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Forgotten photographic processes : experiments based on the descriptions of Robert Hunt

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FORGOTTEN PHOTOGRAPHIC PROCESSES:

EXPERIMENTS BASED ON THE DESCRIPTIONS OF ROBERT HUNT

By Kelly Thielen

A Thesis Project

Presented to Ryerson University

and

George Eastman House International Museum of Photography and Film

In partial fulfillment of the

requirements for the degree of

Master of Arts

in the Program of

Photographic Preservation and Collections Management

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Abstract of Project

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As digital media replaces traditional chemical experimentation, the photograph as an object made from chemicals and light has been replaced by a technology that embodies only the image. Even traditional slide projections and the more current digital presentations do not accurately portray the photograph as an object, focusing instead on its surface image.

This thesis combines production of actual photographic objects, along with technical descriptions, chemical recipes and formulas. The project, created to be a teaching collection and process sample guide uses Robert Hunt's early photographic descriptions from both *A Popular Treatise on the Art of Photography* (1841) and *A Manual of Photography* (1853).

The actual collection of objects that is the product of this work is held at Ryerson University and George Eastman House. It is comprised of a clamshell box that houses photographic processes including The Chromatype, The Energiatype and The Fluorotype, along with a self-published book. The photographs and text are intended for use as a resource for photography students, teachers, historians and museums with an advanced knowledge of and interest in photography.

Acknowledgements

This project would not have been possible without the support of many people. I first want to thank the staff at George Eastman House (GEH). Thank you to Grant Romer, Director of the Advanced Residency Program in Photographic Conservation and Roger Bruce, Director of Interpretation who both agreed to act as my advisors. Their guidance was invaluable. I also wish to thank Grant Romer and Rick Hock for the use of their studio space. Without their generosity, the project would not have been possible. A very big thank you goes to Jiuan-jiuan Chen, Assistant Director for Conservation Education for her interest and encouragement during this project and for taking on the responsibility for photographing and undertaking a conservation survey of the Robert Hunt objects at GEH. Thanks go to David Wooters and Joe Struble for allowing the Hunt objects to leave the archive and letting us handle, view and photograph them. Thank you to Mark Osterman, for his interest and vast knowledge of all things 19th century. Thank you to Ralph Wiegandt, Senior Research Fellow for his suggestions. Thank you to Katharine Whitman, Mellon Fellow in the 4th cycle of the Advanced Residency Program, who designed and created the clamshell boxes in which this project is housed. Thank you to those directly involved in the graduate program at George Eastman House, including Alison Nordstrom and Sean Corcoran.

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There are so many people whose knowledge, interest and encouragement propelled me along this last year as I worked toward completion of this body of work. Thanks to Joyce Neimanas, Carl Chiarenza, Heidi Katz, Mike Ware, Luis Nadeau and Larry Schaaf.

Most of all, thank you to my family for their support and interest in everything I do.

Dedication

This project is dedicated to my Dad, Dan Thielen.

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Chapter One
Description of Project

The research for this project was undertaken to fulfill the thesis requirement of a Master of Arts degree in Photographic Preservation and Collections Management. This graduate program is through both Ryerson University in Toronto, Canada and George Eastman House International Museum of Photography and Film (GEH) in Rochester, NY.

With my background in photography and a strong desire to continue applied artistic work, I wanted to undertake research in the area of early photographic processes and to reproduce these processes through chemical experimentation. I became aware of early photographic texts by Robert Hunt during my graduate work and chose to pursue photographic processes by Hunt in depth. My plan was to build a collection of photographic objects in the form of a teaching collection and process sample guide. This teaching collection would be accompanied by a book, which would not only illustrate the objects, but also incorporate the history of early experiments, translation of measurements and chemicals and the methodology I used in the recreation of this body of work.

Currently we are seeing a technological shift in photography away from its chemical roots toward digital technology. This shift may unfortunately result in a minimization or even a loss of the knowledge of the chemical foundations upon which photography has been built. It may also be impossible to teach the history, evolution and processes of photography without the chemical knowledge of the objects themselves. Traditional slides and the more current digital presentations fail to convey to the student or historian anything about the object other than the image on its surface. As a result of this impending loss, the last decade has seen a marked revival of both interest and practice in the early photographic processes, even while commercially manufactured films and papers are becoming harder to find.

While the practice of some antiquated processes have been revived or continued since the peak of their success in the nineteenth century, my investigations into the processes written about by Hunt and his contemporaries left me wondering why these techniques had become virtually

unknown today. I questioned what it was about them that led to their failure to be recognized as commercially viable in comparison to other processes of the same era, such as the daguerreotype, calotype and salted paper print.

