The Gum Bichromate Process

OVERVIEW AND EXPECTATIONS

At first glance, the gum bichromate process looks amazingly uncomplicated. However, to nearly every one of my students who has been seduced by the process, and for those artists who are dedicated to it, gum is one of the most complex in the alternative genre. Gum bichromate printing is certainly seductive due to its limited chemistry, simple water development, and unlimited color potential with watercolors of the artist’s choice. Gum printing is quite flexible and easily combined with other processes and graphic disciplines. Because of its pigment, paper, and brush roots, gum bichromate is one of the few photographic processes capable of achieving that wonderful element of *gesture*—gesture being that painterly expression of the “artist’s hand” in the creation of a mark.

In this chapter I, as always, give you a little history and describe how the process works. I then discuss the negative and a technique, euphemistically referred to as registration, that will allow you to place multiple applications of color on the same piece of paper without losing the original sharpness of the image. You will also learn how to make a gum print from a single contact negative.

You’ll learn about mixing the chemicals for the sensitizer and the relationship among the three primary ingredients in the technique: gum arabic, a dichromate sensitizer, and watercolor pigment. This is followed by instructions for applying the coating, processing, and the reapplication of the sensitized coatings. A discussion about development and clearing gum prints is included, and the chapter concludes with a comprehensive trouble-shooting section.
Christopher James, *Grace in Gum, 1977*

This is from a series of gum bichromate portraits that I made from damaged internegatives that had been thrown in the trash in the Harvard photography labs. The final negative was enlarged on SO-339 direct duplicating film (now SO-132) and then abused for several days with gum bichromate applications, paint, ink, dyes, bleaches, and etching tool abrasion in wet emulsion.

(Courtesy of the author)
Considering the surface simplicity of the process, you’ll notice that there is a lot of information to absorb, and I want you to see that the variables within gum printing are infinite. If you investigate the process beyond this book you will find published evidence that will occasionally seem contrary to portions of the information in this chapter. Some of that information will work quite well for you, whereas morsels of other instruction will not work for you with equal success. In gum printing there are very few absolutely correct ways to do anything, and much of what has been previously published has simply been the procedure of choice for the individual teacher or author. In my experience, gum bichromate printers are the most passionate and stubborn of all alternative process artists when it comes to their particular way of doing the process. I can just imagine many of my friends reading that last sentence and saying, “He’s talking about me!”

You’ll find that you’ll be able to make excellent gum prints using, and adapting, the instructions in this chapter. Just relax, keep notes of what you are doing, and realize that the gum process will reward you if you work at it without a need for instant gratification. Have a great time individually modifying the myriad elements of the technique to suit your own personal working style, imagery, and intentions.
CHAPTER 13 THE GUM BICHROMATE PROCESS

A LITTLE HISTORY

An interesting hypothesis from a book by Picknett and Prince entitled, Turin Shroud—In Whose Image? The Truth Behind the Centuries-Long Conspiracy of Silence (Acacia Press, 1994) suggests that Leonardo da Vinci (1452–1519) may have been the creator of the Shroud of Turin by using a mixture of dichromated egg with human or animal urine. Guess whose image is on the Turin shroud? — why, it’s da Vinci’s self-portrait, 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. To put this curious factoid in context, the publisher’s catalogue is rife with books dealing with conspiracy theories dating back to the fourteenth century. Who knows? Considering everything else da Vinci accomplished, it might be true.
The earliest attributable thinking about the effect of light on bichromates seems to be the property of the French chemist Louis-Nicolas Vauquelin (1763–1829), at the end of the 1700s. Although Vauquelin published over 378 separate dissertations on chemistry, the bulk of his writing did little more than provide analytical observations and data. Interestingly, he was one of the first academics to consider instructing his students by means of actual, hands-on practice in the laboratory.

Mongo 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 when he discovered that paper impregnated with potassium bichromate was sensitive to light. Ponton modestly christened his discovery the Pontotype. In Ponton’s process, paper was coated with a potassium dichromate solution and exposed to sunlight using objects to create a negative image. The exposed print was then washed, to remove any unexposed dichromate, and dried, leaving a sepia brown positive image that consisted of chromium dioxide. The print was rather handsome at first but tended to fade to a gossamer-like green after several months. Ponton’s single solution Pontotype 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. A year later, in 1840, Edmund Becquerel (1820–1891) added to this rapidly expanding base of knowledge by producing images using starch in combination with iodine. It was Becquerel, by the way, who first figured out that Daguerreotypes could be supplementally intensified by the continuation of the Daguerreotype’s exposure through a red glass filter.

