

Peter J. Blackburn is a freelance photographer working in the Dallas, Texas area. He spends many hours a week working with both gum and casein bichromate printing. He says, "while browsing through a basic darkroom handbook early in my photography training, I came across a section outlining just a few of the many alternative processes. Gum and casein printing were among them. I was floored! It was love at first sight!"—that was back in 1988. For it's intimate beauty and for the option to print either in monochrome or three and four-color, Peter chose to work exclusively with the bichromate process right from the start. He uses the ubiquitous Texas sun to expose his negatives and credits imaging technology and advances in modern sizing for helping to streamline his production workflow.

*I'm a bit eclectic
in my approach,
using everything from
my trusty Rolleiflex
to a Roland printer.
Still, even with access
to modern
accruements,
I have found that
producing a fine
gum bichromate print
is much like playing
classical music well.
It requires discipline,
tenacity, and a
bit of finesse . . .*

*Casein,
on the other hand,
is pure
rock and roll!*

Writer / Peter J. Blackburn
Photography / Peter J. Blackburn

An Introduction to the Gum Bichromate Process

Always be careful when handling chemicals. Read the [health and safety instructions](#).

Expressive, delicate, and inspiring—many are the complementary adjectives showered in praise of the gum bichromate print. Those experienced in the making of gum prints, however, might tend to add temperamental, tedious, and elusive to the descriptive repertoire. From Fox Talbot to Robert Demachy, from the Lumière brothers to Heinrich Kühn, the bichromate process has a long and varied history spanning well over a century. Each artist persevered through their own series of trials and failures. Eventually they overcame, in varying degrees, the myriad of pitfalls encountered on the road to creating wonderful prints. The beginner gum bichromate printer would do well to study the works of those early masters.

After falling out of common use for an extended period of time, a resurgence in gum printing began again in the 1970's through the writings and work of a new generation of artists. Recently, with the digital revolution firmly in place and technical advances in paper sizing, the popularity of all types of dichromate printing is once again building steam and gaining speed. Witness the galleries in this web site and those of gum artists peppered all over the worldwide web. Witness, too, the plethora of new publications devoted to the subject of gum printing and the increasing number of exhibitions featuring both monochrome and tricolor prints. One would think gum printing has, at last, come of age.

There are probably no two gum printers who approach their work in precisely the same manner. The information provided below is just one of many points of embarkment and offered to the reader as basic introductory material. Most of what is presented comes from twenty years of personal experience, and perhaps a bias or two picked up along the way. As you progress in your pursuit, feel free to explore, diverge, and "wander around deck." May your vision increase as you embark on this journey and discover firsthand the beauty of gum bichromate printing.

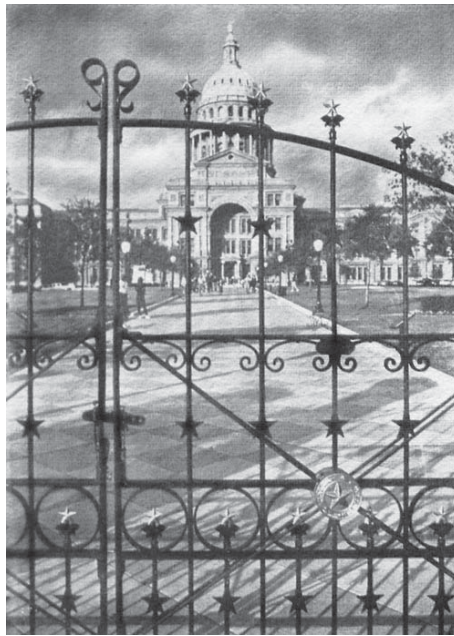
The Process in Brief

Gum bichromate (or dichromate) printing involves creating a working emulsion made of three components: gum arabic, a dichromate (usually ammonium or potassium), and pigment. The emulsion is spread on a support, such as paper, and allowed to dry. A negative or matrix is then laid over top the emulsion and exposed to a UV light source. Usually a contact printing device or a sheet of heavy glass to ensure even, constant contact is employed. The light source will harden the dichromate in proportion to the densities of your negative. After exposure, the paper is placed in a series of plain water baths and allowed to develop until the unhardened portions of the emulsion have dissipated leaving a finished print with the desired highlights, midtones, and shadows.



Baby Teeth, 2000 ©
Single coat gum print
from analogue negative

- [Website](#)
- [Email](#)



Texas State Capitol, 2001 ©

Two-coat gum print from a single digital negative



Number 35, 2002 ©

Three-coat gum print from a single analogue negative—coats kept thin to lend a “nostalgic look” to the image

Materials

- **gum arabic**

A bottled, predissolved, commercial brand should work fine, especially for the beginning printer. Check your local art shop or graphic arts supplier. Later you may wish to make your own by dissolving 30 grams of powdered gum to 90ml (or less) of very warm distilled water. Refrigerate to extend its shelf life thereby reducing the need to add a preservative.