The processes I chose to experiment with are all objects on paper; some are sensitive enough to be exposed in-camera, while others require direct exposure to the sun. The books by Robert Hunt that I worked with included both *A Manual of Photography, 3rd Edition*, originally published in 1853 and reprinted in 1973 by Arno Press: New York, New York and *A Popular Treatise on the Art of Photography*, originally published in 1841 and reprinted in 1973 by Ohio University Press: Athens, Ohio. *A Manual of Photography* was printed in five editions, the first in 1841 and the last in 1857. Within this text are numerous photographic processes described by Hunt; some invented by the author and others that are the result of collaborations or evolutions of processes created by other experimenters of the same time.

After looking through the chapters pertaining to the specific processes, I chose to work with ones that were foreign to me and ones I thought that no one had been experimenting with. I searched through many photographic texts and histories and searched the Internet for references to these processes without finding any examples or descriptions beyond a passing mention. *A Manual of Photography* by Robert Hunt was the first English version of a photography manual ever produced and the third edition I obtained and worked from included the earliest processes put forth by Niepce, Talbot and Daguerre, as well as the experimental processes by Hunt and his contemporaries.

In *A Manual of Photography*, chapters one through five describe the evolution of photographic discoveries of Nicephore Niepce, William Henry Fox Talbot, Louis Jacques Monde Daguerre and Sir John Herschel. I choose to focus on some of the processes listed in chapter six, which are a series of processes originating mainly from Robert Hunt with a few other collaborators. The three processes I chose to explore in this project are: Mr. Ponton's Process (Bichromate of Potash) known hereafter as the chromatype, the ferrotype (known hereafter as the energiatype) and the fluorotype.

Since Hunt was a self-taught chemist and I have no formal training aside from my own personal experiments in nineteenth-century photographic processes, I found reading through the chapter pertaining to his specific processes appealing and wanted to try to recreate them as he described. Not all processes have specific chemical formulas to follow and so much of the experimentation was just that, experiments. I wanted to determine if I could recreate them to see if they worked as described, or if they did not work, to discover the reasons I believed they did not.

While I have been able to successfully create working images based on some of the descriptions given by Robert Hunt in his text, the interpretation of chemical reactions was beyond the scope of this project. While it is possible to determine why particular colors emerge from the mixture of a group of chemicals, or why different exposure times produce unexpected results, I will only be able to make these determinations after further examination and experimentation.

It was my intention that this project and related experiments form only the beginning of my research into these and other processes described by Hunt. This text includes not only the history and methodology of experimentation, but also reproductions of the objects I have made. Anyone with an interest in these processes can get a clear idea of the results even if they are unable to possess the accompanying teaching collection and process sample guide, which I am producing in a limited edition. One of the collections will be held at George Eastman House and another at Ryerson University. It is my hope that this research will be of interest to students of photography, other individuals with an advanced knowledge of early photographic processes, as well as to museums and photographic research institutions.

Chapter Two
Planning and Preparation

To prepare for a project of this size and scope, I needed to not only undertake the necessary research of Hunt and his contemporaries, but also to physically build the camera and UV box which would facilitate making the actual objects. The camera, one I had built and used in a calotype project, was based on the models designed and described by Alan Greene is his book, *Primitive Photography: A Guide to Making Cameras, Lenses and Calotypes*. The camera was built to produce vertical images and uses a Petzval Portrait Lens. It takes papers up to 8" x 10" in size, with the depth of the film holder allowing for papers to be exposed dry or wet when placed between two pieces of glass inside the holder. See Figures 1 and 2, showing the camera in both an extended and contracted position.

I also constructed a UV box for processes requiring more light than what was available for in-camera exposures, due to the inconsistency of sunlight during daily and seasonal changes. It was constructed to allow space for two 11" x 14" print frames to be exposed simultaneously. The box measured thirty inches in length, sixteen inches in height and twenty inches in depth. I used eight twenty-four inch long, twenty-watt Natural Sunshine bulbs, manufactured by Phillips, connected to four ballasts. The bulbs were positioned eight inches above the print frames. See Figures 3 and 4 showing the UV box in its open and closed positions.