In 1854, William Henry Fox Talbot began working on the concept by observing the ability of potassium dichromate to have a hardening effect on a colloidal gelatin that was directly proportional to the degree of UV light that the gelatin received. Fox Talbot’s modest success in this area was followed by the work of Alphonse Louis Poitevin (1819–1882), who continued the investigation of how bichromates were able to render gelatin insoluble on exposure to light. In 1856, Honoré d’Albert, Duc de Luynes, an exceedingly wealthy arts patron, put up a prize of 10,000 francs to anyone who could describe a photographic printing process that was permanent. Poitevin won the prize for two processes: the Carbon Print and the Collotype.

The Collotype, like others within the genre, that is, the Woodburytype, which utilized the unique hardening quality of bichromates and colloids on exposure to ultraviolet light, was a significant achievement and provided a new way to reproduce photographic images in quantity. The only serious drawback to these techniques was that hand-set typography in a “chase” (a wood and metal device used by typographers for blocking, setting, and locking type for inking and subsequent printing) and the photographic image could not be printed simultaneously. It was not...
until the 1880s, with the advent of the half-tone (the dot patterns in magnified press reproduction) plate, that this limitation could be addressed.

From the same time period, 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 (see Figure 2–16). He also made colloidal etchings by coating glass plates with wet sensitized collodion emulsion. The plate was exposed to light, which darkened the entire plate. 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 art-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 sensitized sheet of paper.

In 1895, John Pouncy (1820–1894), a gentleman primarily remembered for his photographic illustrations dealing with Thomas Hardy’s (Return of the Native) home turf of Wessex, gathered everyone’s information and claimed to have produced the first consistent and satisfactory gum bichromate printing process. Pouncy published Dorsetshire Photographically Illustrated in 1857. This book, despite criticism that it lacked halftone characteristics, was the first British book illustrated by means of photolithography.

Woodburytype (a.k.a. Photoglyptie – Stannotype – Photomezzotint)

Walter Bentley Woodbury (1834–1885) created the Woodburytype in 1864—a process that was widely practiced for nearly 25 years and known for its amazing rendition of values and tonal range without grain. 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 squashed into a lead intaglio plate under enormous pressure from a hydraulic press. The lead, having taken the detail of the hardened gelatin impression, would now become the printing plate for the next step. The lead intaglio plate was encased in a mold and pressed against a fine-quality paper. Pigmented gelatin ink was then poured into the mold, where it deposited the gelatinized ink in proportion to the depth of the plate. The Woodburytype is generally a dark reddish brown even though any color could have been used. Interestingly, it was seldom printed in black.

Nadar (a.k.a. Gaspard Félix Tournachon), 1820–1920, Portrait of George Sand, 1877 (from Galerie Contemporaine, littéraire, artistique)

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 the George Eastman House, Rochester, NY)
In the late nineteenth and early twentieth centuries, photographic image makers saw themselves as dedicated artists rather than scientists, and some referred to themselves as Pictorialists. They worked extensively with the gum process due to its innate ability to express the artist’s intentions and feelings. For critics of the movement this indicated that the imagery was warm, romantic, and fuzzy. Gum printing was a technique that was championed in America by the Photo-Secessionists, a coalition of photographers (Steichen, Käsebier, and White, and in due time, Steiglitz) who were dedicated to pictorialist, and individual, expression in the medium. Their inspiration came from the aesthetic integrity of European organizations such as the Wiener Kamera Club (Berlin) and the Brotherhood of the Linked Ring (London), who battled to have photographic art appreciated within its own context rather than as an imitative reflection of informational reality.

How Gum Bichromate Works

Pouncy had come to a conclusion, the underlying principle being: a mixture of a potassium, or ammonium, bichromate salt (dichromate and bichromate describe the same thing) in 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 substrate such as paper, and dried. A contact negative, the same size as the finished print, is placed on the dried sensitized coating in a contact printing frame and exposed to a UV light source such as sunlight. The portions of the sensitized paper affected by UV light through the negative will become insoluble in direct proportion to the amount of light received.

