25–12
Matt Belanger, *Google Search for Weapons of Mass Destruction*, 2005
Matt Belanger was a student of mine when he made this timely and metaphorically dense . . . peace.
(Courtesy of the Artist)

a unique opportunity to place the study of the digital photograph at the fulcrum of an image-making culture based on reproduction, representation, archiving, multiplication, and duplication.

The Signal: Performance

The second aspect of the signal is one of the current driving forces of contemporary digital arts . . . the performance. Within the last 15 years, digital performance has evolved into a major artistic movement, not dissimilar to the one Fluxus enjoyed in the 1960s or the subsequent non-linear Happening movement of the 1970s. This movement of stuff that doesn't hang on a wall, or that can be collected by a corporation (some would call it anti-art), is alive and well. A fine example would be James Downey's 2001 Internet campaign to have as many people as possible direct their personal red laser pointers at the moon at the same moment . . . in order to change the color of the moon. No, it didn't actually work, but it enjoyed the same status and critical theory referencing as the event promoted by New York City radio host Jean Shepherd in 1965, in which he urged the people of New York to construct miniature box kites and come to Washington Square Park to fly them in conjunction with the transmission of pictures from Mars.

Another performance work in this genre is Mike Parr's *Malevich*, at Artspace, University of Western Sydney, in 2001. Parr nailed his arm to a wall, had his eyes taped over, deprived himself of nourishment, and featured all the suffering and humiliation that one would expect in a person willingly nailed to a wall for an extended period of time. The performance was broadcast over the Internet with more than a quarter million hits in the first 24 hours. Parr performed another work the following year called *Close the Concentration Camps* in which he had his lips sewn tightly together to illustrate solidarity with prisoners being held in Australia's detention centers.

These performances bring to mind the legendary performance piece *Shoot* by Chris Burden who, in 1971, created the piece in F Space, Santa Ana, California, where Barbara Burden recorded him being shot in the arm by an assistant. This event became famous via word of mouth and is now, over 40 years later, easily experienced on YouTube (http://www.youtube.com/watch?v=JE5u3ThYyl4).

Given the power of the Internet to create a world stage in an instant, or a private theater as in the case of YouTube, it is mind boggling to consider the impact that Burden's performances may have had if he could have enjoyed real-time Internet transmission to work with . . . like *Jackass* star Steve-O, who repeatedly stapled tender boy parts of his body to his thigh. As one of my artist friends said of these examples, "Some people would chew off their leg to *make it* in the art world."

Figure 25–13
Daniel Rozin, *Wooden Mirror*, 1999–2014 (784 wood pieces, motors, video camera, circuits, custom software, computer, 84" × 84" × 8")
An interactive sculpture made up of non-reflective square wooden pixels. The piece reflects any object or person in front of it, moving fast enough to create live animation. Mechanical mirrors are a platform in which Rozin investigates the borderline and contrasts between digital and analog worlds, virtual and physical experience, or order versus chaos. The first of this series, Rozin's *Wooden Mirror* explores the inner workings of image creation and human visual perception. "I don't like digital," says Daniel Rozin, Director of Research and Professor of NYU's Interactive Telecommunications Program. "I use digital. My inspirations are all from the analog world."
(Courtesy of the Artist)

Digital performance requires the strengths, and the limitations, of the medium's transmissions to be effective and appreciated. Sometimes it's really funny. Sometimes its sole intention is to promote social and political disorder and to disturb cultural lethargy. Sometimes it's deeply personal and poetic as in the case of Marina Abramovic's 1974 piece *Rhythm 0* or her more recent, and intimately beautiful, 2010 work, *The Artist is Present,* at MOMA. In almost every case where art, or anti-art, expression is the motivational intention, the recorded digital evidence forever recelebrates the immediate experience of the performance and the power of the idea being communicated. Financial gain is seldom the reason for the performance, as hanging it on the living room wall is impossible . . . and that's what makes this part of the genre so alive and powerful and thoroughly democratic.

The Eye of the Monitor

This evening I was considering the relationship between technology and intimacy and my thoughts boiled down to *need* ... the human need to connect intimately to a person or place, which can be done so quickly through technology. This digital level of fulfillment, even though it's instantaneously satisfying, fails to meet the essence of touch, temperature, and all of those sensory pleasures that we associate with person-to-person experiences. This failure creates an awkward disharmony in which, after some conditioning, it is ultimately easier to deal with intimacy through the sterile distance of a monitor's screen.

The unblinking eye of the monitor as the piece itself must be considered. In this example, the monitor is both the equipment required (the tool) and the display (the art), and the making of the image on the computer screen, or screens (as in a modular construction), requires the computer's optical and adjustable features to be used in the translation/transmission of the work of art.

This idea got its spark decades ago with the Fluxus (*meaning "flow"*) movement in the early 60s. Fluxus, an international collaborative network of iconoclastic artists, including Nam June Paik, John Cage, Alan Kaprow, Charlotte Moorman, and George Maciunas, was highly regarded for its dedication to the integration of all disciplines . . . a plugged-in Bauhaus if you will. One of the few principles of Fluxus was that a performance required an audience to complete the piece. The late Nam June Paik may be considered the "godfather" of what is presently active in this room of the digital arts mansion. Some examples follow.

In one of my favorite Nam June Paik works is *TV Buddha*, in which a statue of Buddha contemplates a TV with an image of Buddha contemplating the TV . . . permitting the audience to make the connection of this perfect "oneness." In another piece, Paik incorporated the projection of a clear film leader with a numerical 10, 9, 8, 7, etc., sequence that was once so familiar to people who watched movies made with film. When the film leader got to the number 1, instead of rewarding the viewer's anticipation and patience with the film, the leader simply began again, forcing a renewal of excitement for a film that would never be seen.

In 1969, Paik collaborated with classical cellist Charlotte Moorman in a work titled *V Bra for Living Sculpture, 1969* that featured miniature TV monitors in Moorman's bra, broadcasting the sights and sounds of Moorman playing her cello. Earlier, in 1967, they had collaborated on a work called *Opera Sextronique* in which Moorman had played her classical cello topless, resulting in her expected arrest for "indecent" exposure. In these pieces, and in Paik's other major works, the monitor functions as the visual source, the guide, the narrator, one of the actors, occasionally the director, and always the eye of the experience.

In a contemporary context, the monitor plays a role very much like the one that flew over the perpetually raining nighttime city in Ridley Scott's *Blade Runner*. The monitor today is a force field of digital information, designed to distract, pacify, direct, influence, babysit, teach, coerce, seduce, and entertain. Consider Jumbotrons in stadiums, Times Square NYC, or the Ginza in Tokyo. I figure that in all of this there must be a discussion of what the monitor is and what it signifies about the image, artist, signal that is represented from within it, and the culture that it emerged from. Other questions begin to be asked. Who is the monitor directed toward, where is it located, how big is it, and

Figure 25–14
Graham Nash, *Joni Listening*, 1972 (iris print)
Graham is not only gifted as a musician but he also has been at the spear-point of the fine art digital printing movement since 1991 when he and R. Mac Holbert founded Nash Editions, the first fine art digital print studio in the world. An avid collector and historian of the medium, he is also an image maker. This is one of his photographs that I've always loved. Graham wrote, "*I saw Joni listening to her new album and I caught her through the back of a chair. . . . I like to be invisible when I photograph . . . such a beautiful woman.*"
(Courtesy of the Artist)

who paid for it? An example for our discussion might be Doug Aitken's 8-channel powerful 2007 video piece, *Sleepwalkers*, projected onto the side of the Museum of Modern Art. Did projecting it on MOMA, instead of your neighbor's garage, instantly contextualize it as art? Did MOMA's permission to use its building as a screen give the piece critical muscle? Would Walter Gropius, the founder of the Bauhaus, have approved of integrating the ART into the architecture? *Of course!* is the answer to these questions, all of which are simple references to the power and context of the monitor, no matter the size, and how it will eventually replace static advertising, print media, galleries, museums, cultural propaganda, and perhaps, one day, intimacy.

The Print: Graham Nash, Mac Holbert, & Epson

We'll finish up with a return to the familiar, the print on the wall. To begin, much of the credit for the concept, and institutional acceptance, that inkjet materials and process could be considered as an archival and unique system of making art goes to Graham Nash and Mac Holbert of Nash Editions. In the late 1980s Nash and Holbert wrote image-management software and applied it to the creation of large-scale digital images using an Iris 3074 printer, archival inks, and rag paper stock. Their work, research, and inspiration marked the beginning of the mindset and ultimate acceptance of artists integrating photography in their distinctive mediums

Figure 25–15
David Hilliard, *Rising*, 1998 (20" × 96" iris print—Singer Editions)
My friend and colleague David Hilliard is a profoundly excellent teacher and photographer. He writes, "*This image originally consisted of many more panels, referencing the structure of Haiku poetry, presenting the history of a fleeting romance. Eventually the piece was edited to four panels, playing with temporality; the ephemeral, the eternal and our place somewhere in between.*"
(Courtesy of the Artist)

and considering the concept of the *dry darkroom* with an unlimited set of tools and materials for archival photographic image making. The word *archival* is included as part of this definition due to the need of having the blessing of the curators and archivists who were still in charge of the system. It wasn't just about the print. As it turned out, this new digital addition to the process of making a photographic image also instigated a shift in how photographs were made, edited, worked on, archived, and collected, as well as where the artists using this technology fit into the medium's history.

Of all the commercial printer and ink manufacturers, Epson leapt into the fine art category and cannot be given enough credit for its commitment to the photographic arts and for utilizing the willing resources of grateful artists and photographers in the development of its printer and ink product lines. Epson has also shown an amazing ability to consistently improve on its printers, profiles, and pigment-based ink sets while maintaining a business model geared to professionals and students alike. Although Hewlett-Packard and Canon have joined the parade, in my working experience and comparisons, Epson continues to lead it.

At this writing, images produced as state-of-the-art prints are generated from silver gelatin negatives,

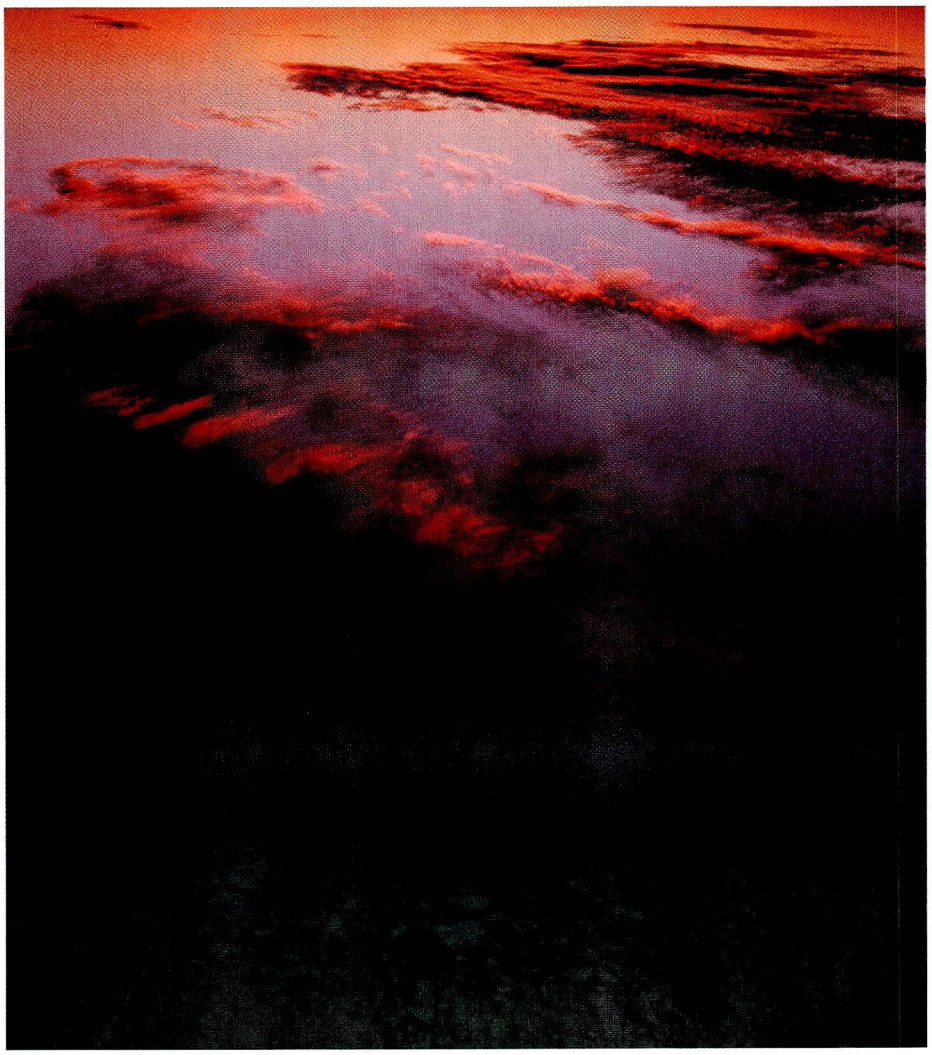


Figure 25–16
John Paul Caponigro, *reflection i5*, 1998 (adagio)
John Paul is one of the primary leaders of the digital photography evolution and is well known for his masterful printing, workshops, authoring editions of Adobe Photoshop Master Class, and vision.
(Courtesy of the Artist)

Figure 25–17
Scott Hilton, *CYCL*, 2012 (digital / wet plate collodion original)
In Scott Hilton's *CYCL*, the words are particles floating on the surface of water but slowly sinking to the bottom. Scott writes, "*Concepts have a tactile presence because they are woven, because they are stitched together from what Barthes calls a* tissue of signs. *I think Wet Collodion is uniquely suited to expressing these ideas.*" By making plates of degraded texts and other materials that record the physical actions taken upon them (like wet plate collodion), Scott's images speak of the connection between ideas and their physical manifestation.
(Courtesy of the Artist)

single exposure or fabricated digital files, and scans of alternative process imagery and integrated media that are reinterpreted digitally to become extraordinarily rich 2-dimensional images . . . or components in a 3-D piece. The current home-based printers, such as the Epson 3880 that I am working with these days, in concert with Epson's Ultrachrome K3 ink sets, have set a standard for excellence that continues to separate Epson from the competition. Included in this digital stew are the individual pioneers whose ways of modifying and working with digital printing technology have induced larger corporate entities such as Epson and Hewlett-Packard to put a lot of effort into mass-market technologies. These individual digital pioneers include landmark figures in the digital evolution such as Jon Cone, of Cone Editions in Topsham, Vermont, whose ink sets, delivery systems, custom printing, and workshop instruction set a bar for all in the industry. Others, besides Nash, Holbert, and Cone, who deserve mention in this sphere of influence, include John Paul Caponigro, Stephen Johnson, Pedro Meyer, xtine Burrough, George DeWolfe, Dan Burkholder, Gary Rodgers, and Mark Nelson.

Photographic prints made with carbon pigment-based, lightfast, water-resistant inks on rag paper can accurately be described as archival with a lifespan that will generally exceed our own. Of course, this is predicated upon the care the print receives and the conditions in which it spends its life. This realized digital artistry is familiar in process to traditional wet lab photography and printmaking, in which editioned prints can be produced from a single source. These images are normally two-dimensional and evaluated, as well as artificially elevated, with the languages of critical theory and historical context that is oh-so familiar to theorists, curators, critics, and enthusiastic MFA candidates.

As a result of the impressive evolution in the quality of the inks, papers, printers, and profiles employed in fine art digital printmaking, curatorial resistance to digital syntax has largely evaporated. The critical discussion of digital imaging has recently changed from one regarding the technical substitution for making photographs to one that is now more centered on content, intention, and context rather than on the devices and programs used to make them.

What has changed, however, is the nature of the critical dialogue. Will it ever be possible, or for that matter relevant, to critique a digitally generated

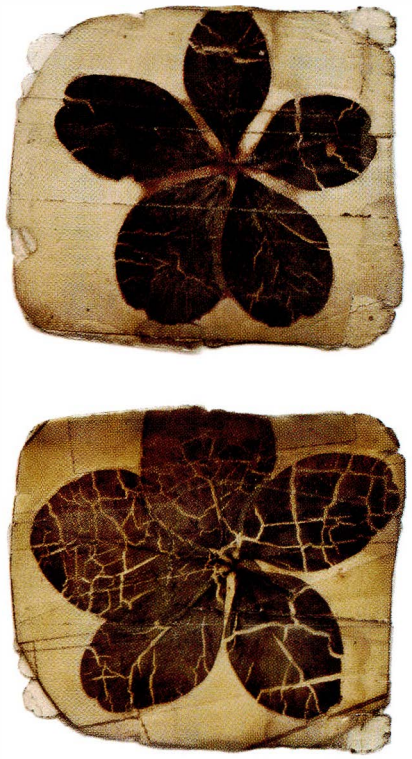


Figure 25–18
Amanda King, *Omie's Clover*, 2013
Over the course of her successful MFA thesis in my grad program at the College of Art and Design at Lesley University, Amanda developed a visual context for the unique dialects within a common language shared with her family. In this pigment ink on rag example, the four-leaf clovers were collected by the women in the family to mark important days in the lives of those they loved and nurtured.
(Courtesy of the Artist)

photographic print without considering the truth of the subject within the print, its originality, or its relationship to Bresson's *decisive moment* . . . for that moment in time can now and forever be digitally readjusted with ease? Does it matter? For me, it doesn't matter any more than it matters if Willem de Kooning's *Woman with a Bicycle* (1952) looks like an actual woman with a bicycle . . . I still love the painting. As long as I'm interested in the content and concepts within the work, and am allowed the pleasure of creating with the artist while looking at her work, I couldn't care less how the piece was generated.

The Art

As has been the case for some time, the puzzle for critics, but presumably a huge relief to the rest of the art world, is that a formal mass of academic and critical theory for determining the merits of any of this new digital work, or the systems that render it, seems to presently be missing or unfinished. There is a tendency to wedge post-modern and post-structural semantic theory into the dialogue of digitally generated expression, but I've yet to hear anyone do it in a manner that communicates a creative philosophy particularly well.

In the genre of the digital arts, it should be difficult to fully comprehend, appreciate, and evaluate the art without a discussion of that art's syntax . . . the technological components and processes that facilitate the construction and delivery of that art. Think of this as the critique of a jockey without a discussion of the merits of the horse. Digital syntax clearly exceeds the comparison of what type of brush a painter uses to render a stroke of paint, as the technology is a true collaborator in the art making.

One of my favorite critical thinkers of late is the German cultural theorist and philosopher, Vilém Flusser, who wrote beautifully about photography and the implications of digital technologies upon that medium in the 1970s and 1980s. His seminal 1983 book, *Towards a Philosophy of Photography*, argued that photography represented a moment in civilization that could only be compared to linear writing and that it had become the dominant representative language of how reality was understood. Photography fundamentally altered the way we understood our world. It was, for my generation, black-and-white truth and the power of the moment and the machine to capture it. I used to sleep with my battered Leica under my pillow! For my students' generation the world is primarily seen in color, and the moment is ever adjustable and interpreted through the construction of the image . . . and often the machine is their iPhone . . . which is likely to also have a place under a pillow but for an entirely different reason.

Within this system of image making there is an endless flow of images from real life and the Internet life . . . constructed, deconstructed, and reconstructed

Figure 25–19

Tabitha Sherrell, *Intimacy, Interrupted*, 2013

Tabitha is an MFA candidate in my graduate program at Lesley University and is a very successful entrepreneur, mother, wife, and artist. She, like many others, is dealing with the influences of technology on her image making and private life. She writes, "*Technology provides an element of limitless possibilities for the photographic artist. It can also be an intruder, interrupting human connection that we so desperately need to live and create. In this work, I explore my own balance between real time and the alter reality that technology offers me.*"
(Courtesy of the Artist)

with the specific intention of, as my friend Lyle Rexer wrote in a recent email, gaining purchase on an experience for the purposes of sharing it with others who will "get it." It is a generational claim of ownership on a method of image making and is not at all dissimilar to generational ownership of music in now non-revolutionary compositions of jazz, rock, and rap. It's exciting, reenergizing, complicated, and totally reasonable as a powerful mode of expression.

It is equally reasonable, and simultaneously impolite, to apply traditional critical theory to the various incarnations and outcomes of digital expression. What

Figure 25–20

Liz Lee, *Cicada*, 2011 (faux cyan, vdb, digital print, Lazertran waterslide)

The evolution of digital processes in combination with alt pro techniques is pretty extraordinary. There is no longer a need for inter-negatives, registration bars, and rubylith masks. Imaging editing software and advanced inkjet printers allow artists to literally create anything within their imaginations. Liz's *Sun Prints* combine digitally composed insect environments as inkjet pigment prints and maps that are overprinted using a Van Dyke process. The print is then run through the inkjet printer again to show the insect as a mock-cyanotype. A final image or text is printed on Lazertran waterslide transfer film and applied to the paper. These are one-of-a-kind images that use photography and digital processing as a compatible syntax.
(Courtesy of the Artist)

Figure 25–21
Steve Bliss, *GA/ME*, 1995
If ever an artist created work that was a mirror reflection of his personality, it is Steve Bliss. Currently the dean at SCAD in Savannah, Steve was making strong and provocative digital imagery when 500k was considered a huge amount of data for a file. *(Courtesy of the Artist)*

is, after all, the criterion? Where is the traditional atelier, as in painting, that the dedicated digital artist can look to for re-evaluation, inspiration, guidance, and mentoring in order to return to the roots of the process? At the moment, analog standards are still the referent, but maybe in the future that will not be the case.

Flusser distinguished painting from photography as a creative process that could be reasonably decoded by a viewer due to the painting style, interpretation of subject, and coloration that the artist had chosen as the language of the work. In comparison, Flusser argued that a photograph harbored information that could not be readily deciphered or decoded simply because photographs of things reflecting light back to film were the result of operations of the *apparatus* (the camera and photographic process), which could not be clearly decoded simply because their existence, unlike a painting, was bound by a set of technical, chemical, and physical rules that were disconnected to creative expression. This may be a similar dilemma to one faced by Peter Henry Emerson in 1890 when Ferdinand Hurter and Vero Driffield explained the photograph as being tethered to the quantitative science of sensitometry and densitometry rather than artistically inspired *naturalistic* practice.

Where will digitally generated art fit in the history of human expression and will the digital apparatus one day be as relevant as the artists using them . . . as, say, the apparatus in horse or stock car racing? I get a sense that this might be coming sooner than later,

especially when I see so many institutions featuring photographic workshops like *iPhone Artistry* as the lure and purpose for attending them.

These are a few of the current questions evolving from the marriage of digital imaging and artistic expression and inquiries that will find their own perfect and unique answers in time. One thing is certain . . . as in every new form of creative expression, there will be voices that will determine the etiquette of the marketplace and there will always be people who will make a living by becoming arbiters of what is, and what is not, art in a particular genre. Fortunately, there will always be artists who will be compelled to blaze new ways of adopting, integrating, and transforming the medium's map to discover new ground without conceding to the accepted protocol, hierarchy, or social scene. The primary hurdle in the formation of a legitimate critical base is more obvious now than it was five, or even ten, years ago. The sheer speed of change in the digital arts makes the shaping of a new theoretical or critical structure quite challenging. As the technology surges ahead, and the speed of the apparatus jousts with the impossibly incomprehensible speed of the human mind and imagination, it will be fascinating to see how we eventually place the old square pegs of formal criticism into the informal round holes that are being so rapidly drilled by digital artists . . . primarily the young guns in the world's colleges of art and design. These gifted young artists are redefining the medium in ways that challenge the status quo of institutional pedagogy and its requirement that everything, including a student's imagination, be assessed with prescribed and standardized *learning outcomes*. Alas, that's food for a presentation to the College Art Association . . . or another book.

Figure 25–22
Willey Miller, *Your Rent Is Past Due, Art-Boy*, 1997
I love this cartoon, as it is a moment in the life story of every artist who has ever held on to the dream. In the moment it is an emergency. In retrospect, it is funny and a treasured memory in which a decision is made between rent, food, or supplies.
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Here's a decent example. In April 2002, Matthew Mirapaul wrote a piece for the *New York Times* about NYC artist Mark Napier, who was attempting to carve out new territory for himself and his art. Mr. Napier, an anointed digital artist whose work had been shown in the cathedrals of the Whitney and Guggenheim Museums, decided that the Internet was not a gallery and that he still had to make a living. The article went on to describe Mr. Napier's solution to the problem. He had somehow succeeded in selling three $1,000 shares in his new work, called *The Waiting Room*. It turned out that *The Waiting Room* was an interactive and animated painting installed in a private gallery in a secret chat-room place on the Internet. If you wanted to play with, or even look at the work . . . you had to invest in the experience. Sure enough . . . as in the fable of the *Emperor's New Clothes*, and the zeitgeist-shaping intellectual performance work of the 1970s, some people actually paid for the experience. For their investment of $1000, the investors received the chance to play with Mr. Napier's software, which generated swirling sights and sounds against a very arty black background . . . with each shape and form linked to a specific hum, beep, or chirp.

Mathew Mirapaul wrote, "*Mr. Napier hopes to sell as many as 50 shares in* The Waiting Room, *an approach that emphasizes the work's participatory nature. When multiple owners (investors) view it online at the same time, they can produce shapes that complement—or obliterate—those made by others (perhaps the other two investors). This sounds a lot like bad manners in the world of graphiti. In any event, the work is the visual equivalent of an Internet chat room with* conversations *occurring in geometric shapes instead of words*."

The article continued by stating that the key investment points were that the shareholders could visit "their" art anytime they were online, that they would be receiving a genuine certificate of authenticity and a

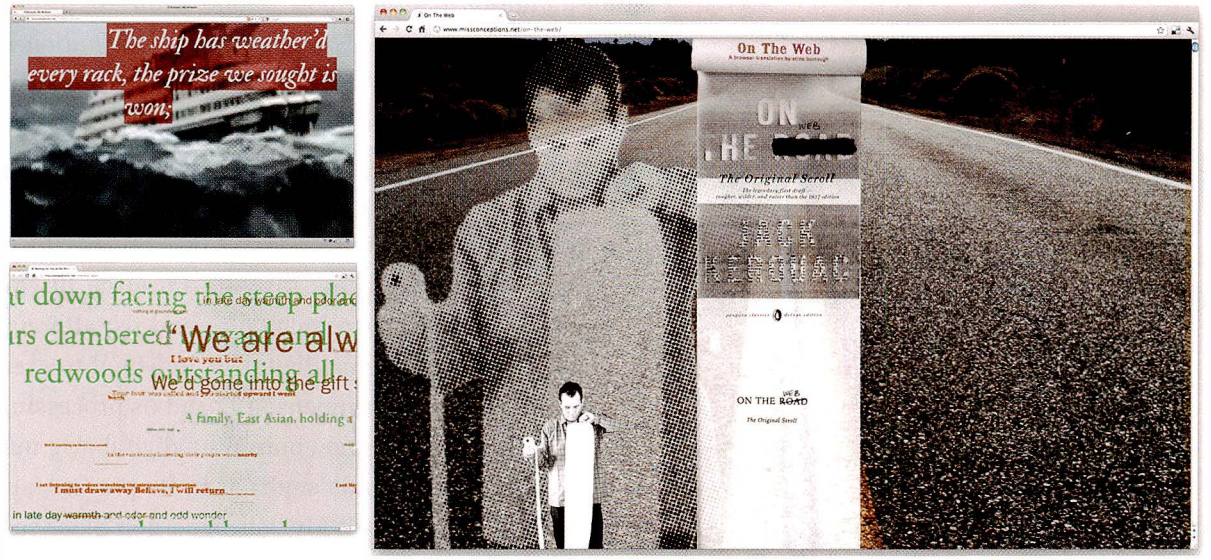


Figure 25–23

Xtine Burrough, *Browser Poems*, 2013 (hybrid literary hyperlinks)

Dear friend, professor, author, and former student xtine Burrough is forever finding new languages to master within the digital world. Her work *Browser Poems* is a series of hybrid literary/hyperlink projects that transform classic works of literature and poetry into interactive displays for the contemporary act of browsing. The attached image includes screenshots of 0 Browser, My Browser, On the Web, and Waiting for you at the Mystery Egg.

(Courtesy of the Artist)

CD that contained the software . . . sort of like going to the theater and getting a T-shirt for *Cats*. The work's value, according to the author, resided not in its keepsakes, but in the experience it provided for the viewer. Says Mr. Napier, hoping to find a marketing strategy to reach a fourth investor, "*Once you forget that there's a computer mediating this, it is just as physically there in the space as a canvas. It's just a question of shifting an art culture that for centuries has been immersed in the collectible object*."

This reminds me of another good anecdote from the Manhattan art scene. There was a self-important artist in New York who announced to a number of self-important collectors that he was going to be producing a very important work and that all they had to do to own and collect this important work was to write him a large check. Of course they did, whereupon the artist endorsed the checks and cashed them. Later, when the collectors inquired as to when they might be receiving his important work of art the artist asked if the bank had returned to the collector, the signed, and cancelled, check . . . which was, of course, the work of art. With digital electronic banking, this strategy fails completely.

Another good example might be the ability of the computer to challenge a sacrosanct discipline . . . such as sculpture. Several years ago, I saw an example of an artist who had her body scanned by an extraordinary laser device that was able to record every nuance, tiny hair, and goose bump of her skin and physical self. The scanner then relayed this information to a computer-controlled casting machine that proceeded to scale, proportion, carve, and duplicate her body in Lucite. Most would agree that evaluating her sculpture from a traditional perspective would be impossible without recognizing the role of the machine/apparatus in its creation. In truth, the present forms of digitally based photographic aesthetics are experiencing philosophical growing pains not all that different from those that photography experienced in its own beginning.

An illustration of this parallel might be even more apparent if we consider a few sentiments from the perpetually cranky nineteenth-century poet and critic, Charles Baudelaire. In fairness, I'll point out that Baudelaire was a man of deep moods and unrelenting despair, whose poetry centered on the inseparable

Figure 25–24
Ben Sloat, *Gerontion*, 2006 (digital)
Ben teaches as a colleague in the MFA in Photography program at the College of Art and Design at Lesley University and is one of the new generation of artists utilizing their critical studies and cultural reference knowledge to create powerful visual statements. *Gerontion* is derived from a T.S. Eliot poem of the same name. Playing with religious imagery as well as with photographic portraiture, this piece references a variety of arts, including Renaissance painting, contemporary photography, and vintage Japanese prints.
(Courtesy of the Artist)

connection between beauty and the inevitable corruption of that beauty.

A former student of mine, xtine Burrough, a legit digital art star, professor, and mother of twins, wrote to me with this thought: "*Yes, in keeping with all-digital-all-the-time you might want to include Critical Art Ensemble's Steven Kurtz's definition of 'digital' as anything that is recombinant, in which the starting elements, and end results, have different meanings . . . hooray for the sign/value system.*"

What's great about this definition is that a computer is not actually necessary for a process to be digital. A digital process (as Ada Lovelace discovered) does not have to include 1s and 0s, although this definition of "being digital" is indebted to great meditation on what happens in 1s and 0s processing. It's possible that at some point, the digital arts may be as defined by its philosophy as by its process, and if relevant, its product. My colleague Ben Sloat sent me an email not too long ago detailing a newsworthy event in which Microsoft's Bill Gates called for "an unfortunate but necessary step to protect our intellectual property from theft and exploitation by competitors," and the Microsoft Corporation patented the numbers 1 and 0. This is an example of digital humor, and if you read the *Onion* then you know this is a parody. http://www.theonion.com/content/node/29130.

When Baudelaire described his first impressions of photography he wrote about it in less than glowing terms, implying that society was squalid and narcissistic in its rush to gaze on trivial images of itself rendered on scraps of metal. He followed that with a critique of an exhibition of photographic impressions in 1859 by writing, "*If photography is allowed to supplement art in some of its functions, it will soon have supplanted or corrupted it altogether.*" This is a disposition that has its twin in statements now uttered by many traditional artists and critics speaking about the brave new world of the digital arts . . . dismissing it as a never-ending avalanche of bad pictures of meaningless stuff. Perhaps Sontag and Szarkowski had been correct all along . . . without realizing why. Unlike a few years ago, however, these critical voices are becoming fainter as the art, flexibility, beauty, and immediate options of the *digital arts* become more deeply embedded in our everyday lives, and as in the idealistic aspirations of the enlightened civilizations of the past, it is getting easier to see the artists' lives within their work.

Figure 25–25

Jerome Strum, *Pocahontas Fire Truck*, 2012

In *Pocahontas Fire Truck*, Jerome is visually sewing three separate photographs together using the Hyper Dynamic Range (HDR) process. In Photoshop he divides the image into layered sections and prints them out onto Epson matte paper. In registration, he then gel transfers sections of the image onto a glass substrate using double coats of Golden Regular Gel. By moving the transparent photographs onto several planes he hopes to create the effect of hand painted lantern-slides.
(Courtesy of the Artist)

Inkjet Photopolymer Gravure: Direct To Plate

OVERVIEW & EXPECTATIONS

This is going to be a brief chapter that will focus on a simple and easily learned variant in the very complex discipline of photogravure plate making. The emphasis will not be on printmaking, as that subject is a separate book that requires an educational experience in a printmaking lab.

I will begin with a discussion of the craft-specific and time-honored traditional steps in the intaglio plate-making process . . . just enough so you will appreciate the simplicity of what is to come. I'll then describe how photopolymer materials work and how they have been used in plate making in both film and ready-to-expose plate materials.

I will then discuss the newest incarnation of this process, and the reason for this small chapter: the miracle of direct-to-plate (DTP) inkjet printing on a photopolymer-prepared plate that can be printed directly in an inkjet printer, exposed to the UV rays of the sun or exposure unit, developed in water, inked, wiped, and run through a traditional intaglio press.

Figure 26–1

Cotton Miller, *MRI*, 2014 (photopolymer plate)

Cotton Miller is a graduate of my MFA in Photography program at the College of Art and Design at Lesley University, and his influence dominates this chapter, as this was the process Cotton used to produce a thesis documenting his diagnosis of multiple sclerosis . . . a demyelinating autoimmune disease that has no test that would result in a positive diagnosis and no cure. Cotton writes, "*Since the diagnostic confirmation of my future with MS I have been adjusting to a new life . . . a* new normal. *This physical and psychological recalibration has been complicated but a necessity in order to move forward and to survive. In the process, i have become the analyst as well as the patient. With this disease, my brain and body will eventually betray me, while my mind will speak with a new voice and source of creative inspiration."* In essence, Cotton has become the curator of his own disease.

(Courtesy of the Artist)

A LITTLE HISTORY

As you will see, the traditional photogravure print is the result of a photomechanical intaglio process in which a metallic plate is coated with a light-sensitive gelatin tissue that has been exposed to a film positive and then etched with an acidic iron(III) chloride/ferric chloride solution in different dilutions in order to etch the copper plate. Once etched, the plate is capable of reproducing the finest details of a photograph in ink and paper.

The earliest examples of photogravure evolved in the 1830s from the experiments and inspirations of the original founders of photography, Nicéphore Niépce in France and William Henry Fox Talbot in England (photographic engraving patent in the 1850s). Both gentlemen were seeking a technique capable of reproducing an existing image in a printing technique that relied upon a traditional printmaking workflow and press. These early images were among the first light-marking photographs, pre-dating the daguerreotype in 1826/1839. Niépce's contribution was the héliographic process that he invented in 1822 and utilized in 1826–1827 to make the "first photograph," *View from the Window at Le Gras*, which is in the care of the University of Texas in Austin at the Ransom Center (see Figure 1–11). To make a héliograph, bitumen of Judea (an asphalt-like material) is coated on glass or metal, placed in contact with a transparent or translucent positive, and exposed to sunlight, where it hardens in proportion to the exposure. The plate is then washed in a bath of nicely scented oil of lavender, where the unhardened and unexposed areas of the plate "wash" off . . . leaving the hardened areas intact. The hardened areas were intended to hold the ink and render the image to paper on a printing press. The word *heliograph* can be an equivalent to the word *photogravure*.

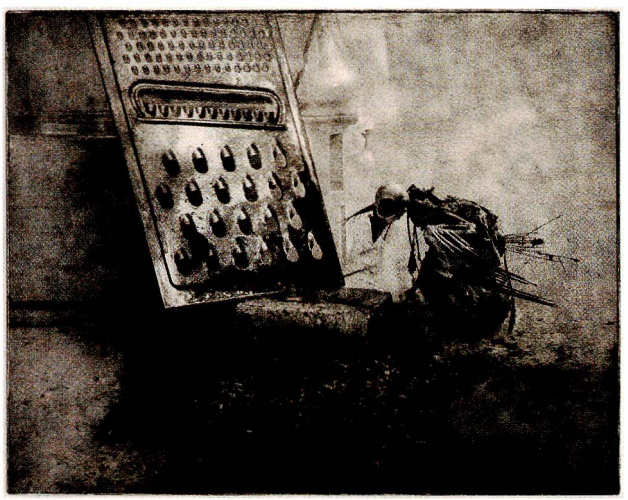


Figure 26–2
Hendrik Faure, *Hunger 1*, 2013 (gravure)
Hendrik writes, *" . . . this bird dropped down from his nest and was brought to me by one of my cats. I laid him down on my studio table and forgot about him. A weekend later when I moved the bird a lot of maggots came out, giving me the chance to make this photograph of bird eating maggots eating him, while he eats them & so on for sake of entropy. Some of my viewers are sensitive so I added the cheese grater so they may imagine the bird eating cheese."*
(Courtesy of the Artist)

The Traditional Photogravure

Step 1 A continuous-tone film positive is generated from an original photographic negative, cliché verre, drawing, etc. The idea here is to make the image so that in the end you will have a different version of the image made up of ink on paper.

Step 2 The second stage is to sensitize a sheet of pigmented gelatin tissue by immersion into a 3.5% solution of potassium dichromate (the same chemical used in carbon printing and gum bichromate for sensitizing) for 3 minutes. Once this gelatin tissue is dried against a Lexan, glass, or Plexiglas sheet, you can move on to the next step.

Step 3 The third stage is to expose your film positive from Step 1 to the sensitized gravure tissue from Step 2. The positive is placed on top of the sensitized sheet of pigmented gelatin tissue. This is then exposed to a source of UV light that you can have some calibrated control over, such as a UV-exposure box or a UV vacuum exposure unit. A separate exposure is then made using a hard half-tone dot screen or random pattern stochastic screen. The UV exposure penetrates the film positive and the screen in stages, hardening the sensitized gelatin in proportion to the degree of exposure . . . just like gum bichromate.

Step 4 The fourth step requires you to bond the exposed tissue to the metallic (generally copper) plate. The gelatin tissue is adhered to the plate under cool water, followed by squeezing it into place and squeegeeing the excess water away.

Step 5 Once adhered, a hot water bath is employed to wash away the water-soluble, unexposed gelatin. As I said, the depth of hardened gelatin is relative to the degree of exposure and forms a topographic resist on the metallic plate . . . which is then allowed to dry.

Step 6 After the plate is dry it is time to bite, or etch, the plate in a series of ferric chloride baths that range from highly concentrated to dilute. The density of these baths is measured in degrees Baumé . . . a scale devised in the mid-1700s to measure the density of liquids. In the bite, the ferric chloride eats through the gelatin, etching the areas of the images that will eventually be rendered as shadows and dense blacks. The etching is continued through tonalities from dark to light as the plate is moved to successively more dilute baths of ferric chloride, all the while biting/eating into the plate so that the recessed areas of the plate will be able to hold the heat-softened ink through the application and wiping stages of the gravure printmaking process. The image, and the textural pattern of the half-tone or stochastic screen, ensures the plates will have the "tooth" to hold the ink during the wipe. The tooth will hold more or less ink in relationship to the depth of the acid etch bite. The final stage in the traditional photogravure process is to warm your plate, ink it up, wipe it perfectly with organza or cheesecloth, place it on a press bed, cover it with your humidified paper, cover it with felt blankets, and crank it through the press rollers under extreme pressure so the ink in the recessed bites will marry the humidified paper as it is pressed into the grooves and textures of the plate. Simple, huh?

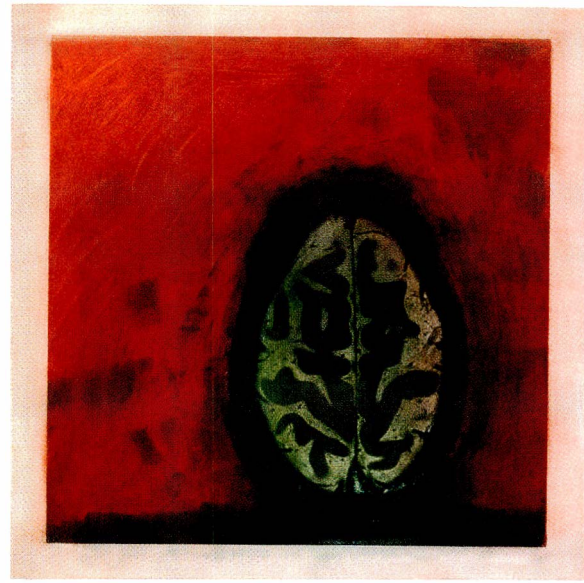


Figure 26–3
Elizabeth Jameson, *Good Egg III*, 2011 (photopolymer Solarplate)
This image is one of Elizabeth's personal MRIs showing the axial view of her brain. She writes, "*Medical imaging produces images of brains and bodies that are naked and without emotional context, lacking passion, sorrow, and all the frailties, humor, and idiosyncrasies of who we are. My focus is to saturate these cold pixels with the numerous colors and emotions that comprise the fullness of a life, and, in my own case, to explore the personal reflections that are within these images as self-portraits.*"
(Courtesy of the Artist)

THE PREMISE

Traditional photogravure practice is considered an exclusive craft and incorporates a great many complex stages, delicate decisions, and toxic materials. It is an art form in itself and requires mastery at a level, from start to finish, that involves extensive training and experience. As digital technology has altered our relationships with cameras, image making, and photography, it has also offered opportunities to improve upon the technologies employed in intaglio platemaking. At present, there are three ways in which you can generate an image on a plate with the purpose of translating that image to ink and paper.

- A single exposure, primarily employed for relief and abstract printing, to the plate using a transparency, cliché verre, oiled paper, or digital film.

- A two-step plate exposure, using a regimented and continuous half-tone dot pattern referred to as dpi or dots in printing . . . often mistakenly referred to as dots per inch. This is also called a line screen. A typical newspaper may be 55 dpi and a magazine might be in the 150 dpi range, whereas a fine art book may be 300 dpi or higher. You may also use a random pattern stochastic screen with a photographic transparency. In this case the screen's role is to create a texture that will hold the ink following the etching stage.
- A DTP inkjet-printed image on a prepared photopolymer plate.

In the first two examples, contemporary Epson printers allow us to generate a transparent positive image that is placed flush to a plate, emulsion layer to emulsion layer, that has been pre-sensitized with a *photo-initiating* polymer emulsion. When this is exposed to UV light, the image is hardened to the plate, where it can be "etched" with water, allowing all of the less-exposed areas to be washed out in proportion to the degree of exposure. This is much like a gum bichromate process. In the DTP example, the direct-to-plate experience, the positive image is printed directly upon the pre-sensitized photopolymer plate, exposed to UV light, and water etched. In this case the sequence is super simplified.

The plates you are using are covered with photo-initiating polymers called *monomers* (simple compounds whose molecules can join together to form polymers). When exposed to enough UV-light energy, these light-sensitive monomers link together and form very strong polymer chains.

