

## CHAPTER 18

### THE GUM BICHROMATE PROCESS

*Fig: 18 -1 here, Christopher James, Alicia in Gum #2, 2012 (gum)*



#### 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, all forms of printmaking and artist's books. I think of gum as the photographic ambassador to the fine arts. Because of its pigment and 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".

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 C-M-Y-K (cyan - magenta - yellow & black) negative separations with ink jet printer output, and relaxed registration techniques... as 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!

*Fig 18-2 here, Keith Gerling, White Elevator, Belgrade, WA, 2012 (gum)*

I'll provide Keith Gerling's workflow in which he produces beautiful gum bichromate pieces on wood and aluminum substrates and 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 C-M-Y 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 trouble-shooting 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.

**Fig: 18-3 here, Clarence White, Ring Toss, 1899 (Ransom Center Stieglitz Collection)**

### **ICON – 1 here, (A Little History)**

#### **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 & 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 University of Oxford, 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.

**Fig 18-4 here, The Shroud of Turin**

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 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.

**Fig 18-5 here, Aspen Hochhalter, hair-2, 2011 (dusting – on process)**

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 following Dichromate Options chapter but in the meantime, here are a few other related techniques to consider.

***Fig: 18-6 here, Felix Nadar, George Sand, Woodburytype – 1877***

## **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 the plate. Interestingly, the Woodburytype is generally a dark reddish-brown and 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... 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 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. 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 that 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 un-exposed and un-hardened 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, un-inked, 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.

*Fig: 18-7 here, (Robert Demachy, Cigarette Girl, 1902 - gum)*

### **Gum and Pictorialism**

In the late nineteenth and early twentieth centuries many photographic image-makers viewed themselves as dedicated fine artists rather than as the gentleman scientist image-makers 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 UK'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.

*Fig 18-8 here, Steichen - Little Round Mirror - 1905 (gum over platinum)*

## **HOW GUM BICHROMATE WORKS**

In the late 1850's, 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, dichromate solution. Again, this is because the pigment, gum arabic - dichromate mixture will harden in direct proportion to the degree of UV exposure received.

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 include 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.

***Fig 18-9, Christopher James\_Tony - Cummington Community for the Arts, 1968 (gum over cyan)***

## **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 what makes the process so interesting and so much fun to do. 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.

*Fig: 18-10 here, (Judy Seigel, Two Men & Tree, 1983 - 2000 - gum)*

## **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 that 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 mono-bath 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

[ICON -2 here](#), (Table Set-Up)

### Table Set – Up For Glyoxal - Gelatin 2- Step Traditional Sizing Process

- 28 g Knox gelatin (4 seven 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.)
- Zip Lock bag (Freezer type) for storage after drying
- 40% glyoxal (Bostick & Sullivan)

### 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, mono-bath variation, both the sizing and hardening stages are done at the same time.

*Fig 18-11, Natalie Rzucidlo, corpse 2009 (gum & cyan)*

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 version) unflavored gelatin (28 grams) that generally is sold in a pack of four or more envelopes containing 7 g each. Do not buy Jell-O<sup>®</sup>, even though it could work, because it stains and sugar's not good for you. Knox gelatin tends to be a little soft, bloom value-wise, but 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.

*Fig 18-12, Christina Z Anderson, Crack a Girls Ribs, 2005*

## **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, i.e. 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.

### **Total Immersion Option in Glyoxal**

Another option in the gelatin hardening process, in Step #4, is to execute a total immersion of the gelatin sized paper in the glyoxal. Prepare your double boiler tray set-up 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.

*Fig 18-13, Christopher James, John Q. w/ His Own Negative, 2005 (cyan & gum)*

### **Step #4: Glyoxal & 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 build up 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, i.e. 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 to 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 zip lock 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 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, 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.

*Fig 18-14, Sarah Van Keuren 'Black Sweatshirt' 2011 (gum)*

## **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, mid-tones 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 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.

*Fig 18-15, Aris Slater -Sandoval, Expectations, 2011 (gum)*

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 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 and so I'm going to keep my suggestions relatively uncomplicated. In the recent past I have been separating transparencies and print scans into separate CMYK (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 & 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-melt and end 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.