By itself, the dichromated salt and the gum arabic (sap from an Acacia tree) will produce a tan-colored image. This particular solution is sometimes employed as a preliminary sizing layer for hand-applied liquid emulsions and was referred to in Chapter 12. If a coloring agent, most often watercolor pigment, but occasionally a gauche or a metallic powder, is added to the sensitized mixture, the color will remain in the UV light-hardened emulsion.

The dichromate/pigment/gum arabic mixture will, as I’ve said, harden in direct proportion to the degree of UV exposure received. In a first exposure, the thinnest parts of the negative (shadows) will allow the most exposure and cause the image on the coated paper to become the most hardened in those areas. The densest parts of the negative (highlights), which require more exposure, will permit less hardening. The exposed print is then “developed” in water, whereupon the hardened gum/pigment remains on the paper in proportion to the exposure, the dichromate sensitizer-to-pigment ratio, and the amount of pigment in the mix. The less-exposed areas will clear in the development in proportion to their exposure, leaving the highlights clear and the middle values open in relation to the above and other factors, which include paper, water, and paint type and how these work with the chemistry and individual technique.

A Few Words Before We Begin

Any change in the principal components of the gum process (gum type, sensitizer type and strength, ratios of both to one another, water type, temperature, paper, time of year, etc.) on any given day, may change the final results you will get in a gum print. This is exactly what makes the process so interesting as long as you avoid investing your self-worth and abilities as an artist on guaranteed success. Be patient and don’t try to conquer the process. My friend Judy Seigel has probably spent more time and
energy exploring the variables of this technique than anyone I know, and she is still occasionally coming face-to-face with unexpected information and imagery. It would be a “fool’s errand” to try to conquer this process in a short time. Judy provides some decent advice when she suggests that one can come to a working truce just by paying attention. The gum bichromate process is amazingly fluid and flexible and should be approached with a spirit of play, adventure, and discovery.

The Gum Negative

Because gum bichromate is a contact printing process it is necessary to have an enlarged negative(s) to work with that will be the same size as your final printed image. The majority of gum printing experiences requires more than a single exposure; multiple applications of sensitized color are the norm. For this reason, it is common to have a set of registered negatives that will allow you to print good
highlights, midtones, and shadow details. 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. With a single negative, all one has to do is adjust the components, such as the concentration of pigment, exposure, and amount of sensitizer in order to make a resolved image.

It is advisable to have negatives that would be appropriate for a normal grade of silver gelatin paper. This means that the negative will have an average negative density of 1.0 to 2.0. This is a general suggestion unless you intend to make gums for interdisciplinary intentions, where the tonal values are secondary to the concept. 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.

There are a host of film varieties and developers available for nearly any type of negative interpretation you are wishing for. Recently, in workshops where timing is tight, I have been separating transparencies in separate CMYK (C= cyan, M= magenta, Y= yellow, K= black) files in Photoshop and printing them out on acetates on a quality inkjet printer. CMYK separations are decent negative options and eliminate the need for darkrooms or the time and money required for dealing with a service bureau. Most of the time, digital negatives are perfectly satisfactory for gums and offer you flexibility and speed in negative reproduction. You may also wish to consider using negatives made from laser copy machines or making your own with a cliché-verre

Figure 13–7

Judy Seigel, Jesus Singers
(Single coat gum bichromate with acrylic border)
Judy Seigel has been a champion influence in the renewed interest in alternative photographic processes. Her specialty is gum bichromate, and her passion for the alternative image is unflagging.
(Courtesy of the artist)
Registration

Registration is done after sizing and 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, it will be necessary to register your negatives. If you don’t register them, you will quite often get curious and unexpected results. This accident may well be a “good” technique if you use it intentionally.

There are many ways to register negatives and paper. Some of the methods include paper punches, pushpin holes, stick-on transparent registration targets applied during negative production, or an old dye transfer punchboard. You can also register simply by laying your coated paper on a light table, quickly registering your negatives to the sensitized paper, and locking it in pieces of transparent tape. Don’t stress about the light from the light table. Even though your dried emulsion is sensitive to light, you still have plenty of forgiveness in the emulsion speed and will have time to secure the registration without fogging the image. The point of registration is to give yourself a repeatable and mechanical way of accurately aligning your negative, or a different one, 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 recoating.
One Example of 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 margins at different lengths of all but one negative so that when they are in registration each piece of film will have a different height but will still be in registration with the others. Run a strip of tape across 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 surface that will accept a pushpin and poke a pinhole through two or three margins of the negative set and paper. These holes will serve as your registration reference guides later on. 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 above. If you have a strong urge to make this process more complicated, please feel free to do so.