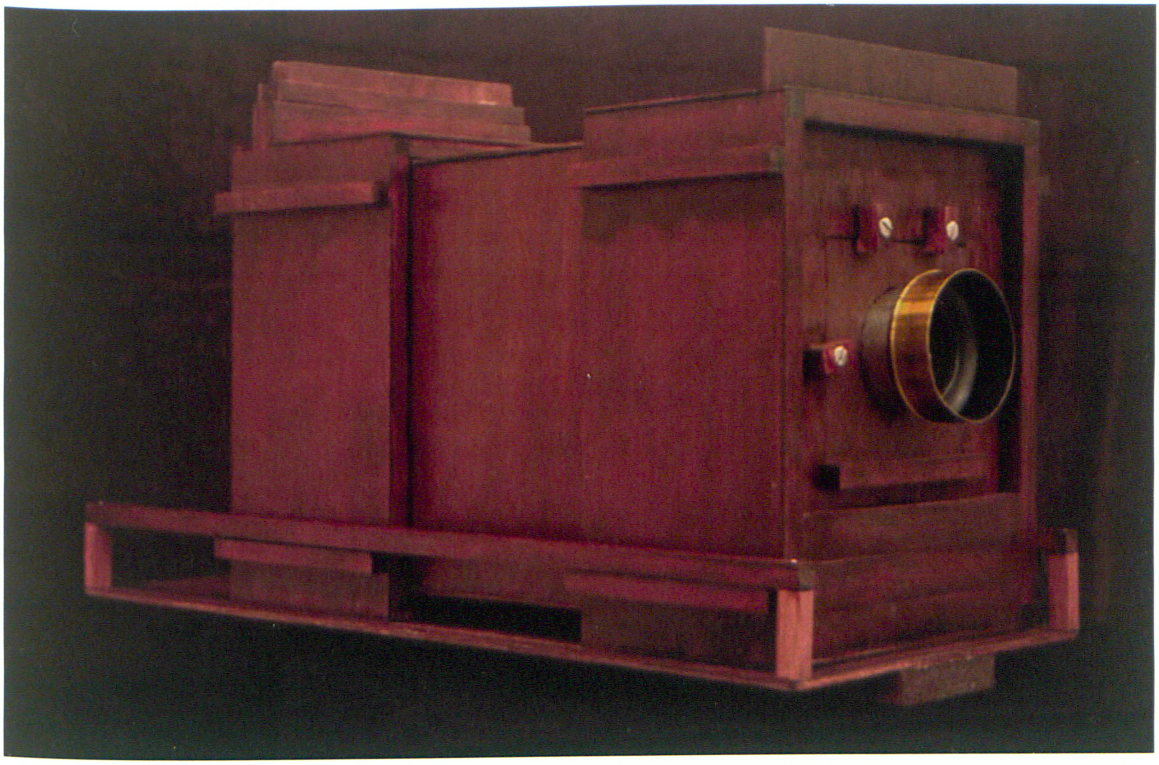

Figure 1, Camera in its extended position

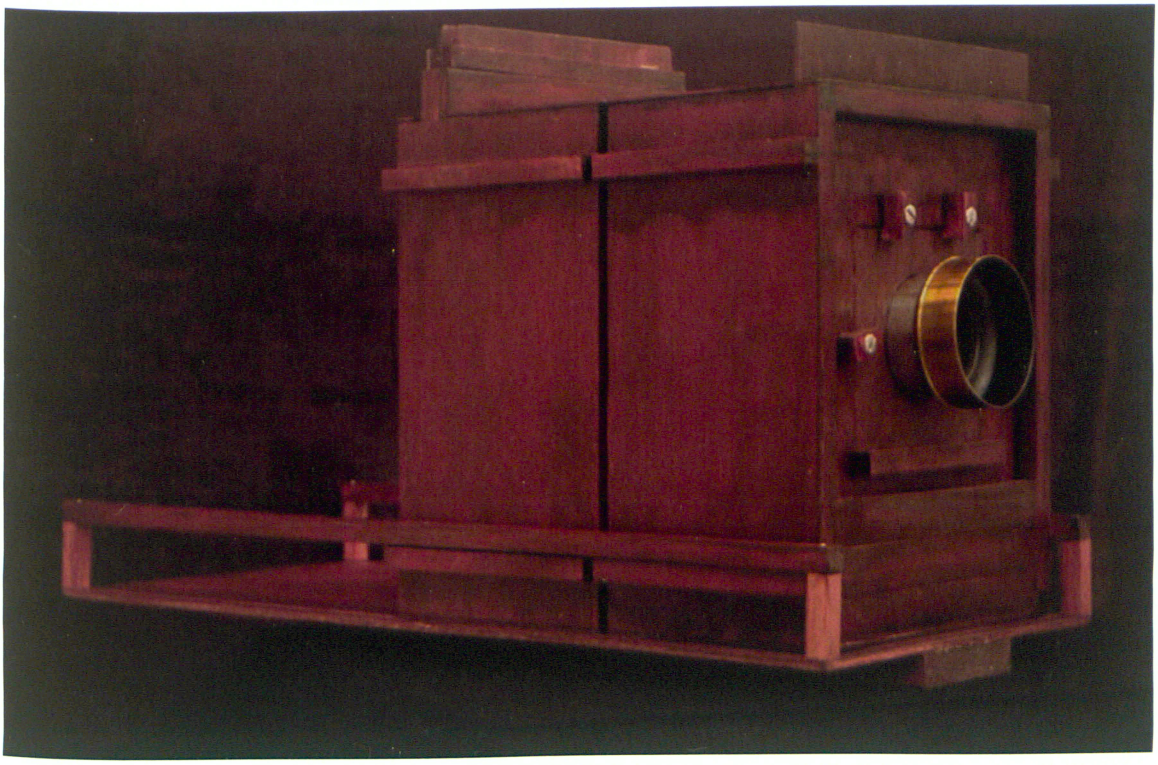

Figure 2, Camera in its contracted position

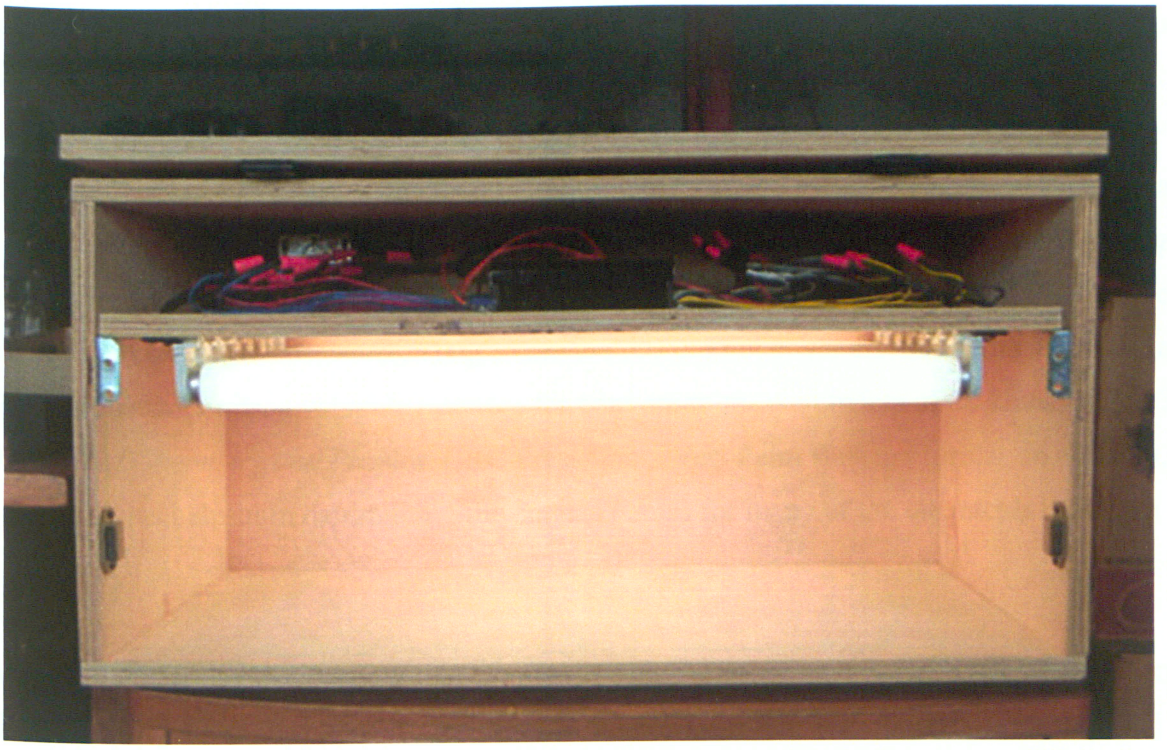

Figure 3, UV Box opened

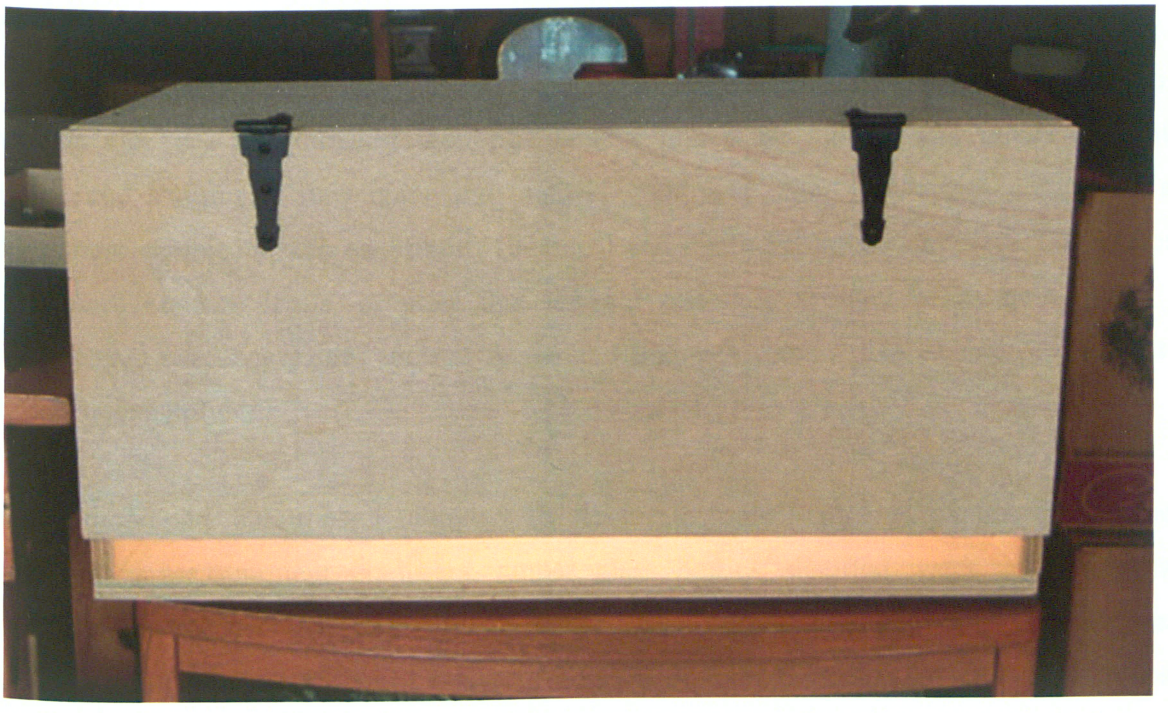

Figure 4, UV Box closed

A large part of the planning for this project required converting the measurements and chemicals listed by Robert Hunt into their modern equivalents. (See Chapter 8 for a conversion chart.) Since these books were originally written over 150 years ago, the chemical terminology has changed and the measurements used then including drachms and grains are no longer in common use. One very useful feature of the 1973 reprint of *A Popular Treatise on the Art of Photography* was the introduction by James Yingpeh Tong, in which some of the measurements and chemicals were already converted. However, Tong's conversions did not cover all the chemicals I worked with. For obscure units, a valuable resource for converting measurements of all kinds is the *CRC Handbook of Chemistry and Physics*: CRC Press, Inc., West Palm Beach, Florida. In addition, the Internet was helpful in determining the current names for many of the chemicals that were not obvious.