*Fig 18-16 here, Applied Gum Bichromate Curve and Comparative Step Wedges*

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.

*Fig 18-17, Peter Lindstrom, Camden Street, No1, 2009 (gum over cyanotype)*

## **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 C-M-Y-K (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 wicked 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 & white grayscale to a C-M-Y-K, or from a 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, designing your own custom curve profiles, or the most sophisticated way to go from grayscale to R-G-B to C-M-Y-K. 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 with several friends; David Stinchcomb, in Oklahoma, Tony Gonzalez in NY, and xtime Burrough in CA. 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 C-M-Y, 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 ([www.danburkholder.com](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: 2<sup>nd</sup> Edition*.

## **GRAYSCALE to R-G-B to C-M-Y-K 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, NY, 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.

***Fig 18-18 here, Christopher James – Alicia, New Mexico, gum separations\_2012***



**Note:** In this grid: **Top Left:** Original wet plate collodion. **Top Middle:** R-G-B interpretation from scan of wet plate and adjusted for subjective intent in Photoshop. **Top Right:** After conversion to C-M-Y-K, 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 R-G-B file so that I might play around with it a little before making my gum separations in C-M-Y-K. I then made coloration adjustments using a few of Photoshop's tools, e.g. Levels, Curves, Hue & Saturation, and Color Balance.

**STEP #1** – Scan the image into Photoshop and save it as a R-G-B 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 > C-M-Y-K.

**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 C-M-Y-K 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, C-M-Y-K negatives for you. These are your separations.

**STEP #6** - For each of these negatives... Go to > File and to > Save As. Title your negative to 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. i.e., 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 #10** - Print out the CMYK negative separations using Pictorico Ultra Premium OHP ink jet film.

***Fig: 18-19 here, Christopher James, Alicia in Gum #2, 2012 (gum)***



### **Final Print Sequence**

- 1.) Naples Yellow in sun for 2 minutes
- 2.) Permanent Carmine (magenta) in sun for 1:30
- 3.) Phthalo Blue in sun for 1:15
- 4.) Separate Phthalo Blue in eyes for 1:00 in sun

- 4-b.) 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 2:00
- 5.) Naples Yellow & Permanent Carmine mix in sun for 45 seconds in sun
- 6.) Naples Yellow & Permanent Carmine mix in sun for 45 seconds – 2<sup>nd</sup> coat
- 7.) Naples Yellow for 20 seconds in sun
- 8.) 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 guide-lines. Flatten the entire image when you're done and you are good to go.

***Fig: 18-20 here, (Tony Gonzalez, Jaclyn, CMY Separation Set)***

## **R-G-B to C-M-Y GUM SEPARATION NEGATIVES**

In the previous example (*Alicia, New Mexico*) we started with a grayscale image, converted it to R-G-B to work with it in color, and then converted that file into C-M-Y-K gum separations for the actual gum printing sequence. In this example we are starting with an R-G-B color file, like one that you would get from your iPhone.

The workflow's intention is to convert it into a set of C-M-Y (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 C-M-Y negatives that you are making.

**STEP #2** - Go to > Image on the Menu Bar, then to > Mode ... 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 3 separate, and distinct, B & W positives for your C-M-Y separations. Execute the following steps for each of the C-M-Y 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

*Fig 18-21 here, Gonzalez CMY Gum Curve Profile*

**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.

**STEP #9** - Go to > File and to > Save As and title your negative to 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 ink jet film.

*Fig: 18-22 here, (Tony Gonzalez, Jaclyn Curtain, 2005 - CMY gum)*

## **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 4 C-M-Y-K separations (*See the workflows above*), 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 C-M-Y-K 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.

There are many ways to register negatives and paper. Some of the methods include Photoshop registration marks (see above), 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 recoating.

### **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.

***Fig 18-23, John Quackenbos, #A - gum 1999,original 35mm***

***Fig 18-24 here, C-M-Y-K Gum Separation Grayscale Sequence***

*Fig 18-25 here, John Quackenbos, Cyan Mural, Maine-4 color gum, 1999*

## **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 will 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 where hard and fast rules apply.