This emulsion is typically available in two forms . . . as a film (like ImageOn) that is adhered to a flat plate substrate, or as a manufactured ready-to-expose plate (like Solarplate). The latter is preferable because the plate edges are well defined, whereas the films are susceptible to adhesion failures along the edges. You can decide how you want your edges to be rendered; some artists actually prefer the less controlled "artifact" evidence of a poorly defined edge. All of the polymer products have their own unique formulas, workflows, and output characteristics, but they all adhere to basically the same principle . . . that UV light causes them to create polymer chains. Areas of the plate where UV light polymerizes the material will be "harder" and more nonsoluble than those places where UV light was less intense or blocked. The transparent positive restricts the effects of light in the positive image area and permits light exposure in the highlights. Where light was held back, the emulsion will wash out in the water development of the plate, and this wash-out, or incised (engraved) area, is where ink will eventually be retained, after wiping, for intaglio press printing on paper.

A Few Words About Screens and Dots

Screens on film are used in two basic forms . . . the line screen and the stochastic. Line screens are made up of regimented dots, which are organized in a grid pattern. Stochastic screens are constructed of unregimented and random dots and most closely resemble a traditional aquatint pattern. An aquatint pattern in an etching is made by sprinkling microscopic resin bits over the plate, in either an aquatint box or, my favorite, a resin-filled toe of a sock that you gently tap with your fingers while casting the resin on the plate's surface. The plate is then heated, melting the resin bits, and then etched in acid. The plate is then cleaned, and the spaces between the resin bits are recessed in small incised wells whose job is to hold the ink for the printing of texture and tonality.

Note: A screen configuration of 300 ppi/dpi is the standard in the reproduction requirements of a photograph, as it meets the needs of most high-quality reproduction. Magazines, books with illustrations, and most other high-quality publications are typically printed at a 150-line screen or lpi . . . for lines per inch. The accepted rule of thumb for determining the dpi required for print is to double the lpi, so for a 150-line screen, a 300-ppi image resolution would be required of the photographer or illustrator. Newspapers do not require the same level of graphic excellence, so a ppi of 55–150 would be adequate for that level of reproduction. The type and size of screen,

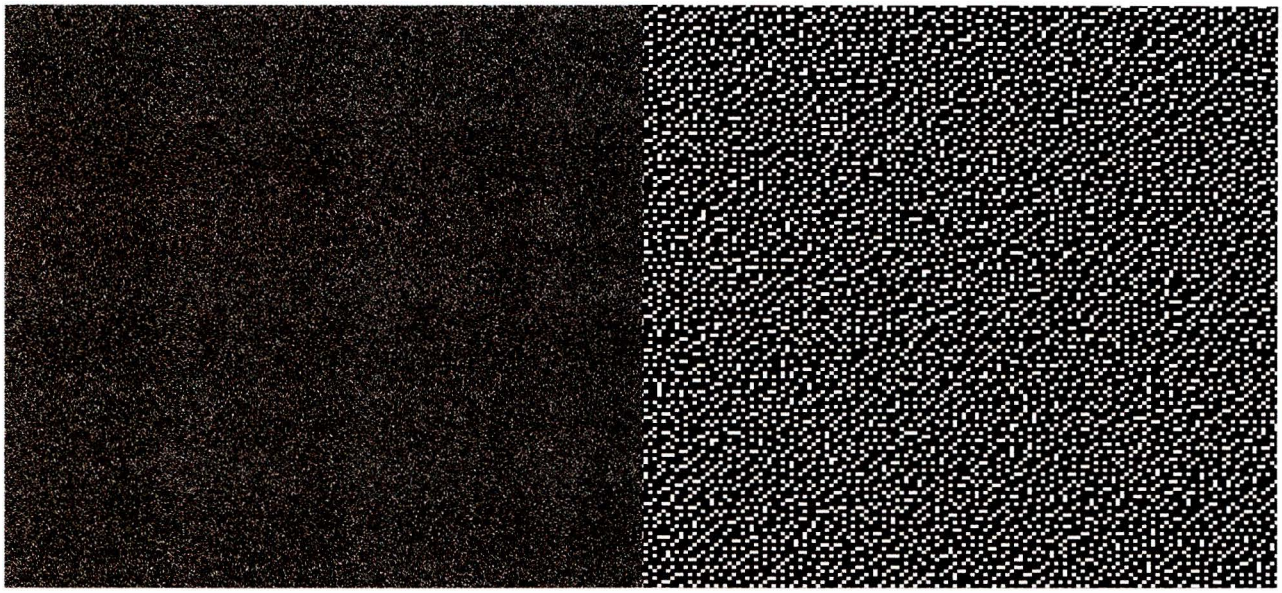


Figure 26–4

Cotton Miller Digital Stochastic Screen

This is an illustration of a Cotton Miller–designed stochastic screen in normal mode and magnified to illustrate the random frequency modulation of the pattern. Simply put, the purpose of a stochastic screen, instead of a half-tone screen, is to eliminate the potential noise of a moiré pattern and to provide a texture for the image to hold onto pigmented ink when printing. Without the screen's texture the ink would simply wipe off the smooth surface of the plate. During exposure, the UV light penetrates the film positive and the stochastic screen in stages, hardening the sensitized gelatin in proportion to the degree of exposure . . . just like gum bichromate.

(Courtesy of the Artist)

from line to stochastic, fine to coarse, can be uniquely specified to match the intentions of the plate maker.

For a time, service bureaus (high-tech reproduction businesses) and fine art printing establishments and publishers were obsessed with the idea of higher dpi, meaning a more perfect and refined viewing experience. Fine art photographic book publishers proudly announced 600 dpi reproductions, and some establishments got their stochastic screen resolutions for photographic reproduction up into the 2,400–3,200 dpi range. Don Messec and David Hoptman, in Santa Fe, New Mexico, were two of the leaders in this area.

Note: 300 dpi is really as high quality as you will need to be impressed. Most of us can't see better than that anyway, and really the only thing that matters is the total pixel count and how large an image you want to eventually make with your file. To keep it simple, if you are planning on reproducing your image, full page, in an 8.5" × 11" book you would do the math . . . 11 × 300 dpi = 3,300 for your longest side dimension. The higher the dpi/ppi number, the more flexibility you will have should you want to make your image larger at a later date.

Contemporary inkjet printing technology is pretty remarkable. By digitally adjusting tonal values in a myriad of ways including customized curve profiles, an inkjet printer can produce a transparent positive with an effective ppi structure, from refined to gritty, as part of the direct output to film or plate.

Printing Directly to Photopolymer Film

Don Messec, of Santa Fe, has been the leader in this area for some time and has a pair of short and enthusiastic videos on YouTube demonstrating the technology of printing directly to photopolymer emulsions. You can see these introductory overviews here: http://www.youtube.com/watch?v=j4xh9P58EPg.

In brief, using the menu of output options that are available in digital printing, evolving inkjet printer

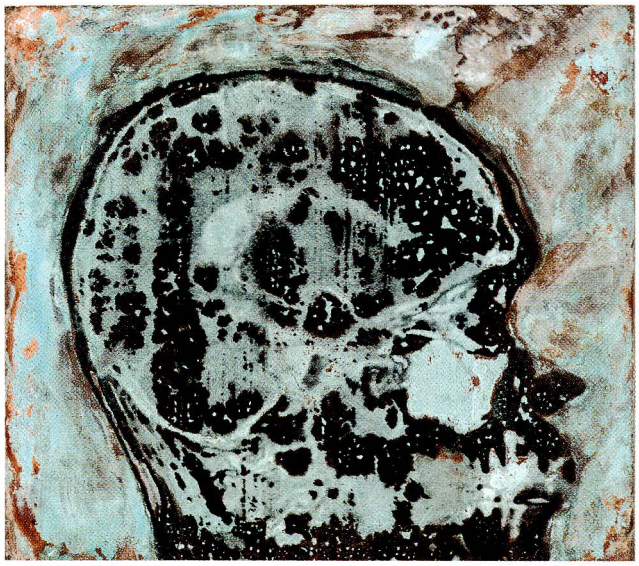


Figure 26–5
Cotton Miller, *MRI 005*, 2012
Cotton writes, "*Inspired by this image I have etched one sequence, and one top view of the brain showing the demyelination. Once the plate is etched I make a state proof, and then I apply a patina to the plate. A patina is a tarnish that forms on the surface of copper and similar metals by oxidation, chemical process, or any such acquired change of surface through age and exposure. Patinas also provide a protective surface to a material that might otherwise be damaged by corrosion. A patina is a perfect metaphor for this concept.*"
(Courtesy of the Artist)

technology allows us to work directly from digital printer to photopolymer film or plate without the need of half-tone or stochastic screen intermediary stages. The simplicity of this technique is obvious. With direct-to-film inkjet printing the screen is built into the image, inkjet output, and printer profile, allowing you to print immediately to the photopolymer film emulsion. If you want specific details and a good education, Don gives workshops in his Santa Fe atelier. See the pages at http://www.photopolymergravure.com.

Printing Directly to the Plate: The Direct-to-Plate Option

In this greatly simplified variant of the photopolymer plate-making experience, the DTP method offers no need for making a transparent film and no need for contact-printing frames. Restrictions on plate size are limited to the size of your printer, and there is a choice of UV-exposure units or sunlight for exposure. The DTP method eliminates the use of a stochastic or aquatint screen, and a digital or film positive. By putting the unexposed photopolymer plate through your inkjet printer, you can print a digital positive directly onto the plate. All you need is basic knowledge of your photo printer, a supply of unexposed photopolymer intaglio plates, a couple of trays of saltwater, and an exposure box/UV unit or the sun, and you can make photopolymer plates ready for printing.

SETTING UP YOUR WORKFLOW

Unexposed Photopolymer Plates

There are a limited number of sources for getting photopolymer plates and most sell the same product but under different codes. According to my friend, colleague, and once MFA graduate, Cotton Miller, the most consistently reliable plate is from a company based in Syracuse, New York, called Boxcar Press. It sells the Boxcar KF-152, unexposed photopolymer plate, which is a non-toxic, steel-backed plate that can, like the photopolymer film, be developed in water. The plates are sold in three different sizes, all of which fit in 17-inch-wide desktop photo printers with a manual feed option—more on that later. Boxcar (https://www.boxcarpress.com) also sells KF-152 scraps so that you can test to your heart's delight without spending a lot of money. Another source for photopolymer films and plates is Toyobo–Global (http://www.toyobo-global.com), which markets the Cosmolight and Printight water-wash letterpress plates. These plates are durable to water-base ink as well as solvent-base and UV ink. The physical structure of these plates, from the bottom up is a polyester film base, an adhesive layer that holds the main photo-sensitive polymer layer, a slip coat layer, and a protective polyester cover film.

One more source for unexposed photopolymer plates is a company called Takach Press (http://www.takachpress.com), based in Albuquerque, New Mexico. When handling the plates you should keep them away from UV light. Full plates, and scraps, are wrapped in opaque black plastic to prevent them from being accidentally exposed. You can keep your working environment light in an ambient state, the same as for most other alternative processes. The plates also feature, for protection, a thin, cellophane-like lami-

nate to protect the photopolymer emulsion surface on the plate. Unexposed plates should be stored in a dark dry place.

A UV Light Source

To expose photopolymer plates, you need a strong UV light source. This can be realized with a sophisticated vacuum UV-exposure box, a UV-exposure unit attached to a timer, or simply the bright rays of midday sun. The preference is yours, of course, and is, in part, based on what you can afford. The benefits of a calibrated unit, or exposure box, are that you can fine-tune the exposure without worrying about the weather or time of day. You won't have to worry about the tremendous level of heat during summertime exposures when excessive temperatures may negatively impact the photopolymer emulsion on the metallic plate.

Inkjet Photo Printer with a Manual Feed Option

A *manual feed* or *flat-bed loading system* option is a mandatory requirement of the DTP process because the photopolymer emulsion is applied to the rigid surface of the metallic plate and will not go through the printer, as would a piece of flexible photopolymer film or a sheet of paper. This sets the photopolymer plate on a front-to-back movement, instead of being spooled through the interior of the printer. For your ink, you can use either photo black (PK) or matte black (MK) inks. Cotton recommends using matte black, as the blacks appear to be smoother.

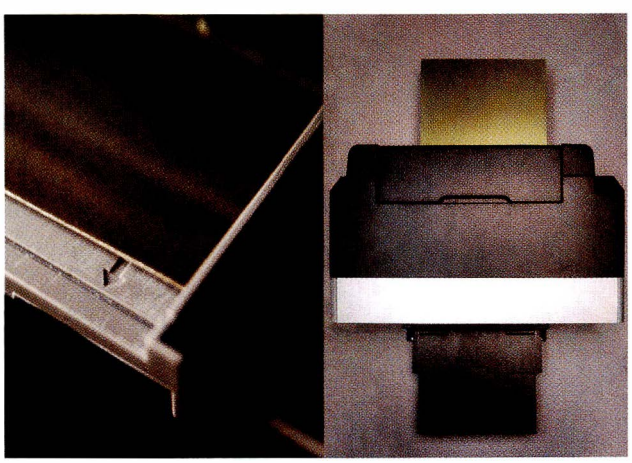


Figure 26–6
Illustration of Manual Feed
A manual feed or flatbed loading system option is a mandatory requirement of the direct-to-plate process because the photopolymer emulsion is applied to the rigid surface of the metallic plate and will not go through the printer, as would a piece of flexible photopolymer film or a sheet of paper.
(Courtesy of the Artist)

Note: NEVER attempt to feed rigid photopolymer plates through the *regular feed* or *fine art feed* slots in your printer. Use flat-bed manual feed printers only!

Digital Image Preparation for Direct-to-Plate Printing

These next steps were laid out by Cotton Miller, who provided them during a demonstration of the process to one of my alternative process workshops. Essentially, preparing an image for a photopolymer plate is identical to preparing digital negatives for other processes. The more difficult part is determining what type of image to print.

Step 1 **Edit an Image**—Open the image of your choice in Photoshop. Go to Mode and convert the image to grayscale/black and white. If it is already in grayscale, check your levels and curves and begin making the image on the screen look like you want it to in your final print off of the press.

Step 2 **Apply Your Custom Inkjet Photopolymer Curve**—You may have to make a custom curve first, and if this is the case, please visit that section of the Alternative Negative chapter. If you have the curve already, apply it using the Curve Adjustment tool. If you need help here, please go to the digital chapter and begin reading. The presets are located in the tiny square at the top of the Curve Adjustment tool. This will reduce the contrast and brightness of the image considerably. Unlike other alternative processes, photopolymer plates require a *positive,* as opposed to a *negative.*

Step 3 **Flip and Size Your Image**—To get the image to print correctly in the ink-to-paper translation on press it is important that your image is flipped horizontally. Also, in order

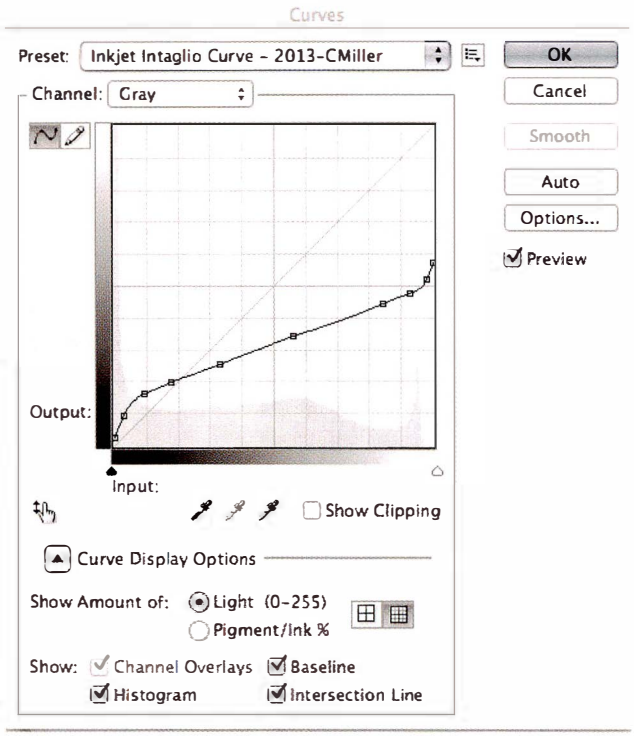


Figure 26–7

Inkjet Polymer Curve

This is an illustration of a custom preset curve profile designed for an inkjet photopolymer application. Unlike the majority of alternative processes, photopolymer plates require a *positive*, as opposed to a *negative*.

(Courtesy of the Cotton Miller)

Figure 26–8

Cotton Miller, *MRI*, with applied curve

This illustration exhibits the plate, with the applied curve, of Cotton Miller's Figure 26–1 completed portrait.

(Courtesy of the Artist)

to print to the edge of the plate, you need to print the image slightly larger than the plate itself. Add about 0.2 inch to each dimension of your horizontal and vertical measurements in Image Size in Photoshop. You can prepare the plate to print two different ways:

Printing an Image on the Plate with a Border

This method is the easiest to negotiate, as there is little chance of having to backtrack and figure out what went astray. The traditional copperplate gravure aesthetic calls for a full bleed of the image to the beveled edge of the plate. According to Cotton, this is the preferred situation. If you want to print a borderless photopolymer plate, you may print the image directly to the plate with the default border built into the digital file and then trim the plate after exposure and processing before entering the formal printing stages.

Step 1 Load your printer with the photopolymer plate according to the *manual feed* instructions for your printer. Remove the thin protective laminate sheet and manually load the printer with the photopolymer emulsion side facing up. Depending on the size of your plate it may be necessary to use a stack of books or darkroom trays to support the plate if it curves downward while hanging out the back of your printer.

Step 2 In the printer driver, choose the correct size of the plate that you are making. Make sure that your image size will fit within the dimensions of the plate, using default margins for the size that you are printing.

Step 3 **Set the Print Settings**—In the Print Settings in your print dialogue box, begin by choosing the paper size. In order to choose the correct

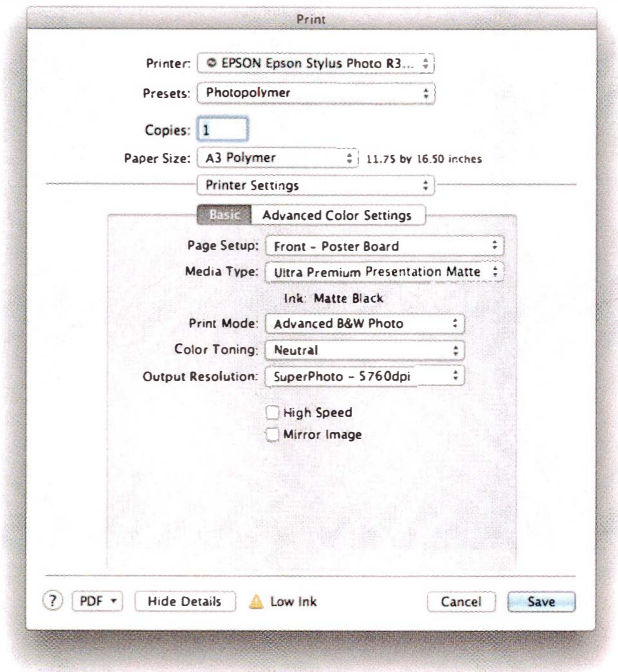


Figure 26–9
Screen Capture of Print Settings
This image illustrates a screen capture of the print settings dialogue page. *(Source: Apple®)*

paper size, after selecting manual feed as the paper source, you may have to create a custom paper size using the appropriate dimensions. Here are your settings.

- **Media Type**: Layout > Print Settings
- **Paper Type**: Matte > Ultra Premium Presentation Matte
- **Print Mode**: Select Advanced B&W
- **Output Resolution**: Select SuperPhoto 5760 dpi
- **High Speed**: Unchecked
- **In the Photoshop Print Driver**: Printer Manages Colors

Using a Guide to Print a Borderless Plate

In traditional intaglio printing, the image extends all the way to the beveled edge. If you want to print a borderless plate without having to trim the plate, follow these instructions:

Step 1 **Printing Your Registration Guide**—Put a piece of plain paper into the manual feed tray and line it up according to your printer. Use a sheet of paper that is a standard size but that is larger than the plate you are making. Print a quick print version of your image onto the plain paper. As soon as the registration guide prints, it is helpful to label which side of the paper prints out first so you remember the orientation of your printer and how you will feed the plate. This will be your registration guide.

Step 2 **Attach Plate to Registration Guide**—Take the carrier sheet, and using blue painter's tape (which is less sticky than double-sided tape and therefore easier to work with) apply a strip along the top and bottom edges of the plate. Next, align the plate to the registration image. Press down firmly and remove the thin protective laminate from the emulsion side of the plate.

Step 3 **Load the Printer**—Load the plate and registration paper guide into the printer so that it is the exact orientation the paper enjoyed in Step 1. Finally, set the output Print Settings and click Print.

Exposing the Plate

Once you have printed the image onto the plate, it's time to make the UV exposure. Where the UV light is restrained, the emulsion will not harden and will remain soluble, washing out in the water development. This incised area will eventually hold the ink during printing. You may make your exposure in the traditional manner and expose using the sun, or you can use a UV-exposure box or UV vacuum exposure unit. All will do the job and are acceptable. A benefit of printing directly to the plate is that you don't have to use a contact frame or vacuum system to keep the film positive in contact with the plate. The image is in even closer contact with the plate than with the traditional way because it exists as a layer of ink rather than as a layer of film. To expose, put the plate inside the UV box, or hold it in direct sunlight. Your exposure time will be between 1 and 2 minutes in either the UV box or direct sun.

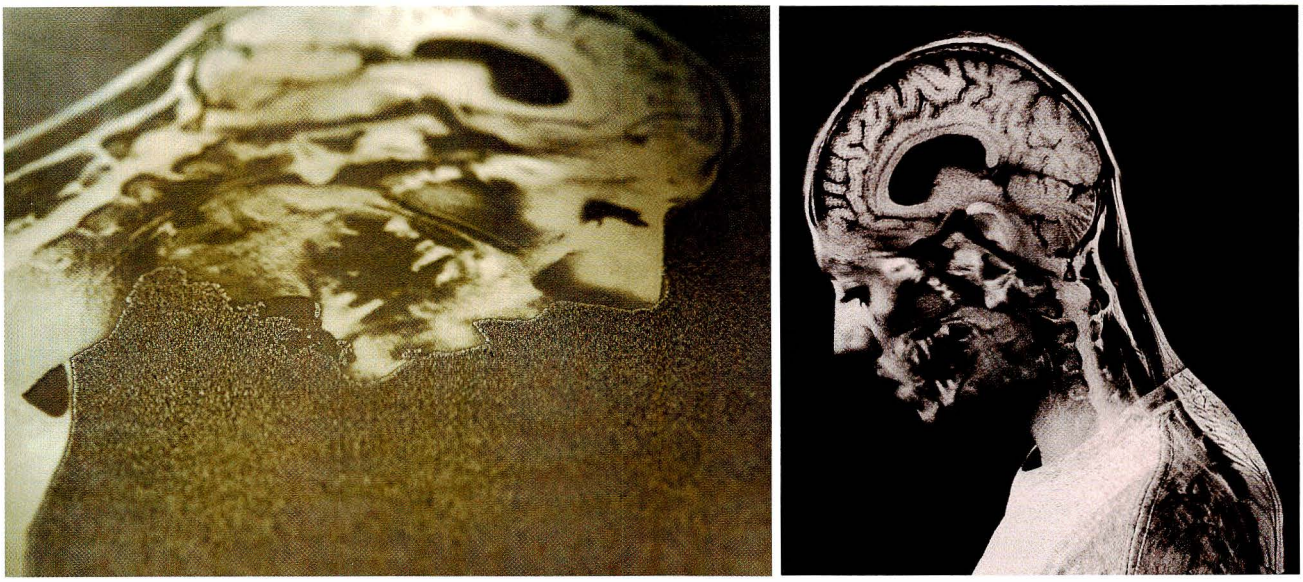


Figure 26–10
Cotton Miller, *MRI*, developed plate & print
On the left side of this illustration you can clearly see the textural evidence of the stochastic screen on the developed photopolymer plate. The right side exhibits the completed print.
(Courtesy of the Artist)

Processing the Exposed Photopolymer Plate

To process the plate, you need to set up two trays:

Tray 1 A single tablespoon of salt per liter of water. This bath will begin the process of development and remove the inkjet pigment from the surface of the plate. Move to the second tray after the pigment is mostly washed off. This will take about 15–20 seconds.

Tray 2 A single tablespoon of salt per liter of water. This bath will finish the development and clean off any residual inkjet pigment. During the development, wipe the surface of the exposed photopolymer plate with a synthetic Richeson or hake brush. Cotton suggests using a magnetic sheet at the bottom of the trays to prevent the plate from moving around during agitation. Develop in this second tray for a total of 2 minutes. Following the development, rinse the entire plate with the contents of a beaker of temperate and clean water.

In the Trays

After the exposure of the plate, immediately process the plate in the salted water trays. As soon as the plate goes in the water, it will begin to wash-develop. The areas of the plate that were exposed to UV light have become hard, or insoluble, in proportion to the degree of exposure those areas received. The areas that were covered by the inkjet pigment will begin to wash out in various degrees according to the tonal range of the image . . . indicating the degree of exposure those areas received, or did not receive. At this point, the surface of the plate is very fragile, and you must take extreme care in protecting it from abrasion. Your total time in the water development trays should not be longer than 3 minutes.

As you remove the plate from Tray 2, pour fresh water over the surface of the plate to remove any unexposed photopolymer residue. This step will help in achieving a flawless plate acceptable for printing.

Drying the Plate

Drying the photopolymer plate well is important to the final outcome. The plate must be spotless and pristine.

If the plate is allowed to dry while not sufficiently clean, water spots will be an issue for you when you are in the final printmaking stages of this process . . . where you will see them reproduced in ink. The goal of the drying stage is to dry the plate as quickly and evenly as possible to prevent water spots from showing up. It only requires three tools:

- A foam brayer or stencil roller
- A hairdryer
- The absorber: Drylite

There is a super absorbent micro-fiber towel made by a company called Sea to Summit. It is a Drylite brand and can be found on Amazon or in shops that cater to Olympic divers and trekkers. It is super absorbent and holds many times its weight in water while simultaneously being extremely soft and non-abrasive. It is important that you wash it or let it soak for a while before using it, as it does tend to leach its color the first few times it gets loaded up with water. To use it, lay it down on the table and place your processed plate nonemulsion side down on the towel. Be sure to get a towel larger than the plates you are making to catch the water run off.

Foam Brayer or Stencil Roller

One of the most successful ways to get the surface of the plate dry in a uniform manner is to use a foam brayer or soft stencil roller. Speedball makes a brayer with a foam roller insert that can be purchased as a package with several roller inserts for a variety of uses. The roller can also be purchased separately if you already have the handle.

Hairdryer

The application of heat with a hairdryer should mean that it will only take a few seconds to complete the drying stage on the surface of your plate. At this point, the plate is ready for the post-exposure stage. You should be able to see your image on the plate.

Post Exposure in the Sun

You have now exposed, developed, and dried your plate. The final step is to move to the final emulsion hardening exposure. By exposing the full plate to a UV-light source (the same one you used for the initial exposure or just go out in the sun) for additional time you will succeed in hardening/curing the entire surface completely. After this final curing, the plate will be ready for the printing stage on a flatbed etching press. Because of the length of exposure for the curing stage, this is where a UV box is ideal. The exposure time for this stage of the process will be 10 minutes in the sun or UV-exposure box.

Printmaking

You now have the plate to move successfully into the art of printmaking using an expensive flatbed etching press or a tabletop home press. You can see some of your options on the Boxcar web site and at http://www.takachpress.com, as well as any respectable art supply that services the needs of intaglio printmakers. The printmaking side of this equation takes time and dedication, as well as the proper equipment and a safe working environment. I strongly recommend taking some courses or workshops in the art of intaglio and printmaking before embarking on the journey. As with any good experience, figure out what you want out of it and have a good time getting there.

Paper and Alternative Substrates: History, Considerations, Preparation, Sizing, & Hardening

OVERVIEW & EXPECTATIONS

In this chapter I'll provide you with a modest overview of paper, its fascinating history, considerations for its use in regard to your work, and information about a few of its unique attributes that will connect with your efforts in alternative processes. I'll begin, as always, with A Little History. Then I'll continue with some additional information about what you will want to know about papers. I'll also incorporate a section detailing specific types of paper that, in my experience, are more than suitable for alternative process work . . . and why.

Another major part of this chapter will deal with alternative substrates and several workflows that will prepare you to apply gelatins, hardeners, sensitizers, and emulsions to simple and complex surfaces such as glass, metal, and ceramics. Included in this collection of techniques will be Galina Manikova's sensitizer and gelatin workflow for porcelain, Monika Ozog's laser transfer on ceramic and surfactants and guidance in the use of A-110 amino silane, and Dow-Corning's Z-6040 for preparing and applying sensitizers and emulsions to glass and microporous substrates.

This section will not describe working with hand-applied emulsions, as that will be incorporated in another chapter. I will also be directing you to additional chapters in which difficult surfaces are addressed but will save the workflow for those techniques for the Hand-Applied Emulsion, Cyanotype Variations and Inventions, and Gum Bichromate chapters. These will include sizing and hardening variations employing the use of gelatin, formalin, glyoxal, gesso, polyurethane, arrowroot starch, liquid emulsion hardener, and other materials. I'll also go into detail about how to prepare and clean glass perfectly, from the wet collodion ambrotype workflow, so that your sensitizers and emulsions will have a prayer of holding on to it. Be sure to check these chapters out if this experimentation interests you.

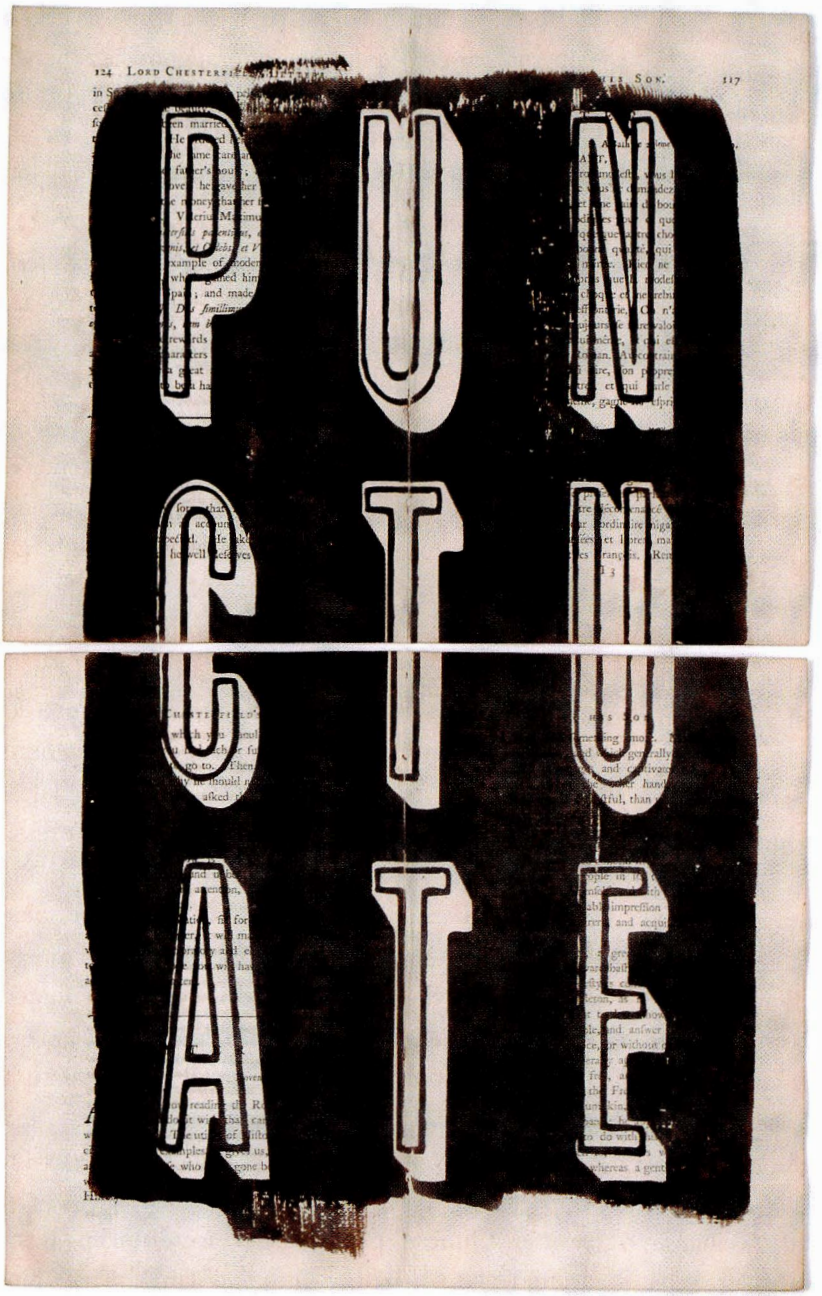


Figure 27–1

Wilber Schilling, *Punctuate*, 2011 (VDB)

Minneapolis artist, designer, printer, illustrator, bookbinder, and publisher at Indulgence Press Wilber H. "Chip" Schilling often works in collaboration with other artists and writers. This image illustrates a Van Dyke process on the pages of a book.

(Courtesy of the Artist)

A LITTLE HISTORY

The concept of a flexible and transportable recording surface, unlike the 1700-pound Rosetta Stone (196 BCE), upon which to enter the decrees of pharaohs, harvests, tomb inventory, lineage, and important historical markings, precedes the accepted origin of paper in ancient Egypt in roughly 3200 BCE. The extraordinary discovery of paper was documented by the hieroglyphics inscribed on the Palette of Narmer . . . a cosmetic palette that illustrated lower Egypt with a hawk holding a tether attached to six papyrus plants (illustrating the plants' importance) and a separate central figure wearing the crown of upper Egypt. This is roughly 700–800 years before the Step Pyramid of Djoster in Saqqara in 2560 BCE, and the Great Pyramid at Giza in 2650 BCE. Papyrus, from which the word *paper* gets its name, dates back to the First Dynasty (3100 BCE), and because there are no earlier examples of any paper-like material with purposeful marks upon it, the ancient Egyptians get the glory.

The plant first used to make a flexible paper-like surface is called papyrus, a 10- to 13-foot reed indigenous to the marshes and riverbanks of the Nile River. The transformation of the papyrus reed into a writing substrate was described by the preeminent Roman naturalist Gaius Plinius Secundus (23–79 CE) . . . affectionately, and appropriately, known as Pliny the Elder. In the section that dealt with aquatic plant life in his 37-volume text, *Naturalis Historia* (the first encyclopedia, by the way), Pliny the Elder explained papyrus as a material that was made from the peeled core pith of the papyrus reed's stem. This white pulp (approximately 68% cellulose) was soaked in hot water, layered in perpendicular strips, pounded flat, re-layered at right angles to the first layer, re-pounded, and finally dried under a heavy weight.

This process resulted in a utilitarian writing surface due to the sugars and natural cell sap (*arabans* and *galactans*) within the papyrus itself where the natural bonding agents held the pulverized pulp together. The technique of intentionally adding starch to the pulp mixture, as a sizing step in the making of paper, was not practiced until 300 BCE.

Once the weight was removed, the papyrus was made suitable for writing by polishing it with a smooth stone or by vigorously rubbing it with the heel of one's hand . . . in much the same way as interior plaster walls were once finished by craftsmen. This rubbing action was also how papyrus was erased in times of draught when there was no fresh papyrus to use for making new paper. This led to the origin of the word *palimpsest,* referring to where the ghosts of previous marks could be seen behind the fresh inscriptions. Pretty word . . . don't you agree? I use it often in critiques to describe something forgotten, or unseen, that lies beneath the surface of a visible idea.

The credit for the actual invention of paper is given to Ts'ai Lun, a eunuch and very highly placed personage in the Imperial Court of Emperor Han Ho Ti (Han Dynasty) in 105 CE. According to legend, Ts'ai Lun stripped bark from mulberry trees, pounded the fibers into pulp, and formed the pulp into sheets. Later he greatly improved the quality of his paper by adding sesame fibers and old cloth rags to his mulberry bark pulp mixture. Over the course of time, Ts'ai Lun accrued great wealth and status in the emperor's court for his paper but clumsily managed to get himself embroiled in a little palace intrigue that led to his being ostracized from court, falling into depression, and eventually taking his own life.

The Chinese went on to improve the papermaking process, advancing the technique by using plants such as bamboo, which they cooked in lye to eliminate the tough bamboo fibers, and incorporating sizing and dyes into the pulp to make the paper less susceptible to the ravages of time, insects, and weather.

Amazingly, China managed to keep Ts'ai Lun's papermaking process a secret for 5 centuries . . . until several Chinese papermakers were taken hostage around 750 CE by the Ottoman Turks. The Chinese papermakers, being quite pragmatic and practical, taught their captors how to make paper in exchange for keeping their heads. Within a very short time, the Turks adopted the process as their own and established a thriving papermaking industry that resulted in the practice of papermaking throughout central Asia and the Himalayan regions of Tibet and India. Paper

mills were also concurrently founded in the great metropolitan cities of Baghdad and Damascus.

The exact path of how paper, and the art of papermaking, eventually arrived in Europe is a little fuzzy. One of the accepted theories is that the knowledge entered Europe in the tenth century during the Crusades via Spain, on the heels of the Moorish conquests of North Africa and Spain . . . consider the Alhambra in Granada. By 1180 a papermaking mill was operating near Valencia, Spain, and in 1283 the still very operational and famous mill in Fabriano, Italy, was established. It was here that major adjustments were made to the manufacturing process that revolutionized what was to become the "art" of papermaking. The mill workers of Fabriano replaced the traditional mortar and pestle with a water-powered hydraulic hammer for pulverizing linen rags. They also introduced gelatin-glue sizing (instead of starch), which made the paper better able to withstand the rigors of wet immersions and aging. The mill also introduced the *watermark* as a sign of the paper's authenticity, and the Fabriano papers became so highly regarded that they soon became the preferred drawing paper for artists such as Michelangelo, Brunelleschi, Raphael, and Bodini.

By the late Middle Ages, ending with the fall of Constantinople in 1453, and into the fifteenth and sixteenth centuries, paper was being manufactured and sold throughout Europe. The Reformation, jumpstarted by Martin Luther's *95 Theses on the Power of Indulgences*, written in 1517, required an unfathomable amount of paper simply to write about the new theological concepts. With the spread of moveable type throughout Europe (it had actually been available in Asia since 700 CE and in Gutenberg's print shop since 1455) to publish all of these new ideas, the papermaking industry boomed. Paper merchants became mill owners and made their presence felt in the evolving publishing industry, as the hard reality of paying for the paper "up front" became the norm. Technology continued to improve, and by the end of the sixteenth century, a small mill could turn out over 4,000 sheets of paper a day. This amazing efficiency led to serious supply problems with raw materials such as rags . . . and this, of course, led to government regulations that, true to form, made the problems worse.

An effort to find a papermaking material to replace cotton rag did not succeed until the mid-1800s. Prior to 1853 there was no process for producing pulp via washing and bleaching in a single operation . . . although the British government had granted a patent to Charles Watt and Hugh Burgess for their improvements in the wood-to-paper process. Finally, in 1854, Marie Amed and Charles Mellier received a patent for the first chemically treated wood pulp—the advent of very cheap pulp paper that you do not ever want to use for your alternative process printmaking.

PAPER TYPES & CONSIDERATIONS

Paper Making: Handmade, Cylinder, & Machine Made

Specific techniques produce three varieties of paper: handmade, cylinder-mold-made and Fourdrinier machine–made. Handmade papers, in the style of Ts'ai

Figure 27–2
Pinky Bass, *Cuerpos Santos III* (*Ivy Brain*), 1986–2006
Cuerpos Santos III (*Ivy Brain*) is part of a series using handmade paper, Van Dyke brown for printing, iconic stamps from Mexico, and embroidery thread. The pieces in this series are 8" × 15" and were made in 1986–2006. *(Courtesy of the Artist)*

Lun, are lovely and esoteric but are generally inadequate substrates for alternative process work unless additional sizing steps are incorporated into the process or in post-production. This is due to the inevitable abuses of long water and chemical immersion times and the need to provide the paper with some integrity to deal with that abuse. There are commercial exceptions, of course, like Buxton paper from Ruscombe Mill and Fabriano Esportazione, a paper that requires four separate craftsmen to make a single sheet.

Cylinder-mold-made paper provides an efficient industrial speed to papermaking with the look, feel, surface, and composition of a handmade paper. Cylinder-mold-made is drum rolled rather than mold-and-deckle made, as in the handmade process, and will likely be the type of paper you will use for most of your alternative process work. Mills that produce high-quality cylinder-mold-made papers include Fabriano, Arches, Saunders, Somerset, Rives, Revere, and Cranes. If you are unsure about the paper you are buying, simply ask the proprietor of the art supply, or go online and research the paper yourself. I have tried to cover a lot of the important stuff in the paper descriptions in this chapter to save you the bother, but if you want to know more, go directly to the paper mill's home page.

Most machine-made papers are not likely to be of particular interest to you. Wood pulp, whether chemically treated or unadulterated, lacks the archival quality of mold-made papers made from cotton rag. There are a few machine-made papers that are perfectly adequate for many alternative process endeavors; these are manufactured as acid-free or *high alpha cellulose* papers. They are chemically treated to be neutral and contain less of the *lignin* found in most wood pulp papers. This gives the paper a composite integrity that is similar to a cotton-based paper. The distinctive difference is the paper's performance when subjected to long immersion times in water. In this situation, cotton-based stock is superior. Paper mills that make quality machine-made papers that you can use for drawing and transfer processes would include some brands of Fabriano, Cotman, Canson, and Strathmore. Again, it is a good idea to ask about, or research, the paper's manufacturing process.

Ream Weight, Acid-Free, & Additives

When buying paper you want to know who made it, what manufacturing process was used, the manufacturer's stated purpose or function of the paper, its *ream* or gram weight, its watermark, its color, its sizing, and its surface texture. Paper in the United States is designated in terms of *basic weight*, where the density of paper is expressed by the term *ream,* defining the pound weight of 500 sheets of a specific type of paper. A typical package of recycled office paper will usually have a weight of 20 pounds (75 gsm) for a mass of 500 sheets. A good-quality printmaking paper, like Cot 320, has a 320-pound weight for the same mass of 500 sheets. For your information, in case you're ordering a lovely paper like Kozo for instance, Japanese paper is measured by the weight of 1,000 sheets in kilograms.

There is often a lot of conversation and concern about the concept of "acid free" paper. According to accepted standards, this means a paper has a neutral pH of 6.5–7.5. Keep in mind that paper that is made acid free may not be able to stay that way depending upon storage and weather. When buying a paper, look for the words "neutral pH" rather than "acid free." Neutral pH implies that the paper is neither too acidic nor too alkaline . . . it is in the middle.

Acid-free paper occasionally has alkaline buffers, like calcium carbonate, to make the paper less acidic. Avoid trying to perform iron-based processes, like cyanotype, on buffered papers, as the alkaline buffering agents make the paper too alkaline and this reacts with the chemistry by pushing the pH from a neutral 7 to a pH of 8.5. My feeling is that the paper will remain in neutral pH state as long as it is well cared for but that extended exposure to lab chemistry, careless handling, or polluted air will likely affect its status. Then again, perhaps considering all of the chemistry you're about to introduce to your paper, it may not matter if you are not overly fussy. A great many of my students simply buy what they can afford rather than what they wish for, and oftentimes it turns out very well. I have seen extraordinary work done on the stock market pages of the *New York Times*.