The Components in a Gum Emulsion

The emulsion for gum bichromate printing is prepared in simple and separate steps. Begin by mixing your dichromate solution. Most gumists 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 tends to be a bit slower than ammonium dichromate but generally clears out in the highlights a little better than does ammonium. Whichever sensitizer you elect to use is added to a mixture of gum arabic and watercolor paint to make the complete solution for coating. Additional water can also be added and will help make your emulsion smoother. The proportions of gum arabic to sensitizer can be adapted to suit your contrast and exposure time requirements as well. Some gum practitioners also substitute a liquid glue (like Gloy®), or albumen, for the gum arabic. I hope you can begin to see that the process is not one where hard and fast rules apply.

The Ammonium/Potassium Dichromate Sensitizer

Ammonium or potassium dichromate is your sensitizer and is added to your mix of liquid gum arabic (with a specific gravity of 12˚ to 17˚ Baumé) and watercolor pigment when you are ready to make an exposure. It is a typical alternative emulsion, suitable only for contact printing under UV light. You don’t have to worry very much about working with it under normal low-light conditions because it doesn’t become truly light-sensitive until it is dry. I once gave a workshop demonstration in gum printing in a motel lobby where we hung the motel’s yellow sheets over sun-filled windows and there was no problem with fogging. I performed another gum demonstration in the back of a van in a parking lot on a rainy day and had
no problems there either. Avoid excessive fluorescent light as you would with other alternative processes.

Making a Working Saturated Solution of Ammonium or Potassium Dichromate

Dichromates are used in a saturated solution. A saturated solution is defined as one where no more of the chemical can be dissolved in water without leaving a sediment. As mentioned earlier, ammonium dichromate is saturated at around 25% to 30% and potassium dichromate 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 notice will be that exposure time will be shorter with the ammonium dichromate. The contrast, all things being equal, will be the same, but you may experience an easier time clearing the print with potassium as your sensitizer. Again, one factor will impact another and you'll need to work out your own system to accurately predict outcome.

If you decided to use potassium dichromate as your sensitizer, make a saturated solution of it. For the purpose of simple explanation we’ll use a 10% solution as our goal. Knowing that potassium dichromate is in a saturated solution at 10%, take a digital or triple beam gram scale, weigh out 10 g of potassium dichromate, and stir it into solution in 100 ml of water. This makes a 10% working dichromate solution. 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 would be making a slightly faster sensitizer. You can experiment and decide what strength is best for your own work. In any case, this saturated dichromate solution, whether it is potassium or ammonium, will last for a very long time when stored in a dark air-tight bottle. Be sure to label the bottle with information regarding its contents, its percentage, and the date it was mixed, and be sure to store it in a safe place where children cannot reach it; when mixed, dichromate solutions look a lot like sugared drinks!

Be cautious in how you handle ammonium or potassium dichromate: It is dangerous and poisonous. This chemical can cause lesions on your tender flesh through contact and can damage your lungs by breathing it in. Be very careful with storage and never leave the chemicals unlabeled or where children can get their hands on them. Please reference the chemical section in the Appendix before using dichromates.

Watercolors

The watercolors you use should be of “professional” artist quality, not student or “academy” grade paint. Inferior paint often does not clear well in the highlights and shadows and can be one of the reasons, besides poor paper preparation, and too much sensitizer in the formula, for paper staining. There are exceptions to this warning about academy grade paint, but I’m not sure which paints they might be. For beginning work it is a good idea to have “primary colors” on hand. The primary colors include red (alizarin crimson), blue (thalo or cobalt), and yellow (new gamboge or cadmium). Naples yellow is also a nice color and is creamier than the other yellows, as is Transparent Yellow. You may also wish to have a black and/or a gray such as Davy’s Gray. Of course, use any color you wish from the manufacturer’s stock as long as the quality is good. Those readers who are color blind, or color impaired, might be considered creative, so don’t avoid the gum bichromate process for those reasons. Be aware that some colors are suspect in regard to permanence and ability to clear in the wash development stage. It would be numbing to provide this list 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 identical color from another. You will have to discover those that are best for you within the parameters you work in. I recommend Winsor–Newton, because that is the brand I have always used. Again, keep careful notes and you’ll work it all out eventually.