*Fig: 18 – 26 here, Sarah Van Keuren 'On the Line' 2010 (gum)*

### **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 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 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), the lower the dichromate's sensitivity to UV light. Conversely, the more acidic the water, the lower the pH (less than 7), 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.

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 it is self-combustible. Please reference the chemical section in the Appendix before using dichromates.

*Fig 18-27 here, (Christopher James, Grace in Gum, 1989 - gum)*

### **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 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 this 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, permanent carmine), blue (phthalo or cobalt), and yellow (lemon yellow, new gamboge or cadmium yellow medium). Winsor and 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 their archives that discuss gum bichromate color.

**Note:** Daniel Smith, one of the best art suppliers to be found anywhere, gives information regarding such things as 'light-fastness' in their catalog. Daniel Smith also makes and sells their signature line of high quality watercolors and these can be found on their site... [www.danielsmith.com](http://www.danielsmith.com).

**Fig 18-28 here, Christina Anderson \_6\_Can I- (gum over cyanotype)**

### **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 the 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 and able to stand up to all sorts of abuse and have 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 in 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.

*Fig 18-29 here, Keith Gerling-Magnolia, MN, 1999 / 2010*

### **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 for me 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:**

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 gesso-pumice & 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 hang 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' x 8' sheets of 1/2" 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.

***Fig 18-30 here, Keith Gerling\_Ranchester\_WY-2012 (gum)***

## **GUM ARABIC**

### **Gum Arabic: Acacia Tree Sap**

Gum arabic, or gum acacia, can be traced back in time to 2650 BCE where 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 desert. 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 US 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 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 little tiny bottles for a lot of money.

Kordofan No. 1, is a good grade of gum arabic and 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 vs. 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, e.g. 30

grams 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 ... this amount of mercuric chloride is 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!

**ICON – 2 here, (Table Set-Up)**

#### **TABLE SET UP FOR THE GUM BICHROMATE PROCESS:**

Glyoxal & 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 / C-M-Y-K or grayscale negatives for contact printing

Paper towels

A collection of small and sealable containers for the sensitizer mixes. Best ones tend to be urine sample containers and high-end plastic storage ware.

**ICON – 3 here, (Measuring Chemistry)**

## **GUM BICHROMATE SENSITIZER**

*Fig 18-31 here, Rebecca Welsh, Gum Flower, 2012*

### **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 their unique way of performing it and this includes their 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 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 1/2" 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" x 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 1/2" to 3/4" of paint to be in the ballpark.

- 6 ml of gum arabic
- 1/2" to 1" watercolor pigment
- 6 ml of 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.

**Fig 18 - 32 here**, (*Carmen Lizardo, American flag blue house, 2006 – gum*)

Gum bichromate artist, 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, e.g. cadmium red vs. 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 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:

- First Coat: 2.5 grams linel’s helios yellow
- Second Coat: 2.5 grams linel’s ruby red
- Third Coat: 4 grams linel’s hortensia blue

Notice that Stephen doesn’t have a black (K) pass as he feels the 3-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.

**Fig 18-33**, (*Stephen Livick, Kali Mural #528, 1991 – gum*)

### **3 - COLOR C-M-Y GUM BICHROMATE**

It isn’t always critical to have a set of C-M-Y-K separations to make a beautiful gum bichromate exposure. 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. (*See Fig 16 – 12*)

In detailing the way he makes his C-M-Y 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 C-M-Y-K 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, Magenta, & 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.

***Fig: 18-34 here, (Tony Gonzalez, Rachel, Nail Polish, 2004 – CMY gum)***

### **Gonzalez Exposure Unit**

**Note:** Exposures are made using an exposure unit with an outside dimension of 18" x 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:** 10ml 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 1/2 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 1/2 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 1/2 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 1/2 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 1/2 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 1/2 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 1/2 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 1/2 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 1/2 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 1/2 hour.

### **A Traditional Gum Sensitizer Option**

- 9 ml of gum arabic
- 1/2" to 1" of artist's grade watercolor pigment
- 3 ml of 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. Each individual will adopt his or her 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 they are and what it is they need 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 of gum arabic
- 10 ml of warm distilled water
- 1" or more of quality watercolor paint
- 5 ml of 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 above.