While I am not a chemist, I know that proper precautions must always be taken when working with and mixing these chemicals into solutions. Companies that sell chemicals are required by law to include Material Safety Data Sheets (MSDS) that list toxicity hazards. This information was read and stored in my workspace. In addition, I wore respirator when appropriate, I mixed and measured the chemicals in a well-ventilated area and always wore gloves while working. It was extremely important to know as much as possible about the materials being used; some chemicals are very dangerous if their powders or fumes are inhaled and others can cause irritation and staining if they come into contact with your skin. Numerous companies sell photographic chemicals such as Artcraft Chemical and Photographer's Formulary, but for some of the more obscure items, or ones that are not generally thought of as being used for photography, I used companies such as Acros and Sigma-Aldrich. (See Chapter 8 for a list of materials and suppliers.)

In order to prepare solutions, I obtained an electronic scale, weighing papers, filter papers, funnels, glass measurement graduates, amber glass bottles, distilled water and waste jars. Because of the toxic nature of many of the chemicals used, it is important that the waste solutions did not go down the drain, but were instead poured into receptacles for proper disposal. In setting up the darkroom, I covered a table with both plastic sheeting and a layer of brown paper to protect it. I purchased glass Pyrex kitchen trays to use for my solutions since they do

not absorb the chemicals and are easily cleaned. I also strung a clothesline with clothespins to hang papers once they were coated so that they could dry without touching anything. Plastic clothespins are preferred over wooden ones since they do not absorb chemicals and can be easily wiped clean. For lighting, I used red bulbs instead of the standard yellow darkroom bulbs. Not knowing the sensitivity of certain chemicals once mixed and coated onto the paper, I wanted to ensure that the darkroom was as dark as possible, while still light enough to allow me to work and see clearly.