An Interesting Fact Regarding Dichromates

The speed of the emulsion will be slower in proportion to the pH of the water used in creating the coating solution. The more alkaline the water, the higher its pH (above 7) and the less 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.
It is important to use a paper that is well made and able to stand up to all sorts of abuse: specifically, repeated washing times of extended duration. 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 1,160 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, it is a good practice to gelatin size and harden the sizing if more than a single pass is planned for.

**Gum Arabic**

Gum arabic can come in a variety of purities. Winsor-Newton makes an expensive one that is very clear, comes in tiny little bottles, and sells for a premium. I like the look of their product, but it is not very cost effective. A printmaker’s supply will sell a gum arabic that is syrupy and quite dark at a price that is not nearly as precious. Don’t concern yourself with the color of the gum, because it seems to make little difference in the quality of the print. 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. Gum arabic is also handy for masking. Essentially, you are buying the sap from an acacia tree, and the color of it does not always determine the quality. Most art supply outlets sell it by the quart or gallon to meet the requirements of printmakers and lithographers.

Using Glue as a Substitute for Gum Arabic

There is a nice idea that I have not attempted yet 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 g 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.” 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!

A Traditional Gum Bichromate Sensitizing Formula (Ammonium Dichromate)

\[
\begin{align*}
9 \text{ ml} & \quad \text{gum arabic} \\
\frac{1}{2} \text{” to } 1\text{”} & \quad \text{artist’s grade watercolor pigment} \\
3 \text{ ml} & \quad \text{saturated ammonium dichromate sensitizer solution}
\end{align*}
\]

Begin by adding the 9 ml of gum arabic to a small plastic, paper, or glass container. Next add the watercolor paint and stir the paint into the gum until it’s smooth. To sensitize this paste, add 3 ml of a saturated ammonium 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 time (more or less). It works perfectly well, but it isn’t, by any means, the last word in gum formulas. Each individual will adopt his or her own personal working styles, techniques, and mixes to suit his or her intentions and imagery. In addition, each person’s coating technique, washing style, or purist to nonpurist approach will be different according to who they are and what it is they need from the ratios and combinations of gum, paint, and dichromate. As they say in the gum labs, “It’s not how impeccable your formula is, it’s how you use it.”

**Another Sensitizer Formula (Potassium Dichromate)**

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 according to the directions for ammonium dichromate. Pigments have different densities, and therefore the amounts used in an 8” × 10” formula such as this one will fluctuate, depending on the color.

- 6 ml gum arabic
- ¼” to 1” watercolor pigment
- 6 ml saturated potassium dichromate solution

**An Alternative Sensitizing Formula: “The 5-10-10”**

This formula makes a coating that is texturally smooth and a bit pale. I like it as a formula for high detail negatives. It’s a good choice for print details that are delicate and built up patiently over subsequent exposures. This is 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 (poured into a small plastic or glass container)
10 ml distilled water (add to the gum and stir)
1” or more quality watercolor paint (add to the gum and water and mix well)
5 ml ammonium dichromate (stir into the solution to sensitize)

**Sensitizing the Paper**

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 any success with the process before, select one of the dichromate formulas above and prepare for success.
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. This lighter color is often used to print for the highlights in the negative. 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 tungsten light and stir slowly until all of the ingredients are together as one.

It is not uncommon to make a first exposure using only the gum arabic and the sensitizer. This exposure, providing it is not too long, will give you a light tan-colored image of your negative. 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 tungsten light and stir slowly until all of the ingredients are together as one.

It is quite permissible to work under normal room light conditions, but I generally prefer to mix my colors 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. Don’t worry about this change, because the orange color will wash out during processing.

A Few Words Regarding Conventional Gum Wisdom and Staining

One of the “old rules” stipulates that a greater concentration of paint than “normal” (meaning more than 1” of paint in a standard mix for an 8” × 10” print) will result in staining in your print’s highlights. I have generally found that a greater concentration of paint in the emulsion will actually result in less staining. Judy Seigel confirms this point in Issue #2 of her excellent Post-Factory Photography Journal.

For many years, I have been laying multiple gum arabic washes on watercolor papers prior to making watercolor paintings. By doing this I was able to paint and then return to specific sections with a wet brush to pull away pigment and expose highlights. This was possible because the paint was sitting on the gum arabic rather than the paper. It made sense, thinking about this fact, that extra paint would not be a significant factor in staining when sitting in a gum arabic solution. In fact, I had always thought of extra pigment (more than 1”, but not so much that flaking occurred) 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.