- **a dichromate solution** of either (choose one) ammonium or potassium

To make a near saturated solution (29%) of ammonium dichromate add 29 grams to 100ml of very warm distilled water.

To make a near saturated solution (13%) of potassium dichromate add 13 grams to 100ml of very warm distilled water.

My preference favors a potassium solution. Potassium dichromate, widely used in other processes such as carbon printing and photogravure, provides reasonable exposure speeds while minimizing the tendency to leave an orange stain. Should you choose a very strong UV source, a weaker solution may offer better control of your exposures. I use a 5% solution of potassium dichromate. Either compound can be purchased in a bright orange crystal granular form from a chemical supplier. **Handle with care and take proper safety precautions; keep out of reach of children; consult a Material Safety Data Sheet (MSDS) for further handling instructions.**

- **water-soluble pigments**

Virtually any brand of watercolor will provide at least a few pigments that will be suitable for gum printing. Some pigments may stain your paper resulting in flat, low-contrast prints with ruined highlights. However, you may find the staining effect suitable for certain images. For your beginning work try cadmiums, cobalts, ultramarines, earth pigments, and lamp black. You might try a mixture of Prussian Blue with Burnt Sienna as an alternative to single black pigments.

- **brushes**

The gum bichromate emulsion is essentially a modified watercolor. As such, I recommend investing in a few good quality watercolor brushes (flats or wash brushes; 1” and larger). Unless you enjoy plucking stray hairs out of your sticky emulsion, hake-style brushes might better be reserved for other artistic purposes.

- **paper**

Again, the gum bichromate emulsion is essentially a modified watercolor. Therefore, begin experimenting with **watercolor papers** that can handle repeated washes. In my opinion, you have two basic choices.

First are watercolor papers that can be classified as “old school” in that they utilize tried-and-true gelatine as a key sizing agent. Size, a term used in paper manufacturing, is a paper additive designed to regulate how and to what degree moisture will interact with the paper’s fibers. Gelatine is a very effective size and one that many gum printers continue to use today with excellent results. Papers that are gelatine sized sometimes need additional size applied to the surface followed by an application of a weak formaldehyde or glyoxal solution (hardener) to help maintain paper quality throughout multiple print layers and many water baths. **Again, consult a MSDS for handling instructions if using either hardening solutions.**

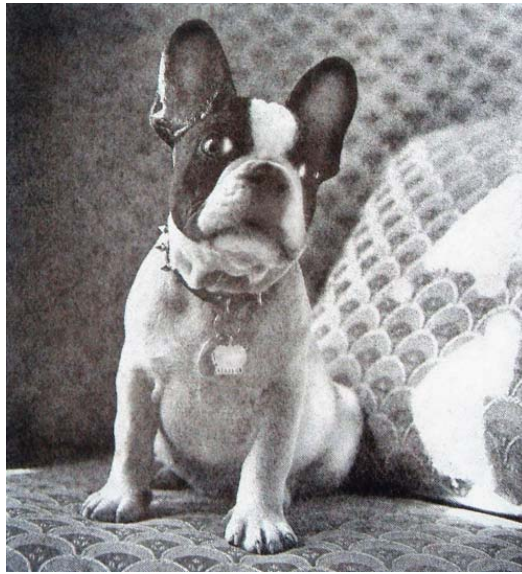
Your second choice include “high tech” papers that incorporate an inert, synthetic size called alkyl ketene dimer (AKD). These papers are quite robust, maintaining their sizing qualities through many washes. High quality prints are possible without any additional sizing. AKD-sized papers are my personal preference and have been for many years.

Most watercolor papers come in a variety of surface textures ranging from hot press (a very smooth paper) to cold press (a paper that features a lightly textured surface) to rough (a more pronounced texture). Many gum printers, including myself, prefer the hot press surface while others are drawn to the cold press varieties. Paper formulations can change, often without notice, greatly affecting the quality of your work. Consult a paper supplier or the manufacturer for current information. **The beginner gum bichromate printer would do well to further investigate and increase their knowledge of paper. It is an essential key to quality gum printing.**

You will need to preshrink your paper if you plan to do multiple print layers. Let your paper soak in very warm water for at least 10 minutes (some papers may require more soaking time) and then dry allowing the paper to shrink. That procedure will help maintain the registration of your negative(s) as you progress from one print layer to the next.