Be aware that paper is also often manufactured with optical brightening agents. These are incorporated into the paper with the explicit purpose of making the paper appear whiter and brighter just for you when you

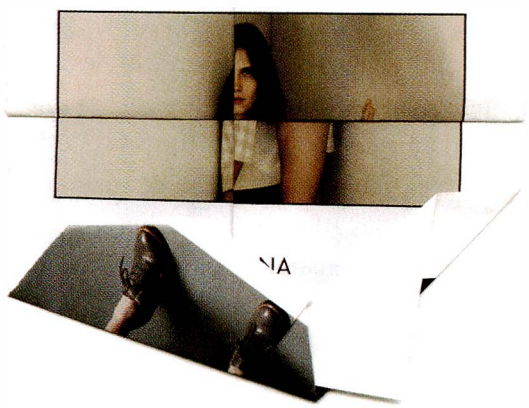


Figure 27–3
EV Krebs, *Folded Paper Series*, 2013
Florida artist EV Krebs is an MFA candidate in my graduate program at Lesley University and is doing some wonderful work with paper and image alternation. She writes, *"I am experimenting with the social politics of appropriation and meaning. At present I am dealing with the concept of the pre-existing page, removing it from its established context, altering its meaning and intention, and pushing its limits."*
(Courtesy of the Artist)

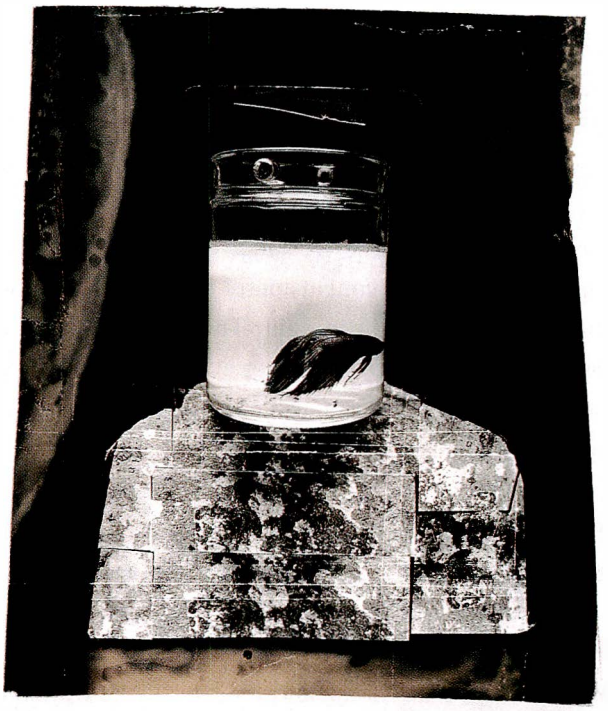


Figure 27–4
Pablo Ortiz Monasterio, *Big Brother,* 1997 (film montage with toners and tape)
Mexican artist Pablo Ortiz Monasterio is best known for his major photo documentary portfolios and books about Mexico City and its people. Following his last major project, Pablo decided to begin playing with the thousands of negatives that he had in his files by cutting them up and creating toned montages from a more conceptual vantage point. *Big Brother* is primarily a black and white with sepia work.
(Courtesy of the Artist)

go looking in the art supply for something to print on. These optical brighteners wear out, and eventually the paper goes back to like it was before the brighteners were added. There is evidence that optical brighteners actually make the paper a bit dull looking once the brighteners lose their effectiveness. You'll know if there are optical brighteners in your paper because it will glow like a shimmering Hollywood-like alien when placed under a UV light source.

By and large, your choice of paper will depend on your intentions and the process that you are using it for. Surface is an important consideration. Platinum/palladium (Pt/Pd), Ziatype, and the kallitypes, for instance, look best to me when the technique is performed on a hot-press paper in which the surface has been made smooth with hot rollers during manufacturing. If you were doing gum prints you might look for a paper that had more ream weight, meaning you would want a 300 lb paper versus a 90 lb paper that you would use for salted paper printing. If you were going to really abuse your paper with many hand techniques you might even consider one of my favorites, a super-heavy paper such as Arches 1200 lb cold-press paper, which comes in 40" × 60" sheets . . . if you fail, you can always use it to patch a hole in the roof. Again, all of your decisions should be based on what would be best for the translation of your intentions and your individual taste.

With few exceptions, those being alternative substrates such as glass, tin, steel, plastic, ceramics, or

dry toast . . . the one basic fact of alternative process life is that to make a print, it is necessary to lay down a sensitizer, or sensitized colloid emulsion, on a piece of paper. This is nice, as it is a romantic and pleasant exercise to mix chemistry to hand coat your own paper. The downside of this romantic experience is that it's necessary to remove all residual chemistry from the paper's fibers at the conclusion of the process or your efforts will have been in vain. The other problem is that the sensitizer might not get deep enough into the paper's fibers. In this scenario, the print will disappear right before your eyes as you process it.

Most of the time, alternative processes involve the sensitizer being applied directly to the paper. The exceptions are those processes, such as carbon, that employ a tissue transfer to a paper support or gum bichromate, where it is necessary to prepare your paper with a hardened gelatin sizing. In gum, this is necessary to keep the dichromate-sensitized pigment from penetrating your paper's fibers, which allows your highlights to clear to white during the wash-development stages. In this situation, the sensitizer rests on the glyoxal-hardened gelatin layer that has bonded to the paper substrate. Please refer to the gum bichromate chapter for much more information.

The paper you select should be compatible with the process you are performing. As an example, if you are making a gum bichromate print you will likely not be selecting a delicate rice paper for your substrate, as the process will require repeated brush applications of sensitized pigments and lengthy soaking and wash-out times. Your paper will simply not be up to the task of staying in one piece . . . even with sizing. You will also want a paper that is acid neutral (6.5–7.5 pH) and that can be categorized as archival. You will hope for a paper without additives, except for a bit of internal or surface sizing to enhance wet strength and to allow for a smoother application of sensitizer when not using a surfacant, such as Tween 20, in your sensitizer. All other considerations, such as surface, texture, and color, are subjective choices.

Iron-based processes, such as cyanotype and Van Dyke (they employ ammonium iron(III) citrate), generally have a problem penetrating the fibers of the paper they are coated on, and they often sit on the surface in the form of crystals. When this happens, the image always looks terrific before processing but, because the sensitizer has not been able to penetrate the paper, the image washes off the paper and goes down the drain. This makes you blue instead of the paper. These processes often benefit from a single drop of the surfactant, Tween 20, in their sensitizers.

Processes that use ammonium iron(III) oxalate, such as New Cyanotype, chrysotype, Ware-Malde Pt/Pd, and Ziatype, have much less difficulty penetrating paper fibers, which makes the use of Tween 20 unnecessary most of the time . . . depending on the paper you are using. The downside of using a surfactant is that the sensitizer may penetrate too deeply into the paper's fibers, resulting in a pale-looking print without a decent D-max.

The happy medium is a paper that allows the ammonium iron(III) citrate processes to penetrate and the ammonium iron(III) oxalate to sit up and not penetrate too deeply . . . and that has all of the other features essential to alternative process printing. Not many papers are able to do all of these tasks equally well. Here are a few papers that I personally like to use and that satisfy many who work in the alternative process genre.

Figure 27–5
Susan Arena, *Midnight at Giza,* 1988 (emulsion and oil paint)
World adventurer, artist, and mom Susan Arena made this piece as part of a portfolio while a student of mine at Harvard. It was the beginning of her dedication to painting, an artform she has taught at Yale and practiced since.
(Courtesy of the Artist)

RECOMMENDED PAPERS

Bergger's Cot 320

Bergger's Cot 320 is my personal favorite. There isn't much about this beautifully made paper that I don't like, although a few years ago it was plagued with some manufacturing issues and was nearly impossible to get. As of this writing, all of the problems have been solved, and it is available again. Cot 320 is a 100% cotton rag paper that is surface sized with gum arabic. The closest paper to it, in terms of look and feel to the touch, is Arches Platine. In my experience, depending on the process, it benefits from a drop of Tween 20 in the sensitizer to assist in the absorption into the paper. Cot 320 has a luxurious finish and a thick 320-pound weight. It survives extremely well in water, dries reasonably flat and doesn't *pill* easily if your coating technique is a little rough. It is a tad expensive but not unreasonable for the quality. If you can afford to give yourself an art-treat, the experience working with it is well worth the price. I order Cot 320 for all of my classes and workshops and use it for much of my personal work in albumen, salted paper, Ziatype, Ziatype on salted gelatin paper, and Pt/Pd.

Buxton/Ruscombe Mills

This paper is the most frequently mentioned as a favorite by many of my alt pro friends and deserves all of its praise and following. The Ruscombe Mill paper makers, originally from Gloucestershire, England, but now relocated to Margaux, France, are renowned for their excellent attention to detail and in particular for producing a paper called Buxton that is perfect for a variety of alternative process printing, especially iron-based processes.

In 1992, Mike Ware and Ruscombe Mills's Chris Bingham collaborated to produce a handmade paper that would be ideal for the iron-based process research that Mike has been so heavily involved in throughout his career. After significant testing and analysis they created a paper called Buxton, which is 100% cotton alpha cellulose, wove laid (no watermark), internally sized with *Aquapel* for superb wet strength, and natural white with no added brighteners, no additives of any kind, no chalk alkaline buffer, and a neutral pH of 7.5 . . . essentially the perfect paper.

Note: It is important to add here that cyanotype and albumen prints do not fare well at all in a typically buffered (calcium carbonate added) environment that is common in museums and acid-free storage containers. The fact that Buxton is unbuffered is significant and indicates that it would be a successful substrate for cyanotype, albumen, argyrotype, palladiotype, and kallitype.

There is also a gelatin-sized version of this paper called Talbot that is particularly well suited for gold processes such as chrysotype and the very particular calotype process. Buxton also performs well with single coat gum bichromate applications, which would make it an ideal paper to use if you were performing a Pt/Pd print and wanted to do a single pass gum on top, *without* having to size the paper, to intensify shadow details or add a tint. The only downside of getting addicted to Ruscombe's beautiful papers is that they are occasionally hard to get in the United States and are quite expensive . . . but worth the money.

Arches Platine

Arches Platine paper is a French mold-made paper manufactured by the Arjomari-Prioux Mill (it also makes Rives). The paper's pedigree is formidable, as the Arches mill began producing beautiful papers in Lorraine, France, in 1492! That mill continues to be in production to this day. Arches Platine was designed specifically for platinum printing. I personally love the smooth finish and color of this 100% rag neutral pH paper, the fact that it has no buffers (alkaline reserves) or optical brightening agents, and the fact that it coats very easily.

Be aware, Arches Platine is only surface sized on one side, and coating it on the wrong side will often result in spots and an uneven image tonality. It is an excellent paper for Pt/Pd and Ziatype, fair for cyanotype and Van Dyke, but not a particularly good choice for argyrotype or albumen. The paper looks great at the conclusion of the toning stage with albumen and then takes on other attributes as the process continues, often drying a bit yellow in the highlights. This same yellowing malady is sometimes seen when working with high temperatures

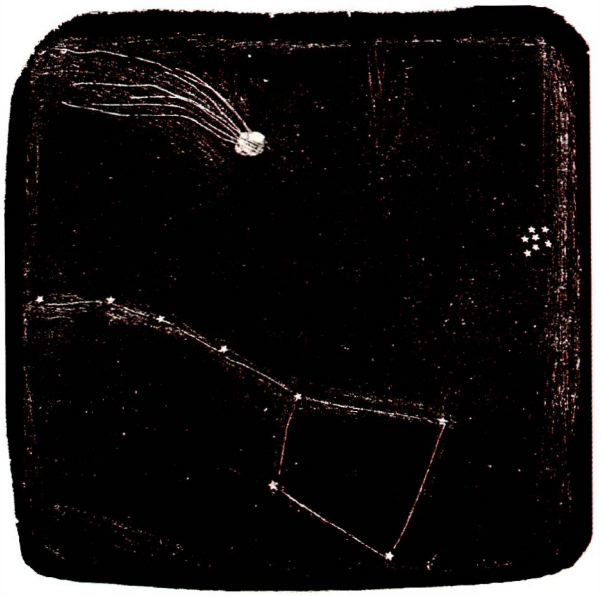


Figure 27–6
Michael Donnor, *Silver Cosmos*, 2012
Michael is a friend and a graduate of my MFA in Photography program at Lesley University. Possessed with a gymnastic intellect and a fascination for the unknown, his work, like an Italo Calvino short story, is a cross between the reasoning of an adult and the unlimited wonder of a child. Best of all, he is unafraid and tenacious in his defense of either position. *(Courtesy of the Artist)*

and humid conditions or when using public water supplies with additives to make teeth cavity free. In these situations I've found that a final 5-minute soak in distilled water is beneficial for keeping highlights from becoming discolored on dry down, especially with albumen and salt.

Revere Legion Platinum

I began using Revere Legion Platinum paper in my workshops in Santa Fe a few summers ago, and I have to say that it has become a strong contender for an ideal paper to use in a workshop environment. Specifically created by the historic Mangini paper mill in Italy for one of the most demanding fine art mediums—platinum printing—this mold-made paper features 100% cotton rag content with no alkali buffering. It is a neutral pH paper, is chlorine-free, possesses superior wet strength, and is sized for platinum printing. It is also very cost efficient for the quality.

Crane's Platinotype

Crane's Platinotype is a machine-made, 100% cotton white or cream buff white paper manufactured in the United States. I've been using Crane's Platinotype for years in workshop and class situations, as it is durable, is compatible with most processes, and has terrific wet strength. It clears well and is manufactured with a neutral to slightly acidic pH. It is also affordable.

Lanaquarelle

Since 1590, the Lana mill has been producing fine art papers for artists in all disciplines. Lanaquarelle is made on a cylinder-mold-made paper machine, giving it the look and feel of a handmade paper. This 100% cotton paper is perfect for gum bichromate printing at 140 lb and 300 lb hot or cold press. In workshops and class situations, this is the paper I always demo gum bichromate with. It is a neutral pH, 100% rag, calcium carbonate buffered (to make it slightly alkaline) paper and is colored natural white or buff. Being buffered, it is not a great paper for albumen or cyanotype because of the bleaching effect caused by the buffering calcium carbonate agent.

Arches Aquarelle

This is a nice paper for cyanotype/Van Dyke–gum bichromate combination printing. It is also a great paper to use when first printing a digital inkjet image that will be followed by an alternative process. It is 100% rag, mold-made, compatible with pigment and inkjet inks, fast drying, and it has no optical brighteners.

Canson Platine Fibre Rag

Canson Platine Fibre Rag is a premium 100% cotton platinum paper that Canson has supplied for many years to the platinum and platine photographic market. Now, however, it has been combined with a new microporous coating, making the traditional paper customized for your digital printing and presumably, alternative process printmaking. More than likely this would include carbon that requires a microporous surface. Canson indicates that it has the look and feel of Baryta Fibre paper. This paper has an extremely high D-Max potential and is 100% rag, compatible with pigment and inkjet dye inks, water resistant, and lacking optical brighteners. Like Arches Aquarelle, it is archival, internally buffered, and acid free.

Arches 88 Silk Screen and Intaglio Paper

Mold-made in France, Arches 88 is a 100% cotton, acid free, internally buffered, smooth white, unsized (for high absorption) heavyweight paper that is recommended for screen-printing, monotype, and intaglio presswork.

Somerset Satin

Somerset Satin is a 100% cotton, pH neutral, mold-made paper that is a favorite of albumen printers. It is made in England by St. Cuthberts Mill, is both internal and surface sized, and has two natural deckles. Somerset is known for its excellent quality for printmaking. The paper is ideal for drawing, charcoal, and pastel, as well as digital applications.

Lana Royal White/Lana Royal Crown

Lana Royal Crown is made by the Lana Mill in France and is a mold-made, 100% cotton, neutral pH, alkaline-buffered paper with two deckle edges and a smooth surface. Kallitypists are fond of this paper.

Weston Diploma Parchment Plat-Pal

Weston Diploma Parchment Plat-Pal is produced by the Butler-Deardon Paper Co. in Boylston, Massachusetts. The paper is velvety, machine made, warm white, 100% rag denim, medium weight (177 gsm), and rosin alum sized, and it has no brighteners or buffering, comes as large as 28" × 34", and has a pH in the slightly acidic neighborhood of 5.5 to 6.5. This indicates that it is a good choice for Pt/Pd and cyanotype combination printing as well as Pt/Pd. In its original incarnation as Weston Diploma Parchment it had a manufacturing record of more than 50 years. This newer version of the paper, which is identical to the earlier version, is excellent for a large variety of processes but is likely not well suited for those that involve long soaking stages.

Rives BFK

This is a pretty nice paper for printmaking, but in my experience it has not held up well in long soaking alternative process situations. Like the Arches papers, Rives is also made in the Arjomari-Prioux Mill in France. It is a mold-made, 85% cotton, 15% linen, internally sized, acid-free and buffered paper, without optical brightening agents. This is a traditional intaglio printmaking paper and is unbeatable on a flatbed press. It humidifies evenly and well.

Cranes Kid Finish—AS 8111

Manufactured as a premium stationary, Crane's AS8111 is an expensive, 32-pound, lightweight, 100% cotton fiber, smooth white paper with a luxurious finish. It comes in a variety of sizes including 8" × 11" and 21" × 33". It has a slightly acidic pH, and I like it as a substrate for calotypes and salted paper. The only things I don't enjoy about this great paper are all of the little watermarks that are scattered throughout each sheet. For that reason I often buy the larger size paper so I can tear off watermark-free pieces while using the watermark-infested portions for testing.

Fabriano Artistico

From the famous and ancient Fabriano Mills, founded in 1268, this is a 100% rag, neutral pH, and internally and externally sized paper. It was once sized with gelatin but now contains no animal by-products of any kind and is sized synthetically. It was also once slightly alkaline but is now neutral and acid free. Fabriano Artistico is expensive for a 22" × 30" sheet but is one of the most beautiful papers made . . . and one of my favorites for alt process work and watercolor since my days as an undergraduate and graduate student at Mass Art and RISD. It comes in both hot- and cold-press versions but is rather thick and requires a generous amount of sensitizer for a good coating when used in a process without an external gelatin or glyoxal sizing.

Hahnemühle—Photo Rag Inkjet Paper

This is the paper that I use personally for 100% of my carbon-based inkjet printing. It is, in my opinion, the best inkjet paper made if you want a matte surface and almost gravure-like finish. It is also a good choice of paper for salted paper printing, gum on inkjet, and Pt/Pd on inkjet.

Kozo

This delicate and translucent rice paper is made from mulberries and has extraordinary wet strength . . . you

can literally wring the water out of it and lay it flat. Kozo paper has no added buffers or brighteners, is fairly white to begin with, and is not subject to bleaching out. Kozo and its cousin, Gampi, are also very low in lignin content, and its fibers are far stronger and longer than western papers. As a representative example, there are Kozo scrolls in Japan that are 800+ years old, and the scrolls still roll/unroll without cracking or falling apart. I recommend Kozo for processes that can perform well on thin papers with short immersion times such as Pt/Pd, Ziatype, and salted paper.

Gampi—Gampi Torinoko

Gampi is a handmade, 100% Gampi fiber, Japanese paper with a beautiful pearlescent finish. It is often referred to as "the king of papers" due to its long and very fine fibers. Creating Gampi is a slow and arduous process due to the time consumed in removing "chiri," the dust and dirt that is harvested from the low-lying plant that provides the fibers. Gampi is ultra smooth, transparent, and slightly acidic, making it a contender to use with the Pt/Pd process.

Stonehenge HP 90 lb

Stonehenge 90 lb has received rave reviews for its ability to work well with Van Dyke . . . specifically due to the deeply rich sepia tonalities and the extra contrast it brings to the technique without use of a ferric citrate contrast control. Many papers are not suitable for VDB, but both Stonehenge and Arches 90 lb hot-press watercolor, which is heavily sized during manufacturing, keep the sensitizer on the surface, preventing it from sinking too deeply into the paper's fibers.

Bienfang 360

This is a specially formulated graphic arts translucent paper made to accept felt nib markers with heavy coverage without bleeding through to the next sheet. Colors flow smoothly yet hold sharp edges. Bienfang 360 has the attributes of vellum and is a beautiful paper to work with if you can deal with the wrinkles at the conclusion of the process. It is a paper with excellent translucency, and you can purchase it in blocks from 8" × 11" up to 19" × 24". Bienfang is machine made, smooth, bone white, and a bit acidic . . . which is not a bad thing. It clears easily and efficiently and is best when the sensitizer is applied with a brush like a Richeson synthetic. Pt/Pd on Bienfang 360 is beautiful and when backlit, almost ethereal.

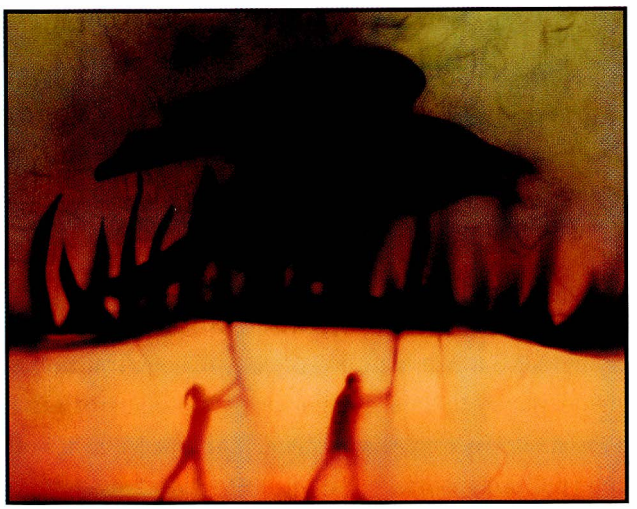


Figure 27–7
Angelina Kidd, *Holding Up Crow*, 2012
Angelina is a graduate of my MFA in Photography program and a truly eclectic artist in the best of ways. Regarding this piece from her thesis she writes, *"It's true that there is no scientific proof of life after life and of the human soul. However, I believe there is a soul and it is energy recognized as light."*
(Courtesy of the Artist)

Japanese Tissue

There is a large selection of exotic Japanese-made tissue papers that are exceedingly complicated to work with but are often worth the effort. They don't have the wet strength of a rice paper like Kozo, but they make up for it with translucency. Gertrude Käsebier coated on a Japan tissue to create a viewing experience in which the backlit reflection would come through the image, resulting in a more luminous experience for the viewer.

When Using Delicate Papers

When using a very delicate paper like tissue, newsprint, or some rice papers, I recommend creating a plastic screen "hammock" for the paper to lie upon during the lowering and raising of the paper in solutions in trays. Take a length of screening that is narrower than your trays but larger than your paper size. Staple the

screening to two medium-width dowels, one dowel for each end of the screening, so that you can hold the dowels and raise the paper gently from the solutions by spreading the dowels apart.

SIZING PAPER

The majority of cylinder-mold-made papers can be purchased with internal sizing, in which alum-rosin, or Aquapel, is integrated into the pulp. External sizing, usually gelatin, and sometimes gum arabic, occurs when the sizing is applied to the paper's surface. Occasionally this sizing may be a combination of the two. Paper is sized in order to provide it with a little more integrity and wet strength in long water baths and in order to bond the fibers of the paper. Additionally, when combined with a hardener such as glyoxal, it is intended to prevent pigments and chemicals from penetrating into the actual paper substrate.

Papers that are not sized are referred to as "waterleaf" papers and are generally unsuitable for alternative process work unless you decide to size the paper yourself. Papers can be sized with a variety of pH neutral sizing agents; two of the most common are gelatin and starch. For your consideration, be cautious about using papers that are heavily sized in manufacturing when you are doing platinum printing, as the platinum(II) binds to the gelatin and this makes the reduction to metallic platinum more difficult than it needs to be.

A paper that does not deal well with extended immersion times should be sized and hardened to prevent the loss of the paper's integrity and to avoid highlight staining. Some customized handmade papers and rice papers are examples of fragile paper that will probably not hold up well with repeated immersions in water. If you are working with a process in which the sensitizer becomes one with the paper, as it does in cyanotype, Van Dyke, and kallitype, you may wish to add an initial gelatin sizing and hardening step for the purpose of improving the highlight and shadow clarity.

If you are using a colloid/chromate process, such as gum bichromate or dusting-on, then you will most certainly want to size and harden with gelatin and glyoxal so the chemistry and pigment remain on a layer above the actual paper. Basically, if you plan to do any of the following things you should consider preparing your paper with one of the sizing and hardening recommendations that follow.

- If you intend to employ mixed-media techniques, work in two or more alternative processes on the same paper, or subject your paper to extended and multiple washing stages.
- If you intend to register negative(s) for multiple applications of color or impressions, as you would in a straight gum bichromate process, or when using the gum technique to enhance shadow density in a different process with more than a single, or short exposure, pass. The latter would include as an example a Pt/Pd print with a short cyanotype exposure on top to enhance the color and density of the shadows in the image. See Steichen's *Moonrise Mamaroneck*, Figure 8-23, as an example.
- If you intend to work with customized or handmade papers that are fragile. When working with an unknown paper, it is a good idea to purchase a sheet and immerse it in water to see how it will hold up. There is little point in investing time, chemistry, and money in a paper that cannot survive the coating and washing adventures to come.
- If you intend to use liquid, hand-applied, photo-sensitive emulsions on paper, you have an option to gelatin size, or produce a gum/dichromate hardened layer, in order to keep your highlights clean. Another option is to use a product like Black Magic Liquid Hardener. Adding this hardener to your paper developer will greatly improve the paper's ability to deal with the exposed and developed liquid emulsion.

SHRINKING

Quality, 100% rag printmaking and watercolor papers will change dimensionally after being wet. These papers are made of cotton rag fiber, so, like a pair of jeans, they shrink after washing and drying. If you intend to make two separate impressions on a single piece of paper, as in a traditional gum bichromate printing workflow, or if you are combining gum with another process, or

Figure 27–8
Judy Seigel, *Probably Viollet-le-Duc*, 2003
My dear friend Judy was quite curious about the life and work of Viollet-le-Duc, the nineteenth-century French architect gothic revival theorist whose ideas and restorative designs were seriously out of fashion and ran against the popular tide. To those who know Judy, this adoption of the iconoclast spirit makes perfect and total sense. Here is one version of her work inside a scribble turned into a negative as "frame." It contains three gum coats, plus a solvent transfer of a flower. *(Courtesy of the Artist)*

combining two or more processes, it is necessary to shrink you paper first. If you don't perform this step, your registration will be complicated.

Shrinking your paper is a simple process of hot water immersion and drying in order to tighten up the cotton fibers. Fill a tray, or sink, with hot water at 120°F–140°F and soak your paper for 10–15 minutes. Be sure that each sheet is completely saturated by gently shuffling through the sheets, but keep your eyes open for any sign that the sizing in the paper is leaving the paper. This is most evident in surface-sized paper. Pull the sheets from the tray one at a time and hang them with clothespins on a secure line until they are dry. If you have a dry mount press on hand, flatten them. Be careful when handling the wet paper because the fibers will be fragile.

ALTERNATIVE SIZING OPTIONS

Note: In the Gum Bichromate chapter you will find an extended discussion of gelatin–glyoxal sizing workflows that are specific to the gum bichromate process. This will include a traditional two-step gelatin and glyoxal sizing, glyoxal options including glyoxal and bicarbonate of soda for bond strength, total immersion gelatin and glyoxal single-step sizing, and old-school formalin sizing. For now, the following are several alternative sizing options and methods that you can use in place of gelatin and glyoxal. These include arrowroot, chrome alum, acrylic gesso, and others.

Old Dickie's Instant Sizing

This procedure is courtesy of Dick Sullivan. Place a sheet of 1/4" plate glass or Lucite that is larger than your paper to be sized on a flat surface in a horizontal landscape format. Gather your materials: the prepared plain or salted gelatin sizing, your paper, a glass rod or a Puddle Pusher, a turkey baster, tape, and a car window wiper or squeegee. Be careful when using the wiper or squeegee to avoid roughing up the surface of the paper. Then, securely tape the paper that you intend to size to the glass or Lucite along the edges. If you are in a hurry, or the tape stands up so much that it interrupts the smooth stroke of your wiper blade, simply hold down the top of the paper with your fingertips and swipe away from them. If you are sizing for gum, add glyoxal to your list of ingredients and then follow the directions for gelatin–glyoxal single-step sizing in the Gum Bichromate chapter of this book.

Now, partially fill your turkey baster with your warm prepared gelatin . . . meaning that you have followed all of the steps in the normal gelatin or salted gelatin preparation. Place your glass rod flat on the paper. Squirt the gelatin solution along the bottom edge of the rod and drag, as in a Puddle-Pusher technique, the warm gelatin across the paper's surface. Quickly take the car window wiper and gently squeegee dry the paper. Drying is instantaneous, and coated papers can be stacked immediately, allowing your workflow to be more efficient.

Arrowroot Sizing

Arrowroot starch is a sizing ingredient option that is often recommended by manufacturers of alternative process materials. The primary reason for this is that arrowroot prevents liability problems and is really safe to use.

To make a solution, place 20 g of arrowroot starch in a cooking pot and add a small amount of hot distilled water. Stir this concoction until you have a paste. Then add 1000 ml of distilled water and stir it into the solution. Put the pot on low to medium heat. Stirring constantly, bring the solution to a low boil for 5 minutes. Allow it to cool to room temperature and store it in a sealed plastic storage container. This solution will spoil in a fairly short time, so use it within 48 hours. It is applied to the paper by dunking, brushing, or squeegee, and the paper is line dried.

Bernie's RG-4A Gesso-Gelatin Size

This sizing option comes from Judy Siegel's *The World Journal of Post Factory Photography*, which is sadly no longer in publication. The sizing is called Bernie's Gesso-Gelatin Size and is the invention of Bernie Boudreau, "gum printer to the stars." There are several variations of this sizing, and I'll pass along the one that seems to be most universally practiced.

To make this sizing, add one part thick gesso (gesso gets thicker with age) to three parts 3% Knox gelatin. If your gesso is fairly new and too fluid, increase the gelatin to 3.5%–4% concentration.

Judy wrote in an email to me several years ago that her best gum bichromate results came when she used this RG-4A gesso-gelatin sizing recipe, a gum sensitizer emulsion consisting of equal parts gum arabic and ammonium dichromate, and the watercolors carmine red, viridian green, and phthalo blue.

Gesso—Acrylic Medium Sizing for Porous Substrates

This is a pretty good formula for preparing porous materials, such as artist's canvas or linens, for alternative process sensitizing. In a plastic container, combine equal parts of white gesso, acrylic gloss medium, and water. Stir these ingredients into a smooth solution and coat your papers with a brush. Some artists who employ this sizing technique often apply a new coat between each gum bichromate color application, and I've had good results with this sizing technique when making black gum bichromate images on canvas.

Acrylic Matte Medium & Water

Make up a solution of acrylic matte medium and water in a proportion of 1:1 and brush it on your paper with a foam brush. After it dries, which doesn't take very long at all, coat the paper with your gum bichromate sensitizer mix of potassium dichromate, gum arabic, and watercolor or gouache paint. My students who have used this method like it for the speed and being able to avoid hardening gelatin with glyoxal.

Gum Arabic–Dichromate Sizing

For a few decades I have used gum arabic and acrylic sizing paper surface preparation for my paintings. Gum provides a simple layer for the paints to lie upon and simultaneously allows me to go into the painting with a water-wet brush in order to pull out highlights and details that may have been compromised by the ebb and flow of the painting materials and process.

A gum arabic–dichromate sizing works in much the same way but remains effective long after a single immersion in water. The reason for this is that the gum is mixed with a light-sensitive ammonium or potassium dichromate, which will harden the gum upon exposure in proportion to the time under the influence of UV light. The process is a quick and efficient sizing/hardening technique that was fashionable many years ago. It does, however, leave you with a soft buff-colored surface to work on and precludes the possibility of pure white highlights. This has a significant upside if you are seeking a romantic/atmospheric base coloration. Here are two variations of the technique.

Gum Arabic–Dichromate Sizing Option #1

Mix up a gum bichromate solution consisting of 5 ml of a saturated solution of potassium, or ammonium, dichromate, 10 ml of gum arabic, and 10 ml of water. Do not add any watercolor pigment unless you want to make a colored background. Coat this solution on your paper and expose it to sunlight or in a UV light exposure unit for 5 minutes. After the exposure, wash the print for 15–20 minutes in clean running water and hang it up to dry on a line.

What you have made is a hardened, and tan-colored, bichromate surface that will protect the paper sufficiently during many water immersions. This

Figure 27–9
Christopher James, *Irezumi #2,* 1986 (watercolor, gum, chine-collé, and carbon)
This painting is an example of my work in which I begin the piece by laying down multiple layers of gum arabic in order to eventually alter the way pigment and paint set up on it and can selectively be removed from the paper's surface.
(Courtesy of the Artist/Author)

tan undercoating is particularly nice when combined with a cyanotype blue print. If you want to size with this technique and retain the natural white in your paper, try the following #2 option.

Gum Arabic–Dichromate Sizing Option #2

A variation of the gum arabic–dichromate sizing #1 option is to mix up equal proportions of a *saturated* solution of ammonium, or potassium, dichromate and an equal amount of liquid gum arabic.

Note: Ammonium dichromate is in a saturated solution at 25%. Potassium dichromate is in a saturated solution at 10%–13%. This solution is coated on a paper, dried, and subsequently exposed to UV light for 2–3 minutes. The paper is then washed well until it exhibits its natural paper coloration. If the white of the paper doesn't wash clean, then the following sodium metabisulphite bath comes into play.

Sodium Metabisulphite Clearing Bath

This clearing bath, one that is commonly employed in the gum bichromate process, is made by mixing 10 g of sodium Metabisulphite into 1000 ml of water. If you cup your hand and pour in a small mound of metabisulphite you will have about 10 g. There is no need to be fussy with this weight. The exposed paper is either immersed in the solution or it is sprayed on the paper for not more than a minute. You should see the staining go away. Following the sodium metabisulphite application, wash the paper well for 10 minutes and hang it on a line to dry.

Chrome Alum Hardening Option Carbon

Chrome alum is a hardener that is used in traditional rapid fixing baths in silver gelatin photography. It is effective in hardening gelatin but has a short life in fixing baths and can leave a green stain. As a result, it is used mainly for high temperature processing and in the manufacturing of emulsions.

The following is a paper-sizing process that Sandy King employs in his excellent carbon process technique. This formula works for gum bichromate printing, and there is an even-money chance that it will be another option for you to use as a sizing for glass (remember to clean it first), Plexiglas, or ceramics. It's fairly simple, so give it a shot.

Ingredients

30 g photo-grade or Knox gelatin dissolved in a liter of water

Add 3 g of chrome alum that is first dissolved in 50 ml of warm water. You may substitute 2–3 ml of glyoxal or formalin in place of the chrome alum, but be sure that you have superior ventilation in your coating area. If you use chrome alum, let it age for a week or so before use. If you're in a hurry, use glyoxal or formalin.

If you want a matte finish to your print, add 2–3 g of cornstarch to this combined solution.

This is normally a paper application in which the paper is first soaked in warm water for about

10–15 minutes. Then the paper is squeegeed on a flat surface and wiped gently with a paper towel. If you are using glass then you already have a flat surface, so simply warm the glass with a hairdryer. The rest of this sequence will be the same with paper or any other substrate. Simply apply the warmed gelatin, with a hardener, to the surface by pouring (like you would for wet collodion) or brushing. It takes 100 ml of solution to coat a 22" × 30" piece of paper. Obviously, glass isn't going to absorb much solution, so plan accordingly.

Beer, Sodium Silicate, and Corn Starch Hardener for Glass or Ceramics

Here's yet another idea, bound to get your attention due to the party potential, from an old recipe that I had in some notes. I can't remember where the original idea came from, but it's a fun technique.

Ingredients

500 ml	room temperature and flat beer
1	tablespoon baking soda
40 ml	sodium silicate
	Albumen (egg white from a single egg)

Begin by letting about 500 ml of beer get flat and non-bubbly over the course of a few hours. When the beer is ready, add a tablespoon of baking soda and 40 ml of sodium silicate. Sodium silicate is also called *waterglass* or *liquid glass*. It is available in aqueous solution and in solid form, and it is a compound used in cements, passive fire protection, and textile and lumber manufacturing. Stir it into a soup-like solution and wait a short time for it to settle.

While it's aging, whip up the white from a single egg with a hand blender (this whips and blends in all of the stringy bits in the albumen) and paint a thin 1/8" to 1/4" wide line of albumen on the top and around the edge of the glass or ceramic surface with a cotton swab. You may also flood the entire surface of the substrate you'll be using if you choose. This will give you, as it does in wet plate collodion glass ambrotypes, a "hook" for the sizing to adhere to. Finally, warm up the beer, cornstarch, and silicate solution and pour it on the warmed piece of glass and dry it flat. After it is dry, coat with cyanotype or any other sensitizer.

PERFECT GLASS CLEANING WORKFLOW

Gelatin–Glyoxal Hardening for Glass & Ceramics

Make no mistake about this . . . putting any alternative sensitizer/emulsion on glass is not for the timid or insecure, but it can be done well if you follow some simple rules. Basically, it is the cleaning of the glass, cleaning it very well, that is predominately important. Here is the process for getting glass absolutely free of anything that will hinder your efforts.

Whiting Glass-Cleaning Formula and Workflow

Once your glass is cut to size, so that it fits into your plate holder, file the edges with a handheld sharpening stone, glass appropriate sandpaper, or medium mill file to prevent any inadvertent cutting of your fingers on the sharp edges. Put on a pair of gardening gloves. To take the sharpness away, place the file at a 45° angle on the edge of the glass and draw the file away from you several times. Repeat this step on all 8 of the sharp edges. Then, if you have a dishwasher, wash all of the plates using Bon Ami instead of detergent. If not, wash by hand in hot soapy water and rinse in very hot water.

The glass must be totally free of any solvent, grease, and debris, or the solution you're applying will not adhere to the glass effectively. A traditional glass cleaner is *rottenstone*, a fine grit-like material that can be purchased at stores, or web sites, that sell furniture-finishing supplies. It is a fine gray powder, and mixing it with equal parts of powder, water, and alcohol produces a good glass-cleaning solution. You can also make up a bottle of calcium carbonate, or "whiting," to accomplish the same purpose. Personally, I prefer the whiting to the rottenstone.

Here's the formula for a very good calcium carbonate/whiting formula for cleaning glass. Mix it and store it in a small bottle like the culinary arts drizzle bottles that sous chefs use to make their sauces look exotic on your plate. The proportions of water to alcohol can vary so don't get too compulsive about the formula. Some friends of mine simply go with all alcohol and omit the water from the formula. This makes it evaporate a lot faster. The formula below will be useful to you for well over a year.

80 g	whiting
100 ml	water
20 ml	grain alcohol

Place your sheet of glass in a glass-cleaning vise or on a rubber pad like the type that is sold as non-skid shelf liners. Quickly clean the surface of the glass with a grain alcohol, like Everclear, from a liquor store or a different type of alcohol from a hardware store. When the surface has dried, apply the whiting solution to the glass liberally, and with one piece of cloth, or a wad of cotton balls, vigorously cover the entire plate in a swirling motion until you hear a squeaking sound. The glass is now "squeaky clean."

Then continue to buff the surface with a fresh piece of cloth or cotton pad, removing any, and all, whiting residue and lint from the glass. To verify that your plate is cleaned properly, breathe on the glass and check to see if there are streaks showing in the mist condensation from your breath. If there are, continue cleaning. An 8" × 10" sheet shouldn't take more than a minute or two.

Super-Clean Last Step with Bon Ami

Once your glass or ceramic plates have been cleaned with whiting or rottenstone, you may want to make them perfect. The best way to accomplish this is to put your cleaned plates in a dishwasher and to add some Bon Ami to the detergent holder instead of dishwasher detergent. Run a short cycle and you'll be good to go without any problems whatsoever.

If, by chance, you still are having issues with adhesion, you can try subbing the plate (essentially laying down an alternate surface) with an albumen subbing that is identical to the one used when preparing ambrotypes in wet plate collodion. This is made with the white (albumen) of one egg, 2 drops of ammonia, and 500 ml of distilled water.

Whip the ingredients together in much the same way you do when making albumenized paper. Using a handheld blender, whip the albumen until there are no stringy "ligands" in the egg whites. If you don't have a hand blender, just put the ingredients in a small container, like a mason jar, and shake briskly. To use, either flood the glass or ceramic surface with the albumen and allow it to dry or paint a thin 1/8" to 1/4" wide line of albumen on the top and around the edge of the glass or ceramic plate with a cotton swab. Both methods work well and should set you up for applying a gelatin or similar emulsion.

AMINO SILANE SURFACE PREPARATION

Amino Silane Surface Preparation for Emulsions or Sensitizers on Glass

To create a good coating of a colloidal emulsion, like gelatin, you need to have a hydrophilic (meaning it likes water) base surface to lower the surface tension difference between the liquid emulsion and that surface . . . in this case, gelatin and a non-absorbent substrate like metal, glass, or ceramic. With an absorbent substrate like paper, a better degree of absorption and bonding can be achieved by adding a surfactant like Tween 20. Surfactants have a multiple personality, both hydrophobic (meaning it does not like water) and hydrophilic at the molecular end. This essentially means that the surfactant has the ability to make an interface between opposite materials like glass and an organic emulsion. As an option to bonding on a non-porous material, Tween 20 is worth a try, as it is more commonly found in the lab.

Simply coating your glass or ceramic surface does not guarantee that your dried emulsion or sensitizer will stay on the substrate you've applied it to. Most of the time something will go wrong with the adhesion and you will need to start over. To get the emulsion to stick you have two options. The first option is subbing the glass plate with a very diluted hydro-alcoholic solution of gelatin and hardener, or albumen. The second solution is adding a surfactant, like Tween 20, that reduces the surface tension of a liquid that it is combined with.

This strategy will offer the potential of creating a strong adhesion to both the glass surface and to the gelatin. If you use a silicium-based surfactant like Dow Corning's Z-6040, or a more easily acquired A-1100 amino silane that is sold to alternative process folks by Bostick & Sullivan, you will find, with practice, a possible solution to your adhesion problems. Amino silane is a pale yellow aromatic liquid alkoxysilane that must be handled with great care and adequate ventilation. Please read the MSDS sheet before using it. When used, a part of the amino silane binds chemically to the gelatin, while another part of it sticks to the glass

surface. If you add 1% of Dow Corning Z-6040 to the emulsion you should also realize an adhesion to most difficult substrates. I'm going to talk about the amino silane that is available from Bostick & Sullivan.

A-1100 Amino Silane from Bostick & Sullivan

Silane adhesion promoters serve as molecular bridges between two very different materials such as gelatin and glass or ceramics. Adhesives and sealants are based on organic polymers, while the substrates they bond with are most often inorganic in nature, for example, glass, metal, or concrete. Silanes improve adhesion by chemically bonding to both types of materials simultaneously, forming a molecular bridge that is strong, durable, and resistant to the negative effects of moisture . . . in a sense, microporous once the bond is complete.