Chapter Three
Robert Hunt (1807-1887)

There is very little written about many of the people included in this text. The majority of information about Robert Hunt is found in James Yingpeh Tong's introduction to the 1973 reprint of Hunt's *A Popular Treatise on the Art of Photography*. For a detailed biography of Hunt, that text is the best source.

Robert Hunt was a contemporary of William Henry Fox Talbot and Sir John Herschel. While the names of the men he collaborated with continue to be well known today as pioneers of photography, the name of Robert Hunt has fallen into obscurity. As a self-taught chemist, he experimented with photographic processes on paper, invented his own processes and wrote numerous technical papers. He authored books on the subject of photography, including *A Manual of Photography, Researches on Light* and the first English photography manual, *A Popular Treatise on the Art of Photography*. In addition to his contributions in the field of photography, Hunt also wrote texts of poetry and folklore. He was also a noted geologist and a mineralogical museum was established in his name in Redruth, England.

Hunt was elected Secretary of the Royal Cornwall Polytechnic Society in 1840. In 1854, he was selected a Fellow of the Royal Photographic Society of London and in 1873, both Hunt and Talbot were elected the first two honorary members of the Royal Photographic Society of Great Britain. Given such honors, it is strange that today his name is unknown. His photographic processes, among the many over the years that did not become commercially viable, slipped into obscurity. Still, Robert Hunt experimented, collaborated and wrote volumes and papers describing his photographic research, which formed the basis of this project.

Of the earliest photographic processes, few are known or practiced today. Those that do, include the daguerreotype, which could be used in-camera and offered extraordinary clarity and the calotype and salted paper print, the first negative to positive process that gained wide acceptance and offered ease of use as well as the ability to make multiple prints.

In the earliest days of photographic experimentation, information sharing was key. This is evident when reading the text by Robert Hunt included in this text. Hunt includes the following names: Sir John Herschel, Alexandre Edmond Becquerel, Robert J. Bingham, Mongo Ponton, Robert Ellis and Dr. Woods. While names such as Herschel, Becquerel and Ponton are known to historians of photography, the others are not and Hunt does not give background information on his collaborators.

Chapter Four
The Chromatype Process

I began this project working with the chromatype. After reading through *A Manual of Photography* and gaining a basic understanding of this process, I counted eleven variations to experiment with. In order to fully describe my working method, the description for each variation given by Hunt in his text is recorded first in italics, followed by my methodology with reproductions of the resulting tests and finished prints.

The following chemicals are necessary for making the chromatype. The chemicals are listed below on the left as they were named originally and in their contemporary terminology on the right.

Bichromate of Potash	Potassium Dichromate
Sulphate of Indigo	Indigo Carmine
Sulphate of Copper	Copper Sulfate
Nitrate of Silver	Silver Nitrate
Sulphate of Nickel	Nickel (II) Sulfate
Chromate of Potash	Potassium Chromate
Carbonate of Soda or Potash	Sodium or Potassium Carbonate

Mongo Ponton first put forth the idea of using potassium dichromate as a light-sensitive agent in photographic processes. The evolution of the potassium dichromate process was developed by not only by Robert Hunt, but also by Alexandre Edmond Becquerel and Robert J. Bingham. While this process is listed in *A Manual of Photography* as 'Mr. Ponton's Process', Herschel proposed grouping all processes using the same light-sensitive agent under the name of that agent, hence, the listing of all variations described herein as chromatypes.

The use of potassium dichromate in these early experiments formed the basis for later photographic and photomechanical processes. The ability of the dichromate salts to harden

organic matter once exposed to sunlight made it an ideal medium to be used in combination with materials such as gum arabic, gelatin or albumen.

Please note that the use of quotations at the beginning but not at the end of some paragraphs is taken directly as written in the text and is not an oversight.

From *A Manual of Photography*, by Robert Hunt, Chapter six, pages 72-76

Mr. Ponton's Process (Bichromate of Potash)

Under the general term of the Chromatype, I would propose to include all those processes which involve the use of any of the salts of chromium. It was originally introduced to distinguish a particular process which I discovered, and published at the meeting of the British Association at Cork, in August 1843; but it appears very convenient to adopt the principle introduced by Sir John Herschel, of grouping the phenomena of photography under a general heading, derived from the most prominent chemical preparation employed.