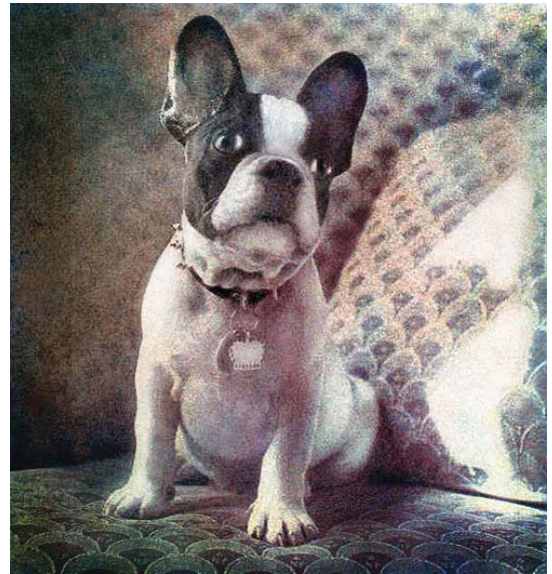
- **a UV light source** (see Dr. Mike Ware’s page entitled, “Preparation for Iron-based Printing”)
- **plate glass with spring clamps or a contact printer** (see Cyanotype process page)
- **a few developing trays** a bit larger than the dimensions of your paper
- **small chemical-resistant plastic or glass jars for mixing emulsion, stirring rods, two eye/medicine droppers, protective gloves, timer**

Continued on next page.



The King, 2007 ©

Two-coat, single pigment gum print from a single digital negative—in this case a burnt umber dry pigment was used for both layers



The King, 2007 ©

Three-coat gum print from a single digital negative—in this case a different primary color (CMY) was used for each layer

Making the Print

1 Gum printing is a contact printing process. A good print begins with a good negative. You must have a negative produced in the actual size of the finished print. It can be as simple as taking a digital image and using photo manipulating software to invert (and flip) the shot to a negative making an inkjet print on paper or transparency film. You might also consider using an imagesetter to make quality negatives. Try to start with negatives that have good (not necessarily high) contrast and density.

For many years (and occasionally still) I made negatives using the analogue method of enlarging medium format transparencies onto orthochromatic film. I developed the film in dilute Dektol (1:20).

Much has been written about producing digital negatives and using software for alternative processes. Indeed, a properly made negative is one more key, among the many keys, to creating technically and esthetically pleasing prints. I would advise you to research, experiment, and practice!

“... a train of thought ...”

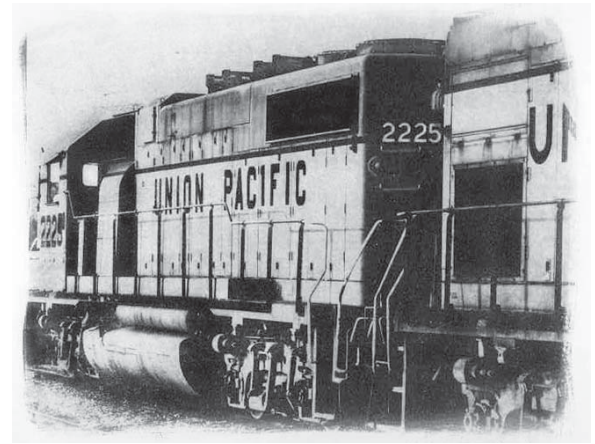


Union Pacific No. 2225, 1990 ©

Original image made on Agfa RSX slide film

Union Pacific No. 2225, 1998 ©

The slide was converted to an enlarged negative and gum printed—this example is a one-coat print using a lamp black pigment.



Union Pacific No. 2225, 1998 ©

For this example, a higher gum ratio was used to deliberately produce flaking during development creating mood. The print was then watercolored while still damp.

Union Pacific No. 2225 Mosaic, 1999 ©

In this surreal version, several gum prints were made using blues, browns and blacks, cut into pieces and assembled. Gouache was added as the final touch.



2 With your negative ready and under subdued light or a safelight, combine one part gum arabic, one part dichromate, and a small length of watercolor from a tube. As an example for a typical 8 x 10 print, combine 3 eyedroppers full of gum with 3 eyedroppers full of dichromate. Then add about 2-3cm of watercolor from a tube. Mix thoroughly! With experience, you will discover that some mixtures require more pigment, others less depending upon, among other things, brand and color. Remember—mix thoroughly and occasionally stir as you use it!

3 After you have mixed thoroughly, brush the emulsion onto the paper over an area slightly larger than your negative. Brush as quickly and evenly as you can. You may need to switch to a dry brush to help smooth the emulsion. Try not to lay the emulsion on too thick or thin, with your primary aim keep it even. Here is where finesse plays an important part in the process.