Amino silane can be used as an additive or wiped on a non-porous surface with a cotton ball and promotes benefits such as superior adhesion in wet and dry states and weather resistance. In the last decade, amino silane has been experimented with extensively by Dick Sullivan and Howard Efner as a surface additive to be used with carbon process. In their work, the silane is used as a dilute solution in methanol and applied with a cotton ball, to exceptionally clean glass, as a very thin film and is allowed to stand overnight. The carbon tissue is then mated with the glass and developed normally for carbon.

Here's a recipe and workflow for making gelatin adhere to glass even when that gelatin is unhardened with glyoxal or subjected to an alkaline developer.

Ingredients

8 ml amino silane (A-1100 silane from Bostick & Sullivan)

(Also called 3-amino-propyltriethoxysilane - CAS#: 919-30-2)

11 ml isopropyl alcohol

1 ml deionized water

(Deionized water is not the same as distilled water . . . it is water that has been run through an array of filters and ion exchange resins that have removed unwanted ions, making the water quite pure.)

Mix the ingredients and allow the solution to age quietly for a full day. The solution, in this state, is only good for a single week. While you're waiting for the silane to age, clean your glass plates, following the instructions for glass cleaning with whiting and alcohol that you'll find earlier in this chapter and in the Wet Plate Collodion chapter.

Figure 27–10
Monika Ozog, *Of Many Tongues*, 2013
Monika, a former MFA in Photography candidate and graduate of my program at the College of Art and Design at Lesley University is a master at integrating imagery with her ceramic substrates. This is a piece she created at the end of her first year in the program. The professors in the ceramic department thought she was a certified genius, and I would have to agree. *(Courtesy of the Artist)*

The next day, take 1 ml of the solution made in step 1 and add 20 ml of isopropyl alcohol to that. This solution is good for about 12–18 hours. Then, with a large cotton ball, or clean paper towel, lightly apply the solution onto your well-cleaned glass plates. You will see a white haze appear on the surface of the glass. Don't mess with the haze; simply let the plates sit for an hour or two in order for the silane to bond to the glass. If the haze remains on the glass, and if it will not be compatible with your plans and image, you may try to remove the haze with an ammonia-based glass cleaner like Windex. If you wait more than 4–5 hours to remove the haze you will find the task a bit difficult. The glass plates are now perfectly storable until you are ready to use them.

Note: Whenever you work with amino silane, please do so only in a well-ventilated and safe area. Wear protective eyewear and examination gloves, and think about investing in a dual carbon filter mask.

LASER TRANSFER ON CERAMIC: MONIKA OZOG'S WORKFLOW

One of my recent MFA graduates, Monika Ozog, has recently been working on a laser transfer technique on ceramic that I really respond to. It is relatively time consuming but clear and simple enough in its workflow to permit a lot of alternative inspiration. All you need is a laser printer (not inkjet), clay, mason stain, a kiln, and a few other easy-to-acquire materials.

Table Setup

- Laser printer
- Clay
- Mason stain (ceramic powder—see below)
- Linseed oil
- Nitrile or latex examination gloves
- Respirator mask
- Apron
- Gum arabic
- Brayer
- 2 sponges and 2 bowls of water
- A spoon for burnishing

Laser Transfer on Ceramic Workflow

1. Print out your images in black and white with a laser printer (NOT inkjet). It is important, if you have lettering in the image, that you flip the transfer, since the image will be upside down. If you don't, the text will not be right reading.
2. On a hard and flat surface such as thick glass (best), plastic, or Lucite, with your fingers, spread a puddle-layer of gum arabic that is slightly larger than your image.
3. Place your image, face up, on top of the gum arabic and slowly rub the gum, from the sides into the image until the paper is covered with a thin layer of gum. Clean up any excess gum around the edges.
4. The ink prepared to roll over the image is a "ceramic ink" made up of linseed oil and mason stain. Mason stains, although safer than oxides, are still not considered safe to breathe and have excessive contact with. While mixing use latex gloves and stay in a ventilated area. Create a 1:1 proportion of linseed oil and Mason Stain (you can pick any color you wish) to get a consistency that is not too paste-like but not too runny either. The ink must mature for at least 24 hours, so mixing it before your work session would be a good idea. Always mix the ink into solution before you place some on the glass, Lucite, or board, and then roll the brayer over it repeatedly until it is smooth. This provides a more even and consistent coat.
5. Carefully roll over the image until it is covered in ink and you can no longer see the image.
6. In one bowl of water add a splash of gum arabic . . . about a teaspoon for a quart of water. Using one of the sponges, squeeze water over the inked image and then mop it up gently. The ink should be sticking to the black toner in the image and will not adhere to the white of the paper.
7. Repeat the inking and sponging process up to three times.
8. Place your image face down on the clay, which should be "leather hard." With the other sponge, and a fresh bowl of water, gently sponge the back of the image, smoothing it onto the clay.
9. With a spoon, gently burnish the image, allowing the ink to adhere to the clay. Lift the corner of the image to check on the progress, and if unsatisfied, continue burnishing.
10. When satisfied, lift the paper off of the clay completely.

At this point, the transfer is complete and you are able to kiln bisque fire the slab of clay with the image transfer. *Bisque firing* is a term used to describe the result of kiln firing the clay for the very first time in order to remove all traces of moisture from it. This is usually done with a kiln temperature between 1700°F and 1850°F and between cones 08 and 06. The mason stain ink will be powdery after bisque firing but will adhere when fired to the temperature of the clay body.

An alternative to firing right away is to alter the slab by cutting, gouging, shaping or attaching it to another slab. These actions will manipulate the image. Monika Ozog, whose work is represented here, writes that one of her favorite techniques to manipulate the clay and image is stretching, or throwing the slab onto a flat surface in one direction to abstract and stretch the clay form. With some practice, this photolithography transfer process is applicable to even 3-D surfaces.

Applying a glaze, and subsequent kiln firing, over the transfer can cause the ink to "run," depending on how much stain and glaze is applied. Gently brushing on glaze with a hake or synthetic Richeson brush allows for a sufficient glaze coating to help avoid the problem. As always, in every time-consuming discipline, a test run is recommended. Testing the transfer in combination with glazes is both frustrating, and beautiful, and part of the seduction of working with ceramics is the nature of its unpredictability.

HOW TO USE MASON STAIN

Mason Color Works is one of the oldest manufacturers of ceramic stains. Mason Colors are powdered pigments made of a combination of oxides and frits that create beautiful, uniform, rich colors. You can add mason stains to dry glaze recipes to produce color in an opaque or transparent base glaze. They can also be added to decorating slips, washes, and clay to make uniquely colored clay bodies. Mason stains can be mixed with water to create washes that add a splash of color. Mason Color Works recommends adding a small amount of dry ball clay to help the stain adhere better or a frit to help the stain melt and give a polished look. Frit is the material from which glass is made and refers to a ceramic glaze in this case . . . try frit 3124. Mason stains are blendable and can be used alone or mixed with other mason stains to create custom colors.

Mason stains can appear lighter or darker than the image depending on the percentage of stain added. As a general guide, use 10% stain for the Crimson Series, 8% for the Encapsulated Series, 5% for the Brown Series, 10% for the Green Series, 2%–5% (for dark colors) and 10% (for light blue) in the Blue Series, 10% for the Violet Series, 10% for the Yellow Series, 6% for the Black Series, and 10% for the Grey Series (except Sage—use 2%).

Figure 27–11
Galina Manikova, *Egg01*, 2012 (decal on porcelain)
This is an example of Galina's work integrating decals and porcelain. Decals are created using a digital laser print on decal paper. The resulting images are then transferred to high-fired porcelain and fired once again at 1940°F, making them permanent. There is also new ceramic decal material available, allowing decal printing in full color. Temperature and color are also dependent on the glazes that are used. *(Courtesy of the Artist)*

Most stains are stable up to 2300°F in both oxidation and reduction and are lead free. It is always recommended to test your mason stains to ensure the stain works well with your base recipe. One last thing: when used with food-safe glazes, mason stains are food safe as well.

A SIMPLE DECAL IMAGE TRANSFER WORKFLOW ON CERAMIC

There is a simple single-fire workflow for placing images on ceramics, or glass, and all you need is a pack of image transfer paper, such as Fired-On Images Transfer Paper, a black-ink-only laser printer, some water, and access to a kiln. You can kiln fire on top of unfired bisque clay or even previously glazed ceramics like your favorite dinnerware. It is food and microwave safe. Here's how it works.

Decals are transferable black laser ink prints on ceramic that are fired at around 1060°C (in the cone 6 neighborhood). You simply find an image or text that you want to transfer, print it out on the decal transfer paper in the laser printer, and let it dry for a half hour or so. Then immerse the decal paper in warm water for about 30 seconds or until the decal part begins to separate from the paper backing. Next, place the paper face down on the transfer surface and slide the backing paper away from the decal that will be adhering to the substrate. While wet you can continue to move the image around until you have it where you want it. Blot off the

Figure 27–12
Galina Manikova and Sara Ben Josef, *A Flight of Stairs*, 2012
In this collaborative project with Israeli ceramicist Sara Ben Josef, Galina is working with the equally powerful components of intellect and her craft. She writes, *"The title* A Flight of Stairs *relates to the forms, the images and also the symbols that have been used in this work. A flight of stairs symbolizes a path of life towards the sky or to nowhere with all its ups and downs and all its twisted turns."*
(Courtesy of the Artist)

excess water and wait a few hours until it is completely dry. Then all you have to do is fire the transferred image and the substrate in the kiln for a permanent bond.

The color of the image using this system is warm sepia brown, but you can change that up a bit by using different-colored glazes and under-glazes in partnership with the decals. Be aware that you can't use any old printer. It is the inexpensive HP or Canon laser printers, where the toners have iron in their toner formula, that determine the sepia tonality. You can use any HP or Canon black-and-white printer. A full list is available online at the Fired-On Images web site.

Note: There are other brands of image transfer paper that do not require a kiln, but those are more of the "craft" variety (think of the image of a Renaissance putti [a floating cherub with a bow and arrow] decorating a large candle. There are some new full-color systems, but I haven't tried them yet, so I will advise you to investigate on your own if you're interested.

GALINA MANIKOVA'S VAN DYKE ON PORCELAIN WORKFLOW

Galina Manikova is acclaimed for her work placing images on impossible surfaces such as steel, glass, porcelain, and ice. In this workflow I'll describe how Galina applies and prints a Van Dyke sensitizer on porcelain. This description will give you a good idea of her workflow, but to accomplish this task you will need to go to the Van Dyke chapter and learn how to use the Van Dyke sensitizer formula on a less-complicated substrate such as paper. Be patient; do that first and then return to this section. If you are already familiar with the Van Dyke process then have at it.

Preparing the Porcelain Form

To execute this technique you will need liquid porcelain, Danish type, from Royal Copenhagen (http://www.royalcopenhagen.com). The liquid porcelain is cast in a plaster form, dried, and fired twice. The first firing is to 900°C (cone 06 or 07). The second firing is at a temperature of 1280°C (cone 9 or 10), this time with a white matte glaze. It is important that you don't simply show up in a ceramics studio and think that you're going to get straight into creating forms for your liquid porcelain and firing in a community kiln. You will need to get some instruction, and my best advice is to register for a class or workshop in which you can become familiar with the materials and tools found in a ceramics studio and how they are used safely. This knowledge is especially important when using a group kiln because one exploding piece can destroy others in the kiln during a firing. Don't be intimidated; working with clay is an amazing amount of fun.

Hardened Gelatin First Coat

Once the pieces that you intend to place your images on are complete, they are covered with a gelatin and formalin base that is made in the following manner. Take one teaspoon of gelatin and add a small quantity of cold water to it, as little as it takes to dissolve the

gelatin and allow it to bloom. After 10 minutes, dissolve the bloomed gelatin in a hot water bath by partially immersing the container holding the bloomed gelatin in a larger vessel containing hot water. This is the same setup we use for gum bichromate gelatin hardening. Once the gelatin transitions from the bloom state and is made more liquid, add a few drops of 37% formaldehyde or substitute with the prepared glyoxal that is sold by Bostick & Sullivan.

Using a hairdryer, heat up the porcelain form that you are going to be applying your image upon so that it's warm, preventing the gelatin from firming up too quickly . . . like a gelatin dessert placed in a refrigerator. Next, using a foam brush, coat the porcelain object and let it dry overnight. Galina recommends that if you have the time, allowing the seasoning and drying time to take a full month is an even better idea. The gelatin base needs to harden perfectly.

Applying the Gelatin Van Dyke Sensitizer to Porcelain

After the drying time is complete, perhaps a month later, it is time to make up the gelatin and sensitizer mix that will allow you to place an image on the porcelain and keep it there. To make the sensitizer, add 2/3 the volume of Van Dyke sensitizer (ferric ammonium citrate, tartaric acid, silver nitrate, and water . . . see the Van Dyke chapter) to 1/3 the volume of gelatin prepared the same way you did earlier but this time without the formaldehyde or glyoxal hardener. This solution can be applied in a variety of ways but must be kept warm during the coating. Be sure that you are wearing nitrile or latex examination gloves and eyewear. You always need to protect your eyes and skin when using silver nitrate. Do not be casual about this, as an errant splash of silver nitrate in your eye could cause serious problems.

Apply the gelatin and Van Dyke solution to the warmed porcelain forms quickly and then place them in a darkened environment to dry overnight. The next day, under safelight or low ambient light, tape your negative to the ceramic form. If the form is flat, tape down the negative and cover it with a sheet of glass to create a good compression. Your negative can be a traditional silver gelatin variety, a Pictorico Ultra Premium OHP digital film, a cliché verre on glass, or a transparent flexible surface such as a waxed paper negative, a calotype negative, or a photogram object.

At a distance of around 16 inches, and using a 300-watt bulb, expose the coated sensitized ceramic object for 10 minutes. After exposure,wash it under very cold running water for about 3 hours. Allow the coating to dry completely and then expose the piece again, to the same light and at the same distance, for 30 minutes.

You will notice, if you are familiar with the Van Dyke process, that there is no sodium thiosulphate fixer used in this workflow following exposure. Aside from the highlights being more yellow than in a Van Dyke that has been fixed in sodium thiosulphate, there is no apparent issue with image deterioration. Galina reports no problems with this procedure, and this is likely due to the fact that the sensitizer is sitting on the surface of a hardened gelatin and not residing in the fibers of a thick paper substrate. You may also begin to consider using other sensitizers in this workflow. Once again, go exploring and have fun.

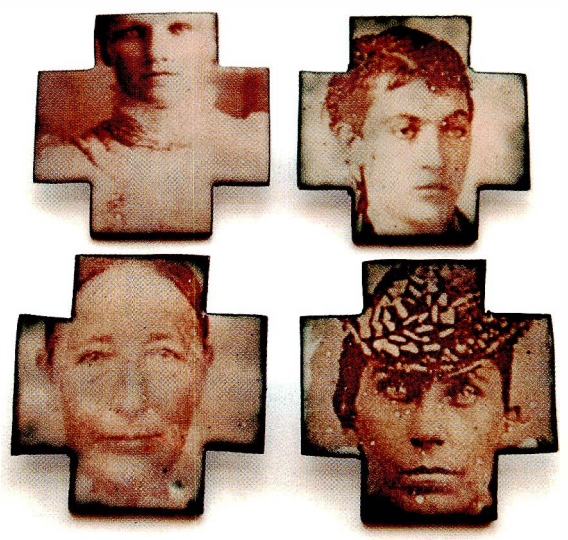


Figure 27–13
Anne Dinan, *Unknown Relatives*, 2014
New Hampshire jewelry craftsman and artist Anne Dinan created this piece in a series of forms inspired from a box of old photographs found on her great uncle's farm in Menominee, Michigan. The pieces in the edition are kiln-fired, digital waterslide transfers to vitreous enamel on copper.
(Courtesy of the Artist)

Light Markings

OVERVIEW & EXPECTATIONS

This chapter is a little different than the chapters that preceded it. Although there will be a few examples of my favorite techniques, ones that could not justify a dedicated solo chapter, this chapter is really about alternative ways of thinking about photography . . . or more accurately, some of the ways I've been thinking about photography lately. I'll be discussing concepts and reflecting on how ideas are processed when thinking about making marks with light . . . rather than simply describing the syntax and processes used in the construction of photographic images. As I paraphrased Mr. Twain in the beginning of this book, it hardly matters when your technique is perfect if your imagination is out of focus.

I think of the first part of this chapter as the beginning of a book I've had in mind for many years about a *new photography* and the opportunities that this concept offers. As I wrote earlier, consider the non-confrontational thesis that photography is one thing and that its sibling, digital imaging, is quite another. From my perspective, photography was in large part responsible for setting painters free, and digital imaging may ultimately be responsible for freeing photographers in much the same manner. In a sense, photography permits the unexpected embrace of those rare moments of serendipity and feeds the hunger for the accident that has given photographic artists new ways of expressing the realities they choose to capture on sensitized film, glass, metal, and paper.

Oddly, this freedom may be a reciprocating event by which digital imaging artists will then be free from the obligation of making their visual concepts behave like photography. It's possible that what photography did for painting, digital imaging will do for photography . . . and photography will then do, in turn, for digital imaging. What will happen at that point is anyone's guess, but from my perspective, photography and light marking will then become fully integrated with all of the arts. *Digital Imagining*, its own chapter in this book, is a companion piece to the *visual literacy* beginning of this chapter, and I invite you to read them with that in mind.

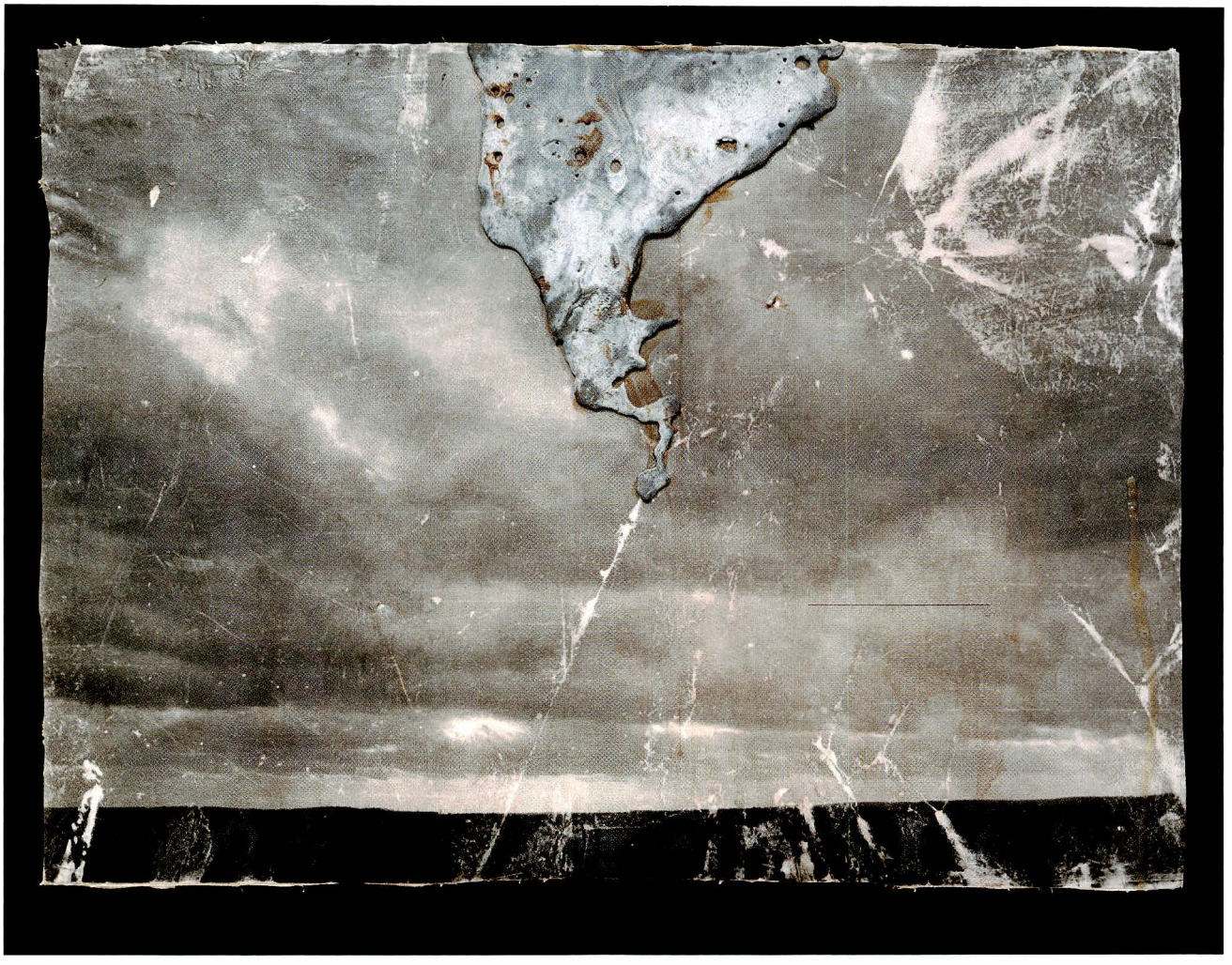


Figure 28–1

Anselm Kiefer, *Strike,* 1985 (lead, shellac, synthetic adhesive, and graphite on photograph, mounted on canvas)

When asked who my favorite artist is, the first name that I speak is Anselm Kiefer. For decades, his spontaneous and brilliant inspirations, making inseparable connections between content, context, and syntax, have impacted my experience of looking at art like no other contemporary artist. In this piece, Kiefer over-fixed an exposed and developed negative, destroying the emulsion and causing stress and streaks that adopted the metaphor of lightning . . . both beautiful and deadly. The lead is antithetical to the airiness of a cloud but appropriate to the weight of electricity and the following thunder that emanate from it.

(The Metropolitan Museum of Art, New York, NY Image copyright © The Metropolitan Museum of Art. Image source: Art Resource, NY. © Anselm Kiefer)

In many ways, the beginning of this chapter represents the curricular and philosophical design of my MFA in Photography program at the College of Art and Design at Lesley University, where the scaffolding of the program is built upon art-making, photographic and cultural history, critical and professional studies, and the fluid integration of contemporary media with traditional and alternative photographic practice. These ideas are predicated upon the philosophy that photography is no longer a single entity and unique among the visual arts in its ability to successfully merge established and contemporary technologies and investigation in the art of making impressions with light. It is, more than any other form of visual expression, an ideal nexus of art and culture.

My intention in this chapter, like the ones throughout this book, is to inspire you and perhaps your own students . . . with conceptual ideas that address the creative process of the individual rather than the system, or institution, housing that person. I've included a personal account of the precise moment that I fell in love with photography and felt my life change. We all have experienced this, and it's important for you to read my story in order to remember yours. Equally important, I've included an editorial titled *Visual Literacy: Revolution, Arts, & Mirrors* that expresses ideas that I've been tossing around since my time in graduate school at RISD in the early 1970s.

I will also try to drive home the concept that really amazing ideas don't just come along and surprise you by accident. You need to be working hard at your craft to allow them access. They arrive in the mess of your studio and from the disappointment of your latest "failure."

What you will encounter in this chapter are lectures I've been thinking about, notes from the back of envelopes, stories, opinions, and invitations to try out ideas that I won't spend a lot of time explaining in detail . . . just enough to get you interested so that you will want to teach yourself. I'll cover a few techniques and I will also drop in a lot of alternative light-marking images. I think of this chapter in much the same way that I thought about my secret cigar box as a young boy. Let's begin.

MY FIRST PHOTOGRAPH

Permit me to tell you a story that will describe a moment that you may find familiar. It is a story about the moment when my life changed forever.

In the late 1960s a mystery group of investors, inspired by the idealism of that time, and perhaps Robert Rimmer's book *The Harrad Experiment*, spent the better part of a year traveling the country interviewing art students with the intention of putting fourteen of them together, our expenses paid for as long as it lasted, with the only stipulation being

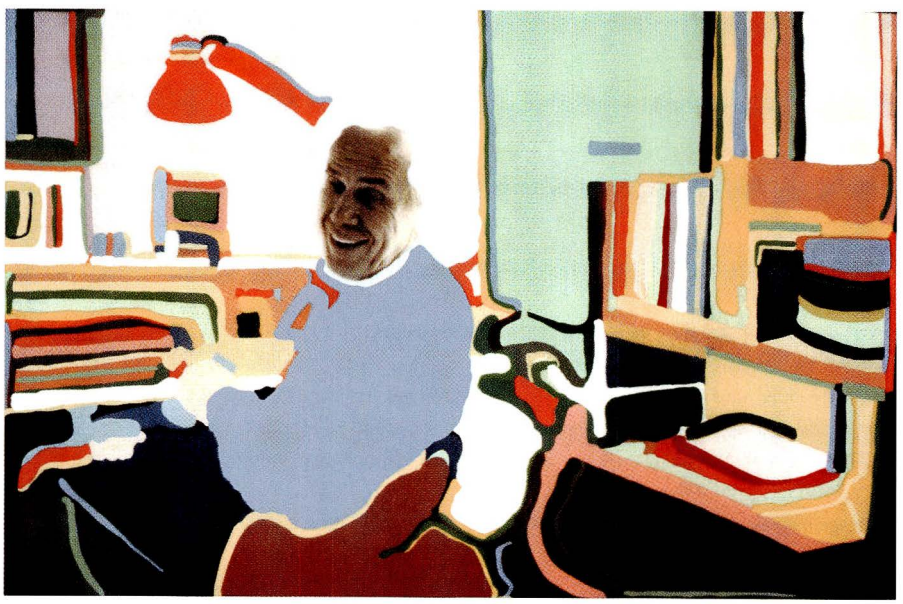


Figure 28–2
Christopher James, *Minor White at M.I.T.*, 1971 (photograph with airplane enamel paints)
One of the things that I enjoyed most, after finishing my graduate studies at RISD, was going to MIT in Cambridge and having disagreements with Minor White about the meaning of photography. For me, it was like being able to go and visit Stieglitz. I knew what I was in for but embraced that unique opportunity to learn. Minor never liked my work very much . . . even after I showed him my special "zone" paints.
(Courtesy of the Artist/Author)

that we work in a medium that was unfamiliar to us. I was tagged, sold my BSA motorcycle to buy a black VW with white wings painted on the side, and moved to an arts-centric commune in Western Massachusetts called the Cummington Community. With my friend Kevin, I constructed what I thought was a darkroom in a run-down donkey barn using opaque black silage plastic from a local farm supply to eliminate the light. In the summer it might well have served double-duty as a sweat lodge.

There was a hose for running water, hooked up to a well pump outside the main barn where we all lived on a single open floor. My mom had sent me an ancient Russian enlarger that she had found in a church flea market that would set a negative on fire if the exposure lasted longer than 9 seconds. My safelight was a caver's headlamp with red cellophane . . . saved from a caramel apple wrapping.

On a run-a-way to New York with fellow barnmates Martha and Tony, I had made exposures with my very first used camera, the exact same model that David Hemmings had photographed Veruschka on purple seamless with in the film *Blow Up*, and I was eager to see if it worked. I also had a manual, *Enlarging Is Thrilling: Or the Joy of Making Big Ones out of Little Ones* by Don Herald, a book

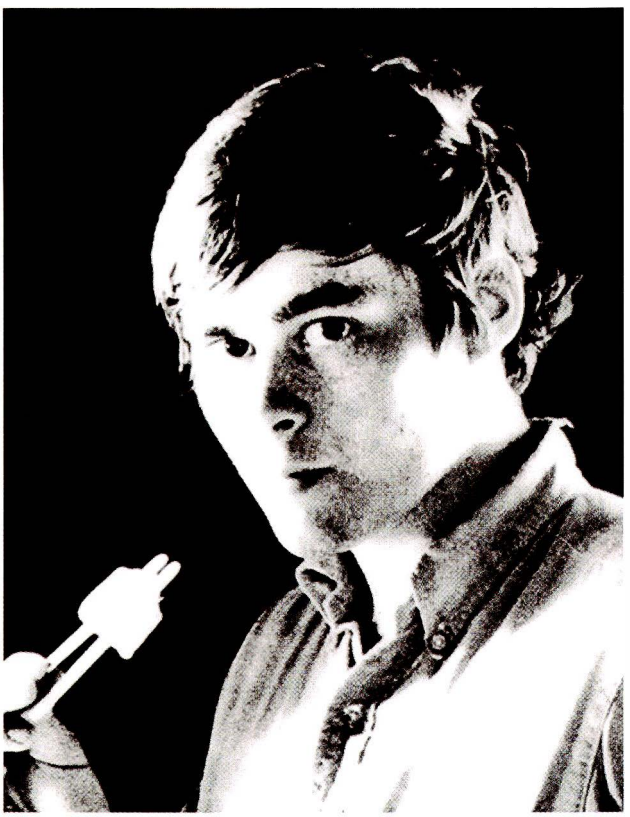


Figure 28–3
Christopher James, *Self Portrait with Popsicle*, Cummington Community, 1968
In the late 1960s I was living in an arts-centric commune in Western Massachusetts called the Cummington Community and had constructed a darkroom, in an old shed, using opaque black silage plastic from a local farm supply to eliminate the light. There was a hose for running water, hooked up to the main barn where we all lived. My mom had sent me an ancient Russian enlarger that she had found in a flea market that would set any negative on fire if the exposure lasted longer than 9 seconds. My safelight was a caver's headlamp with red cellophane saved from a caramel apple wrapping.
(Courtesy of the Artist/Author)

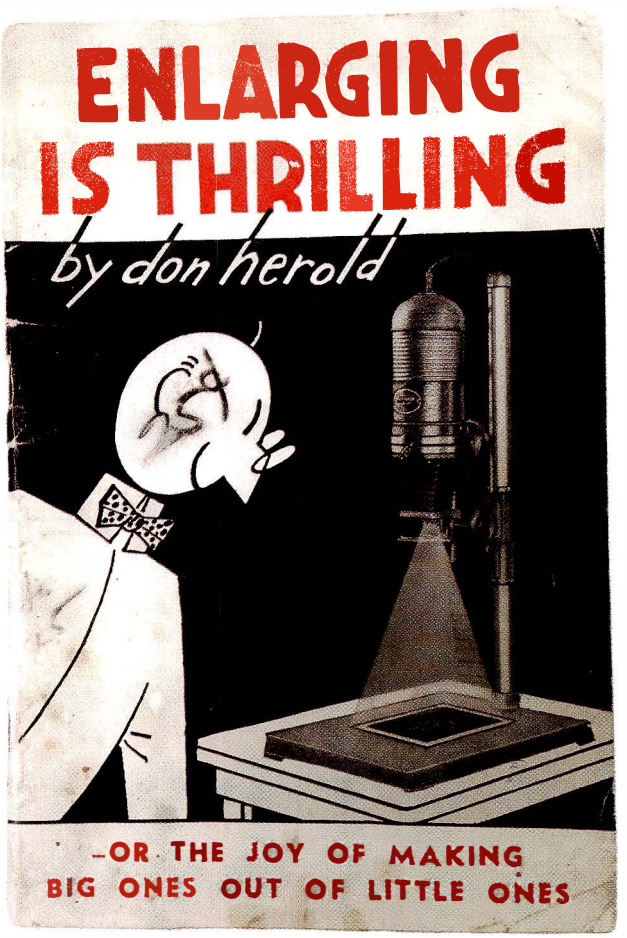


Figure 28–4
Don Herold, *Enlarging Is Thrilling*, 1945
After processing my first roll of film in a tall Galliano bottle, I consulted my only photo book for the next stage . . . making a print. Federal Manufacturing & Engineering Corp printed the book, *Enlarging Is Thrilling: Or the Joy of Making Big Ones out of Little Ones* by Don Herald in 1945 to serve as a manual for their model # 269 enlarger in a suitcase for only $39.50. But wait . . . There's more!
(Courtesy of the descendants of Don Herold)

Figure 28–5
Christopher James, *Sidewalk Supper*, NYC, 1968
I placed the negative in the Russian enlarger's negative carrier and exposed a precious piece of Agfa 111 paper until I smelled the smoke. I took a deep breath, immersed my first paper-based exposure in the magic water, and 20 seconds later a picture of a man eating alone in a Times Square automat began to emerge. And in that very moment, in the midst of my satori, I knew exactly on what the rest of my life would be centered.
(Courtesy of the Artist/Author)

printed in 1945 to serve as a manual for the Federal Model #269 enlarger in a suitcase for $39.50.

After processing my first roll of film in a tall Galliano bottle that I had discovered behind the barn, I set up the shed for printing. I placed the negative in the Russian enlarger's negative carrier and exposed a precious piece of Agfa 111 paper, held down on the table with tape, until I smelled the smoke. I took a deep breath, immersed my first paper-based exposure in a horse's water bucket that held the developer, and 20 seconds later a picture of a man eating alone in a Times Square automat began to emerge. And in that very moment, in the midst of my satori, I knew exactly where the rest of my life would be centered.

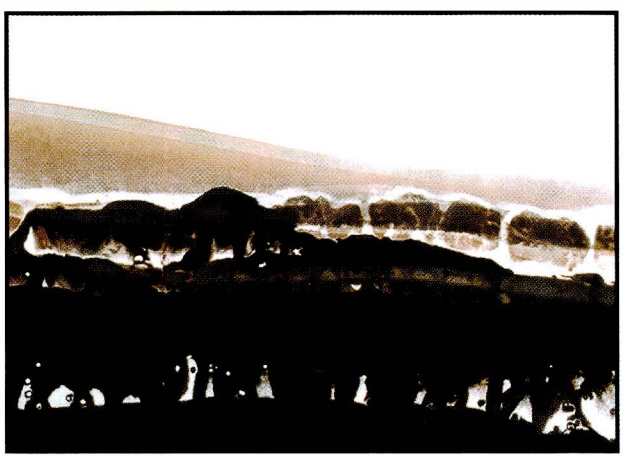


Figure 28–6
Christopher James, *Solargraph #22*, 1971
I made this Solargraph in graduate school at RISD when it had become crystal clear to me that I had to make images that were mine, and not ones that were dictated by academic paradigms regarding what a photograph was, or how it had to be made. This was the beginning of my life making marks with light and chemistry and creating alternative imagery and process.
(Courtesy of the Artist/Author)

VISUAL LITERACY: REVOLUTION, ARTS, & MIRRORS

Visual Literacy

You've arrived at an interesting point in the book. This paper beast is now significantly larger than my last two books, but there are still a lot things I'm interested in talking with you about . . . specifically the definition of visual literacy, the education of young artists with headstrong dreams, and where alternative processes and the integration of photography with all of the other mediums will fit in the grand puzzle of this rapidly changing medium. The inclusion of this essay may initially seem out of context for a book dealing with alternative processes, but it actually couldn't be more relevant. With digital imaging hosting the new "mushy democracy" of photographic

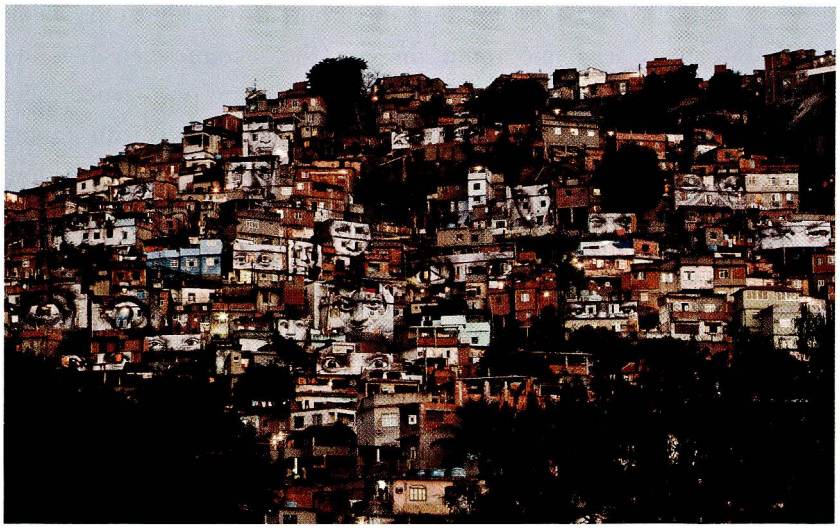


Figure 28–7
JR, *Rio de Janeiro, Women Are Heroes,* 2008
Moro de Providencia is a favela in Rio de Janeiro that is infamous for its violence between the drug dealers and police, poverty, and fragility of structure. It is a complex neighborhood of steep alleys and danger for the unconnected and an odd place to create something so profoundly beautiful. JR is one of my favorite contemporary artists. Working with people from the locale, he has made art an act of access and imagination for the people who live day to day in the favelas, the slums of Paris, and within the walls of separation in the Middle East. There is not enough room in this caption to express my admiration . . . look him up.
(© JR)

expression—one in which the equipment finds the faces, exposes for neutral feeling, and then makes the perfect print—there is literally a *hunger* for the accident and the imperfect raw artifacts of life. The genre of alt pro satiates this need in spades and celebrates, with every attempt, success, failure, and the love of the handmade image and its process.

Photography is the one universal form of expression in which people in many cultures happily participate. I will assume you realize I am making a point and not ignoring the popularity of singing, dancing, and making love. When questioned about the order in which things are rescued when a person flees a burning house, most respondents will say children, pets, and family photographs. That might now be altered to children, pets, and electronic devices. Alas, things change quickly, and the treasured family album has been replaced with whatever has been saved on your telephone.

My students' generation is the most visually sophisticated in history. They arrive from high school with a visual vocabulary that dwarfs that of their parents' generation. They may not know all of the buzzwords and political *art-speak* yet . . . but the ease, and facility, of their visual expression is stunning. So many times I've finished running a critique seminar and thought how amazing it would have been to have possessed the operant visual conditioning they have grown up with when I earned my degrees at the Massachusetts College of Art and the Rhode Island School of Design. That's when I begin to think about *how* they see versus *what*

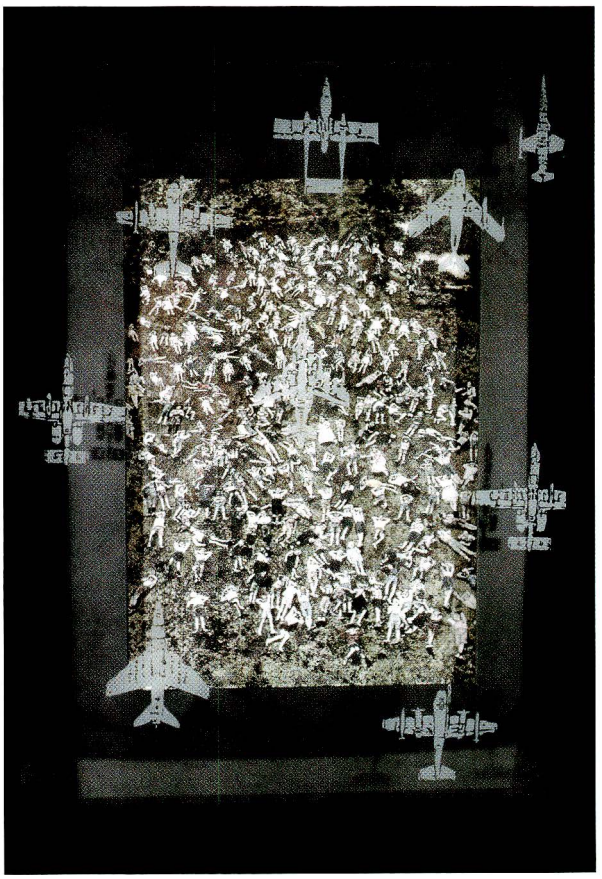


Figure 28–8
Rosemary LeBeau, *I Dream Awake/I Dream of Falling Dolls,* 1998
This piece, by a dauntless and creative artist, really needs to be seen in person . . . and lifted. Like many of Rose's works it begins with a found image that is laser copied and transferred to a substrate. The work is then hand colored and selectively edited within the imagery to discover qualities that were not initially evident. To complete this 24" × 36" piece, Rose placed the image in a box and sealed it with thick glass that she sandblasted airplane icons upon to create the impression of war.
(Courtesy of the Artist)

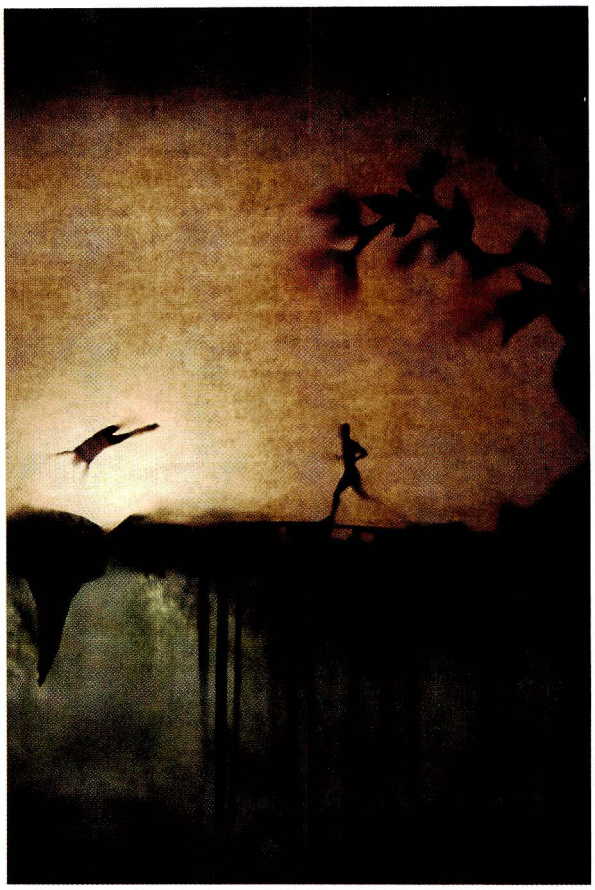


Figure 28–9
Angelina Kidd, *Jumping Into Vortex*, 2013
Continuing the dialogue from Angelina's earlier caption (Figure 27–7), *"The belief of the afterlife can be traced to prehistoric times and it suggests a natural human state to believe in life after life. What we know for sure is that death is inevitable and an equalizer. Life is fragile and short, and grief is inherent with the loss of a loved one. With my light constructions, I do not seek to exploit this emotion but rather to provide a visual salve for my viewer to consider that after death, life will be unknown."*
(Courtesy of the Artist)

they see. With machines and popular media defining what the seemingly easy-to-explain words *good* and *art* mean, the best place to begin the conversation is to tell you what I believe.

For me, visual literacy is not simply the ability to see and identify what is seen. More to the point, it is the capacity to interpret, associate, and contextualize and to cognitively communicate with signs, symbols, codes, marks, signals, and metaphors. A visually literate person draws upon a knowledge base that includes cultural and art history, criticism, and semiotics . . . the academic vessel that sails the sea of meaning and how that meaning is established and understood. Don't get fidgety and impatient here. I won't be going on an academic romp through the incomprehensible and political mine-fields of semiotic and post-structuralist theory, and I promise not to beat on you with important life issues such as modalities, representation, paradigms, and syntagmatic analysis. However, what I will do is offer you a simple and short trip into Critical Theoryland so that you can impress your friends at dinner. What was the joke in Daniel Chandler's *Semiotics for Beginners*? "What do you get if you cross a semiotician with a member of the Mafia? An offer you can't understand."

A Short Trip into Critical Theoryland

I'm not a great fan of critical theory discussions because, like most committee meetings in academia, they eventually distill into endless hours of intelligent people playing with themselves. But since you asked. . . .