The Relationship of Sizing Type and Color and 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 ammonium dichromate and stain. This results, in some cases, in a yellow tinting of color within the print. These yellowish tints can generally be cleared in a sodium metabisulfite or potassium metabisulfite bath. Plastic sizing, like the gesso/matte medium formula, often provides a more “true to the tube” pigment interpretation. It does,
however, occasionally yield an image that results in more contrast. There are also instances when the gesso/matte medium will flake off in development, so keep a record of the proportions that you are testing.

Coating

Coating a gum bichromate emulsion on paper is not difficult but requires practice. There are several ways to coat well. One of them, the standard way, is to work on dry, sized, and hardened watercolor paper using a hake or foam brush. Mark the printing area with light pencil registration marks and quickly brush-coat in even vertical and then horizontal strokes. Work fast, smoothly, and lightly until the emulsion just begins to become tacky. Select the width of your hake brush by the size of the area that you are coating. Obviously, a 1˝ brush is a more difficult tool to work with if your coating area is large. Although it is less expensive to use a hardware store type of foam brush, and certainly viable as a coating instrument, I personally prefer working with the hake brush. This is because the hake brush absorbs less of the emulsion, can be easily washed for additional use, and simply feels better in my hand. Again, be careful to paint lightly, cover the entire area that will be printed, and to be graceful with the coating.

When the emulsion begins to “set up” (looks and feels more gummy than liquid), take a clean and dry 4˝ hake 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 semidark 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, because this will yield the best image. 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.

Exposing the Negative

It is pointless to attempt a uniform gum “standard” for exposure or contrast control, because the variables are too numerous to define such a standard. These variables include density and type of pigment, humidity, time of day, negative density, strength of sensitizer, type of gum arabic, type of paper, or 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 part of the process is a variable that will change when another variable enters the equation.

The exposure is made, as in other alternative processes, with a UV light source such as the sun or UV printing unit. The advantage of a 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. In my experience, sunlight appears to provide a “crisper” image and a faster exposure time. As with all of the previously defined alternative processes, you will need a hinged-back contact printing frame for sun printing.
It might be a good idea when beginning a new print to make a test strip of exposures using a “step-wedge.” If you don’t have one, 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 what exposure times you should use—that day. Remember that the gum process is an evolving one and is more like printmaking than traditional silver gelatin printing. Make a plan for your printing strategies and be patient.

Printing a Single Color Gum with a Single Negative

Quite often, especially in a workshop environment that compresses many alternative processes within a short time, it is common to demonstrate the techniques of gum with a single negative. This is a cost- and time-efficient method of describing how gum bichromate works without taking the time to produce multiple density variations, like CMYK separations, of a single negative. This method of demonstrating has occasionally been a source of confusion due to the discussion of strategy regarding printing for highlights and shadow details within the parameters of a single source negative. The solution is not complicated; the key is the variability of the emulsion.

You can also play with the proportions of gum to dichromate sensitizer with ratios as concentrated as 1:1 or 2:1 (gum to dichromate). The reason is the contrast is bumped up by the reduced sensitivity of the emulsion and the degree that the highlight areas will clear due to the concentration of gum arabic in the formula. At the same time, the open shadow areas will not completely “close up” (overexpose) on you.

During the water development, the highlight areas clear quickly (contrast), while the exposed shadow areas will not have had enough exposure to close up on the details within them. In order to penetrate the highlight densities 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 gum and dichromate in order to lay down a “tan”-colored base for the highlight detail. This would, or could, take the place of a color if you don’t clear the paper with sodium metabisulfite or sodium bisulfite.

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 above. On subsequent exposures you can increase the ratio of gum to dichromate, back to the standard, 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 don’t necessarily want to print for the finished image on a single pass. The reason for this is that you may find your shadows blocking up. It’s bet-
ter 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.

**Development: Clearing**

Development of the exposed gum print is very simple. There is no development chemistry, just a good water soaking and time that may range from a few minutes to many hours. There are ways to enhance and clear areas of the print that I mention in a few sentences. These are simple and easy to employ during the development stage.

Following exposure, immerse your paper in a tray, larger than your paper, which is filled with ambient temperature water. If the water is too hot you will unwittingly erase subtle details. If the water is too cold, the clearing will take forever. Gently agitate the paper for about a minute and then very carefully change your water. Then place the print face down in the 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 emulsion you will wreak havoc on a wet, fragile 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 will be lying peacefully on the bottom of your wash tray.