- 4 Allow the emulsion to dry. A fan or a blow dryer set on the cool mode will help to speed the process along.
- 5 Place your negative on top of the dry emulsion taking care that the “emulsion” side of your negative is in contact with the gum emulsion. Insert into your contact printer or sandwich with your plate glass (see step three in the Cyanotype process).
- 6 Now expose your image to a UV source. A sunlight exposure may take from 1 to several minutes depending upon many factors such as pigment choice, gum/sensitizer ratio, time of day/season of year (if using the sun), and negative density. As an arbitrary starting time for your very first print, set the timer for three minutes and adjust your next prints accordingly.
- 7 When the timer goes off, remove your print from the contact printer or plate glass. Rinse the emulsion for a few seconds (5-10) under a very gentle stream of water to remove the least affected dichromate first. You will probably see some orange solution wash away almost immediately. Why let your paper soak unnecessarily in dichromate that otherwise can easily be removed by a brief initial rinse? After the rinse, place your paper face down in a tray of water for 5-15 minutes, then gently into another tray for an additional 5-15 minutes, then finally (if needed) into a third tray for the same amount of time. Your goal is to develop an acceptable print within 20 - 30 minutes. It is not unusual to use a small brush to help clear away small areas of unwanted pigment. However, if you find that the print is not clearing away in the allotted time or you need to scrub your emulsion to remove unwanted pigment, try exposing the next print for a shorter period of time. On the other hand, if the emulsion has swept off your paper or is flaking and fragmenting during the brief initial rinse time or in the first wash, try doubling or tripling your exposure time.
- 8 Now you may hang your print to dry or place face up on a drying screen. Afterward, it is usually recommended that another coat be applied of the same color or perhaps another color over top of the first layer to help improve the tonal range and density of the print. Simply repeat steps 2 through 8. After the last coating sequence, when your paper has dried, some printers suggest to remove any residual dichromate (indicated by an orange stain especially visible in the highlights) by briefly soaking the paper once more in a 5% (or less) solution of potassium metabisulphite.

Managing the Gum Bichromate Process

Successful gum printing can be achieved through a careful management of the many variable factors associated with the process. Those factors include the following:

Paper	preshrinking, adequate sizing
Humidity	moisture content in the paper and working environment
Exposure	UV sources; diffusion vs undiffused sources, time of day/month of the year (sun)
Pigment	consistent quantity and quality; staining control
Gum/Pigment Ratio	gum arabic – using more gives higher contrast, too much causes emulsion to flake in development
Developing	water temperature, bath manipulations
Technique	brushing style, measuring style, development style
Negative	damage from heat under hot lights, registration issues, density and contrast

Consider the variables above (you will discover others) as control knobs on a console. As you begin printing in dichromate, try to standardize as many variables (preset the console) as you can such as paper, pigments, dichromate, gum, etc. Then, as you evaluate your progress, adjust only one or two of the knobs at a time. Often just a minor adjustment of one or two knobs will make a big difference. You will find that some variables, such as paper and pigment batches, change without warning requiring major adjustments to be made to other knobs on the console.



Assorted Fruit, 2007 ©

This is a **three-color gum** print using negatives of chosen contrast/density and paper size to keep highlights white, and in this case, to allow the image to float on the paper (no background).



Assorted Fruit, 2007 ©

This is a **three-color casein** print. I have found casein to have most of the advantages of gum while being a far more tolerant process.

Producing quality negatives (ones that have adequate contrast and density) and paper sizing are perhaps the most important variables to master, especially as you begin. The process is more forgiving as those two variables are effectively grasped. Artists choosing to use the sun for their UV source can expect to see a greater degree of variation from print to print than those using a more consistent light source.

While we are the subject of constants and variables, I would encourage the reader to also consider gum's related process, casein printing. Substituting gum arabic with a casein binder, in my experience, has greatly helped to make the operation more forgiving especially when the sun (what I call the "constant variable") is the selected UV source. The variables become more manageable while the image quality is virtually identical. Information on casein printing can be found elsewhere on this site.

In closing, here are four helpful disciplines you may wish to include in your printing routine:

Start with a Good Negative

Check for adequate density and contrast.

Manage the Variables

A poor print is usually the result of failing to control one or more variables. Evaluate your negative(s) first and then your sizing quality if you persist in achieving unsatisfactory results.

Keep Accurate Records

Use the back of your prints to note exposure/pigment information and keep a log.

Make a Daily Test Print Especially If You Use the Sun

Start your sessions exposing a small test print of a step wedge or a negative with long tonal range for reference to help keep time and material waste to a minimum.

Recommended Reading

James, Christopher *The Book of Alternative Photographic Processes*, Clifton Park, New York: Cengage Delmar Learning, 2001. 400 pp.

Livick, Stephen *Gum Printing*, Toronto: Stephen Livick, 2001. 65 pp.

Rexer, Lyle *Photography's Antiquarian Avant-Garde: The New Wave in Old Processes*, New York, New York: Harry N. Abrams, 2002. 160 pp.

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