This short trip begins with Swiss linguist Ferdinand de Saussure's observations that when considering image or language, one will usually find a *signifier*, or the form that a sign takes, and the signified, the concept it represents. Read that again. A common example of what this means is apple versus Apple . . . a simple fruit popular in biblical dialogues or the company that made the computer I'm working on . . . or in an entirely different context, a tattoo of either of these *apples* inked into someone's flesh for life . . . quite a commitment to the signified. You can see where I'm heading.

Saussure referred to this as a *dyadic*, or a two-part model that defined a *sign*. In this case, each element in the conversation, whether it was the fruit apple or the business Apple, required an explanation. As the explanation was being offered, the discussion and meanings became increasingly complicated because each component required still more interpretations due to its contextual association.

Saussure believed that all languages have their own concepts (the *signifieds*) and sound images (the *signifiers*). He believed that languages have a relationship within the comparison of their elements and that their words and accepted meanings only become clarified by comparing and distinguishing the difference in their meaning to one another.

Figure 28–10
Brian Taylor, *Pavlov's Wife,* 2013 (toned silver print bound in a 15" × 22" artist's book)
My friend Brian writes, *"I always wondered if the Russian scientist, Pavlov, had trouble with his family ruining his experiments by spoiling his dogs."* Here's Brian's vision of the reluctant wife of 55 years, Seraphima Karchevskaya, pampering one of the test subjects, the non-reluctant and spoiled dog. *(Courtesy of the Artist)*

Again, this exercise becomes even more obtuse as the person explaining the words works harder to make meaning of the signs and signifiers . . . ignoring the truth that what something means always changes with each individual listener's life experience or in what social or cultural context it was seen or experienced in. Think of the apple/Apple tattoo etched into someone's flesh forever and then complicate this meaning by adding the context of where that person chose to place the tattoo on his or her body. This would mean that the original meaning of the apple tattoo would *always be altered by context*, whether personal, cultural, political, or in this case, anatomical.

Here's another simple example: Margaret Bourke White's photograph of people standing in a relief line after the great Louisville Flood in 1937 . . . beneath a sign boasting that we live in a country with the "World's Highest Standard of Living."

The American subscribers of *Life* magazine saw this image as an example of charity and benevolence personified, where the hungry and displaced people of Louisville could be cared for by those who were unaffected by the floods . . . the perfect two-dimensional family that hovered above them like gods driving down from Olympus.

America's political and social critics at the time used this identical image in a different way—to signify the

Figure 28–11
Margaret Bourke White, *The Louisville Flood,* 1937
Margaret Bourke White's photograph of people standing in a relief line after the great Louisville Flood in 1937 . . . beneath a sign explaining that we live in a country with the "World's Highest Standard of Living." American subscribers of *Life* magazine saw this image as an example of charity and benevolence, where the hungry and displaced people of Louisville could be cared for by those who were unaffected by the floods . . . that perfect two-dimensional family that hovered above them like gods on Olympus. French philosopher, Jacques Derrida, proverbial "Papa Bear" of the post-structuralists, argued that meaning was simply an endless chain of deferments of meaning and thatthe difference between what is signified and the signifier was the forever-unexplained space in between the two words. And what that means is that context is everything. *(Margaret Bourke-White / Time Life Pictures / Getty Images)*

oppression of the poor, non-white people in America by those above them, including white dad, white mom, two white kids (perched like angel wings on the

mother's shoulders), and a white dog . . . all smiling, chubby, and out for a drive. This cartoon of America, floating above the people in the relief line, depicted the signifiers and the signified simultaneously . . . simply because the medium of photography allowed that confluence to happen.

French philosopher, Jacques Derrida, proverbial "Papa Bear" of the post-structuralists, argued that meaning was simply an endless chain of deferments (remember the apple/Apple tattoo) of meaning and that the difference between what is signified, and the signifier, was the forever-unexplained space in between the two words. And what this means, again, is that context is everything.

A photograph, because of its specific relationship to reality and time, constantly shifts from one meaning to another based upon our personal, cultural, or political perspective and knowledge. A photograph of an airplane flying low over a crowded urban environment meant one thing before September 11 . . . and quite another on September 12.

Thus endeth the short trip to Theoryland.

Creativity and Language

Visual literacy means different things to different people. Following the merger of the Art Institute of Boston with Lesley University in 1998, now the Lesley University College of Art and Design (LUCAD), where I am the director of the MFA in Photography, some important points came to light about culture and context. Here's the proverbial rub . . . the issues relating to visual literacy, and those that are relevant to programs in a professional college of art, are not always in harmony with those in other programs at a parent institution, such as a university. If you dissected our respective paradigms (a favorite academic word that means settling for safe answers and solutions to complex questions) with the same academic scalpel, we would bleed the same color blood, but our blood types would differ, as would our methods of assessment and how we would define *learning outcomes*. But if you put aside the specifics, and internal political agendas, you will begin to recognize that what we do as educators coalesces into a mission with the same goals . . . to allay the fears of imagination, especially of those young artists who often possess great ones, and to inspire individual explorations on the edges of the creative process.

Creativity, to me, is as important as language. It's difficult to be creative if you are afraid to fail . . . just as it's impossible to sing if you are afraid to hum. Nurturing creativity is one of the very few gifts that a parent or teacher can give a child that will continue to evolve over the child's lifetime. The mentors whose influences remain in me are the ones who bestowed the unexplainable gift of how I could teach myself to see. Read that sentence again.

I'm reminded of a story I recently heard from a grade school teacher that makes the point about how confidence and imagination are nurtured. In a first grade classroom, a teacher passed out a piece of paper to each of his students and told them to draw a picture . . . this being the 15-minute portion of the day that the school's standardized curriculum model had set aside for creativity. A 6-year old in the class began to draw, and the teacher came by her desk asked what the picture represented. The girl replied that she was drawing a picture of God. The teacher then asked, "Well, you can't draw a picture of God because no one knows what God looks like." There is a stand-off.

The girl thought about this for a heartbeat and then, looking up from her drawing, replied, "Well, they will in a minute."

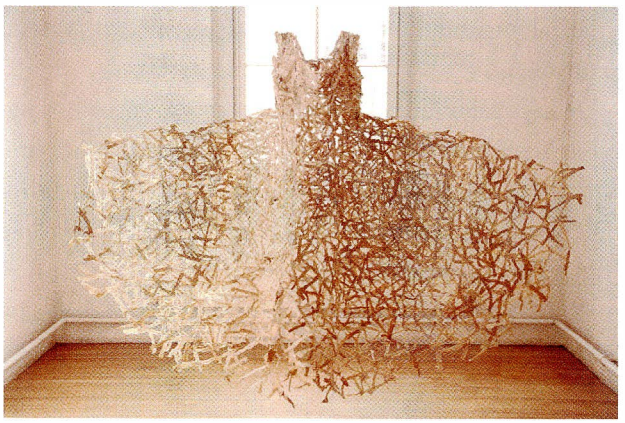


Figure 28–12
Christine Elfman, *Storydress 1*, 2003, (VDB installation)
Christine Elfman's wonderful *Storydress 1* is an installation piece from a series of Van Dyke Brown prints that she made into a dress that is made of torn story books.
(Courtesy of the Artist)

Bauhaus . . . Is a Very, Very, Very, Fine House . . . Fine House

Walter Gropius, one of the founders of the Bauhaus (1918), admired the medieval guilds, the *Bauhatten*, that created the great cathedrals in his native Germany. Gropius sought to emulate that model while creating a cultural synthesis and reconciliation between the atelier, modern art, and the goals of the industrial revolution. His goal was to develop a curriculum that was essentially a *foundation* program in which students were expected to become visually literate through the study of drawing, design, color, and form. Essentially, this model's approach to learning was to create a marriage between art, craft, and technology. This is, as you know if you have experienced it, the traditional structure in most art schools today and has been for nearly a century.

The paradox that arises within this Bauhausian model is that "good" art programs are dedicated to promoting *individualism* while simultaneously graduating students who have been forced to learn their required subject matter in a repetitive, cookie-cutter curriculum that is evaluated through one form or another of standardized assessment. This is a significant disconnect and not at all dissimilar to the way public education is designed and assessed through mass testing standardization and assessment.

The Industrial Revolution and Arts Education

Our present educational system for teaching the arts is predicated on assessment models and values established during the Industrial Revolution in the nineteenth century. Nothing defined that revolution more than the assembly line . . . and the method of assessing a line's success was predicated and dependent upon reaching specific levels of performance, volume, and generic consistency from one object to the next as the object rolled through the process to the consumer. There was nothing subjective about it. If there were no inconsistencies, if the workers adhered to their specific tasks and performed them in the prescribed manner, the line could go faster. Without change, increasing the efficiency of the line meant greater production, and this equated to greater profit for the machine. The concept was so successful that it was totally logical to deduce that what worked so well in the factories could be directly applied to other areas of society. And no area of society was as ripe for this model as public education.

Education was presented as a standardized package and the guaranteed path to employment, success, and a better life . . . as long as the line kept moving. The school was the factory, the children were the products, and they were assessed by assigning grades indicating success, failure, or an average in-between, at defined intervals. If the child-product failed, it meant a failure to meet the defined standard and a return to the beginning of that line, where the child could be remade.

It was a fairly simple task to assess and quantify success in mathematics, science, English, and the like, where learning through repetition, by rote, was the norm. However, when it came to subjects involving imagination, and the creative process, there was a problem applying the assembly line paradigm to success. Grades had to be given, but because it was absolutely impossible to successfully mandate competency in creativity and imagination, a significant disconnect occurred. The standards for creative competency were based on assessment ideals that a school could not possibly define or influence . . . that of an individual child's imagination.

One additional glitch in the system was that the industrial model mandated a connection between the education of the child and that child's eventual ability to be employable. I assume this is where the guidance counselor job was born. The theory was that a literate and productive workforce would make the line move faster and better and that all in society would benefit. Unfortunately, it was clear that not a lot of artists, musicians, writers, or dancers were making a living in art factories or aspiring to become vice president of art. That led to an institutional perspective that asked the question "If immediate employment and success could not be guaranteed, like a car from an assembly line, then what exactly was the point of including it in a curriculum?" As Henry Ford said in 1909 when talking about the Model T options for his customers, "You can have any color you want as long as it is black."

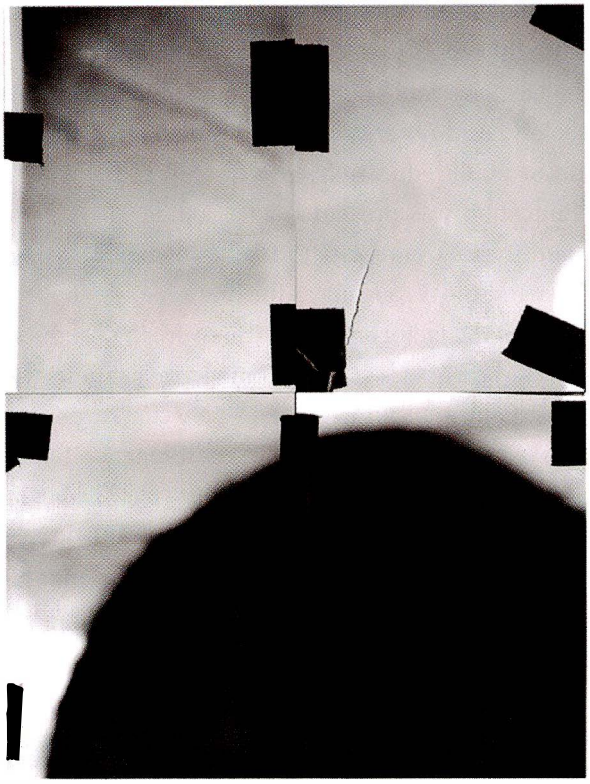


Figure 28–13
Dan Baird Miller, *A Valuable Risk*, 2013
Dan is a recent graduate of the MFA in Photography program that I direct at the College of Art and Design at Lesley University, and this image is a component in his thesis. To make it, Dan constructed a camera that he could be inside during the act of exposure, interrupting the flow of light to sensitized materials and creating the start of a conversation explaining the experience of making images and personal connections to that experience. The piece articulates Dan's solution to the primary issue of image communication and a difficulty in defining a common language to address image meaning.
(Courtesy of the Artist)

But you can't argue with "success," and you can never stop the line. Getting everyone into higher education became so efficient that we determined, in the same way that Susan Sontag reasoned that photographs had become meaningless due to their sheer numbers, that the homogenized, and standardized, high school diploma had lost its value . . . simply because everyone had one.

I'm going to try to close this circle now.

Mirrors and Windows

Many years ago I was sitting in a lecture hall at Wellesley College listening to John Szarkowski, then curator and photography tsar of the Museum of Modern Art, delivering a lecture. I suppose most of us were there to see if we could figure out how to get him to recognize our genius and give us a ticket to the club where you could get a show at MOMA or a Guggenheim Grant. Szarkowski spoke of the valuelessness of photographs and how there were now more of them in the world than bricks. This lecture also served to reinforce Szarkowski's primary curatorial argument that there were two types of photographers (or artists) in the world and they were represented by the metaphors of *windows* and *mirrors*.

The "mirrors" photographers made images that were, for better or worse, describing their personal sensibilities, and this was the primary meaning and intent of their photographs and the engine that drove their individual process. They were their own unique context.

The "windows" photographers made pictures that described information. Their images documented facts as well as commented on the "system" of making photographs. Often their subject was the medium itself and its very scientific, informational, and observational essence. It was clear that Szarkowski had the majority of his curatorial weight in the windows camp (he was transfixed by Atget), but it wasn't perfectly clear that he was ready to announce that the discussion had come to an end.

This hesitation can partially be described by the landmark MOMA exhibition *Mirrors and Windows: American Photography Since 1960*, which he curated in 1978. I was included in that exhibition and attended the opening courtesy of the Phillip Morris Corporation, but for some curatorial reason, several artists, including myself, who were stretching the definition of photography, were not included in the accompanying exhibition catalogue or its index. I've always considered that decision a legacy choice on the part of Szarkowski. And for the record, I carried his seminal book, *Looking at Photographs* (MOMA, 1976), around until the cover fell off.

The late Robert Hughes (try to read everything by him you can find) wrote in a 1978 *Time* essay, "*Everything that happened, one might suppose, happened before a camera; there has never been anything like the sheer bulk of visual documentation left as the residue of a popular-photography culture. People and*

Figure 28–14
Cary Loving, *View,* 2012 (acrylic gel transfer, acrylic paint, ink, and material on wood)
In this photo-transfer painting, Cary combines washes of acrylic paints and inks with digital transfers. There is also a scrap of stained fabric employed as a collage element. The transfers are photographs printed onto laser decal paper and inkjet film positives, which are then transferred to a wood panel using acrylic gel medium. The imperfection of the transfer process, which is unique in each application, suits Cary's intentions that center on memory, time, erosion, fading, decay, and survival.
(Courtesy of the Artist)

events seem ghostly unless they have been verified by a camera. Wars, elections, riots, disasters, communal ecstasies, the speeches of politicians and their deaths . . . all are eaten up by the omnivorous lens, as photography (through journalism) defines the terms of our fictitious intimacy with the world. This intimacy means a ravenous consumption, rather than contemplation, of images." I mean, seriously, how prescient and appropriate is that observation?

In 1978, Szarkowski cynically insisted that most issues of importance couldn't be photographed. This may be compatible with Salman Rushdie's sentiment from *Midnight's Children*: "Most of what matters in your life takes place in your absence." From Szarkowski's *window* view, that perception was not a surprise.

Szarkowki's world of "more photos than bricks" has been superseded by what Robert Hughes saw coming like a train. We are presently swimming in the limitless sea of digital photography, where everyone makes, from a nineteenth-century critical perspective, "good" pictures. I suspect that now, where every camera has a telephone attached, there are more photographs made every day than in the entire twentieth century. If Hughes was concerned about volume leading to ravenous consumption rather than contemplation, and Szarkowski was cynically insisting that issues of importance in life cannot be photographed, then the sheer volume of digitally made images defined by a social networking aesthetic, and stored in increasingly humongous archiving systems, is a debate destined to grow more animated in the future. It seems to me that the choices are more clarified now than ever.

The long running show of silver-based gelatin films and paper is coming to an inevitable end. This particular image-making system will probably be designated as an official alternative process in the next few years, but since it is not yet on life support, I have refrained from including it as a separate chapter. The people who loved photography for its accidents, expression, and unpredictability are moving in droves to alternative process image making or investigating how photographs can be integrated into all mediums. This transition is not at all unlike the painting and printmaking tsunami that swept through the contemporary art world in the late 1950s and early 1960s, and it is healthy for the genre. I am not saddened by the change . . . it is a great opportunity.

The Future of Photography Is in Its Past

Several pages ago, I wrote that visual literacy is the capacity to interpret, associate, and communicate signs, symbols, codes, and marks, and that for a contemporary

digital photographer, being immersed in the history, criticism, and semiotics of the medium could lead to being in perfect harmony with the new "windows" definition ushered into our language by Szarkowski back in the 1970s. In fact, they seem made for one another. Digital photography might well be a marriage of Jef Raskin and Donald Norman's "information appliance" and Szarkowski's "windows," where an image is as much about the information recorded as it is about the system of archiving and delivering that information. Think social networking and the traditional family album and apply the last sentence to those systems of image delivery.

In his 1936 essay "The Work of Art in the Age of Mechanical Reproduction," Walter Benjamin wrote about a shift in the perception of works of art as a result of the ease of reproduction of that art through the medium of photography and film. He referred to the *aura* of an original work of art, its unique authority to inspire a sense of wonder, and the loss of that aura through mechanical reproduction of that art. While Benjamin acknowledged that artistic reproduction, such as acolytes of a master painter painting canvases and frescos in the style of the master, had existed throughout history, mechanical reproduction completely altered the experience and authenticity of a work of art. John Berger echoed this sentiment a few decades later in his seminal 1972 text *Ways of Seeing* when he wrote, "For the first time ever, images of art have become ephemeral, ubiquitous, insubstantial, available, valueless, free." This hike through the jungles of critical theory continued in the writing of others such as Susan Sontag and Barthes, but it was Benjamin who carried the machete.

From the mirrors perspective, visual literacy emphasizes and celebrates the light markings as well as the maker of the image. In alternative and integrated process printmaking, the hand and eye are equal partners in the crafting of the image. The print itself is a sign, a symbol, and a mark . . . each artifact in the image a reflection of the process of making a print by hand . . . thus bestowing a degree of *aura*. Obviously, there are no absolutes in this conversation, and valid creative issues arise in every form of expression. I know many digital artists who are deeply involved in their art and the very relevant issues of visual literacy that can be explored quite well within their discipline. In fact, the addition of digital technology to the Bauhaus menu would be an ingredient of which Gropius would have greatly approved.

Figure 28–15
Sarah Nesbitt, *Losing the Collection*, 2011
Sarah Nesbitt's work is often a puzzle and very successful at pulling the viewer into the play of conversation, vision, and meaning. Sarah writes regarding this image, *"A handful of famous photographers have attempted to bury, burn, or otherwise hide their negatives to hide/escape from history. Several of these photographers never lived to see their negatives resurface to much historic fanfare and acclaim. The negatives presented in* Losing the Collection *have survived underground only to resurface later . . . many of which went on to serve a great purpose when recovered."*
(Courtesy of the Artist)

I believe the future of photographic, and photographically integrated, image making will find its nutrients in its past and in the philosophical foundations that ground the physical act of making art. Contemporary alternative process artists are, as Lyle Rexer said so well, members of the *antiquarian*

Figure 28–16
Paul Adams, *The Clam Digger's Wife and her Clandestine Trampoline,* 2012
For several years I have been a big fan of BYU photography professor Paul Adams's visual magic-realism and his superb control of the syntax of digital storytelling and image translation in photo polymer gravure. One of the cool things about this piece is the title of it. It amplifies, for me, the visual meaning of the image well beyond the piece itself.
(Courtesy of the Artist)

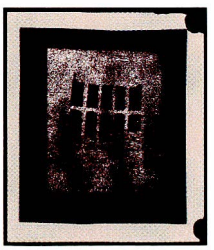
avant-garde . . . a movement defined by individual humanistic sensibilities, cultural and critical perspectives and influences, and skilled hands in harmony for an equally refined conceptual vision. Alternative process image making is not about the technique employed, the camera, or the use of digital or film capture. Nor is it about the "artifact" or accident within the image that represents a contemporary artistic gesture that miraculously makes an image artistic and expressive. Alternative process image making has its heartbeat strongly allied to a tradition of making images by hand, using light and chemistry. It is driven by a curiosity to see where a process will lead the artist and his or her imagination, and that living philosophy is the soul of this book. It is, in my mind, a representation of the *new photography.*

THE PLASTIC CAMERA

This section of the chapter covers A Little History of the plastic camera beginning with the Great Wall Plastic Factory in Kowloon in the 1950s and describes the attributes and varieties of this great toy . . . and serious piece of art-making equipment. The primary reason for the plastic camera to be in this book, as it really isn't an alternative process, is to make a point about the value of *play* in art.

If you are a teacher, at any level of mentoring, or an artist in need of a wake up call as to why you decided to fall in love with photography in the first place, this is your ticket to happiness. If you are totally invested in digital, there's something for you here as well . . . simple modifications and custom cheap Holga lenses for your very expensive digital adult camera or iPhone.

Figure 28–17
Christopher James, *Market,* Cairo, Egypt, 1992 (plastic camera)
This image was shot in an open-air market in Cairo, Egypt, with a modified plastic Diana camera. It is a piece within a series dealing with final moments, in this case, of this angel-like chicken's life. An inter-negative was generated on a piece of SO-132 film (sadly, no longer made) and used to make this print.
(Courtesy of the Artist/Author)



A Little History

Once upon a time . . . there was a novelty manufacturer in Kowloon, Hong Kong, called the Great Wall Plastic Factory. Its contribution to the history of photography

Figure 28–18
Lucy Soutter, *Dog Run*, Hyde Park, London, 1988
Lucy, a former student of mine at Harvard and author of *Why Art Photography?* and *Role Models: Feminine Identity in Contemporary Photography* is a professor in the Department of Critical and Historical Studies at the Royal College of Art. One of the great things about the plastic camera is its predilection for illustrating the moment-to-moment simplicity of simple and perfect memories, like taking the dogs for a run, without the need of high-definitive optics. *(Courtesy of the Artist)*

was molding several pieces of plastic into a Diana camera that made nifty looking images. The Diana, with mandatory taping of every single joint and seam, and a few other modifications, became the camera of choice for photographers seeking alternatives when making images that expressed what they felt, rather than living with the optical perfection of modern photographic equipment, or as we used to refer to them, "adult cameras."

Beginning with its development in the late 1950s and early 1960s, the Great Wall Plastic Factory manufactured and sold the Diana and the Diana-F, a special designation F-model because it came with a built in flash, for about $2.25 apiece. Shutter speeds were tenaciously capricious, but if you were really curious you could calibrate and test your camera's shutter and find that its speed ranged between 1/15 and 1/250 of a second, depending upon the age of the shutter spring inside. Apertures were equally unpredictable, but most cameras featured apertures that fell between *f*4.5 and *f*16 . . . not too bad for a $2.25 camera.

Focus was another whimsical characteristic, and it was essential that you knew just how out of line your camera's viewfinder was in order to capture what you wanted on film. Many plastic camera shooters carried a bag full of cameras, each with the specific camera's idiosyncrasies scratched into the body for identification. Shooting with them requires calculations akin to a sniper accounting for wind and distance. Eventually, desiring the plastic lens but tired of the bag of cameras, I had one of my Dianas fitted with a Graflex shutter and the least-scratched single element plastic lens in my bag.

In the years since the Great Wall Plastic Factory created the Diana, the plastic camera has re-emerged with nearly the same shape and parts but with a different name attached to its body. Some, like the unpredictable Diana, are considered treasures and sell for premium collector dollars on eBay. Other plastic camera types held together for a very short time and were shunned due to chronic failures or, ironically, too much perfection in the plastic lens. Among the cameras that have fit the prerequisites of the plastic toy camera are Anny, Arrow, Arrow Flash, Asiana, Banner, Debonair, Diana, Diana Deluxe, Diana F, Dionne F2, Dories, Flocon RF, Hi-Flash, Holga, Lina, Lina S, MegoMatic, Panax,

Figure 28–19
Jonathan Bailey, *Playa del Carmen,* 1984
Jonathan is one of the champions of plastic camera simplicity and elegance . . . as this image well represents.
(Courtesy of the Artist)

Photon 120, Raliegh, Rover, Shakey, Stellar, Sun Pet 120, TraceFlex, Tru-View, Valiant, and Windsor. Of these, the most commonly found these days is the Holga.

The Holga is occasionally too well made and predictable for me to feel emotionally connected to it. For me, in order to be considered a true and worthy toy camera, the following qualities and attributes have to be present: a mysterious shutter speed, minimal aperture control, no actual way to focus in a predictable manner, a romantic interpretation of subject and light, the potential for disaster, and infinite charismatic charm, and it must be cheap enough to unload and give away to deserving strangers if they are smitten by the toy. There is a certain Zen-like peace attached to the act of making pictures and not knowing if they will come out. Read Eugene Herigel's *Zen and the Art of Archery* (1953) for an explanation of this point. This is the book that was a wide detour on the artistic road map for the abstract expressionist painters of the late 1940s and 1950s and one that I still assign to beginning students if they appear too invested in making perfect photographs. What I tell them is that the hole that the arrow makes in the target has no relationship to the shape of the arrow or how long it took the archer to send the arrow into that target.

Toy Camera Philosophy

Throughout the 13 years I taught at the Carpenter Center for Visual Arts at Harvard University, and for the last 23 years at the Art Institute of Boston at Lesley University, I've worked tenaciously on eliminating the myth of "great equipment equals great photography." My intent has been to create an attitude in my students about image making that has, at its core, the love of craft, image, and printmaking married to the act of play—the one truly universal learning process that all living things with faces enjoy and share in common. I want to instill in my students several salient and critical truths regarding learning. These are closely tied to the beliefs about creativity that I articulated at the beginning of my career—and the beginning of this chapter.

Learning Truth #1 You have to love doing something before you will invest your time and resources into learning to do it well.

Learning Truth #2 Almost everything you do really well in your life, outside of such natural gifts like breathing and digesting, you will teach yourself.

Learning Truth #3 Play is the most effective and persuasive method to teach anyone anything. To paraphrase Aristotle, ". . .play and introspection are the only two human pursuits that are engaged in just for the hell of it."

With that premise in mind, at the beginning of each semester or workshop, I continue to purchase a few dozen plastic toy cameras and make a gift of them to each student. Initially, the cameras were the classic Dianas, then Banners and Dories. I would also provide a roll of black gaffer's tape to ensure a light-tight toy, although the Holga has almost eliminated this need, and a couple of rolls of 400 ASA 120 mm film per student. Ilford has a nice 3200 ASA speed film, which is terrific for the low-light plastic camera experience. In the past few years the Holga has improved and now features foam pads behind the film spools, preventing the *dreaded fat roll* and a push/pull lever to switch between regular and time exposure modes. I fear it is getting close to being too good.

Figure 28–20
Amanda Cole, *Locked Out*, Boston 1991
One of the great things about shooting with a children's toy camera is that you can photograph the most awkward situations and get away with it because it's a toy. A plastic camera is not political or judgmental, and it simply makes pictures of the way it is. This is an image from one of the best practitioners of the machine, my friend, Amanda Cole.
(Courtesy of the Artist)

Figure 28–21
Christopher James, *Morning*, Calcutta, India, 1994
Somehow, trying to describe that morning in Calcutta with anything other than a single plastic element toy camera would have been inaccurate. An adult camera lens, regardless of its perfection, could not possibly have recorded what I was feeling when I made this shot.
(Courtesy of the Artist/Author)

I would ask my students, as I have in every foundation class, to put away their sophisticated gear and their perception that good equipment could mask, and make up for, any shortcomings in technique, imagination, and creativity. I offered them the opportunity to experience, with their new "toys," several significant things that I call the Five Plastic Virtues.

The Five Plastic Virtues

Plastic Virtue #1—The True Memory

The plastic camera is an image-making tool that records life the way it is remembered rather than the way a sophisticated and conventional lens, far more perfect than any human eye (your basic F1 experience), renders it.

Plastic Virtue #2—The Element of Gesture

Gesture is a creative device and a key element of personal expression in all of the arts. Unfortunately, due to the technically dependent nature of the medium, photographers have traditionally been unable to indulge in this characteristic . . . unless something goes wrong and the artist is lucky, or has the know-how and experience to translate the accident into a creative option. Gesture is a complicated thing to locate in a photograph, and an even more difficult treasure to access in one that is made with digital tools. Photoshop filters or iPhone apps are only able to provide a simulation of gesture. In the alternative process arena, with all of its hand-applied emulsions and sensitizers, and opportunities for failure, gesture becomes part of the photographic equation.

Plastic Virtue #3—The Contentment of Being Anonymous

The nice thing about using a "toy" to make your art is that only those with a similar experience will take you seriously. In this context you may be a little bit like Jacques-Henri Lartigue, who was able to produce images of great energy and beauty in part because he was a 9-year-old child and no one felt threatened by

Figure 28–22
Rebecca Welsh, *Hydrangea*, 2007 (digital plastic bag camera)
In the last few years, my wife Rebecca has been working hard to humanize the syntax of digital photography, a system of image making that is more often about signifiers of the system than the subject of the image. An issue that is most relevant to her work is the recording of gesture and emotional light that was so compatible with film and so complicated with pixels. One of her simple solutions . . . a plastic zip-lock bag.
(Courtesy of the Artist)

his camera or his interest in making images with it. A beginning student can move about freely, encountering curiosity rather than suspicion . . . even in this odd paranoid era of red and blue politics.

In my own experience, shooting in many different cultures and countries with nothing but my trusty and indestructible Dianas (the crème de la crème of cheap photographic equipment), I have been able to photograph in places where "real grown-up" cameras are forbidden and unwelcome. As an aside, the confessionals in the Vatican, where you are not allowed to photograph, make exceptional low-light changing bags for switching film or salvaging the occasional fat roll.

Plastic Virtue #4—The Pleasure of Simplicity and Play

A plastic camera has few qualifying controls and thereby eliminates the problem of doing something wrong . . . a great relief to a beginner. The cameras are inexpensive, incredibly simple, and generally sell for under $25.00 . . . although I saw that the Sundance catalogue is selling them for $75.00 because they are now so chic. This particular version of the camera is accompanied by a useless roll of black tape.

There are two aperture settings, sun and sun or cloud with lightning bolt, which doubles as a hot shoe setting. There are also four focus options: a contemporary lonely single person (you'll be shooting in this setting most of the time), a 1950s Disney-definition of the perfect nuclear family, an academic committee, and the mountain range of your choice. The camera can be dismantled, modified in an infinite number of ways, and rebuilt to allow you to achieve specific image-making goals.

Plastic Virtue #5—Plastic Inspiration

Due to the utter simplicity of these cameras, they can be thought of as tools rather than machines, and their output as gifts. The great thing about the play/learning duality is that almost everyone, from beginning student to experienced photographer, learns to love the process of image making while exploring the techniques that are traditional and essential to the medium. Once a student is in love with the process, much like falling for a cuisine, a culture, or another person, then he or she will be eager to digest the nuances and beauty of that process's language.

As for the argument that the plastic camera is a gimmick, and that it does not teach a person how to be a photographer, I ask critics to remember that photography is simply making marks with light. I would also pose this question: *Where is the greater value to a young artist: learning through positive play, mistakes, and failures or learning to use technically predictable tools and assignments that may not allow*

Figure 28–23
Shawna Suffriti Baruh, *Living*, 2005
Shawna, a former student of mine at the Art Institute of Boston, made this atmospherically rich image of her friends surfing in the fog of Cape Cod.
(Courtesy of the Artist / Shawna Baruh)

for fortuitous mistakes and interesting failures? To me, the indelible benefit of process is in the play and the love of making images that are unexpected and personal. The philosophical difference is the gift of a lifetime versus the perfect technical information of the moment. Seriously, do you need a manual to teach you how to kiss someone you love?

The plastic camera is one of the best solutions to the problem of creative lethargy. The expense and replacement costs are minimal, and thus, it also addresses concerns of equal quality equipment being available to all students by putting the same camera and technology in each student's hands. It also generates a willingness to play within a technology-based learning process. Best of all, this "toy" will mold a person's affection for seeing and photography for life . . . rare achievements for any learning process.

PLASTIC TIPS

The Lens Cap Is a Good Frisbee . . . Throw It

Recycle the lens cap immediately. You are using a single-element plastic lens and it doesn't need protection.

The Viewfinder & Lens Are Only Remotely Connected

The viewfinder and the lens are two separate parts that are only remotely in sync because they both point in the same direction.

Shutters Are Meant to be Taken Apart

If you want a very low-tech solution to the shutter speed issue you may opt to remove the entire shutter mechanism from the camera and use the lens cap as a shutter. I recommend this technique for very low light situations. The new Holgas have a time/bulb setting lever that makes this all pretty elementary.

The Dreaded Fat Roll

A *dreaded fat roll* situation is when your plastic take up spool, also referred to as the *free gift*, on the right inside of your camera doesn't roll the exposed film tightly enough. This means that it is increasingly difficult for you to turn the advance winder. The new Holgas have foam pads in the camera, behind the

Figure 28–24
Christopher James, *Secret Inflator Hose for the Great Pyramid*, Giza, Egypt, 1992
A plastic toy camera image . . . and my random thought while making it in Egypt.
(Courtesy of the Artist/Author)

plastic spools, to prevent this problem, but I would advise carrying some tinfoil with you to wrap the film in, just in case.

Finally, lighten up a little . . . this is a toy you're working with. If you approach the plastic camera with the proper attitude, it will reward you with all of those great feelings you had when you first decided that being a photographer was a perfect way to spend your life.

The Digital Plastic Toy Option

For all of you digitally raised image makers . . . if you want to experience the thrill of imperfection and gesture in your light markings, and are on your way to alternative process image making, here is how you can have it both ways. Two of the web sites that are presently offering a cheap Holga lens to fit snugly on your expensive DSLR or iPhone camera are http://www.photojojo.com and http://www.holgadirect.com. All you need is about $30.00 and they can fix your plastic camera lust with a cheap plastic lens that mounts directly on your camera's body.

Figure 28–25
Brady Wilks, *A Poem Could Best Describe*, 2012 (acrylic gel lift transfer to wood)
Brady's *A Poem Could Best Describe* is an acrylic gel lift transferred to wood. Brady's primary intention is to marry the syntax of the process so that it seamlessly supports the visual and symbolic relationship to the subject matter.
(Courtesy of the Artist)

Here's how Photojojo phrases the pitch: "*Since its invention in 1982, the Holga has been the king of toy cameras. If you've seen a fantastic lo-fi medium-format shot with some vignetting, lens flare, and funky light leaks, chances are good it was taken with a Holga. Now you can get the same great Holga shots with your DSLR. In fact, you can get thousands of 'em—play around as much as you want, since you don't have to pay for that pricey medium format film or wait for it to be developed. Go nuts. You can even take Holga-style video with your DSLR. How cool is that?*

"See, magic is real, and it can be yours—all yours!!!"

A little excessive in the marketing perhaps, but you get the point.

IMAGE TRANSFER PROCESSES

One of tools that I enjoy using quite a lot is the color copier. Like a scanner, it's quite like a very large and expensive plastic camera . . . great for playing and discovery with very few expectations for image perfection. One of the most conventional, versatile, and graphically interesting options involves breaking down the thermographic dyes on the copy with a solvent and transferring it to the paper, fabric, or ceramic of your choice. For many artists influenced by the work of people such as Robert Rauschenberg, this transfer stage is the beginning of a new way to express oneself. The following techniques are a few of the ways that you can transfer copy images. Later in this chapter we'll discuss an equally interesting transfer system using digital prints. But first, since we are about to get into copying images, let's have a short discussion of copyright.

"©"—Copyright

Copyright (©) refers to a constitutionally mandated law protecting original creations by artists, authors, and anyone else who converts an original idea into a tangible form. Intellectual property reflects a different bundle of ideas and deals with issues that are the products of the mind and intellect. Oddly, he writes with a touch of sarcasm, this concept is not entirely understood by anyone and is the matter of quite a few controversial encounters in the courts between artists and suits.

Figure 28–26
Patty Kennedy-Zafred, *Women of Color,* 2011
Patty is a quilter who works with fibers, photographs, photographic archives, and image transfers with the intent of telling a story through images, associations, and memories. She is a quilt maker in the tradition of curating a family or cultural history within the utility and syntax of that craft.
(Courtesy of the Artist)

In these postmodernist times, when the value of that movement's stature has been impaired due to its often incomprehensible and over-inflated language, it is often difficult to differentiate between an original idea, the expression of that idea, the work itself, or a physical commentary about the making of that work.

The term *postmodernism* originally described the practice of appropriating an architectural style from the past in the design considerations of contemporary building . . . Doric columns on a ranch house, for instance. This term has come to represent work that exhibits a reference to, or inclusion of, evidence of the culture that it originates from. For even more confusion on this pressing critical matter, find a current MFA candidate and ask for an explanation of the debate surrounding modernism and postmodernism theory.

Under copyright law, only the tangible expression of an idea is protected. Regardless, conceptualization and appropriation are non-contact sports and it is quite common to find images from contemporary sources incorporated into the work of active artists.

In collage, digital montage, and interdisciplinary works of art, there is always a risk of infringement, but it can be argued that fair use, parody, commentary, and reinterpretation do not constitute a violation. It is my understanding that as long as the appropriated imagery is altered in an original way, and sufficiently expresses an artist's original intent, it is not considered an infringement on copyright. Making an acrylic lift of a portion of a reproduced image in your work may well be free of litigation issues, unless you happen to become rich and famous. If you feel clarification is needed, I recommend that you click on Boston arts lawyer Drew Epstein's informative web site at http://www.photolaw.net. Drew is a specialist in photographic and artistic copyright law and a nice guy as well.

Copiers allow you to appropriate and utilize almost anything in print as long as you alter the original concept, form, or meaning in the process of expressing yourself. As a rule, copyright problems occur when there has been little effort to create a personal perspective or reinterpretation on an appropriated image. Appropriated work that is derivative, that is, work that is *derived* from another source and that expresses a *different intention* in an original manner, appears to avoid copyright infringement issues. Also, any image from the Library of Congress is also free and clear of copyright under "fair use" because you, the taxpayer, paid for it. There are guidelines, of course, and you can find those here: http://www.loc.gov/rr/print/195_copr.html.

Most estates with ownership rights recognize that a serious artist who takes an existing work and alters it, with concepts, alternative materials, syntax, and context, has simply created another work of art using existing material. This is Sherri Levine's rebuttal to the critical rejections of her found historical revisiting. If Walker Evans can find the migrant mother, how is that any different than her finding a picture of the migrant mother and making a picture of a Walker Evan's picture? She has a point, and only graduate students, young curators, and academics are likely to appreciate it in total.

On Michael Mandiberg's web site, http://www.aftersherrielevine.com, there is an opening statement that defines the discussion nicely. I'm hoping he doesn't mind if I borrow it . . . that's an ironic joke.

"*In 1936 Walker Evans photographed the Burroughs, a family of sharecroppers in Depression*

Figure 28–27
Patty Kennedy-Zafred, *Dawn to Dusk—The Boys of the Mines*
In this quilted work, Patty has incorporated the Library of Congress images of Lewis Hine, taken between 1908 and 1924 and made on behalf of the National Child Labor Committee. The images documented the working and living conditions of working children . . . in this case, the children in the mines. Patty's quilt, made of fibers, fabric, and transfers, pays homage to Hine's investigative photographs and their influence in altering the child labor laws in the United States.
(Courtesy of the Artist)

era Alabama. In 1979 Sherrie Levine rephotographed Walker Evans' photographs from the exhibition catalog 'First and Last.' In 2001 Michael Mandiberg scanned these same photographs, and created http:// www.afterwalkerevans.com *and* http://www.aftersherrielevine.com *to facilitate their dissemination as a comment on how we come to know information in this burgeoning digital age.*

Here on AfterWalkerEvans.com *you will find a browsable selection of these images. Links to the high-resolution exhibition-quality images to download and print out. Along with a certificate of authenticity for each image, which you print out and sign yourself, as well as directions on how to frame the image so that it will fulfill the requirements of the certificate.*

By building the image's URL into the title the images are locatable and downloadable by anyone who sees or reads about the image. By distributing the images online with certificates of authenticity, the images are accessible by anyone. Unlike the work of the late Felix Gonzalez-Torres, known for his spills of candy and stacks of paper from which the viewer can take a piece of, though the sculpture stays complete because the owner possesses the certificate of authenticity, the right to reproduce the certificates here is used to insure that each satellite image be considered with equal authenticity, not the opposite. This is an explicit strategy to create a physical object with cultural value, but little or no economic value."

How a Color Laser Copier Works

When you make a copy on a color laser copier the machine assembles four colors—yellow, cyan, magenta, and black (CMYK)—to form the final image. The photoconductor creates "charge images" using blue, red, green, and white illumination in successive order and then uses those colored images to form image patterns of yellow, cyan, magenta, and black toner particles. These toner particles are then superimposed to form the final image. The copying entails a stage called "fusing." This fusing process permanently bonds the thermographically sensitive toner to the paper. When the loose toner image on the copied paper reaches the fuser unit, the image made of toner particles is fused to the paper by means of heat, roller pressure, and silicone oil.

Color copiers are part of an ever-expanding family of contemporary electronic imaging systems that are adding to the myriad options we have as visual artists. Laser copies from these machines are capable of producing a wide variety of output, yielding both positive and negative imagery that can be used in your work. The potential of this technology is seemingly unlimited . . . as digital compatibility improves and home computer and printer capabilities become more cost accessible. The film and paper images produced by these disparate sources can be utilized as intermediate and final stages, and as appropriated additions, in the translation of your creative process. A few of the examples of this might include the manipulation of existing imagery, fabric transfers, montage, collage, drawing,

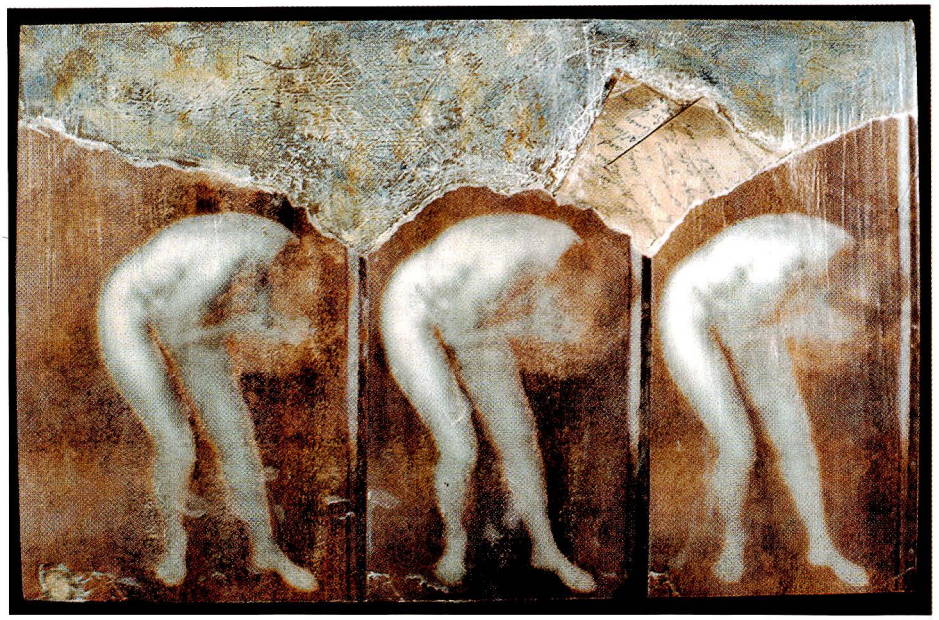


Figure 28–28
Donna Talman, *Presence #12,* 1998 (solvent laser copy transfer, batik wax, and wood)
For the past several years, Donna has been intensively exploring alternative photo processes and the possibilities of image transformation. She is less drawn to a camera's objective reality and more to the psychological, emotional, and spiritual aspects of existence. Her approach is to transform images in a way that combines reality with these other, less recordable, elements. Donna created this compelling montage by solvent transferring laser copy images and incorporating batik wax, resists, and wood in the transfer process. *(Courtesy of the Artist)*

sculpture, digital morphing, and giant modular murals. Using the copier to create CMYK-separated negatives and/or masks for gum bichromate is particularly effective and cost efficient.