There are many preparations which are affected by light in a similar manner to the salts of silver. Several have been tried as photographic materials, but as yet without much success, with the exception of the bichromate of potash, which was first announced as a useful photographic agent by Mr. Mungo Ponton, in the Edinburgh New Philosophical Journal; from which I quote Mr. Ponton's own account.

"When the paper is immersed in the bichromate of potash, it is powerfully and rapidly acted on by the sun's rays. When an object is laid in the usual way on this paper, the portion exposed to the light speedily becomes tawny, passing more or less into a deep orange, according to the strength of the light. The portion covered by the object retains the original bright yellow tint it had before exposure, and the object is thus represented yellow upon an orange ground, there

being several gradations of shade, or tint, according to the greater or less degree of transparency in the different parts of the object.

"In this state, of course, the drawing, though very beautiful, is evanescent. To fix it, all that is required is careful immersion in water, when it will be found that those portions of the salt which have not been acted on by the light are readily dissolved out, while those which have been exposed to the light are completely fixed on the paper. By the second process the object is obtained white upon an orange ground, and quite permanent. If exposed for many hours together in strong sunshine, the colour of the ground is apt to lose in depth, but not more so than most other colouring matters. The action of light on the bichromate of potash differs from that upon the salts of silver. Those of the latter which are blackened by light are of themselves insoluble in water, and it is difficult to impregnate paper with them in a uniform manner. The blackening seems to be caused by the formation of oxide of silver.

"In the case of the bichromate of potash, again, that salt is exceedingly soluble, and paper can be easily saturated with it. The agency of light not only changes its colour, but deprives it of solubility, thus rendering it fixed in the paper. This action appears to consist in the disengagement of free chromic acid, which is of a deep red colour, and which seems to combine with the paper. This is rendered more probable from the circumstance that the neutral chromate exhibits no similar change. The best mode of preparing paper with the bichromate of potash is to use a saturated solution of that salt, soak the paper well in it, and then dry it rapidly at a brisk fire, excluding it from daylight. Paper thus prepared acquires a deep orange tint on exposure to the sun. If the solution be less strong, or the drying time less rapid, the colour of the object will not be so deep."

To test the descriptions given above, I began by making a saturated solution of potassium dichromate.

Chromatype Formula, Variation 1 and 2

100 ml Distilled water
Potassium Dichromate

I measured 100 ml of distilled water into a 250 ml amber glass bottle and added potassium dichromate to the water until no more would dissolve, indicating that the solution was saturated. For this process, I started by testing *Southworth Resume* paper, using 8.5" x 11" sheets that I cut into quarters.

Hunt indicated that the paper should be immersed in the saturated solution of potassium dichromate and dried in front of a fire. In order to determine why those specific instructions produced better results, I took my first four test sheets and instead, coated them with a cotton ball on the surface of the paper. Using my clothesline in the darkroom, I allowed the tests to air dry. After they were dry, I exposed three of them in the UV box for different amounts of time, using a leaf to make a photogram. Figure 5 shows a test that was exposed for five minutes, Figure 6 shows a test at fifteen minutes and Figure 8 shows a longer exposure of thirty minutes. Figure 7 shows a test that was placed in front of a window in the studio for ten minutes to see if natural light would make any difference. Each test, when removed from the print frame, had a visual impression of the leaf, but after washing had lost much of its density. The excess potassium dichromate dissolved out when rinsed, which left a much fainter image than what was evident after first removing the test from its exposure in the print frame. This result indicated that Hunt was correct in his observation and explanation that the dichromate not acted upon by the light was readily dissolved out, while the salts that were exposed remained fixed on the paper.

Figure 5
Chromatype test at five minutes
Potassium dichromate in UV Box
Southworth Resume Paper, hand-coated

Figure 6
Chromatype test at fifteen minutes
Potassium dichromate in UV Box
Southworth Resume Paper, hand-coated

Figure 7
Chromatype test at ten minutes
Potassium dichromate in sunlight
Southworth Resume Paper, hand-coated

Figure 8
Chromatype test at thirty minutes
Potassium dichromate in UV Box
Southworth Resume Paper, hand-coated

Coating the paper using a cotton ball soaked in the saturated potassium dichromate solution proved easy, but the solution did not soak very far into the paper and there were areas that I missed in coating. The solution was a bright yellow, but under the red safelight in the darkroom, it was impossible to see the color and to tell if it was coated evenly.

I tested two more sheets of the same paper, but this time I immersed the paper entirely instead of coating it with the cotton ball as suggested by Hunt. To test this specific variation to the method I previously used, I again let the tests dry on the clothesline. In comparison, these two test sheets took on a much darker yellow tint and appeared to have absorbed the solutions quite evenly. Figure 9 show a test exposed for ten minutes and Figure 10 shows a test exposed for thirty minutes.