*Fig: 18-35 here, Aspen Hochhalter, clear gum test, 2011*

### **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.

*Fig 18-36, Peter Liepke, A New Day 2011, (gum over cyan over Pt-Pd)*

### **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 C-M-Y-K 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.

### **ICON – 4 here (Brush Coating)**

#### **COATING**

Coating a gum bichromate sensitized emulsion on paper is not difficult but requires practice. There are several ways to coat well. The standard technique is to work on dry, glyoxal-gelatin sized watercolor 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.

**Fig 18-37, deRosette Dobelman, Casual Panic, 2012**

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 it set on a cool setting. Write down all of the technical information, such as the coating formula, paint amounts, and 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.

**Fig: 18-38 here, Ernestine Ruben, Big Bird, China, 2007 - gum**

### **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 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 haz-mat 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.

**ICON – 5 here, (Contact Printing Frame Icon)**

*Fig 18-39, Dan Estabrook\_Small Fires\_2012 (calotype & gum)*

## **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 / 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 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, see an impression where the UV light had altered the color of the sensitizer, and when you water-develop the print, it could all go down the drain (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 ultra violet 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 2 sheets of plate glass... especially for larger works where a contact sheet is impractical.

*Fig 18 -40 here, Lisa Elmaleh, The Long Goodbye, 2006 – gum*

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.

*Fig 18-41 here, Cheryl Harmeling, Brynmore, 1998, single color gum*

### **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.

By this point you should be getting a good idea of how to think about gum printing so I'll not 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, e.g. 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 above. 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 paint, about 1/2" 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?

**ICON – 7 [here](#), (Sink Set Up)**

### **SINK SET UP 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 metabisulfite for clearing highlights and intensifying, by association, contrast and color values. There are other metabisulfite types but I prefer the potassium version.

**Tray #3:** If you use potassium metabisulfite 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 metabisulfite rather than immerse the print in a complete bath. This is fine, especially for selective brightening and larger sheets.

*Fig 18-42, Christopher James, Diver, 2002 (gum)*

## **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 and recoat with the same or a different color, and expose the negative again for a slightly longer time.

*Fig 18-43, Dan Herrera, Dance\_of\_Cthulhu's\_Daughter, 2012 (5-color gum)*

### **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 a 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 overexposed prints is simply to let them soak overnight. 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 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 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, 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 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.

*Fig 18-44, Sandra Davis, Mother Mary, 2006 (gum on glass)*

### **Forced Wash-Development**

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, 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

*Fig: 18 - 45 here, here, Christopher James, Irezumi #2, 1986*

### **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*.

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 an 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 metabisulfite bath following the wash-development... but there is a better solution to this problem; a cold fresh water 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 Metabisulfite**

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 metabisulfite. Simply mix together 10 grams of potassium metabisulfite 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 metabisulfite 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 metabisulfite 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 metabisulfite because it may be more aggressive than you anticipate. Also, don't use a sodium *bisulfite* 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 metabisulfite 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.

**Fig: 18 – 46 here** (*Stefanie London, Tulips, 1989 – gum and mixed media*)

### **TROUBLE-SHOOTING 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 you are experiencing staining, the very first thing I would look at is my glyoxal-gelatin sizing and 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 towards 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.

*[Fig 18-47 here](#), Diana Bloomfield \_2\_ Saint Sebastian on the Hill - gum*

## **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.

## **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 where 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 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.

*Fig 18-48 here, Carmen Lizardo, Santo Niño de Antoche, 2006 - gum*

### **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, a lighter version of the negative... especially if it's a digital negative, just adjust your curves. Also try 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 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, i.e. 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 metabisulfite, 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, and / 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, i.e. 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, i.e. 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 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.

*Fig 18-49 here, Christina Z Anderson, Ketchup, 2010 (gum)*

## **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 the opposite is true in their work... go figure. 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 and so you thought that maybe, just this once, you could make a nice gum 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 you may have used too much hair dryer 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 is impure or rotten... don't forget, it is vegetable matter.

*Fig 18-50, Erin Mahoney -Behind-the-Birch-Tree, 2012 (tri-color gum)*

### **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 and / 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. 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.

***Fig 18-51 here, Barbara Eberhard,-Pizza-Joint (gum)***