In any event, there are a few things to keep in mind when working in this genre. When ordering copies, ask that your copy be printed in "mirror mode" so that when you flip it over to transfer to another paper, the image will be "right-reading." When your intention is to transfer the laser copy image, ask that it be intentionally overexposed. Always have your black-and-white images copied as if they were in full color CMYK mode. This request adds additional layers of dye to your paper that will make for a more saturated transfer since there is more toner on the copy.

Materials You Will Need

- Several copies of an image; high-quality color, or black-and-white, laser copies
- A quality substrate: paper such as Arches, Lana, Fabriano, Rives BFK, or Arches Platine or a fabric such as canvas, silk, or cotton
- A piece of Plexiglas larger than the paper or fabric that you are working on
- A cheap paintbrush or woodblock printing brayer
- Tape, scissors, PO Blender pens for smoothing color, and assorted art toys
- A commercial solvent such as Kleen Strip®, oil of wintergreen, or citric acid, all of which are easy to locate

Be really careful with paint strippers like Kleen Strip®. They work very well, but the fumes are horrendous and they eat most surfaces they come into contact with—including your skin, the paper cup you put the solvent into, and your desktop. An excellent solvent is Duracryl®, an automotive painting solvent. This product works very, very well and is great if you can find it. Check out automotive supply businesses or body shops.

Solvent Transfer Technique

Begin the process by placing your paper on a hard and clean surface such as a piece of Plexiglas because that material will stand up to the solvents and save the finish on the table surface.

On a light table or window, register the copies and tape them together at the top. Lay them face down on the paper that you are transferring to and tape the registered set on the receptor paper. This allows you to check on your progress while you are working, without losing your registration. To facilitate this registration, do this . . . trim each of the copies (three or four will be fine) at the top so that when they

are registered, each piece of paper will be slightly different in length from the others in the group but still in perfect registration where it matters . . . in the image portion. This technique will allow you to make multiple transfers of the same image in registration on the paper by simply cutting off a used copy and flipping down to the next one in the pack. When the copies are registered and taped together, tape the corners down so that the copies and final print paper stay in one place. Then prime the receptor paper with a coating of the solvent.

Next, flip the first laser copy face down on the "primed" receptor paper. Doing this means that your print is now reading backward, which is why you ask for the "mirror setting" when getting your copies made. Dip your brush in the solvent and quickly coat the back of the first copy. Now begin to burnish the laser copy as if you are pressing the copy's image into the receptor. You may use a woodblock brayer, a stubby brush, or a metal or wooden spoon for this step, although the spoon may show lines. You may add more solvent to the back of the first copy if necessary, and if you don't get the density you are looking for, all you have to do is remove the first copy page and flip the next one down to repeat the process. There is no need to coat the base paper a second time. Doing so will likely mess up your first transfer.

Think about working in a grid pattern or in small areas, in sequence, rather than as a single transfer operation. You will see the image as you work, and when the first sheet is completely painted, lift it up very slowly and check your densities. If you are satisfied, then you are done. If not, tear the copy that you have been working on away from the registered stack and flip the second copy in the set down on the receptor paper. Repeat this process until you are happy. Color transfers almost always take several sheets to give the saturation you will likely be looking for. Black and white transfers take fewer sheets but tend to get "gooey" as you lift more transfer copies off the receptor paper. Remember to lift the donor copy slowly from the receptor paper that you are transferring on.

To complete and fine-tune your transfer, you can use PO Blender pens on the finished print to smooth any rough areas or flaws. These blender pens can be found in almost all art supply establishments, or online art stores, and are common tools for graphic designers and illustrators. PO Blender pens are filled with a clear solvent and come in a variety of tip widths.

I have used citric acid, all natural Citra-Solv®, and oil of wintergreen in place of the more toxic commercial solvents and have been quite pleased with the results. Oil of wintergreen works very well but leaves an everlasting impression on the audience whenever the work is displayed indoors. My former student Rose Lebeau uses a product called Duracryl® that is common in automobile painting shops.

Figure 28–29
Rosemary LeBeau, *Daisy Chain,* 2010 (image transfer and etched glass)
Here is another example (see Figure 28–8) of Rose's art, *Daisy Chain,* for which she begins with a photo-transfer drawing generated from a photocopy and an automotive paint solvent. The transfer is worked with colored pencil and airbrush, and then stippled with ink. Molded paper daisies and sandblasted glass give the piece its three-dimensional quality.
(Courtesy of the Artist)

Note: You should be aware that in many states it is illegal to dispose of used solvents and thinners. Please read all safety warnings and dispose of the solvents in an environmentally safe fashion.

Water/Dry Mount Process

Soak a piece of quality watercolor or printmaking paper in warm water.

Place your laser copy face down on damp paper and put both pieces into a hot (250°F–300°F) dry mount press for 1–3 minutes. Most art/photography departments will not enjoy your putting wet paper and thermographic dyes in their dry mount presses. Be sure to ask first and perhaps purchase your own base pad and safety papers so that the press is not compromised for those who will follow you. The image will often transfer well and will occasionally provide a very intense color field. In this method, the colors seem to separate and transfer in reverse of the order in which they are printed, so the time in the press becomes a factor. The sequence order seems to be black, red, orange, yellow, blue/green. Hot-press papers work best.

Transfers to Fabric

Another transfer option using a dry mount press or an iron instead of a solvent to move the image employs the fabric transfer films and positives that you can have made in the same laser copy establishments or at home on your desktop printer. Epson, for instance, makes heat transfer sheets specifically for its printers. These transfers can be combined with many of the alternative processes on fabrics (cyanotype, Van Dyke, etc.) for some amazing effects. Because fabric is the base material for both the heat transfer and the alternative process, you may begin to think about such things as sewing, fabric montage, clothing, murals, and bed linens.

Recently, I was looking through recent editions of *The Fiberarts Design Book* and Quilt National competitions. In years past, these venues were dedicated to traditional fiber crafts, but in the last few years, more and more fiber artists are employing photography, digital imaging, digital transfers (see Lazertran later on), alternative processes, and laser transfer systems within the syntax of their fiber arts. This, I believe, is the shape of things to come, and I am hoping that you can get a feel for this new vision from the examples in the book.

Figure 28–30
Joy Christiansen, *The Dialogue*, 2003 (two wingback chairs, Epson iron-on transfer on upholstery with embroidered text)
This 72" × 48" × 36" installation piece consists of two Victorian chairs facing each other as if joined in conversation . . . or conflict. Dialogues occur within the embroidered text that is embedded in the chairs' fabric. The text and transferred images of the figure succeed in bringing the chairs to life, like a memory of what may have occurred in thought or internal conversation in the past.
(Courtesy of the Artist)

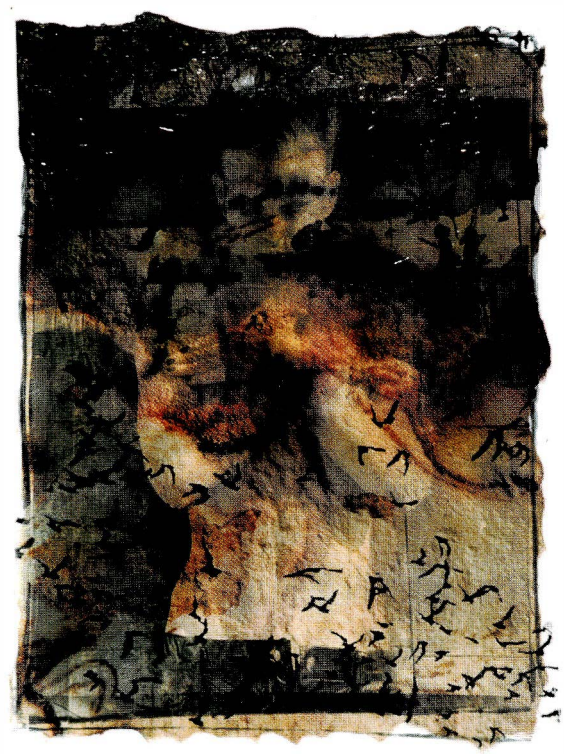


Figure 28–31
Bina Altera, *13th Hour Montage,* 1996 (acrylic lift)
This is a nice example of artist and friend Bina Altera's emulsion lift montages that are always dense with graphic complexity and surprises. *(Courtesy of the Artist)*

Acrylic Gel Lift Transparencies from Printed or Digital Sources

To make an unusual positive or negative, that is a lot of fun on many levels, try this technique. The materials you'll need to perform this task will be a container of acrylic gloss medium, a little dishwashing soap, a tray with warm water, and a pile of nicely printed glossy magazines for inspiration. The process is simple and flexible and is described fully in the Alternative Negative chapter.

LAZERTRAN TRANSFER PROCESSES

Lazertran Transfer Papers for Artists

The Lazertran transfer process is a contemporary variation on color laser transfer and one that enables you to transfer images onto nearly every surface imaginable. Caroline Reeves, a former student of mine from England, made wonderfully comical transfers of her family on toast. She made an effort to transfer her cousins onto a fried egg, but that proved to be one of the few surfaces that was problematic for the material.

Figure 28–32
Karen Divine, *Twisted,* 2010 (gel transfer on wood panel)
Karen created this coating gel medium on the first image printed on Epson fine art paper and transferring it onto a panel. When dried, she wet the paper and peeled it away until only parts of the image remained. Karen then montaged pieces of other images and applied them on top of the first transfer. With sandpaper, she scraped away unwanted areas and continued adding images, gel medium, and sanding until it was complete. She wrote that this was her first attempt to create a layered effect without Photoshop. The finished piece is then varnished. It's called *Twisted* because it was such a new and distorted way for me to present layers, completely shifting away from my usual thought process.
(Courtesy of the Artist)

Figure 28–33
Caroline Reeves, *Family Portrait*, 1999
This is a Lazertran transfer on breakfast toast from Caroline's family portrait series. Caroline made this series while participating in a semester-long student exchange residency at the Art Institute of Boston. *(Courtesy of the Artist)*

Lazertran papers have been specially developed for use with color photocopiers and are manufactured in accordance with ISO 9001 quality standards. Lazertran is considered a *waterslide* paper that allows the transfer of color images onto almost any surface including glass, paper, canvas, ceramic, Perspex® (a high-quality acrylic material), metal, plaster, wood, stone, and vacuum-formed plastics. Because the transfer is transparent, the Lazertran images can be overlaid repeatedly, allowing one image to be seen through another. This layering allows the creation of multiple and modular image construction. By utilizing the "tiling" ability of most high-end copiers, with which mural size images can be proportioned from smaller ones, you are able to create large pieces by having a single, or montaged, image made to virtually any size that you desire.

The Lazertran process is pretty straightforward and simple, and with a little practice you will be able to transfer laser copy, and digital, images on most papers, fabrics, ceramics, glass, wood, plastics, and assorted foods. Lazertran products come in several types including Lazertran Silk, Lazertran Textile, Light and Dark Cloth Iron on Paper, Waterslide Decal Paper for Inkjet Printers, and Waterslide Decal Paper for Laser Printers. They are ideal for getting your imagination out of a rut and are so versatile that they are perfect for ceramicists, printmakers, fiber artists, painters, and photographers. Here are a few short explanations to engage your interest.

Lazertran Waterslide Decal Paper for Inkjet Printers

This version of Lazertran is designed for smooth non-absorbent surfaces such as glass, ceramics, plastic, and metals. There is enough gum on the back of the decal to give good adhesion, although a little (methylated spirits) alcohol on the receiving surface improves adhesion.

1. Print your image on the smooth, white eggshell or chalky side of the paper.
2. Do not use too much ink, and click off any high-speed or draft options.
3. Allow it to dry for 30 minutes.
4. Cut to size and soak in water until the decal releases (approximately 60 seconds).

For more absorbent surfaces such as wood, use turpentine to *melt* the decal to the surface.

1. Paint the wood with a good coat of real turpentine (white spirits or any substitute will not work).
2. Apply the decal onto the turpentine-painted surface image-side-up and carefully remove any air bubbles.
3. Leave to dry for several hours. The decal will dry with a white background.
4. To finish apply a few coats of any oil/spirit-based varnish to protect and make the decal transparent.
5. If you wish the decal to remain white, apply a water-based varnish.

Figure 28–34
Maggie Hall, *Self in Red,* 2006 (Lazertran transfer on canvas)
Kansas-born Maggie Hall made this large piece during her Foundation Seminar at the Art Institute of Boston. Maggie related that the gist of this Lazertran piece is that no one person or family experience is straight . . . it's all tangled. The threads are those little pieces of our emotional, physical, and familial past and present, and like memories, they are most often tangled and hard to read.
(Courtesy of the Artist)

Using Water-Based Adhesive Lazertran for Paper or Canvas

Step 1 Make a color laser copy on the specific Lazertran paper by removing the protective tissue and running the transfer paper through the copier so that the image is printed on the shiny side of the paper.

Step 2 In the studio, stretch a piece of canvas or pin down a piece of paper so that the surface you intend to transfer on is flat. Then, coat the paper's surface with an acrylic matte polymer emulsion or, if using canvas, with an acrylic primer. Allow the coating to dry thoroughly. While the surface is drying, cut the copied image on the Lazertran paper to the required size. Remove the borders and trim as necessary.

Step 3 The next step is to immerse the Lazertran image in a bath of warm water and allow it to soak for 1 minute. It will curl naturally, so don't be alarmed.

Step 4 Apply a thin coat of the polymer emulsion with a short nap paint roller (for smooth surfaces) to the specific area you wish to transfer. These paint rollers can be large or very small, like those used for painting trim.

Step 5 Carefully remove the Lazertran from the warm water and lay it face down on a sheet of newsprint. Place your hand flat on the backing and partly slide the image off. Then flip the image over and position it face up on the surface to which you are transferring. Gently slide the backing paper off from underneath.

Step 6 Using a rubber wood block brayer, gently roll over the surface, removing any bubbles until the transfer is laying flat. When the image is dry (after a few hours), apply another coat of copolymer or matte acrylic medium to protect the image. Additional images may then be applied using the same technique. Lazertran can be applied over acrylic paint and oil, and acrylic can be applied over the Lazertran surface.

Fixing a Lazertran to Paper, Wood, Stone, and Plastic with Turpentine

Follow the steps just listed until you get to the part where you lift the Lazertran paper from the water and lay it on the newsprint. At that point, use a brush to coat the surface that you are applying to (the ceramic, glass, stone, or wood) with a generous coating of turpentine. Now, lay the transfer paper, face down, and work the transfer into the surface. For a transfer onto paper, carefully roll the transfer into the paper substrate and leave it for 8 hours. The transfer will melt and become part of the paper. You can assist the integration of the transfer into the

pores and crevices of materials like stone, wood, and toast by spraying a fine mist of turpentine onto the material.

Lazertran Silk

Lazertran Silk is used to transfer images onto sheer Habuti-type silk and also as a fast etch resist. Keep in mind that it is difficult to transfer onto open-weave silks such as organza, or chiffon, as the toners only adhere to the weave and fall off the holes—leaving a ghost of the image. Here is a rough idea of the steps to make this technique work.

Step 1 Gather the images you want to transfer onto silk and head to your local laser copy center. When you are ready to copy, have your images reproduced on the Lazertran Silk transfer paper and return to your studio or workspace. Set up an ironing board, plug in your steam iron, and set it to the "silk" setting, without steam.

Step 2 Iron your silk flat on a silk fabric setting.

Step 3 Set the iron hot enough for the toners to stick to the silk.

Step 4 Lay your silk over your image and iron until the silk is stuck to the image.

Step 5 Without pulling at the paper, place the silk, with the Lazertran paper attached, in clean warm water, paper side down, and leave until the paper falls off.

Step 6 Lift the silk carefully from the water and lay the image face down. Then, lightly iron with a cool iron until dry.

Step 7 When dry, turn the silk over, image side up, and place a sheet of silicon baking parchment over the image.

Step 8 Iron through the baking parchment with a hot iron and then allow it to cool. When cool, peel off the parchment. This method produces a beautiful result that can be rinsed in warm water but will not stand up to a vigorous wash.

Lazertran Silk on Polymer Clay & Non-Absorbent Substrates

Note: Please refer to the Paper and Alternative Substrates chapter for specific information about how to use waterslide decals and ceramic substrates. That chapter, and the information presented there, will provide you with a relatively complete overview of the beginning elements in the workflow. The information included in the chapter is very basic and applies to using a less sophisticated setup than if you were working in a kiln-equipped ceramics studio. Do not confuse the two separate workplaces . . . they are quite a world apart.

Step 1 Have your image printed in reverse using a laser copier machine.

Step 2 Condition white polymer clay according to brand guidelines until it can be easily worked. Smooth, or roll, the clay out to a flattened shape of desired size.

Step 3 Cut, or tear out, your image from a sheet of Lazertran Silk and place it, image facing down, on the flattened surface of the polymer clay. It is important to have the image fully touching the surface of the clay at every point to avoid an incomplete transfer. Smooth the image down firmly into the clay.

Step 4 Allow the Lazertran image to stay in contact with the polymer clay for about 30 minutes.

Step 5 Place the clay with the Lazertran Silk image attached into a bowl of water for 2 minutes. Swish the water, and the paper backing will float off the polymer clay, leaving the full image attached to the clay.

Step 6 Remove the clay from the water and allow it to dry for an hour.

Step 7 Bake the clay in your oven at a temperature and time directed by the individual manufacturer.

Step 8 Cool and seal with acrylic gloss medium or polymer clay varnish if desired.

Note: If you wish to make an image transfer onto a rounded or domed surface, leave the clay with the image on for a few hours; then you can shape the piece without the colors cracking.

Lazertran Silk: Temporary Tattoos

Step 1 Copy onto the Lazertran Silk transfer paper in mirror or reverse view.

Step 2 Apply a thin coat of Spirit gum (the adhesive used in the theater for false beards) over the image and apply it to the skin.

Step 3 Press well until stuck; then wet the backing paper.

Step 4 Keep wetting until the backing paper slides off.

Step 5 Go and be dangerous looking.

Step 6 Return home itching. Your temporary tattoo can be removed in a hot shower or by using makeup remover.

Figure 28–35
Brenda Kleinfelder, *Musings from the Gatherings*, 1998
Brenda Kleinfelder made a portfolio of image transfers and hand-sewn works of her neighbors while working as a long-line fisherman in Alaska. These fabric pieces are mostly whimsical in nature but nicely illustrate the strength of the subjects who brave the weather for her photographs and performance works. This work is a 20" × 20" laser transfer on fabric and miscellaneous media.
(Courtesy of the Artist)

Lazertran Etch as an Etch Resist for Printmaking

Lazertran used to make a product called Lazertran Etch, and I'm going to include the instructions for it in the event you still have some or come across it. These days, Lazertran Silk is the product to use, so here is the short version.

This is a simple way to transfer toners to a plate to act as an acid resist. Fine and detailed tonalities may be difficult to realize, but it does offer up an opportunity to experiment in printmaking.

1. Copy your image in grayscale, and negative, setting the toner density to high, onto a sheet of Lazertran Silk paper.
2. Degrease your etching plate.
3. Cut the image to the size of the plate.
4. Put the plate onto a hot plate set at about 180°C/350°F, and place the image face down onto the plate and rub flat with a tissue until the image is well stuck to the plate's surface. Immediately immerse the plate in a bath of boiling hot water and wait until the backing sheet slides off.
5. Allow the plate to dry and then place the plate back onto the hot plate or in a domestic oven to make sure all the toners are properly adhered.

You are now ready to etch. An aquatint may be applied.

Although Lazertran doesn't get specific about this point, you may want to put a dot screen down on your negative in Photoshop so that your inking has something to hold on to. The aquatint will work to a degree, but a dot pattern will help as well.

Before printing, remove toners with solvents, or heat until melted and wipe off with a rag and turpentine.

Note: For a more advanced technique utilizing inkjet textures and inking in conjunction with intaglio printing, please refer to the Inkjet Intaglio chapter in this book.

Original Instructions for Lazertran Etch

Lazertran makes a product called Lazertran Etch, which, when using a color copier, is capable of replacing most existing photographic etching systems. Your image is copied onto Lazertran Etch as a negative and affixed to a metal etching plate using an iron. The plate is aquatint compatible.

Lazertran has recently discovered that isopropyl alcohol, available from the pharmacy, can be substituted for real turpentine in its etching process. This may suit many printmakers, as the smell is more tolerable and the product, which is basically rubbing alcohol, is far less toxic than turpentine. Use in a well-ventilated room and follow the warnings on both the turpentine and the alcohol containers. Another reason for using isopropyl alcohol is that some new types of toners dissolve in real turpentine so alcohol has to be used to remove the decal after baking it onto your plate.

Note: Some printmakers of late have been having trouble with bubbling. This can be due to the toners not being fused properly during printing. If fusion of the powdered toners is not complete, as they turn from dust to liquid, tiny air bubbles are released under the decal. To avoid this, after printing your image, and before soaking it in water, just pop it into a hot domestic oven for several seconds or until the black toners go very shiny. You can also run a hot air gun (paint stripper) over the image until the toners go shiny. This will help enormously with this problem.

Step 1 Using a color copier, copy your image in black and white, in a negative rendition, onto a sheet of Lazertran and then cut the image to the size of the plate. Bump up the density of the toners to get good solid blacks. You may have to work with the image in Photoshop first, invert it, and print the negative version out for the copier.

Step 2 Soak the Lazertran copy in water and then place the decal image-side-down onto the metal plate. Wash off any gum from the decal and use a soft rubber squeegee to expel all air bubbles, creases, and moisture.

Step 3 Put the plate on the bottom rack of a domestic oven at a very low temperature to remove any moisture. By low, I mean the lowest temperature the oven will permit. Leave it there for at least 1 hour or longer. Increase the temperature slowly over the next 1.5 hours until the decal melts and becomes tacky. This can occur within a range of temperatures, depending on how long the plate has been left in the oven.

Step 4 After cooling the plate, place it in a bath of pure turpentine until the decal washes away, leaving only the toners on the plate. You can use a soft brush to help remove the decal, and you will feel the clean metal (no longer slimy) when it is ready. This takes about 15 minutes.

Step 5 If you are using isopropyl alcohol to remove the decal, do not use a bath. Instead, pour a little of the alcohol onto the plate. Leave it for a short time and then wipe it away with a non-abrasive cloth or paper. Repeat this step until the decal is gone and you are back to the metal. This will take some time and quite a few applications of the alcohol. Be sure to remove all of the decal, as any residual decal will block the plate from etching.

Step 6 Carefully wash the plate and any melted decal in warm soapy water.

Step 7 The toners are then removed with acetone, wintergreen oil, or heat until the toners melt and wipe off. Finish the plate with a metal polish.

Step 8 You are now ready to etch. An aquatint can be applied at this point. This method can also be used on glass and metal if you want a full-color image and wish to remove the decal.

Figure 28–36
Ivorytype
The ivorytype was originally created by Englishman John Edwin Mayall in 1855 as a photographic image printed on an artificial ivory substrate that was made by combining a colloid, a hardener, finely ground baryta, celestine, bone, and every once in a while, actual ivory. The ingredients were used to create thin faux ivory sheets. In Mayall's original technique, a gold-toned positive image was transferred onto the "ivory," and a collodion transparency was placed on top of the transfer. The contemporary ivorytype is a playful mix of a digitally scanned alt pro image printed out on matte inkjet paper and enhanced with hot melted wax and saturated colors. Have fun!
(Courtesy of Charles Schwartz, Ltd.)

THE IVORYTYPE: OLD SCHOOL/NEW SCHOOL

A Little History

The ivorytype was originally conceived and patented by Englishman John Edwin Mayall in 1855 as a photographic image printed on an artificial ivory substrate that was made by combining a colloid (like gelatin or albumen), a hardener (such as alum), finely ground barium sulphate (called baryta), celestine, bone, and every once in a while actual ivory. The ingredients were used to create thin faux ivory sheets or plates. In Mayall's technique, a gold-toned positive image was transferred onto the "ivory," and a collodion transparency was placed on top of the transfer.

The materials used for ivorytypes were described in this dialogue by Philadelphia daguerreotypist Marcus Root in 1864: "*This imitation* [ivory] *is a compound of barytes* [barium sulphate] *and vegetable albumen which, kneaded together and rolled into sheets, is permitted to dry, and is then submitted to a polishing process whereby a surface of the smoothest texture and purest ivory color is obtained, constituting an admirable recipient for the image, as a basis for the artist's operations. Plates of this material are manufactured expressly for photographs, to be colored in imitation of miniatures upon ivory, and may be procured* [from Paris]."

In 1858, Philadelphia daguerreotypist Frederick Wenderoth created what was called the American ivorytype but that Wenderoth called the toovytype. His version of the process looked remarkably similar to Mayall's but was performed in a different manner by adhering a gold-toned and water-colored salted paper print to the backside of a sheet of transparent glass with hot wax, varnish, or glue. The sheet of glass was then backed with a second piece of plain paper, which was colored with highly chromatic colors and strong geometric shapes approximating the same major forms of the original salted paper print. This second sheet was placed into registration with the original. When combined, and seen as a single presentation, the tonalities of the highly chromatic sheet were visible through the waxed mounted image of the original image adhered to the glass. When done with artistic skill, the image served as a reasonable facsimile of a painted ivory miniature, but at a fraction of the cost. The process was very similar in many respects to the *crystoleum* technique in which an albumen print was transferred to a sheet of starched or gelatinized glass and backed with a highly colored and abstracted version of the transfer and bound together to create a single image.

The following description of the American ivorytype process is from the *British Journal of Photography*, August 5, 1864 (*The Camera and The Pencil*).

The American Ivorytype: *British Journal of Photography,* August 5, 1864

This picture was recently invented and introduced by Mr. Wenderoth. It is a coloured photograph, finished so as to resemble a miniature or portrait on ivory.

The mode of making it:--Select a vigorous, clearly-defined impression, with margin enough to allow for mounting upon the painter's stretcher or painting board. Damp the print with a sponge dipped in clear water; then paste its edges upon the stretcher, and with clean paper over its face, rub the print down smoothly. When dry, it will be tight and firm for the artist to operate upon. Or mount it upon a sheet of glass, with its edges ground to hold the paste.

The photograph is now coloured upon the face, as a miniature, with permanent colours; but colours much stronger than those commonly employed on surface-painting, as the manner of mounting the completed pictures upon plate-glass has the effect of lowering the tone of the colours used.

As transparent colours are reduced, or lose considerably in tone by this mode of mounting, they should be painted in much more strongly than for surface-painting; while the body colours should be kept down or reduced in tone, since they are heightened or made more brilliant and vigorous by the manner of mounting.

The coloured print is now mounted on a perfectly clean sheet of plate-glass, face downward, as follows:—Melt bleached, pure white wax, and, while hot, pour it upon the glass plate, which is also made and kept hot on a steel or iron plate, or a soapstone slab, under which one or two spirit-lamps are continuously burning. While the wax is quite liquid take the print by the ends, spring it in the middle, and lower it gently into the heated wax, carefully pressing from the middle outward both parts of it down into the wax, and then with a straight-edged paper-folder, of ivory or bone, or some similar article suited to the purpose, press and work out all the air-bubbles and superfluous wax. This operation must, of course, be executed while the plate is quite warm.

The paper-folder should be carefully rubbed from one extremity of the print to the other without lifting it therefrom or suspending the process, as a mark would thus be left on the picture, which will be thoroughly saturated with wax, and which, if properly handled, will be transparent, smooth, and beautiful.

Some artists use a compound of one part gum dammar to eight parts wax; or Canada balsam and wax; or gum elmer and wax; same proportion of one to eight parts of wax. Others use a larger proportion of the gum-varnishes.

Finally the picture is finished by placing upon its back and firmly sealing to the glass a clean sheet of white paper or cardboard, with a cardboard border or mat between the picture and the paper, and with small lumps of hard wax stuck upon the dark or opaque parts of the picture, so arranged as to keep them about one-sixteenth or one-twentieth of an inch asunder. This distance must be determined by effect or appearance produced, and regulated by the judgment of the artist, when the picture is ready for the frame. Sometimes a duplicate tinted print of the face is placed behind to give more colour vigour.

To produce this picture in its perfection requires the highest degree of artistic skill.

The Contemporary Ivorytype

Materials

- A hotplate with a solid heating surface (do not use one with burner rings)
- Sheets of glass cut to size
- Glass cutter and oil
- Salt, kallitype, albumen prints on translucent papers or vellum
- Watercolors and brushes
- A watercolor palette for mixing color
- White wax candles, like the kind you find on alters in a Catholic church
- Cheesecloth for straining hot melted wax
- A small metal creamer/beaker for holding the hot wax
- Black masking tape for bonding glass wax-mounted print and colored backing image

- Mat board scraps for backing of the glass and smoothing print with hot wax
- Cork wine stops for smoothing print to glass
- Digital copies of original wax-mounted salt print, on matte paper, that are 4–5 stops lighter in tonality than the original . . . for high chromatic watercolor paint application

The Contemporary Ivorytype Process

Step 1 Make a small salt, albumen, kallitype, Ziatype, or platinum/palladium print.

Step 2 Scan the print from Step 1 digitally and on a matte inkjet paper produce replicas of it that are 4–5 stops lighter in tonality than the original print.

Step 3 Cut a sheet of glass that is approximately the same size as the print.

Step 4 Heat white candle wax in the metal creamer on your hot plate.

Step 5 Lay the sheet of glass on a hot plate on a warm setting.

Step 6 Pour the hot wax onto the glass plate so that you can flex and then float the original print onto the wax puddle. (See the instructions for laying the image into wax in the description from the *British Journal of Photography* presented earlier). Use a wet collodion coating technique if you have the proper hand protection but remember to keep the glass warm and the wax in liquid form. If possible, keep the glass on the hot plate rather than hand-holding it. Remove the glass to a counter surface that is protected with mat board.

Step 7 Take a small strip of mat board and "squeegee" the print surface, squeezing the hot wax from beneath the print, until you create a tight bond between the print and the glass plate. If you see air spaces, reheat the glass plate, remelting the wax, and use the cork stopper to smooth the air pocket area so that the air space is eliminated.

Step 8 Take your pale digital print, and your watercolors, and paint upon the print with highly saturated colors, like filling in a coloring book page with colors. For instance, if you want a pale blue sky, then paint a deeply saturated blue sky . . . if you want simple flesh tones, paint highly saturated pink/orange flesh tones. In other words, animate the color.

Step 9 Register the colored print behind the wax bonded print on the glass plate and you'll see a nice ivorytype. Make a tight sandwich of the different parts and tape them together with black masking tape. Or go antique shopping for an old gilded folding case, like the kind used for ambrotypes

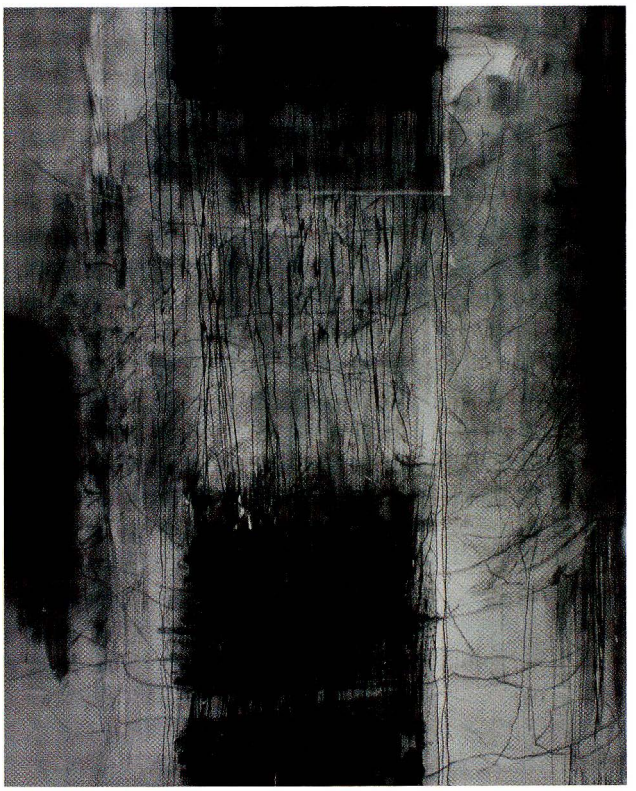


Figure 28–37
Dan Welden, *Roaring Laughter*, 2012 (Solarplate etching)
Dan Welden, the creator and inspiration behind Solarplate, is an active artist and printmaker. Here is a 42" × 32" Solarplate image with three intaglio colors and eight screen prints on top that Dan made while on an artist's residency in China.
(Courtesy of the Artist)

and daguerreotypes. Presto, you've made a useable bridge between the nineteenth and twenty-first centuries!

SOLARPLATES

For those who are interested in integrating traditional printmaking techniques with their images, or in placing images on steel surfaces, there is a terrific product distributed by Dan Welden's company, Hampton Editions, Ltd., that goes by the name of Solarplate. The Solarplate technology is enticing because it is both a safe and uncomplicated introduction to graphic and photographic arts plate making. Solarplates are made of steel and are manufactured with a UV light sensitive polymer emulsion that is only affected by light and water. Using Solarplates is simple and an acid-free alternative to etching or embossed relief printing and can be employed easily by anyone familiar with the basic working processes of a printmaking studio and photographic lab.

Figure 28–38
Christina Pumo, *About a Room*, 2013 (photopolymer Solarplate etching)
Christina Pumo's Solarplate generated print, *About a Room*, is a densely complex and noir-ish depiction of a transitional and volatile period in her life. She wrote, *"The piece evokes a feeling of unease, depicting a lack of center and sense of identity. The figure is immersed in a feeling of perpetual darkness, ruled by the absence of light in the room itself. The opening suggests a possibility of another side, leading to a different point in time."* *(Courtesy of the Artist)*

Solarplates come ready to use in precut sizes ranging from 5" × 7" to 18" × 24", with well-written instructions for their use.

As with other contact-based exposure procedures, all you will need is a positive or negative film, glass plate, cliché verre, acetate, or photogram stuff. Any areas of the plate that are blocked from UV exposure by the transparency will remain water-soluble. All areas that have been affected by the UV light will harden and will not wash out during the water development. The exposure and development principles here are very consistent with the way you would be thinking about a gum bichromate exposure, the difference being that if you intend to take the print to the traditional intaglio printmaking stage on a press, you use a film **positive**, rather than a negative, to make your exposure.

Exposing a Solarplate with a positive transparency, easily produced for contact exposure with Pictorico Ultra Premium OHP digital inkjet film, followed by a soft water development, results in a negative *intaglio* plate that is recognized by its etched depressions and that will accept ink for printing on paper. The word *intaglio* comes from the Italian *intagliare* meaning "to carve out or cut into." The original, unbitten plate surface that is wiped clear of ink with a cheesecloth, after the warmed plate is wiped down, will be higher than the ink-filled etched grooves (that will escape the wiping) and will print as highlights (*no ink = no impression = highlight*). If you were to expose a positive image in a right-reading state to a plate and etch it, it would end up on a developed plate as a negative image reading backward. This negative, backward-reading image would then be inked, wiped, and printed, resulting in a positive right-reading image on paper.

You may, of course, elect to make the plate as an individual stand-alone object without extending the process to a printing press. A transparent negative will result in a positive relief image of your negative. This type of plate can be inked and shown as a powerful ink and metal statement and will have a look that is conceptually in the same neighborhood as the late Naomi Savage's magnificent inked, and unprinted, metal plates.

Figure 28–39
Dennis Olsen, *Scudo*, 2005 (porcelain w/Solarplate impression)
Dennis Olsen is professor of printmaking, drawing, and digital media at the University of Texas at San Antonio and in 1970 cofounded the Santa Reparata Graphic Art Centre, now the Santa Reparata International School of Art (SRISA) in Florence, Italy. Dennis makes his porcelain tablets by using very thin layers of clay into which he presses exposed and processed Solarplates. The bone china pieces were first made in plasteline using his normal method of pressing Solarplates into the surface. They were then cast in plaster and slip cast in bone china.
(Courtesy of the Artist)

You are not restricted to using photographically based imagery. Artwork for transfer to the plate can be made on a great variety of surfaces such as hand-painted or digitally derived acetates. Or you may elect to make cliché verre transparencies on glass or vellum with many different materials, such as oil paint, ink, wax, syrup, batik resist, lithography crayons, dried salted sensitizers, and photogram objects. Using Solarplates would be an ideal time to mix up your media a little.

Consider using a contact transparency and laying acetate with text on top of it prior to the exposure. Remember to think about the way this text will read at whatever point you decide to stop the process. Once you have determined what you will lay on the Solarplate's UV-sensitive polymer emulsion, begin to set up the plate for exposure by making a layered sandwich, starting from the top and moving to the bottom. Use a contact-printing frame if you have one large enough for the plate and transparent film that you are using. If not, use a sheet of clean glass to compress the transparency to the plate with plastic wood clamps. Or, simply use glass for your original film and UV contact print it on the plate.

Materials You Will Need

- Your transparent film, artwork, acetate, or photogram objects. Be sure that you determine how it will be rendered once the entire sequence with the plate is completed. The normal placement is emulsion to emulsion.
- The Solarplate, UV-sensitive plate, polymer emulsion side up and mated to the film positive.
- A piece of compressed rubber, or bubble wrap, to lay the plate upon. Or make the positive on glass and use it in a contact-printing frame with the unexposed Solarplate.
- A hard, flat surface, such as a board, for moving the work around between the lab and your exposure area.
- A set of clamps, or contact-printing frame, to hold everything together.
- Consistent sunlight or a UV-exposure unit.
- A timer and a large tray or sink for washing.

Once you are ready with this layered setup, move into the sunlight and expose the Solarplate for between 2 and 12 minutes in direct sun. This is obviously an average exposure recommendation, and you will likely experience an assortment of correct exposures at different times of the day and year. Different transparent materials will always require a test of some kind in order to be sure. *Always buy a few small plates to use as tests before committing an 18" × 24" plate to the sun.* Once the exposure is complete, move the plate to a tray of 68°F

Figure 28–40
Elizabeth Jameson, *Celebration* (Solarplate)
Elizabeth writes, "*I am an artist that creates art that celebrates the beauty, complexity and mystery of the brains of those individuals who have one of the most common neurological diseases of the human body, multiple sclerosis.*" Celebration is a solar etching of an angiogram of her friend Marc's brain. It portrays the blood vessels in his brain dancing and holding hands. Marc has progressive multiple sclerosis and she did this etching in order to portray some of the beauty and playfulness of a brain that also happens to have a devastating disease.
(Courtesy of the Artist)

water. The water development is used to etch the polymer plate rather than using a more traditional acid bath for the same purpose. The longer you develop the Solarplate in water, the deeper the intaglio cut in the polymer.

Once your Solarplates are ready for etching, gently scrub the emulsion with a very soft nylon vegetable scrubbing brush while you pour temperate water on the surface. During this washing-out stage you will begin to see the image emerge on the plate. You will also see a milky residue in the wash. This milky residue will remind you that you should be wearing latex gloves while you're doing this task.

After the development, blot the plate with paper towels, and blow-dry the surface with a hairdryer. Then, take the plate and return to the sunlight for a *post-exposure hardening* of between 5 and 10 minutes. After that, you can do what you want with the plate, from inking to painting to intaglio printing. Be careful to use only oil-based inks as you would with most traditional etching techniques because the Solarplate emulsion is affected by water.

Double-Exposure Technique with an Aquatint Screen

If you decide to take your Solarplate into the traditional intaglio process, there is the possibility of the polymer emulsion wearing away or washing out. The solution to this is a double exposure on the plate with an aquatint or stochastic screen. This step allows you to retain extensive areas of deep black in the intaglio image because you are supplying a screened texture to the plate and image. The double-exposure technique eliminates the problem of the polymer washing away . . . . a situation that would create large "open" areas that could not hold the ink during a "wipe." This is what printmakers call an "open-bite" in the traditional etching process. By manipulating exposure times, you can vary the depth and richness of blacks in your image and eliminate problems that are associated with deep grooves holding too much ink, a situation that causes ink-bleed during printing. Here's how to make a double exposure with an aquatint screen, a product that you can easily obtain at a decent art, graphic arts, or printmaking supply retailer.

Step 1 Make some test strips so that you can adjust separate exposure times for both the image and the screen.

Step 2 Next, expose the Solarplate with the *aquatint* screen for 1 minute. You will notice that the aquatint screen has both a shiny surface and a less shiny, semimatte surface. The semimatte surface is the emulsion side, and it must be placed face-to-face with the sensitive plate surface for the first exposure.

Step 3 Remove the aquatint screen and place your positive transparency on the plate for 1 minute. This time may need to be adjusted depending on the quality and density of the positive film that you are using. When you have completed the second exposure, remove the positive transparency and proceed to develop your

plate in water. Dry and post-expose the plate as defined in the instructions, and then print.

Step 4 To increase the richness of blacks, darken your image, and retain more detail, just reduce the exposure times. Conversely, if you experience problems with the etched grooves in the plate holding too much ink, then too much polymer is washing away. To lighten your image, try increasing exposure times.

Troubleshooting

- If the plate won't clear sufficiently to show a defined image, you have likely overexposed the plate or your washing time is incomplete.
- If the plate is sticky following development, then it is probable that your post-exposure time was omitted or was too short in duration.
- If your image is blurry, the contact of the negative emulsion to the plate emulsion was not compressed enough to ensure close contact and sharp details. Consider using a heavier piece of glass, a contact-printing frame, or plastic furniture clamps for compression of the art to the plate.
- If you have abnormal spots, try heavier weight acetate or dust the emulsion side of the acetate, prior to laying it down, with a fine dusting of baby powder. A fine mist of talc on the film is also a solution for Newton's rings.
- If you have black spots, go back and clean the glass or transparency a little better for the next exposure attempt.
- If your plate shows water spots, take more care in blotting and drying the plate immediately after it has been through the water development and prior to post-exposure.
- Above all, treat this material as an invitation to really cut loose with some interdisciplinary thinking about your work.