In my experience, light colors will yield a perfectly developed print within 10 to 15 minutes, providing you haven’t radically overexposed the image. Black prints will take 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 minutes to clear. Clear means that the highlights are paper base clean and when 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, and recoat with the same or a different color, and expose the negative again for a slightly longer time.

Prints that have been overexposed may show less contrast, flat highlights, or blocking in the shadows. These flaws can often be repaired by making a bath of 15 ml of ammonia or household bleach to a liter of water. 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.

Another method for clearing heavily stained or overexposed prints is simply to let them soak for a day. Again, if you underexpose the print you only have to dry it, recoat it, register, and reprint the same color and negative. Your exposure on this second “pass” will likely require less time to achieve the effect you were going for in the original exposure because you will be building on a layer of detail that already exists. Personally, I prefer a series of small exposures to one big exposure, but this is just a matter of personal taste and workflow.

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, where you leave a good deal of original color behind (especially in the highlights), can be achieved 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 a development in progress because you like the way it looks, you can harden the image by reexposing the paper to UV light after it has dried.

On the other hand, forced development of the print, where 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, 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 on 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.

**Clearing Stains with Sodium or Potassium Metabisulfite**

In the event that you have dichromate stains in your highlights or borders (the tan color), you may clear them out with a simple 1% to 5% solution of sodium metabisulfite or potassium metabisulphite. 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 metabisulfite on problem areas. You can also try potassium alum, but this chemical may not help the archival intentions you have for your image. This step will be your last one after all of your color impressions have been made.

Clear the print in the sodium metabisulfite bath for 1 to 2 minutes and wash it for 10 minutes in clean water. Be cautious of the percentage concentrations of the metabisulfites because they may be more aggressive than you had anticipated. Be sure to do a test piece before committing your print to a bath and adjust the percentage strength as necessary. You may also spot-clear with this solution with a small brush. If you notice that your emulsion has become fragile in the sodium or potassium metabisulfite clearing baths, 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.

- First, review your sizing and hardening technique.
- Try changing the brand of paint. This can often rectify staining in the highlights. One manufacturer’s formula for cadmium red is seldom identical to another’s.
- In the same line of thought, try changing the type of gum arabic you are using. There are many varieties and not all will work exactly like another with your choice of paint.
- Soak the print face down in a water bath—for a very long time. This solution does have its disadvantages; lengthy water washes will damage the paper and deteriorate the sizing.
- If nothing is working, and you’re feeling particularly stubborn, soak the print in a solution of 1 liter of hot water and 10 ml to 30 ml of ammonia. This solution will leave a lasting impression on the print, and it will look quite different from your original intentions. Just immerse the print and watch your image rapidly, and forever, change personality. Please be careful about the fumes that this technique brings forth.
- You can also try exposing for less time, printing immediately on drying, or changing paper, because different types of paper will clear differently.
- Try incorporating a greater proportion of gum arabic to the dichromate in your formula. Too much sensitizer may be the problem.
- You may wish to try, after a significant degree of clearing frustration, blasting warm or hot water onto the print to see if you can get any separation of values and detail. Chances are you will be saying good-bye to all delicate highlight details, but for many gum printers it is the mass, rather than the detail, that is important. Spraying warm water can also open up blocked shadows.
- You can try using a 2% solution of Ilford’s Acid Hardener as a clearing bath.
- Last, but not least, you can be upbeat about the entire experience and start over again. You might also consider using the print as a base for another process or a canvas for you to paint, paste, and play on.

**Other Miscellaneous Trouble-Shooting Notes and Suggestions**

Any of these notes and suggestions may be disregarded if they don’t fit your working style.

**First Impressions**

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 on. You may also consider making a gum “pass” on top of a platinum/palladium print if you want to raise some eyebrows. Actually, this combination was quite pop-
ular 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 Steiglitz did.

**Staining**

Many of the solutions for dichromate staining are covered in the section you’ve just read. There is, however, also paint staining to consider. If you are experiencing staining, try duplicating your technique with a different brand of paint. Always use the highest quality watercolors you can buy. Student-grade 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 always had awful problems with greens. When I want a green I will generally mix a blue and a yellow rather than opt for the tube green. It has been suggested that a Rowney Thalo Green clears well, but I have not tried it as of this writing.