Launching The New Solarplate (2014)

- As we go to press with this third edition, Dan Welden, the principle and guiding force behind Solarplates, has announced some changes in manufacturing and workflow of his company's photopolymer printmaking plates for artists. As of fall 2014, Welden has obtained distributorship of new, gold colored, Japanese manufactured photopolymer Solarplates and there are some important general guidelines and differences for you to be aware of. I am including Solarplates original workflows in the chapter but will begin with Dan's new notes so that you are aware of the changes. Please read the new guidelines when you begin working with the gold plates. As always your own experimenting and testing is crucial to the success of your images. The new Solarplate is equal if not better in most ways than the old one, and is here to stay.
- The new Solarplate is environmentally safer than any other polymer, since it is truly water soluble, unlike the other polymers that are water dispersible.
- It is a gold colored light sensitized steel-backed polymer material when exposed to UV light, becomes hard about twice as fast as the orange plates.
- Each Solarplate comes with a protective plastic sheet that makes the material easier to handle. It should be removed before exposing. The plastic is not UV protective and it must be removed before exposing. Separation of plastic and plate can occur and when it does, the plate is subject to oxidation and can cause different effects. The 'separation' of plate and film, should be taken into account when exposing the image.
- A major concern is that the 'Gold' plates are more sensitive and expose with much less time. A 45 second aquatint exposure as opposed to 90 seconds, works well. I have also found that exposing art for 30 seconds or less, works best. When in doubt, expose less.
- Washout time takes slightly longer.
- Each style and technique of art should be tested on a small Solarplate before exposing on a larger plate.
- The plate works well with digital transparencies, photocopies, direct painting onto the plate with Akua Intaglio ink and my favorite, drawing with Stabilo 8046 pencil on grained glass.

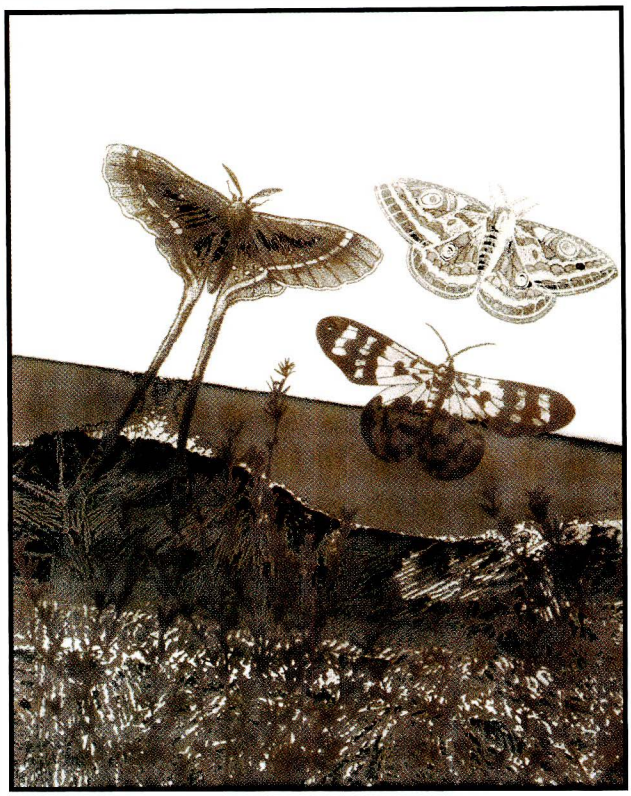


Figure 28–41
Jean Pierre Sudre, *Insects*, 1979 (mordançage)
Jean Pierre Sudre was, and will always be, the acknowledged master of the mordançage process. This is a perfect example of his technique and sensitivity to subject and process.
(Courtesy of Claudine Sudre and the Sudre Estate)

- While washing with water, you will notice a slight chemical smell, which we have been assured is not harmful. Use proper ventilation at all times.
- The plate is slightly harder and therefore is less likely to hold plate tone, resulting in a greater range of tonal quality.
- Time and longevity are yet to be determined, however, we expect to be able to print more intaglio impressions with the new plates. Relief printing will be approximately the same.

THE MORDANÇAGE PROCESS

A Really Quick Overview

In this very brief section you will be introduced to an often stunning, mercurial, and chemically driven post-print manipulation technique called the mordançage process. Unfortunately, the process requires a traditional wet darkroom as well as the great outdoors, or a superior ventilation system. I'll provide you with a little information regarding the process and its history and will then describe the materials and procedures you will need to follow in order to learn its many idiosyncrasies. I expect you'll find this process quite seductive, but don't let that distract you from the fact that the chemistry required to perform the technique is not at all compatible with your skin or respiratory system. Be vigilant with safety precautions, wear nitrile gloves and a dual-filter respirator, and make every effort to work outdoors with the wind at your back.

Figure 28–42
Elizabeth Opalenik, *Windswept*, 1993 (mordançage)
Elizabeth learned the mordançage process directly from Jean Pierre Sudre in his studio in France and has been one of the leading practitioners of the technique ever since. The process begins with a high-contrast gelatin silver print, and through a sequence of chemical manipulations, the photographic silver emulsion is chemically lifted, removed, or physically rearranged in the shadow areas. Elizabeth recently published her monograph, *Poetic Grace*.
(Courtesy of the Artist)

The Process

The mordançage process appears to have made its formal debut in L.P. Clerc's book *La Technique Photographique*, in a chapter entitled "Generalities sur les visages par teinture sur Mordançage," in which Clerc refers to R. Namias's use of mordants of various metallic ferrocyanides. This process is quite lovely when it works but is unfortunately rife with bad vapors and chemistry. The other problem is that it requires a traditional darkroom and chemistry and silver gelatin paper . . . all of which will be more difficult to find with the passing of time. Although the mordançage process made an appearance in the early days of photographic history, it was not until Jean Pierre Sudre adopted and refined it as his own that the technique received much recognition. Little was known about the technique, and for years it was practiced only by people who went to Sudre's home in France to study with him. One of those travelers was my friend Craig Stevens, and the chemistry in these notes are adapted from those given to me by Craig. Here's the basic overview.

Mordançage Chemistry: To Make 1 Liter of Mordançage solution

750 ml distilled water in a plastic beaker
10 g copper chloride (stir this into solution)
50 ml glacial acetic acid (*always add acid to water)*
25 ml to 35 ml of 30%–35% hydrogen peroxide
Add water to make 1 liter of working solution.

30% Hydrogen Peroxide

This is not the 3% drugstore version you use for cuts. If you can't find the strong 30% hydrogen peroxide (H_2O_2), you will have to buy the 12%–18% liquid solution that is available in hair and beauty salons. If you are using the 12% or 18% concentrations, substitute as follows:

- 18%: 50 ml instead of the 25 ml with the 30%–35% concentration
- 12%: 75 ml instead of the 25 ml with the 30%–35% concentration

Note: Be sure to ask for the clear formula of hydrogen peroxide. Many salons sell the "crème" version.

WARNING: Before you go any further, it is imperative that you put on a pair of surgical-quality latex gloves and a dual-filter respirator. You should also be outdoors with the wind blowing at your back or under a chemical fuming hood.

Step 1 Begin with a washed and wet fiber-based print. Brovira is the paper Sudre used, but Ilford Warmtone works as well. Warm-tone quality papers appear to work better than others, and few papers work anymore.

Step 2 Using tongs, immerse the print in the mordançage solution for 3 minutes or until the image has bleached out. It will turn yellow at first, and then the image will begin to etch away. You may subjectively determine at what point you will stop this step because every choice you make from this point on will result in a unique final print.

Step 3 Remove the bleached print from the mordançage solution and immerse it in a tray of clean water. Wash the print for 15 minutes and replace the volume with fresh water every 3–5 minutes.

Step 4 After the washing stage, redevelop the print in a 1:5 to 1:10 solution of Dektol paper developer or any very dilute toner, for example, Kodak Sepia (sodium sulphide) Toner Part B, or Polytoner. The degree of dilution of the redevelopment chemistry will have a pronounced effect on the colors that come up in the print.

Step 5 When the redevelopment is complete, rinse the print briefly in a silver gelatin paper stop bath solution.

Step 6 Depouillement: Gelatin Removal (removing the skin)—Remove the print from the stop bath and lay it on a firm piece of Plexiglas. Begin to rinse it with a strong spray of water. Wipe away loosened gelatin portions of the image, as your imagination sees fit, with cotton swabs or an assortment of brushes of different sizes and degrees of stiffness.

The original print exposure will determine what areas of the print will lose gelatin.

During this stage you will begin to see a varied display of effects. Some will be as pronounced as a solarized image, while others will be more delicate. The degree will be based on the original image and its densities. You will see a bas-relief-like effect as the gelatin loosens and portions of the original paper base will be evident to you. When the gelatin removal is complete, immerse your printed image in a 1:5 to 1:10 Dektol, or any exhausted developer solution, for 3 minutes or until you see the image in the way you want it realized.

Step 7 Oxidation—Remove the print from the Dektol developer, roll it flat on a hard surface with a rubber woodblock brayer print side down, on a paper towel. Turn the print over, place it on fresh paper towels, and allow it to oxidize and dry. Keep in mind that paper towels are white because they are bleached to be that color. If you leave any photographic print face down on a wet paper towel it will eventually show an imprint of the towel's texture.

Step 8 If you want to stop the process at any time the print may be briefly immersed in a paper stop bath, washed for 30 minutes, and screen dried. Redeveloped prints can also be retoned to further alter the coloration. Play with the process, but be careful and do not attempt to experiment with this procedure unless you are outside or have extraordinarily good ventilation. Do not play with, drink, bathe in, fool around with, or splash the mordançage solution.

THE CORE TRUTHS OF CREATIVE PROCESS AND LEARNING: OR SOME IDEAS I WAS KICKING AROUND IN GRAD SCHOOL AT RISD IN 1971

Truth 1 The things that you do best in your life you teach yourself.

Truth 2 Play, and the spirit of play, is the only consistently perfect way to teach yourself to do, and to learn, anything. Every single little bear in the woods knows this is the truth.

Truth 3 The Industrial Revolution's assessment model, on which our entire public school system was designed, does not apply to the arts (with the sole exception of the bottom-line-driven popular music industry) or to arts education. Coming out "all the same" doesn't work very well in the arts. *Little boxes, on the hillside, little boxes made of ticky-tack . . .* tra-la. . . .

Truth 4 The history of humanity is known primarily through the art it leaves behind. Think about it . . . when was the last time an archeologist unearthed a political speech?

Truth 5 Don't ever be frightened by anyone who possesses a rich imagination . . . including yourself.

Truth 6 The single greatest gift a mentor can offer to a student is the gift of seeing, respecting what is seen both inwardly and reflected, and making sense of it . . . no matter how long it takes to see. This gift will be forever cherished.

Figure 28–43
Christopher Painting Two Cowboys, Dublin, NH, 1950
This may have been the start of it all . . . a photograph my mother Edith made of me painting two cowboys in my grandfather Alexander's studio in Dublin, New Hampshire . . . where I am writing this caption. I was 3 years old in this picture, and I still believe that play is the best way to learn anything no matter how difficult it is . . . or will be, as it becomes your life. *(Courtesy of the Artist/Author)*

Figure 28–44
Holly Roberts, *Small Wolf w/Forest*, 2000
I have been a big fan of Holly Roberts's work since the first moment I saw one of her painted photographs on a stairway in Maine many years ago. Then I invited her to be a Visiting Artist in my MFA program and ended up liking her work even more. Holly begins by preparing a panel with acrylic paint. Then she collages digital prints and varnishes the surface. The final stage is to paint with oils, allowing the push and pull of the paint, and painting to create an enigmatic, compelling, and mysterious work of art.
(Courtesy of the Artist)

Chemical Safety Considerations, Definitions, Information, Small Volume Conversions and Formulas

CHEMICALS & MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS Online
http://www.msdsonline.com

This is an online resource for all MSDS and Chemical Abstracts Services (CAS) information. You will have to register, but it only takes a minute.

MSDS.com
http://www.msds.com

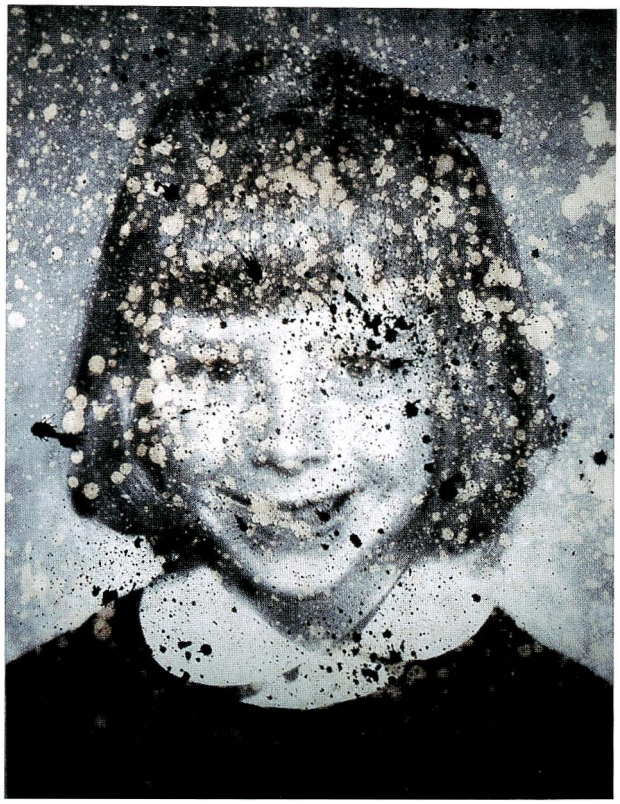
Periodic Table of Elements
http://www.webelements.com

This site has information regarding the periodic table of elements.

A FEW BASIC CHEMISTRY DEFINITIONS

ACIDS: Acids are compounded solutions with a **pH of less than 7**. Acids neutralize alkalis such as developers. An acid will turn a blue litmus paper a pink-red. Acids are compounds containing hydrogen that can be replaced by a metal to form a salt; that is, the metal sodium will replace the hydrogen atom in hydrochloric acid to form the salt, sodium chloride. Acid strength affects two of the most common functions: imparting a sour taste and creating an acid environment to limit microbial growth.

NOTE ON ACIDS AND WATER: Heat is released when strong acids are mixed with water and increasing the amount of acid adds to the level of that heat, releasing more heat. If you add water to acid, you will create an extremely concentrated solution of acid immediately at the point of the addition. So much heat is released that the solution may actually boil violently, causing eruptions of concentrated acid. Conversely, if you add acid to water, the solution that forms at the point of the addition is very dilute, and the level of heat released is not sufficient to cause a violent reaction. Remember Triple A . . . **A**lways **A**dd **A**cid to water and never the reverse.



APP–1

Jacquie Mahan, *Self as Kid*, 2003

Jacquie graduated from the Art Institute of Boston a few years ago and went on to own and operate the Mahan Gallery in Columbus, Ohio, which was recognized as one of the most influential new galleries in the United States. This self-portrait explains a lot about her sense of humor and her experiences in junior high.

(Courtesy of the Artist)

ALKALIS: Alkalis are compounded solutions with a **pH greater than 7**. Alkalis are the assorted soluble metallic hydroxides that neutralize acids to form salts. An alkali can also be a compounded salt. It functions as an accelerator in photographic developing formulas (often potassium and sodium hydroxide). Alkalis turn red litmus paper blue. Examples of alkalis are sodium carbonate and borax.

ANHYDROUS: Meaning a solid substance without water or crystallization.

BASE: Bases are the chemical opposite of acids and react with acids to produce water and to form salts (or their solutions). Some general properties of bases include bitter taste, slick texture (like soap and water), violent reaction with acids, caustic to organic matter, and turning red litmus paper blue. A base is a substance that will neutralize an acid but will not dissolve in water (e.g., iron and copper). A base that dissolves in water is called an alkali (e.g., sodium carbonate).

BUFFER: Weak acid(s) or base(s) dissolved in water that hold the pH near to a constant value when an acid or base is added. Buffering is the ability of a weak acid/salt combination, such as citric acid and sodium citrate, to control the amount of free hydrogen ions. When certain amounts of acid or base are added, the system resists changes in pH. Citric acid has the widest effective buffer range—from pH 2.5 to 6.5. Tartaric acid can only be used for buffering between pH 3.0 and 4.5.

DELIQUESCENT: A deliquescent chemical is one that readily absorbs moisture from the air. Salts are a prime example.

pH: One explanation of the acronym pH is that it's an early twentieth-century acronym from the German word *potenz* (meaning "power") and hydrogen, or the power of hydrogen. A pH number designates a numerical value assigned to an aqueous solution to indicate that it is either acidic or alkaline. It also represents a chemical symbol for the logarithm of the reciprocal of the hydrogen ion concentration in gram atoms per liter. What you need to know, in the context of this book, is that it informs you of the acidity or alkalinity of the chemistry you are using.

SALT: A salt is formed when an acid and a base are mixed and the acid releases H+ ions, while the base releases OH^- ions. This process is called hydrolysis and creates an ionic compound. The pH of the salt depends on the strengths of the original acids and bases:

Acid	Base Salt	pH
strong	strong	pH = 7
weak	strong	pH > 7
strong	weak	pH < 7
weak	weak	depends on which is stronger

SATURATED SOLUTION: Definition of a solution that cannot accept any more solid (solute) at a given temperature without leaving sediment in the solution. An example of this is the preparation of

saturated potassium or ammonium dichromate for gum bichromate sensitizing (e.g., potassium dichromate saturates at 10%–13%).

SOLUBILITY: The maximum weight of a substance that will dissolve completely in a given volume of solvent and at a specific temperature.

SURFACTANT: An agent, such as Tween, that reduces the surface tension of a liquid, enabling it to more easily penetrate a paper substrate.

HOW CHEMICALS CAN AFFECT THE BODY

- **Breathing:** Airborne chemical matter and vapors in the form of gases can enter the body through your nose and mouth. Work in a well-ventilated environment, preferably outdoors or using ventilation that will not pull the vapors past your face on their way to an exhaust fan. Paper painter's masks offer only modest protection against chemicals and practically none against harmful fumes.
- **Ingestion:** It is a bad idea to eat while working in the lab, or with chemistry, because you are quite likely going to ingest that same chemistry. Eat somewhere else.
- **Absorption:** Chemistry can enter the body through the skin and get into the bloodstream. Open cuts or healing wounds on your skin can be an avenue for absorption as well. Wear barrier gloves and a mask when mixing chemistry. Gloves may present a number of problems. Commonly available types are made from a variety of materials, not all of which provide an adequate barrier from specific chemicals. Gloves made of nitrile, available from laboratory and chemical supply houses, work well for most chemicals that you will use in alternative process. Except for mild chemical usage, avoid latex or kitchen gloves, because these are susceptible to chemical reactions and are often clumsy.

Protecting Yourself: Be Prepared

The key to chemical safety is controlling the degree of exposure to the hazards encountered in the mixing and use of all chemistry. Ingestion and absorption are easy to protect against in a working lab, it's simply common sense. However, if you are working in a home lab, and you have children or pets, it is imperative that you store your chemistry in a safe and secure place. Prohibit any eating, drinking, and splashing in the toning area. Prevent skin absorption by keeping chemicals from contacting the skin or eyes. If you have sensitive skin, or your skin has cuts, or abrasions, protect it with some type of separation such as tongs, splash goggles, and nitrile gloves. Safety goggles are essential when mixing powdered chemistry, because eyes will readily absorb and pass contaminants along to the rest of the body. If you wear contact lenses, be extra cautious to prevent the powders and chemical fumes from getting between your contact lenses and your eyes.

IF YOU ARE WORKING WITH DANGEROUS CHEMICALS, HAVE THE SOLUTION TO AN ACCIDENT ON HAND. An example of this would be if you were using potassium cyanide (KCN) as a fixer for wet plate collodion. It would be essential that you have several bottles of 3% hydrogen peroxide (drugstore variety) with you to convert a dangerous spill to an inconsequential one. Hydrogen peroxide will change potassium cyanide (health hazard Level 3) to a harmless potassium cyanate (health hazard Level 1). The ratio for this conversion is 6 parts hydrogen peroxide to 10 parts potassium cyanide. If you splash or spill KCN on your skin, don't take time measuring the proportions; just flood the area of the splash with hydrogen peroxide several times and wash with water.

FIRST AID

First Aid for Ingestion of Acids and Alkalis

Curiously, the signs and symptoms for ingestion of acids and alkalis are quite similar, as are the recommendations for treatment. In the past, if an acid was swallowed, the immediate response was to neutralize the acid with an alkali drink (e.g., sodium bicarbonate, several glasses of milk or milk of magnesia, or eight to twelve antacids). If an alkali was not at hand, then the response was to force the victim to rinse the mouth area repeatedly.

Symptoms and signs associated with significant alkali-induced tissue injury include pain in the mouth

and throat, drooling, pain on swallowing, vomiting, abdominal pain, and hematemesis . . . a nice way to say vomiting of blood. If the larynx is involved, local edema may produce respiratory distress and a hoarse voice. Veterinarians recommend giving a solution of one part vinegar to four parts water. Rinse the mouth with water or saline solution and call for medical assistance in either acid or alkali events.

There is disagreement over the effectiveness of having the victim drink large quantities of water. My friend Dr. Jacek Mostwin, at Johns Hopkins, says that the water simply makes the injury spread and that acid or alkali ingestion is not really a first aid situation at all . . . you need professionals right away. One thing is for sure . . . **DO NOT INDUCE VOMITING**. This is especially true for hydrofluoric acid ingestion.

That said, here are the basic immediate first aid recommendations for both acid and alkali ingestion:

- Do NOT induce vomiting.
- Do NOT attempt neutralization.
- Do NOT give oral fluids.
- Do NOT give activated charcoal (for alkali).
- DO rinse the mouth with saline or water for acid.
- DO remove visible material from mouth with water or saline (for alkali).
- DO call 911 and request immediate medical assistance.

First Aid for Skin Contact

If an acid or corrosive chemical is splashed on the skin, immediately proceed to the nearest sink, or emergency shower, and flush the affected area for at least 15 minutes. If the chemical is on your clothing, remove all contaminated clothing.

If a chemical splashes in the eye the immediate response is to flush the eye repeatedly with warm water or first aid saline solution eyewash. If an acid, make a very dilute solution of sodium bicarbonate and use that as well. If an alkali, repeatedly flush with water, or saline solution, and rinse with a very dilute solution of boric acid. In all cases, call for professional medical help.

Seek Emergency Medical Assistance If:

1. The victim has signs of shock, such as fainting, pale complexion, or breathing in a notably shallow manner.
2. The chemical burn penetrated through the first layer of skin, and the resulting second-degree burn covers an area more than 2–3 inches in diameter.
3. The chemical burn occurred on the eye, hands, feet, face, groin, or buttocks, or over a major joint.

Poison Control Telephone: 1-800-222-1222

If you're unsure whether a substance is toxic, call the poison control center at this number: (800) 222-1222. This is the *telephone number* for every *poison* center in the United States. Call this *number* 24 hours a day, 7 days a week to talk to a *poison* expert. If you seek emergency assistance, bring the chemical container or a complete description of the substance with you for identification.

CHEMISTRY & SAFETY

- Do not place an exhaust vent above your face. If you are building a darkroom, install the exhaust in the floor or, better yet, do as we do at the College of Art and Design at Lesley University and build your ventilation system into the sink itself so that the fumes are vented before reaching your face. Having an exhaust above your face just pulls all of the fumes past your eyes, nose, and mouth on their way to the vents. The fan and exhaust capacity should be able to completely exchange the air in the room every 3–6 minutes. Consult with an air quality company for the specifics that will be best for your space.
- Prevent chemical material from becoming airborne through careful handling and mixing of liquids and powders. Work slowly and don't splash.
- Cover trays and tanks when not in use to prevent vapors from filling your working space. Sheets of Plexiglas® work well. Label each sheet with the chemical that it covers so that it is always used for the same chemicals.
- **Triple A.** When mixing, **Always Add Acid to water; never add water to acid**. In this way, which is the only way, heat produced by the acids will not cause a splattering acidic liquid eruption.

- When weighing chemicals on digital gram scales, never place raw chemicals on the weighing platform of the scale. Always place a weighing paper or a plastic/paper cup on the scale to hold the chemistry. Always weigh the paper or cup before depositing the chemical, and re-calibrate your scale to zero by pressing "TARE" so that the chemical weight will be the only thing being weighed.
- Prior to working with any chemical that you are not familiar with, be sure to read the chemical's MSDS data sheet to understand its traits and how to deal with it in the event of an accident or emergency. Mix chemistry in glass or plastic containers—never metal.
- Always wear gloves and safety glasses when weighing and mixing chemistry.
- Always use a plastic funnel to prevent spilling and splashing when transferring chemistry, solids, or solutions.
- Always clean all utensils and equipment that have been in contact with chemistry.
- Always keep your mixed chemistry in labeled and sealed containers.
- Never keep your chemistry in a location that will be accessible to children, pets, and guests. In other words, do not store your chemistry in your home refrigerator, whether it is labeled or not. If your chemistry needs to be refrigerated, buy a small dorm-type unit for your lab and lock it.
- Always mix chemical formulas in the order that the components are listed. There are exceptions to this, but those exceptions should be noted along with the ingredients in the formulas.
- Always have 911 or poison control numbers posted in your lab.
- As an artist, your eyes are your life. You must have an eyewash kit in your lab.

Note: Please be aware that all chemicals are hazardous in one form or another, and any concerns you may have regarding their use and dangers can be found by accessing MSDS web sites or by requesting MSDS data sheets from the companies that supply you with chemistry. If you intend to use any of these chemicals in a class situation, it is imperative and mandatory that you have MSDS data sheets on hand in the event of an emergency.

Dichromates: Safety and Disposal

Dichromates—ammonium, potassium, and sodium versions—are potentially hazardous chemicals, and care should be taken in both their use and disposal. Be very careful to avoid breathing a dichromate dust, because it is toxic, and allowing the chemical to come in contact with your skin. Do not touch your skin, mouth, or eyes when working with any dichromate, and if you experience a problem (burning, coughing, difficulty breathing, vomiting, cramps, blurred vision, etc.), flush the problematic area with lots of water for 15 minutes and seek immediate medical attention. If a dichromate spills on your clothing, remove that article of clothing and wash it well before putting it back on. Wear gloves when working with this chemical. Be especially careful around high-heat sources because this chemical's reaction to heat can be quite intense as it decomposes.

Proper disposal of dichromate solutions is important. As a rule, **never throw loose and dry orange dichromate/bichromate crystals in the trash**. Very small amounts of solution can be disposed of by dilution with copious amounts of water and flushed away. Larger volumes of dichromate are a different matter. One method is to add used developer to a dichromate solution. Another is to make the solution alkaline by adding baking soda to the solution. This change can be detected by using litmus paper that will turn blue in a base or alkali. Once the solution is alkaline, pour it through several layers of coffee filters. The liquid will be free of the chromium and then flushing of the liquid can take place. The sludge in the coffee filters *must* be disposed of by a hazardous waste facility. Check with local college photo lab managers to get the names of these facilities.

CHEMICAL ABSTRACT SERVICE REGISTRY (CAS)

The numbers following each chemical's name are part of a worldwide indexing system called Chemical Abstracts Services Registry (**CAS**). It is used here to ensure that everyone using a chemical is dealing with the same one when describing it for any purpose. The CAS numbers for these, and other chemicals on Earth, can be found at various sites that offer CAS numbers.

CHEMICALS

Acetic Acid CAS# 64-19-7

Acetic acid is a clear fluid and has a pungent vinegar-like odor. It is used in 20%–28% dilutions for photographic purposes, although a 33% solution is called for in calotype (stronger if the ambient temperature is hot). At 28% it is primarily used as a stop bath and is found in a hardening fixer bath. It can also be used as a solvent of gelatin and collodion. To prepare a photo-grade solution dilute 3 parts glacial acetic acid with 8 parts water. A 5% variation is used to make pickles. I have heard that a weak dilution is also used for treating sunburn, but I wouldn't recommend this idea without medical advice. In high concentrations, both its vapors and solution are corrosive and unpleasant for the skin and respiratory system. In low concentrations it will make your eyes sting and may cause an allergic reaction on your skin. Vinegar is a 5% acetic acid. If you spill acetic acid on your skin, wash well with clean water. Do not drink acetic acid at any level stronger than vinegar. If somehow you ingest a strong concentration, take milk of magnesia and seek medical attention. Acetic acid is incompatible with strong oxidizers (meaning that it will generate heat), carbonates, hydroxides, and strong alkalis (a violent reaction). *Never* expose acetic acid to sodium peroxide or nitric acid because it may produce an explosion. Dilute this chemical well before disposing. Store it above 63˚F to prevent it from solidifying.

Note: Glacial acetic acid refers to a very strong concentrated acetic acid, usually between 80% and 99%, with a pH of 2.4. At this concentration it is highly corrosive and is a severe poison.

Alcohol (Everclear)

Grain alcohol (95% 190-proof ethanol) can be difficult to locate. It is not available in all states. Everclear brand grain alcohol can be purchased over the Internet (http://www.shoppersvineyard.com). It can also be purchased in liquor stores in several states including New Mexico, where it is often included in a wet plate collodion kit (as grain alcohol) from Bostick & Sullivan. **Do not drink this alcoholic liquid alone or as a pea-brained additive to a punch-bowl at a party.**

Alum (Ammonium Alum, Ammonia Aluminum sulphate) CAS# 7784-26-1

This component is often found as a hardener for fixing baths and gelatin, hypo-alum toner, and clearing baths. Its fumes will cause distress to your respiratory and intestinal tract, and contact will cause itching and reddening to your skin. If it is ingested, do not induce vomiting. Take normal safety precautions with gloves, goggles, and a respirator.

Ammonia CAS# 7664-41-7

Ammonia is a corrosive gaseous fluid that can cause severe burning reactions to the respiratory system, eyes, and tissue. It is normally used in solution as ammonium hydroxide. High degrees of exposure can cause fatal reactions, including death. Be cautious when using this chemical. There is a very strong odor associated with it, and a dual-filter respirator is advised. Be especially careful of getting this chemical in your eyes because even the slightest amount will cause severe problems—even with immediate first aid treatment and wash.

Note: Never mix ammonia with silver nitrate or gold because it forms explosive azides.

Ammonium Carbonate CAS # 506-87-6

This chemical presents itself as a fine, white crystal with a hint of ammonia in its odor. It is found most often as an accelerator in warm-tone developers and is not particularly dangerous. Vapors may cause respiratory distress, and contact with eyes, mucous

membranes, and skin will result in redness and irritation. It should be kept at a good distance from acids and strong alkalis. Use normal safety precautions.

Ammonium Chloride (Sal-Ammoniac) CAS# 12125-02-9

Ammonium chloride is a white crystal/powder used as an accelerator in sodium thiosulphate fixing baths. It is also employed in salted albumen papers. This chemical is troublesome for the eyes and your respiratory system. It is important to know that heating this chemical will cause a wispy smoke that is very unpleasant (hydrochloric acid and ammonia). Ammonium chloride will cause respiratory distress if inhaled. It is not compatible with acid concentrates, potassium chlorate, and ammonium nitrate. Wear a respirator, safety glasses, and gloves when mixing.

Ammonium Citrate CAS# 12125-02-9

This chemical is a moderately safe one to work with. Inhalation of the powder will cause respiratory distress and is particularly problematic if it gets into your eyes, causing redness and pain. Be careful not to inhale, ingest, or rub this chemical on your skin. If you experience a bad reaction to ammonium citrate on your skin or in your eyes, flush well with water and seek medical attention.

Ammonium Dichromate (also Bichromate)CAS# 7789-09-5

This chemical is used in sensitizers for a number of non-silver and alternative processes (gum bichromate and carbon printing) and behaves in much the same manner as potassium dichromate except that it is more aggressive and becomes saturated at 25% versus 13%. Potassium dichromate is preferred for gum bichromate printing, as it renders more slowly and with less contrast. Its crystals are orange in color and are a strong irritant for literally every part of your being. It can cause ulcerations on the skin and, if inhaled, significant respiratory distress—especially in mucous membranes. Ammonium dichromate is flammable in a dry state, so do not throw out the powder with the trash . . . over-saturate and flush for disposal.

Ammonium Ferric Oxalate CAS# 14221-47-7

(Ammonium iron (III) oxalate trihydrate)

Like all oxalates, this chemical will be toxic to your health and *highly corrosive* to skin, eyes, tissue, and respiratory system. This chemical can be absorbed in the body by breathing or ingesting and can cause havoc with your kidneys. Be very careful around any oxalate. Wear nitrile gloves, a dual-filter respirator, and safety glasses. Also, never work with any oxalate without adequate ventilation. Do not breath the fumes of any oxalate because its fumes can be absorbed through the lungs. If you spill an oxalate on your clothing, forget modesty; remove your clothing and wash well with plenty of water. Do not mix any oxalate with a strong concentrated acid or oxidizer, and do not dispose of it in any place but a hazardous waste facility. Most college photography labs have contracts with chemical disposal services, and you should contact them for assistance if you need to get rid of dangerous chemistry.

Ammonium Hydroxide (30% Ammonia) CAS#1336-21-6

This chemical, also known as *ammonia water*, is often found in developing and toning solutions as an accelerator. Essentially, it is an aggressive form of ammonia and water used in the mordançage process. A 5% solution is the equivalent of household ammonia. Always work with good ventilation and wear gloves.

Ammonium Thiocyanate CAS # 1762-95-4

Also known as ammonium sulphocyanide, ammonium thiocyanate is a component of gold-thiocyanate toning in POP and appears as a colorless, deliquescent (readily absorbs water) crystal with a slight odor of ammonia. It is incompatible with chlorates, oxidizing agents, peroxides, and strong acids, with which contact will liberate a toxic hydrogen cyanide. Inhalation will cause respiratory distress, and all normal safety precautions should be adhered to when using the chemical.

Ammonium Thiosulphate (Rapid Fixer) CAS# 1183-18-8

This chemical, when substituted for sodium thiosulphate, is used as a fixing salt in many high-speed fixers (e.g., rapid fixer). In terms of fixing speed, it is much faster than sodium thiosulphate. It can be used easily as a fixer in the wet plate collodion process and is preferred if you are anxious about working with potassium cyanide as your fixer. It will take a few additional minutes to fix your plate versus using KCN, and the wash time is significantly longer for the plates, but it is safer. Ammonium thiosulphate is a colorless crystalline salt with strong fixer-like odor. Extended contact, as all photographers know, will cause skin irritations. Decomposition or heating of this chemical will release a highly toxic sulphur dioxide gas. Keep it away from cyanotype chemistry. Use tongs when working with this chemical, and wear gloves and a respirator when mixing.

Borax (Sodium Tetraborate) CAS# 1303-96-4

This is powdered laundry soap. Employed as a laundering agent, borax is the same chemical you will find in the supermarket. It is often used as a weak alkali accelerator in developers and in some hardening fixing baths. It is also used to make a gold toner more alkaline and allows for a faster rate of gold deposit. Its use has a moderate health risk, and normal safety precautions should be adhered to when using it. If you ingest or breathe large quantities of it, wash the exposed area well and seek medical attention if symptoms persist (e.g., difficulty breathing, irritation, muscular spasms, itching, or pain).

Boric Acid CAS# 10043-35-3

This chemical is used in hardening fixers containing potash alum and acetic acid. It extends the life of fixers and can be found in some buffered fine-grain developers.

Cesium Chloropalladite

Cesium is a double salt built on an alkaline metal compound. It sits at the lower end of Group 1 on the periodic table and is a very heavy metal used in the Ziatype process (for the brown coloration). This chemical, found in certain non-silver processes, is an irritant to the skin, eyes, and respiratory system. Seek medical attention if physical distress accompanies its use.

Chrome Alum (Potassium Sulphate) CAS# 7778-99-0

Chrome alum appears as a deep red/purple granule and has no odor. It is sometimes employed as a hardening agent for gelatin and has a moderate health risk associated with its use. It is incompatible with aluminum and magnesium and will cause respiratory distress if inhaled. Do not touch your skin, eyes, or mucous membranes while using it, and flush any infected area with copious amounts of water. Seek medical attention if symptoms persist.

Citric Acid (2-hydroxypropane) CAS# 77-92-9

Since we use a great deal of this chemical in alternative process work I have a little more to say about it than others. Citric acid is very useful as a first rinse bath in iron processes in that it lessens the chance of your print developing iron stains. EDTA performs a similar chore as a chelate. Citric acid is the most common food acidulant, an acid combined with a food product to flavor or preserve. It is abundant in unhealthy snack foods. This acid was initially extracted from lemons or other citrus fruit, but today it is manufactured through a sucrose fermentation technique and is recovered by precipitation, evaporation, or crystallization. It is available in two forms—monohydrate or anhydrous (approximately 8.6% moisture)—and is sometimes available as a solution. The product obtained by fermentation is identical to organic citric acid.

We work with citric acid in a white powder form, and it is colorless upon dilution. It is also odorless with a strong acidic flavor. One gram is soluble in 0.5 ml water. The pH of a 1% solution of the monohydrate is 2.3, and the pH of a 1% solution of the anhydrous form is 2.2. The Food and Drug Administration recognizes citric acid as safe.

Citric acid aids in the preservation of texture, color, aroma, and vitamin content of food products and is particularly useful as a chelant. It is the preferred

acidulant to ensure optimum gel formation in pectin products. This chemical is commonly used in toners, as a clearing bath for some alternative processes, and it is one of the alternatives to hydrochloric acid in platinum/palladium clearing. Citric acid is also used to transfer photomechanical ink images, (Rauschenberg used it) via saturation and rubbing the image on a clean piece of paper from the rear of the saturated paper. It is not dangerous to work with but can cause irritations to eyes, skin, and the respiratory system if handled in a cavalier manner. However, do not mix citric acid with metallic nitrates because the reaction may be explosive. It is also incompatible with carbonates, copper, aluminum, and zinc.

Collodion USP CAS# 99994-22-6

Collodion is a viscous fluid that is used in photographic practice as a salted binder for sensitizing wet plate, ferrotype, and ambrotype glass plates. It is not particularly dangerous but is very flammable, and precautions should be made when working with the material. Although it is possible to make collodion at home with nitrated cotton, ether, and alcohol, I strongly advise that you do not do so. Instead, purchase a prepared plain collodion.

When using collodion be sure to have adequate ventilation, wear gloves, and wear a respirator if airborne concentrations are high. Collodion vapors can exist quite a distance from the actual material, and you must be sure that any ignition source is off before use. Keep the collodion away from strong acids and oxidizers and take general lab safety precautions when using it.

When you wish to dispose of unused collodion, spread some newspapers outside in a non-windy place (I use a wheelbarrow in the garage) and pour out thin layers of the collodion on the newspaper. It dries quickly as a thin skin. Repeat the step until your collodion is gone and then clean your container with Everclear alcohol (190 proof). Do not use the newspaper to start a campfire, as it will be explosive.

Copper Chloride CAS # 10125-13-0

Copper chloride appears as a blue/green crystal and is used in many toners, bleaches (mordançage), and intensifiers. This chemical is a strong oxidizing agent and presents a significant health hazard if used casually. Avoid light, air, and moisture in storage. Toxic fumes are harmful if breathed, and its dust must be avoided. Always wear a dual-filter respirator, gloves, and goggles when mixing or using. Copper chloride is incompatible with potassium, sodium, oxidizers, and strong acids that may result in the release of toxic chloride vapors. Overexposure will result in a host of problems, including respiratory distress, chills, burning sensations in the intestinal tract, headache, and so on. Be very careful when using this chemical, and seek immediate medical attention if in distress.

Copper Nitrate CAS# 10402-29-6

Be careful around this chemical because it is harmful to your body. Prolonged or intense contact will cause chills, gastrointestinal problems, and pain. Avoid contact with the skin, breathing, or ingestion. Irritations of many sorts, and burns, are common if precaution is not taken in the use of this chemical. Like all nitrates, you must be vigilant when using it and adhere to all safety precautions: gloves, goggles, and a respirator. Seek immediate medical attention if in distress.

Copper Sulphate CAS# 7758-98-7

Copper sulphate appears as a blue/translucent crystal or powder. This chemical is used in toners (copper), bleaches, and intensifiers. Not a great deal is known about this chemical other than it is a moderately toxic one and all precautions should be taken in its use and handling. Wear gloves and a respirator for mixing or prolonged use, and do not touch your eyes or mouth when using it. Copper sulphate is an irritant. The usual routes by which humans can receive toxic exposure to copper sulphate are through eye or skin contact, as well as by inhaling powders and dusts. Skin contact may result in itching or **eczema.** Eye contact with copper sulphate can cause **conjunctivitis, inflammation** of the eyelid lining, **ulceration**, and clouding of the **cornea**. Upon oral exposure, copper sulphate is only moderately toxic. According to studies, the lowest dose of copper sulphate that had a toxic impact on humans was 11 mg/kg. Because of its irritating effect on the gastrointestinal tract, vomiting is automatically triggered upon ingestion of copper sulphate.

Copper(II) sulphate, also known as cupric sulphate or copper sulphate, is a chemical compound with the chemical formula $CuSO_4$. This salt exists as a series of compounds that differ in their degree of hydration. The anhydrous form is a pale green or gray-white powder, whereas the pentahydrate ($CuSO_4 \cdot 5H_2O$), the most commonly encountered salt, is bright blue. $CuSO_4 \cdot 5H_2O$ is a shade of blue and is very toxic to the environment and is irritating to the eyes and skin. It can be harmful if swallowed. Other names for copper(II) sulphate are "blue vitriol" and "bluestone."

Copper sulphate is a commonly included chemical in children's chemistry sets and is often used to grow crystals in schools and in copper plating experiments. Copper sulphate is also used to test blood for anemia.

For most of the twentieth century, chromated copper arsenate (CCA) was the dominant type of wood preservation for uses other than deep driven piles, utility poles, and railroad ties. It gives the treated wood a peculiar green coloration. To make pressure-treated wood, a large cylinder is filled with an aqueous chemical bath. Copper sulphate pentahydrate is dissolved in the water along with other additives prior to the lumber being placed inside the cylinder. When the cylinder is pressurized, the chemicals are absorbed by the wood, giving the wood fungicidal, insecticidal, and UV-light-reflecting properties that help preserve it.

EDTA

Disodium EDTA (Disodium Salt Dihydrate) CAS# 6381-92-6

Also known as ethylenediamine tetraacetic acid and disodium salt. It is used as a first clearing bath for Pt/Pd. It may irritate the skin, eyes, and respiratory system. This chemical is more of an irritant than a danger and should be handled in a similar manner as its sibling, tetrasodium EDTA.

Tetrasodium EDTA (Tetrasodium Salt Dihydrate) CAS# 10378-23-1

Repeat after me . . . *ethylenediamine tetraacetic acid tetrasodium salt dihydrate* is a chemical recently employed as an alternative to hydrochloric or citric acid in some clearing baths. It is relatively safe to use and is commonly found as a preservative in some foods and in agricultural uses. It may irritate the skin, eyes, and respiratory system. EDTA is generally purchased in a white crystal form and can cause minor problems if you are too casual when using it.

EDTA is commonly found as a preservative in processed foods, in cosmetics to improve stability, as a detergent in the dairy industry to clean bottles, as a treatment for mercury poisoning, and in soft drinks containing ascorbic acid and sodium benzoate (most all of them) to reduce the formation of the carcinogenic benzene. It can also be used in the recovery of used lead acid batteries and is found in cleaning compounds, detergents, and in photography as an oxidizing agent.

Ferric Ammonium Citrate CAS# 1185-57-5

Ferric ammonium citrate is also known as *iron ammonium citrate, ammonium ferric citrate, iron citrate,* and *ammonium iron (III) citrate.* It presents itself as a green, or brown, scale crystal/powder, has a somewhat undetermined structure, and is prepared by treating ferric hydroxide with hydrated citric acid (75%), iron (16%), and ammonia (7.5%). This chemical is commonly found in human-ingested iron supplements, cyanotype formulas, iron toners, and other non-silver formulas, and it functions as a sensitizer. It is not particularly toxic, but you must still exercise care in its handling, storage, and use. It may be the cause of eye and skin irritations if precautions are ignored. If you notice that your urine is pink, then you have absorbed or inhaled far too much of this stuff and you should seek medical attention.

Ferric Citrate CAS # 2338-05-8

Ferric citrate is a brownish red powder in a 17% iron state. There is a purified variation of this chemical, but it is not what you are looking for in alt pro work. Ferric citrate is light sensitive and is used, for our purposes, primarily as an ingredient in preparing a Van Dyke Part C contrast control alternative to be mixed with the traditional Van Dyke Part C. See the Van Dyke chapter. It is not particularly toxic, but you must still exercise care in its handling, storage, and use. It may be the cause of eye and skin irritations if precautions are ignored.

Ferric Oxalate (Ferric Ammonium Oxalate) CAS # 2944-67-4

Platinum and kallitype printers use ferric oxalate as the light-sensitive ingredient in their sensitizers. It is an oxalic acid salt and is toxic. The body can deal with it in small quantities. Ferric oxalate is a weakly bound chemical and will quickly decay to ferrous oxalate and then to oxalic acid and ferric oxide (rust). Please see the potassium oxalate entry for more information.

Ferric oxalate is a green/transparent crystal and is light sensitive. All oxalates are toxic, and you should avoid breathing, touching, or ingesting them. They are corrosive to all parts of your body and can cause ulcerations on the skin. Severe kidney damage can be the result of large amounts of absorption or breathing fumes. Wear latex or nitrile gloves, a respirator, and eye protection when working with oxalates. If you happen to spill ferric oxalate on your skin, wash it well with clean water. If you spill it on your clothing, remove that clothing and wash it well. If it is ingested, call a doctor and poison control. Be extra cautious when using any oxalate because it is a most serious health hazard if used in a casual manner.

EDTA is a chelate that will dissolve ferric oxalate . . . an important thing to know when you need to use it as a clearing bath.

Ferrous Sulphate CAS# 7782-63-0

This chemical is used in standard wet plate collodion developers. It is also used in stain removing and clearing baths. If you have taken in too much of this chemical through breathing, touching, or tasting, you will have an acidic and sour taste in your mouth. It does not keep well in solution. This chemical can cause itching, burning in the eyes, breathing difficulty, and general ill health. Be diligent in its use and follow all safety precautions. Seek immediate medical attention if you find yourself in discomfort or distress when using this chemical.

Formalin/Formaldehyde CAS# 50-00-0

Formalin/formaldehyde, a 37% concentration of formaldehyde gas in water with an additional component of methyl alcohol, is employed as a hardener and preservative in photography. Formalin is used as a tanning and hardening agent of gelatin in gum bichromate and other processes in which sizing/hardening is required. This chemical is highly toxic and unhealthy to the body if safety precautions are not used. Do not breathe the fumes (which are very strong) and work only in very well-ventilated environments, such as outdoors with the wind at your back. Be cautious of formalin-prepared papers indoors, after they are dry, because they will continue to outgas for a day or so and be dangerous to your respiratory system. Fumes from formalin will attack the mucous membranes of your eyes, nose, and throat. This chemical is a carcinogen and you must take it very seriously. If somehow this chemical is ingested, seek immediate medical attention: you will see the following . . . coughing and respiratory distress that persists, violent vomiting, headache, severe abdominal pain, weak pulse, burns, blurred vision, and sudden change in skin color to white. In other words, take this seriously.

See glyoxal below.

Fumed Silica

Fumed silica (not to be confused with silica fume) is *amorphous* (meaning it has undefined shape and form), rather than crystalline, and is a vaporized form of clear solid silica that behaves as if it were a liquid. Fumed silica is made by flame hydrolysis of silicon tetrachloride. Silicon tetrachloride is a liquid at room temperature. It is vaporized and then passed through a fuel/air flame at an extreme temperature to produce fumed silica. Fumed silica is essentially a harmless, non-carcinogen that is a primary thickening ingredient in fast-food milkshakes and is used as an anti-caking agent in powders, an abrasion resister in concrete, and in kitty litter. It also features light-diffusing properties, which is one of the reasons the dark end of the tonal scale looks so nice in an alt pro print that employs it as a pre-coating. It is also found in cosmetics like lipstick and toothpaste. When applying it with a hot-dog roller as a pre-coating to a process on paper, it would be prudent to wear eye protection and a respirator.

Gallic Acid CAS # 149-91-7

Gallic acid appears as a white/pale yellow crystal and is used as a component in cyanotype toning and as a traditional chemical in calotype development and developing-out formulas for processes such as the whey technique. It does not present a significant health hazard but is incompatible with ferric salts, silver salts, alkalis, ammonia, chlorates, and strong oxidizing agents. Overexposure will cause moderate discomfort and should be treated with respect regardless of its low toxicity.

Glyoxal CAS# 107-22-2

This chemical is recommended as a substitute for formalin/formaldehyde as a hardening agent for gelatin in sizing for the gum bichromate process. It is an alternative, in terms of reactivity and toxicity, to formalin, but insufficient evidence has been offered by the scientific community to allow you to treat it casually. Glyoxal should never be mixed with sodium hydroxide or nitric acid, and if heated in an enclosed container, it is explosive. It is also corrosive to all metals. Glyoxal should be used in well-ventilated environments (such as outdoors), and all precautions should be taken to prevent ingestion, contact with the skin, and breathing of its fumes. Note: Just because glyoxal doesn't have an offensive odor like formaldehyde, doesn't indicate that it is safer and that you can relax using it. Treat glyoxal with the same respect you would formalin. After sizing your gum paper with gelatin and glyoxal, hang it to dry in well-ventilated space outside of your living area. It requires an off-gas period of 24 hours. Once dried, label each sheet as glyoxal sized and store the sized paper in a zip lock bag.

Gold Chloride CAS# 16903-35-8

Gold chloride is also known as *chloroauric acid, gold trichloride acid, and hydrogen tetrachloroaurate (III)*. Gold chloride is generally used in dilutions of 1%, 5%, and 8% for purposes of toning in a number of processes. Gold chloride is also a primary component in Ziatype printing and will raise the contrast of the print when added to the formula. Gold chloride is a strong irritant and can cause significant skin and respiratory allergies if you are casual with it. Pay heed to all normal precautions when using this chemical.

Gum Arabic CAS# 9000-01-5

Gum arabic, or gum acacia, can be traced back to 2650 BCE, when it was harvested from the sap of various species of acacia trees in Nigeria, Cameroon, Chad, Mali, and the Sudan. The acacia trees grow primarily in the sub-Saharan (Sahel) areas of Africa, and the Sudanese variety is considered the premium grade. In gum printing, the dichromate is added to the gum to create the liquid foundation of the gum sensitizer. Gum arabic comes in a variety of grades (tints) from colorless to dark brown. On exposure to light, the gum and the ammonium dichromate solution will harden in proportion to the exposure of UV light.

Hydrogen Peroxide (3%) CAS# 7722-84-1

Hydrogen peroxide is a colorless and not very stable liquid used primarily as a bleaching agent, an antiseptic, or an oxidizing accelerator in the cyanotype process. You do not have to be enormously concerned with this chemical when purchased in its 3% over-the-counter form. In dentistry applications it is often mixed with water and used to clean wounds inside the mouth.

In this concentration, which we are most accustomed to as a treatment for cuts and abrasions, hydrogen peroxide is a simple peroxide and an oxidizer . . . which is what is happening when you pour it on an active wound and it generates a white effervescent foam. Hydrogen peroxide is used in alternative processes as an oxidizer for the iron in cyanotypes (the WOW factor effect) when prepared in a very dilute bath for a finished cyanotype, resulting in a very deep and beautiful blue.

Hydrogen peroxide is also used to neutralize potassium cyanide (KCN) wet collodion fixer by converting it to a safe, and unregulated, potassium cyanate. See the instructions in the Wet Collodion chapter.

Hydrogen Peroxide (28%–33%)

In this strong concentration, hydrogen peroxide is used primarily for mordançage bleaching and in beauty parlors to alter hair color. It is a health

hazard. Wear appropriate protection, do not breathe the fumes, and flush exposed areas well with water if you experience problems after contact. If you work in a beauty salon, please wear appropriate protective clothing, gloves, and breathing apparatus . . . this stuff is not good for you and may, under some circumstances, lead to pulmonary edema . . . also known as high-altitude sickness, in which fluid accumulates in the lungs.

Hydrogen Tetrachloroaurate(III) Trihydrate CAS# 27988-77-8

Used in the sensitizer for chrysotype—version S. Also known as gold(III) chloride hydrate and hydochloroauric acid. In early literature it was called gold chloride. This chemical is corrosive and can be destructive to your mucous membranes. Take appropriate safety and working measures when using it.

Kodak Hypo Clearing Bath

This solution is used to accelerate the neutralization of fixer and therefore cut the wash times for films and papers. Two formulas for hypo clearing baths are the following.

Formula #1: 750 ml water, 200 g sodium sulphite (anhydrous), 50 g sodium bisulphite, and water to make 1 liter.

Formula #2: 125 ml hydrogen peroxide, 10 ml ammonia solution, and water to make 1 liter.

Other formulas include sodium sulphite, EDTA, sodium citrate, and sodium metabisulphite. Hypo clearing agents can be mild irritants to the body in concentrated solutions for lengthy exposure.

Lead Acetate CAS# 301-04-2

This chemical is used as a toner. Lead acetate is a possible carcinogen, and like other lead products, is toxic. It can be a problem for your body and can be absorbed by breathing its fumes. It is a poison if ingested and can cause brain damage. Fumes are released when it is heated. Be cautious in all safety respects when using this chemical.

Lithium Palladium Chloride/Lithium Chloropalladite

Lithium palladium chloride/lithium chloropalladite is a double salt built on an alkaline metal compound (lithium), which is a lightweight alkali sitting atop the periodic table. It is used in the Ziatype process and results in a cool black value. Do not drink it or play with it. Lithium is a primary component in medicating bipolar disorder, and high incidences of exposure can have adverse effects on the nervous system.

Mercuric Chloride CAS# 7487-94-7

Also known as mercury(II) chloride, mercuric chloride was used as a photographic intensifier to produce positive pictures in the collodion process of the 1800s. When applied to a negative, the mercury(II) chloride whitens and thickens the image, thereby increasing the opacity of the shadows and creating the illusion of a positive image (Towler, 1864).

Mercuric chloride is toxic, white, and a soluble salt of mercury (at 6%). It has been used in disinfectants, as a fungicide, as a treatment for syphilis before antibiotics, and in photographic fixers. It's also odorless and really dangerous, which is why I'm letting you know about it here. Take all safety precautions when working with this chemical.

Methyl Alcohol (Wood Spirit) CAS# 67-56-1

This is a poison. It can be readily absorbed by breathing and through the skin and is considered very dangerous to the central nervous system. It can cause blindness. Use all safety precautions against exposure when using methyl alcohol. If methyl alcohol is swallowed, administer an emetic (a medicine that induces vomiting) and bicarbonate of soda (1 tsp in a cup of water), and call a doctor.

Muriatic Acid (Hydrochloric Acid) CAS # 7647-01-0

Muriatic, or hydrochloric, acid is a clear, colorless, irritating, vaporous poison that was used as a primary clearing bath with Pt/Pd and as a tray cleaner . . . among other uses. It can be purchased at hardware

stores and pool supplies and is often used by masons for cleaning bricks. Be respectful of this chemical and take precautions while using it.

Nitric Acid CAS# 7679-37-2

Nitric acid is a colorless liquid and will make its appearance known as soon as you unscrew the top to its bottle; a chemical vaporous smoke will appear like an evil genie from the bottle. It is used in some cyanotype toning formulas, as a preservative in Pyro developers, and as a component in bleach. Nitric acid is highly corrosive to most anything it comes in contact with, including your body. At present, there is really no safe way to use this chemical in regard to ventilation except for with a professional chemical hood. Nitric acid is a very aggressive oxidizer and will react violently with a vast range of metals, acids, solvents, and other things found in the lab or home. Although I like using it in cyanotype toning I am not sure if the resulting color is actually worth the risk. If you are a teacher, you mix the formula. Also, be careful of the cap on the glass bottle that the acid is stored in. If it is an old fashioned plastic cap there is a good chance that the acid will destroy the cap's integrity in time. Be hyper-careful in its use and storage. If this chemical is spilled on skin, wipe off what you can, immerse the relevant skin areas in water, and then cover the area with a paste of water and baking soda. Go to a hospital and seek immediate medical attention. If you spill it on your clothing, forget modesty and immediately remove your clothes. If nitric acid is ever swallowed, administer a small amount of soap softened in water, milk, or raw egg. You can also force the patient to drink a small amount of magnesia or plaster softened in water. Seek medical assistance for extreme exposure.

Oxalic Acid (Ethanedioic Acid) CAS# 144-62-7

Oxalic acid is translucent and odorless. This chemical is used in blue toners and as a preservative in certain Pyro formulas. It is found in all leafy green vegetables but is highly toxic in strong concentrations so you must use all safety precautions in its use and storage. Oxalic acid is corrosive to tissue and removes calcium from the blood, which may result in kidney damage. It is incompatible with alkalis, silver, and oxidizing agents. Take normal safety precautions when using this chemical.

Take all necessary precautions when using oxalic acid because it is toxic. Its primary role in your life is likely to be as a cleaning and bleaching agent . . . especially for the removal of rust/iron deposits. In alternative processes, oxalic acid is also used as a reducing agent in the platinum/palladium process. The principle toxicity risk when using oxalic acid is due to kidney failure, which may cause precipitation of solid calcium oxalate, the main ingredient of kidney stones. That said, wear nitrile or safety examination gloves and eyewear when using this chemical.

Palladium Chloride CAS# 7647-10-1

Palladium chloride is dark brown and without odor. This chemical is found primarily in palladium printing and in certain other non-silver processes and is an irritant to the skin, eyes, and respiratory system. Palladium chloride is moderately toxic. It is often associated with bipolar disorder medication. High doses can cause problems with central nervous system functions. Be cautious of contact with the skin, ingestion, and breathing fumes. Use normal precautions in its use and handling.

Potassium Bromide CAS# 7758-02-3

Potassium bromide appears as white crystal and is without odor. This chemical is often used as a restrainer in bleachers and developers. It is also widely used in intensification, reducing, toning, and many other photographic formulas. It is mildly irritating to the tissues of your body and can sometimes cause skin problems. It is a mutagen, and extreme exposures can result in depression of the central nervous system. Potassium bromide is incompatible with strong oxidizers and acids. Use all safety precautions.

Potassium Chloroplatinite CAS# 10025-99-7

This chemical is found in toners and intensifiers, and it is the primary ingredient in platinum printing. It is highly corrosive to human tissue and can cause

severely adverse reactions to extreme or long-term exposure. This chemical is a poison and should be used and handled with all safety precautions.

Potassium Cyanide CAS# 151-50-8

Potassium cyanide (KCN) is a white granular, odorless crystal, much like sugar, and is also known as hydro/potassium salt of hydrocyanic acid. Highly toxic, a health hazard, and Level III, KCN is odorless, but due to hydrolysis, solids emit small amounts of hydrogen cyanide, which smells like bitter almonds. KCN is highly soluble in water and is actively employed in, as well as a preferred chemical for, fixing wet plate collodion due to its ability to lend brightness to the plates, longevity, and coffee and cream highlight coloration in tintypes and ambrotypes and because washing times for the plates are measured in seconds rather than minutes . . . which is useful if making plates on a battlefield or if you are backpacking and can't take along a lot of water. KCN is extremely dangerous and must never be placed in a situation where it can come into contact with an acid . . . thus creating a lethal hydrogen cyanide gas.

Exposure to potassium cyanide can be rapidly fatal. It has whole-body (systemic) effects, particularly affecting those organ systems most sensitive to low oxygen levels: the central nervous system (brain), the cardiovascular system (heart and blood vessels), and the pulmonary system (lungs).

Note: To neutralize a 1.2% potassium cyanide fixer solution (standard dilution for wet plate collodion), put on eye protection, a respirator, and nitrile gloves and place potassium cyanide in an empty and clean drywall bucket or large glass beaker. Slowly add 600 ml of drugstore-grade 3% hydrogen peroxide to a liter of used potassium cyanide. In a short time you will have converted a heavily regulated chemical to a non-hazardous, un-regulated potassium cyanate.

Please read the section on potassium cyanide in the fixing section in the Wet Plate Collodion chapter.

Potassium Dichromate CAS# 7778-50-9

Potassium dichromate (bichromate) is a beautiful orange crystal that is used as a principal sensitizer in the gum bichromate processes and as a contrast boost additive in many non-silver processes. It is also a bleaching agent. It is most often used as a saturated solution or diluted for use as a contrast additive to wash-development baths or sensitizer. It is highly toxic, corrosive, and can enter the body through absorption, ingestion, and breathing. It can cause extreme allergic reactions and is a powerful irritant to human tissues and internal systems. It is a carcinogen and must be handled with care. It is incompatible with any combustible, organic, or oxidizable material. It is extremely destructive to tissue and respiratory systems and may cause distress. If this chemical is spilled on clothing, remove the clothing immediately. Do not be the least bit casual when using this chemical, and seek immediate medical attention if you experience discomfort in breathing, burning, or dizziness.

(*See Ammonium Dichromate for safety and disposal.*)

Potassium Ferricyanide CAS# 13746-66-2

Potassium ferricyanide is an orange-red crystal and has no odor. It is also called red prussiate of potash and is used in reducers, bleaches, toners, and many alternative and non-silver processes, specifically iron based. Ruby red in color, potassium ferricyanide is a low-toxicity-level chemical. It is the Part A (bleaching agent) of sepia toner and is one of the primary ingredients in cyanotype. Potassium ferricyanide is poisonous in high concentrations. Take all necessary precautions in its use and handling. Do not expose it to acids, because it may release a cyanide gas (hydrocyanic acid). If potassium ferricyanide is swallowed, administer a tablespoon of 3% hydrogen peroxide. Have the patient inhale ammonia fumes, provide artificial respiration if necessary, and call a doctor. Potassium ferricyanide is incompatible with extreme heat and can release fumes of cyanide and oxides of nitrogen. It is also incompatible with ammonia. Use standard safety precautions when using this chemical.

Potassium Iodide CAS# 7681-11-0

Potassium iodide, also known as potassium salt, is a white, odorless chemical used as a salting agent in the first stage of the calotype and is responsible, in combination with silver nitrate, for the silver iodide compound. It is not a particularly hazardous chemical, but you should take normal safety precautions when using it. Avoid breathing, ingesting, or placing potassium iodide in direct contact with your skin. If you get any in your eyes or on your skin, flush the area with clean water for 15 minutes. Seek medical attention if irritation or a rash persists.

Potassium Metabisulphite CAS# 16731-55-8

Potassium Metabisulphite is a white crystalline powder with a pungent sulphur odor. The main use of the chemical is as an antioxidant or chemical sterilant. It is a sulphite and is chemically very similar to sodium Metabisulphite, with which it is sometimes used interchangeably. Potassium Metabisulphite is used as a clearing agent in the gum bichromate process.

Potassium Oxalate CAS# 583-52-8

The oxalates are the only salts that are poisonous, but they are not always bad for you or the environment. Oxalic acid is commonly found in nature (e.g., in green leafy vegetables) and is responsible for the bitter taste. Too much of it is not good for you . . . 10 pounds of spinach in one sitting is a lethal dose of oxalic acid. In small quantities the human body deals with the oxalates quite handily, as the body produces natural chelates that render them harmless. The most commonly used developers such as ammonium citrate, potassium oxalate, sodium acetate, and sodium citrate are quite harmless and can be disposed of in a municipal sewage system if well diluted.

Potassium oxalate is transparent and odorless, and it is used in toners and as one of the developer options for platinum/palladium. Like all oxalates, this chemical in a concentrated form is toxic and corrosive to human tissue. Unsafe exposure is foolhardy because this chemical can cause significant problems for all parts of your body. It is incompatible with strong acids and oxidizers. Use all safety precautions, including nitrile gloves, a respirator, and safety glasses. Seek immediate medical attention if you experience distress when using it. Signs and symptoms of distress are nervousness, cramps, depression, corrosive action on the mucous membranes, redness of the skin, blurred vision, burns, and pain.

Potassium Sodium Tartrate (Rochelle Salt) CAS# 304-59-6

Potassium sodium tartrate is a double salt first prepared in La Rochelle, France, in 1675. As a result the salt is known as Rochelle salt and is used in alternative processes in the kallitype. Rochelle salt can be made from common household goods: cream of tartar and baking powder.

Pyrogallic Acid CAS# 87-66-1

This chemical is principally used as a high-octane developer for pyromaniacs. It is a chemical used in many alternative developers such as calotypes and for processing film-based negatives for processes such as Pt/Pd due to the tan coloration it gives the film stock during development. It enters the body through absorption. It may cause respiratory and gastrointestinal problems. Avoid the chemical's dust or breathing its fumes. Use appropriate safety precautions.

Silver Nitrate CAS# 7161-88-8

Silver nitrate appears as a colorless and odorless crystal and discolors on exposure to light. Silver nitrate is highly corrosive. This chemical can cause severe skin and eye problems and is particularly destructive to mucous membranes and the upper respiratory tract. It is the primary silver salt found in photographic emulsions, alternative processes (e.g., Van Dyke, salted paper, kallitype, albumen, calotype, etc.), and intensifiers. Silver nitrate will discolor your skin, is a caustic substance, and may cause blindness if it gets into your eyes. If you get silver nitrate on your skin, you may experience redness and an eventual henna-like brown stain that will last for several days. On exposure, wash the area well with repeated rinses of water. Rubbing the area of exposure with sodium chloride (table salt) will help lessen the damage to a degree and will help with stain removal.

This is more serious . . . if you get silver nitrate in your eyes, immediately flush with copious amounts of water, or saline solution, and continue doing so while medical attention is summoned. If you get a bad silver nitrate stain on anything but your eyes, you can eliminate the black stain by washing the area with a solution of 2 teaspoons of sodium bisulphite in a quart of water. Be cautious of the sulphur dioxide gas that will be created by this act of cleansing. If you happen to ingest silver nitrate you will experience great distress, burning, shock, and coma. **Do not induce vomiting**. Force feed strong salted water concentrations.

Silver nitrate is a very strong oxidizer. It will combust and explode if allowed to come into contact with any ammonia compounds, such as ammonium hydroxide (the strong concentration of ammonia used in mordançage). Never mix silver nitrate solutions with metals such as aluminum or zinc. Use extreme safety precautions especially by wearing gloves, a respirator, and goggles or safety glasses when working with this chemical.

Sodium Acetate CAS# 127-09-3

Sodium acetate is the sodium salt of acetic acid. Its pH rests between 7.5 and 9.5. It is an inexpensive chemical produced in industrial quantities for a wide range of uses. As the conjugate base of acetic acid, it is a relatively strong base. Sodium acetate is used as one of several developer options for platinum/palladium and is not particularly toxic. Sodium acetate is often found in toners such as gold and is employed as a buffer in acidic solutions. It should be used and handled with respect. Use normal safety precautions.

Sodium Bisulphate CAS# 7681-38-1

Sodium bisulphate appears as a white crystal and is odorless. It is used as an acid rinse and in combination with acetic acid, as a stop bath. It can also be used in conjunction with sodium chloride to make a hydrochloric acid substitute. It presents a low health risk, but normal safety precautions should be adhered to when using it.

Sodium Bisulphite CAS# 7631-90-5

Sodium bisulphite is a coarse, white granule and has a strong odor of sulphur. It is used as a preservative in fixing baths and for removing stains from gum bichromate and POP processes. It can be substituted for sodium Metabisulphite. It is a strong irritant to the respiratory system and can cause irritation to the skin, eyes, and mucous tissue. Take normal safety precautions when using this chemical.

Sodium Carbonate (Anhydrous) CAS# 497-19-8

Sodium carbonate appears as a white, odorless granule. This chemical is also called soda ash and hydro-sodium and is used as a primary alkali accelerator in developers. It is also used in cyanotype toning and works as a reducer and bleach on iron prints. It is an irritant to eyes, tissue, and the respiratory system. Sodium carbonate can release a gas when mixed with acid, stop, or fixing baths. It reacts violently with acids, and caution should be taken. Kodak Balanced Alkali (Kodalk) can be used as a replacement for sodium carbonate. Use with care regardless of the low risk.

Sodium Chloride (Kosher Salt) CAS # 7647-14-5

Sodium chloride appears as a white, odorless crystal and has a very low health risk associated with it. It is primarily used in salting gelatin for albumen and salted paper printing, as a fixing agent, as an additive to first rinse washes, and, when mixed with water, as a wonderful substance to go scuba diving in. It is also good to keep on hand in the lab for when you order out for pizza. Note: Do not buy ordinary table salt and think that it is pure sodium chloride. More than likely it is loaded with additives. Buy kosher salt or sodium chloride from a chemical supply. Use caution not to rub it in your eyes, and flush overexposed areas with water to rinse them clean.

Sodium Citrate (Tri-Sodium Citrate) CAS# 68-04-2

Add baking soda to citric acid and you'll get sodium citrate. Sodium citrate appears as a fine, white, odorless granule and is incompatible with strong oxidizers. A common use of this chemical is as a primary ingredient in salted paper gelatin salted emulsion and kallitype developer. This chemical has a low health risk but can

cause mild irritations to the eyes, tissues, and respiratory system. Sodium citrate is used in ice cream to keep the fat globules from sticking together and as a buffering agent. Sodium citrate attaches to calcium ions in water. Compounds with similar functions are sodium carbonate, EDTA, and phosphoric acid.

Sodium Gold Chloride CAS# 13874-02-7

Sodium Palladium Chloride (*see Potassium Chloroplatinite*)

This chemical can cause severe allergic reactions and is an irritant to human tissue. Do not allow it to get into contact with your skin, and do not ingest or breathe its fumes. Use proper safety precautions at all times.

Sodium Potassium Tartrate CAS# 304-59-6

Also known as rochelle salt. It is used in some toners and sensitizers and as a developing component in kallitype. There are no health hazards associated with this chemical.

Sodium Metabisulphite (Sodium Pyrosulphite) CAS # 7681-57-4

Sodium Metabisulphite is sometimes referred to as disodium. It is used as a clearing aid in the gum bichromate process. It is often found in disinfectants, antioxidants, and preservatives. It may act as an irritant to eyes and skin but is generally considered safe. It can be substituted for sodium bisulphite in the gum clearing stage if needed.

Sodium Selenite CAS# 10102-18-8

Sodium selenite is a white crystal salt solid that is soluble in water. It is very incompatible with strong acids and mixing should be avoided. The chemical is toxic if ingested, inhaled, or absorbed through the skin. Wear adequate safety gear when using this chemical. Sodium selenite is a primary ingredient in Kodak Rapid Selenium Toner and will tone silver. If splashed, rinse well. If you splash the eyes, rinse for 15 minutes. If inhaled, get out of the lab and breathe fresh air. If swallowed, drink lots of water and **do not induce vomiting**. Disposal after diluting with a large volume of water is acceptable.

Sodium Sulphite CAS# 7757-83-7

Sodium sulphite appears as a white, odorless crystal. This chemical is extensively used in alternative process wet work as a clearing agent for albumen, Ziatype, and chrysotype, as a preservative in many developers, and as a clearing bath for some films such as Polaroid Type 55 Positive/Negative. It is also used as a primary component in fixing baths and presents a very mild health risk. It can be an irritant to eyes and tissue and will release a sulphur dioxide gas if heated. Use general safety precautions in use and handling. It can be substituted for sodium bisulphite.

Sodium Tetraborate CAS# 1303-96-4

(*See Borax*)

Sodium Tetrachloroaurate(III) Dihydrate CAS # 13874-02-7

This chemical is used in the Part B solution of the new chrysotype sensitizer formula and is also known as sodium chloroaurate and sodium gold chloride. It is very precious in regard to use with a gram cost in excess of $82.00. It is corrosive and can be destructive to your mucous membranes. Take appropriate precautions when working with this chemical, as it may also cause allergic skin reactions.

Sodium Thiosulphate (Hypo/Fixer) CAS# 7772-98-7

Sodium thiosulphate is a colorless and odorless crystal. It is also known as sodium hyposulphate or "hypo" and is incorrectly referred to as hyposulphate of soda since Herschel's discovery of it in 1819. It is used in a vast variety of dilutions depending upon what process you are using it for, and it is one of the very few substances that is capable of dissolving silver bromide. Contact with the skin is not dangerous, but it can decompose through the action of aging or heat and form a sulphur dioxide gas that is toxic. Be careful not to let this chemical come into contact with your eyes, and don't use it as a fragrance behind the ears as one of my students once did.

Sodium Tungstate CAS# 53125-86-3

This chemical, according to MSDS data I have read, is one that is being tested for human mutations in the reproductive cycle. It is a primary component in the Ziatype formula system and will lower contrast in that process. It is supposedly not highly toxic, but it will cause general irritation of eyes, tissues, and the respiratory system if safety precautions are not adhered to.

Sulphamic Acid CAS# 5329-14-6

Sulphamic acid appears as a white and odorless crystal. It is used as a contrast control in the argyrotype process and is employed as an acidifier in ammonium thiosulphate fixing baths. This chemical is corrosive to tissue, eyes, and the respiratory system. It is highly and violently reactive when hot and in combination with nitrates and nitrites. If this sounds like a bomb recipe then you will take great care not to fool around with this chemical near an open heat source. Take great care in using this chemical with gloves, safety glasses, and a respirator.

Tannic Acid CAS# 1401-55-4

Tannic acid is a yellow/tan powder and may not, depending on your sensibilities, have an offensive odor. Personally, I rather like the aroma and think it smells like instant iced tea mix. This chemical is a tanning agent and is often used in the toning of cyanotypes. It is a strong oxidizer of metals, and chronic exposure is harmful to the liver. It is found in grapes, tea, and cat urine. It can be irritating to the mucous membranes, and general caution should be taken when using it. It is incompatible with albumen, gelatin, salts of metals, and strong oxidizers. There is a low health risk with tannic acid, but be cautious of the powder's dust and seek fresh air if you experience discomfort.

Tartaric Acid CAS# 87-69-4

Tartaric acid is a white, crystalline powder with a strong fruit acid flavor that is approximately 10% stronger than citric acid and can be manufactured synthetically or recovered from natural sources. It is highly soluble in water but only slightly hydroscopic. This acid gives apples their sour flavor. It is only mildly toxic, and general safety precautions should be used in its handling and use. Tartaric acid is used in several formulas in order to prevent highlights from getting muddy. It is not used for making tartar sauce . . . and I will not relate the story that goes along with that warning.

Thymol (Phenol, 5-methyl-2-[1-methylethyl]) CAS # 89-83-8

Thymol is used in this book as a preservative for dry plate film emulsion (see the Alternative Negative chapter). Thymol crystals can also be found online by going to beekeeping supply vendors. Make sure it is always in crystal form. Thymol crystals are corrosive and nasty. Do not purchase thymol in oil of any kind. Thymol crystals have two distinct uses in British beekeeping, first as an antifungal or anti-fermentation agent in producing sugar syrup feed and secondly as an aromatic and corrosive sublimation material for use against the varroa mite in special evaporator frames.

Thymol is only slightly soluble in water, but it is readily soluble in surgical spirit (rubbing alcohol in the United States), which is ethanol to which a small amount of methanol has been added to render it unfit to drink. It is normally used to sterilize surfaces, cleanse skin abrasions, and toughen skin. Thymol is a skin irritant. In the event of a spill or a splash, wash everything well with warm water for at least 15 minutes and consider getting medical attention.

3,3′ Thiodipropanoic Acid CAS# 111-17-1

This chemical, with sodium carbonate and water, is the ligand in the S version of the new chrysotype. It can be purchased reasonably from the Alfa Aesar company (see Resources). It is a skin, eye, and respiratory irritant.

Tri-Sodium Phosphate CAS# 7601-54-9

Tri-sodium phosphate is a white, odorless solid and is strongly alkaline. It is commonly found in photographic developers, water softeners, scouring powders, laundry soaps, and dishwashing compounds. In an alternative process application, it works as a yellow toner for cyanotypes.

Tween 20 CAS# 9005-64-5

This is an inexpensive surfactant that may be added to sensitizers, specifically iron-based processes, and it helps in getting the sensitizer into the paper fibers. It can be an eye irritant.

Vinegar

Vinegar strength commonly is measured in "grains." In the United States, this refers to the percent acid times 10. For example, 100-grain vinegar contains 10% acetic acid and 90% water. Distilled vinegar strength ranges from 50 to 300 grains. Specialty vinegars range from 40 to 100 grains. The color of distilled vinegar ranges from a straw color to water white. Most vinegar is 5%.

A SIMPLE TEST FOR RESIDUAL HYPO/FIXER

A simple test to be sure that all of the sodium thiosulphate/fixer/hypo is removed from your print is to make the following solution: 750 ml of water, 125 ml of 28% acetic acid, 7.5 g of silver nitrate, and cold water to make a liter of solution. Place a drop of it in the center of a piece of photographic paper that has experienced the same development, fixing, and washing as the prints you want to keep. After several minutes, rinse the paper with a saltwater solution and examine it for a stain in the drop location. Any color deeper than a very light tan stain indicates the presence of hypo. This means that you should wash your prints longer. Store the solution in a dropper bottle and use it when you are concerned about the success of your washing technique.

A SIMPLE TEST FOR RESIDUAL SILVER USING SODIUM SULPHIDE

One way of determining whether or not you have fixed your print long enough is to give it a simple sodium sulphide drop test. Mix up a 10% solution of sodium sulphide (10 g of sodium sulphide with 100 ml of distilled water) and place a drop of it on a light area of your image. If the drop of sodium sulphide turns brown, this means that you still have residual silver salts in your paper and that additional fixing time is necessary.

READER RESPONSIBILITY

I have placed warnings and considerations throughout the entire text to alert you to possible chemical and health concerns. For a complete overview of all chemicals in use, and their individual MSDS and CAS documentation, please refer to the previous chemical descriptions or to the chemical research sites that have been provided. These sites have connections and links to many MSDS databases, and each of these databases has MSDS sheets for individual distributors of that chemical. If you are a teacher using these chemicals, you must have MSDS documentation in your lab. If you have a question or a concern about a particular chemical, it is solely your responsibility to find out about that chemical before using it. It is completely and entirely the responsibility of the reader to take prudent and appropriate caution in preparation, usage, and disposal when using chemistry of any kind. Although I have made every effort to give you clear and safe instructions, I have no way of knowing if your being is adversely affected by certain chemicals. If you are unsure of your sensitivity, or of the chemistry you are about to use in a process, you must stop and take the responsibility of researching that chemical.

SMALL VOLUME CONVERSION TABLE

These days, the Internet offers you an abundant number of electronic conversion sites that make the following tables redundant and irrelevant. For example, check out http://www.unitconversion.org or http://www.kylesconverter.com. These sites will do the math instantly for you. All you have to do is to specify the starting point on the conversion table (e.g., ounces to milliliters) and type in the number of ounces, and instantly the equivalent amount in milliliters will appear. There are charts for every conceivable conversion. In the event that you do not have access to the Internet, here are the old school equivalent figures.

ORY MEASURE

1 pound = 453.6 grams
16 ounces = 453.6 grams
1 pound = 16 ounces
16 ounces = 7,000 grains
1 ounce = 28. 35 grams
1 ounce = 437.5 grains
1 gram = 0.77 scruple (apothecary)
1 scruple = 1.3 grams
1 gram = 0.03527 ounce
1 gram = 15.43 grains
10 grams = 154 grains
1 grain = 0.0648 gram
10 grains = 0.648 gram
7 g sugar = 1 tablespoon
10 grams = 154 grains
10 grains = 0.648 gram
100 grains = 6.48 grams
1 gram = weight of 1 ml/1 cc water
1 nickel = 5 grams
1,000 g = 2.2 pounds

- To change ounces to grams, multiply (×) ounces by 28.35.
- To change grams to ounces, divide (÷) grams by 28.35.
- To change pounds to grams, multiply (×) pounds by 453.6.
- To change grains to grams, multiply (×) grains by 0.0648.
- To change grams to grains, divide (÷) grams by 0.0648.
- To change grams to milligrams, multiply (×) grams by 1,000.
- To change milligrams to grams, divide (÷) milligrams by 1,000.

LIQUIO MEASURE

1 gallon = 4 quarts or 128 fluid ounces (fl oz)
1 gallon = 3.785 liters or 3,785 milliliters (ml)
1 quart = 32 fl oz
1 quart = 946 ml
1 liter = 1,000 ml
1 liter = 33.81 fl oz
1 cup = 240 ml
4 cups = 950 ml
1 pint = 16 fl oz
1 pint = 473.12 ml
1 fluid oz = 29.57 ml (USA)
1 fluid oz = 28.41 ml (GB)
1 fluid oz = 8 fluid dram
1 tbs = 15 ml/15 cc
3 tsp = 1 tablespoon (tbs)
1 tsp = 5 ml/5 cc
1 dram = 3.697 ml
1 ml = 1 cc (cubic centimeters)
1 cc = 1 ml
1 ml of water = 1 gram (dry weight)
100 ml = 3.38 fl oz
20 drops = 1 ml/1 cc/20 minums
(use a plastic dropper for consistency)
1 drop = 0.067 ml/1 minum

Ounces & Milliliter Conversions

- To change ounces to milliliters, multiply (×) ounces by 29.57.
- To change milliliters to ounces, divide (÷) milliliters by 29.57.

Making a Saturated Solution

A saturated solution is one in which a specific chemical is added to a volume of water until no more of that chemical will dissolve and in which sediment remains in the liquid solution. An example of seeking a saturated solution is when you are mixing up potassium or ammonium dichromate to use as an ingredient in a gum bichromate sensitizer. Dichromates are used in a saturated solution in gum printing. Ammonium dichromate is saturated at around 25%–30% and potassium dichromate at 10%–13%. If you had 100 g of potassium dichromate and you stirred that chemical into 1,000 ml of water you would begin to see evidence of saturation in that 10% solution.

TEMPERATURE CONVERSIONS

To Convert Fahrenheit (F°) into Centigrade (C°)

1. Subtract (–) 32 from F° temperature.
2. Multiply (×) that number by 5.
3. Divide (÷) this number by 9 to get the C° conversion.

Example: 100°F minus 32 = 68, times 5 = 340, divided by 9 = 38°C

Equals: 37.77°C

To Convert Centigrade into Fahrenheit

1. Multiply (×) Centigrade temperature by 9.
2. Divide (÷) that number by 5.
3. Add 32 to that number and get the F° conversion.

Example: 38°C times 9 = 342, divided by 5 = 68.4, plus 32 = 100°F

Equals: 100.4°F

HOW TO FIGURE PERCENTAGES

For figuring percentages, I now use an iPhone app called Soulver that is so so much better for me than pencil and paper: http://www.acqualia.com/soulver/iphone/.

Percentage (%) is a term applied to expressing the concentration of a given solution in which a specific chemical weight has been stirred into a specific volume of liquid. It defines the number of parts in a particular compound when added to 100 parts of a solution. In other words, if you needed to make a 10% solution of potassium dichromate, you would simply add 10 g of potassium dichromate to water until you had a total liquid volume of 100 ml. This is called percent weight per volume **(% w/v)**.

Percentages Can Be Expressed in Three Different Ways

- **% w/v** (*percent weight per volume*): This is used when combining a solid with a liquid.
- **% v/v** (*percent volume per volume*): This is used when combining two liquids. For instance, a 30 % solution of hydrogen peroxide would comprise 30 ml of hydrogen peroxide in 100 ml of water.
- **% w/w** (percent weight per weight): Seldom used as a measurement, this refers to g of a given compound per 100 g of a given solution. *As 1 ml of water has a weight of 1 g, it is not uncommon for g and milliliters to replace one another.*

Figuring a Percentage for a Solution

Here's a quick elementary reference for you to use if you need to make a liter of 15% solution of sodium thiosulphate. Multiply 1,000 by 0.15 and you will get 150. Mix 150 g of sodium thiosulphate into the liter of water for the solution.

If you need to make a liter of 3% solution of sodium thiosulphate, multiply 1,000 by 0.03 and you will get 30. Mix 30 g of sodium thiosulphate into the liter of water for the solution.

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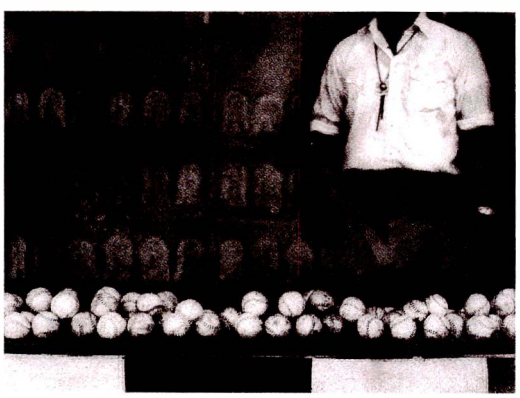

APP–2

Jill Skupin Burkholder, *Man with Baseballs*, 2001 (bromoil)

This image, from the State Fair of Texas in Dallas, is made with the bromoil process. Jill writes, "*I have a strange reaction to this image. Maybe because it's just the torso, it makes me think of the statue* David *which throws me into an antiquity state of mind. The carnival barker seems more like a Greek hero to me, ready to battle the dark forces.*" *(Courtesy of the Artist)*

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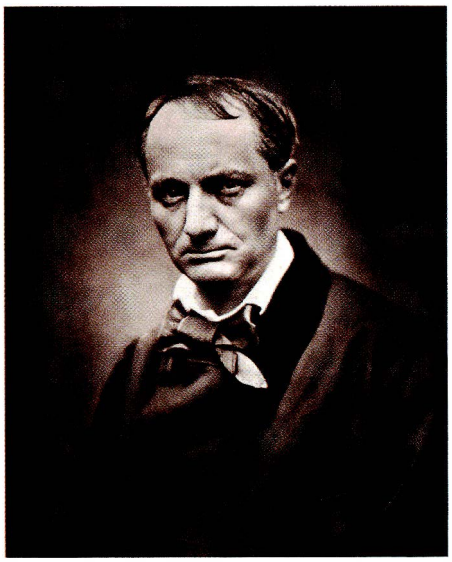

APP–3

Etienne Carjat (1828–1906) *Portrait of Charles Baudelaire*, c. 1863 (woodburytype plate from *Galerie Contemporaine*, Paris, 1878)

Charles Baudelaire (1821–1867) the subject of this image, was a man of deep moods and un-relenting despair whose poetry centered upon the inseparable connection between beauty and the inevitable corruption of that beauty. Baudelaire wrote about his first impressions of photography in less than glowing terms, implying that society was squalid and narcissistic in its rush to gaze upon trivial images of itself rendered on scraps of metal. He also wrote, in a critique of an exhibition in 1859, "*If photography is allowed to supplement art in some of its functions, it will soon have supplanted or corrupted it altogether. . . .*" And that, my friends, is about as positive a statement as Baudelaire ever made.

(Courtesy of George Eastman House, International Museum of Photography and Film)

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