You might try using a different type of gum arabic or add more of it to the formula. You might also consider using a different paper, trying a different sizing-hardener, remixing a fresh dichromate, using less of it in the sensitizer mix, or exposing your colors for multiple and shorter times. You may also need to make a new negative with a more delineated tonal scale. Work carefully and keep detailed notes so that you can go backwards to find the problem.

**To Darken an Image**

Try repeating the same coating and negative, in registration, for a second or third exposure. You may also try a darker paint, a lighter version of the negative, a complementary color, or a little more dichromate in the formula. If you add more dichromate to the sensitizer mix you will experience a reduction of contrast and increase in your exposure time. Adding more pigment to your formula may or may not work, and the success of this choice will depend on a few other variables. Extra pigment will likely add contrast to the image and may result in flaking of the emulsion. Keep track of the paint amounts that you are squeezing into the gum arabic. I actually know of several very successful “gum-mists” who weigh their paint on a digital gram scale.

**To Lighten an Image**

Try using a lighter color, a more dilute color, or expose for a shorter time. Short exposures will often yield more contrast because more of the pigment will unharden during exposure and will wash out during development. Using less dichromate in the formula will result in a solution that is slower (reduced sensitivity) and more contrasty 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. You may also try very hot water, overwashing the exposed image, or using a solution of sodium metabisulfite, potassium metabisulfite, or ammonia.

Figure 13–14

Scott McMahon, *Surveyor 1*, 1997

Scott is another former student of Sarah Van Keuren’s—seems to be a pattern here with gum bichromate—who uses himself almost exclusively as a subject.

(Courtesy of the artist)
To Increase Shadow Density Without Changing Highlights

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

Decrease 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

Use lighter colors, use a higher concentration of dichromate sensitizer and decrease the amount of pigment,
expose longer, and/or develop for less time. 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
Try “flashing” your entire image area without a negative in the contact printing frame with only a sensitizer coating of gum arabic and dichromate and the color you would like as a “whisper” in the highlights. You can also simply omit the color part of this equation and make your highlights a tan color.

A Single Negative Strategy
If you are brand new to this technique and have one large contact negative to play with, here is a possible strategy for you. Try printing a single negative with a long exposure and a small amount of paint. Then, for a second pass, after washing and drying the first pass, use a lot of pigment and a short exposure. For a third pass with the same, or third color, try using the right amount of paint, with the right amount of exposure. You should end up with your first good-looking gum print.
Color Inventory

Some gum artists like to make up their color and gum emulsions in small batches and store them in Tupperware® or urine sample containers from the local health care provider. This allows you to establish a color inventory and save time. Urine sample containers are great because most have an embossed graduate scale on the side and a very secure screw-cap. Next time you go in for a physical check-up, pick up a few for free. Do not add the dichromate yet. Be mindful that these solutions will not last a long time once the dichromate has been added to the gum and paint mixture.

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.

Painting on Gum Emulsions

Try painting on gum emulsions in selected areas of the print, that is, eyes, clothing, and so on, instead of total 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 applied color before it dries. This “feathering” creates a softer edge line.

Create Area “Masks” Using Gum

Painting an extra coating of gum arabic in the areas you do not want completely colored after exposure works quite well. You can also use other masking devices in conjunction with the negative, such as rubylith film or Mylar®. 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 attention to your exposure times.

Exposure

Exposure is controlled by several factors that must be kept in mind when creating print strategy: source of light, the color of the pigment in the emulsion, the time of exposure, the proportion of dichromate to gum, the thickness of the application, and the humidity. Some practitioners find that the higher the humidity, the shorter the exposure. Others report the opposite is true in their work. Long
exposures will result in less contrast because more of the sensitizer becomes insoluble and refuses to clear in the water development. Shorter exposures work in the opposite manner.

Photoshop and Illustrator

If you are proficient using Adobe Photoshop or Illustrator, try making your CMYK gum separation negatives in the computer and having them reproduced as film negatives at a local service bureau or doing it yourself on your desktop printer. Be sure to separate in CMYK (see Chapter 3, “Digital Options”). In a CMYK separation set, C = thalo blue, M = magenta, Y = cadmium yellow/hansa yellow, K = lamp black.

If 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.

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 put the print face down in the water and do something else for a while (this will make sense later on). Gum bichromate is different from others in the alternative process genre, and it is unhealthy for your creative self to think there is a perfect way to do it. 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. 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.