Figure 9
Chromatype test at ten minutes
Potassium dichromate in UV Box
Southworth Resume Paper
Immersed and air-dried

Figure 10
Chromatype test at thirty minutes
Potassium dichromate in UV Box
Southworth Resume Paper
Immersed and air-dried

Next, I again coated two sheets of paper using the immersion method, but dried one each rapidly with a hair dryer to simulate drying in front of the fire as stated by Hunt. This testing indicated that full immersion and rapid drying made quite a difference in the overall look of the object. Figures 11 and 12 show the coating results were smoother and a greater density was obtained than in the previous tests that were not immersed or rapidly dried with heat. Figure 11 shows a test exposed for fifteen minutes and Figure 12 shows a test at thirty minutes. As indicated in the text, the deepest colors are obtained when the paper is immersed and rapidly dried. Since the solutions used in the tests remained saturated and were not changed, it is therefore indicated that it is the drying time and addition of heat that brings out the deeper tones.

Figure 11
Chromatype test at fifteen minutes
Potassium dichromate in UV Box
Southworth Resume Paper
Immersed and heat dried

Figure 12
Chromatype test at thirty minutes
Potassium dichromate in UV Box
Southworth Resume Paper
Immersed and heat dried

When I tested other types of papers under the same conditions, the results changed. While rapid drying worked best for the *Southworth Resume* paper, a different paper, *Staedtler 100% Rag Vellum* produced a noticeably mottled appearance, as seen in Figure 13. However, tests of this

paper, when allowed to air-dry instead, did not produce the mottled appearance. Another type of paper, *Southworth Connoisseur Collection 100% Cotton 32lb*, was heavier than the *Southworth Resume* paper first tested and absorbed much more of the dichromate solution, leaving the image softer and with less contrast, as seen in Figure 14. Due to the soft image quality and poor wet-strength, I did not pursue any further tests using the *Connoisseur Collection 100% Cotton 32lb* paper.

Figure 13
Chromatype test at thirty minutes
Potassium dichromate in UV Box
Staedtler 100% Rag Vellum Paper
Immersed and heat dried

Figure 14
Chromatype test at forty-five minutes
Potassium dichromate in UV Box
Southworth Connoisseur Collection 100% Cotton 32lb
Immersed and heat dried

Having tested a variety of papers, I settled on using the *Staedtler 100% Rag Vellum Paper*, allowing it to air dry after having initially been coated by immersion. This paper had superior wet-strength and produced the most vibrant colors with the best contrast.

I originally decided to make the final prints 8" x10" in size, but I found it was cheaper to get the vellum in 11" x 17" sheets, which allowed me to cut it in half. This left the papers 8.5" x 11", leaving the option to trim the images down once they were complete. By doing so, I could eliminate the marks on the corner made by the clothespins and on the diagonal corner that gathered the majority of the chemical solution as it dried, leaving a darker area. After much consideration, I chose to leave the prints untrimmed, which allows the viewer to see remnants of the process. The following images show the final prints untrimmed, as they are included with the collection as final prints of the chromatype.

After the testing phase was finished, I began to make the final prints for inclusion in the teaching collection and process sample guide. For the sake of clarity and ease of identification, I chose to use the same type of fern when making all of the chromatype variations and a different type for each of the other processes.

As Hunt indicated in his text, two variations may be obtained based on the length of exposure time. A shorter exposure time leaves the yellow staining from the potassium dichromate underneath the object being exposed, but a longer exposure time causes this staining to bleach out, leaving the unexposed areas white and the background a darker yellow. When first reading these results in Hunt's text, I did not understand why this occurred, but my tests indicated that it did indeed produce the results he described.

Figure 15 shows the final print of the chromatype, variation #1, exposed for thirty minutes, which retained the yellow staining. Figure 16 shows the final print of the chromatype, variation #2, exposed for forty-five minutes, illustrating the bleaching-out effect of the area that did not receive any exposure. While Hunt indicated the paper should remain in the sun for numerous hours for the second variation, I found that forty-five minutes in the UV box produced the described results. Since my initial tests were done during the winter months, I did not attempt to expose a test sheet in the sun for several hours as Hunt did in the tests he described.

Figure 15
Chromatype Variation #1, Final Print
Immersed and air-dried, UV Box exposed for thirty minutes
Staedtler 100% Rag Vellum Paper

Figure 16
Chromatype Variation #2, Final Print
Immersed and air-dried, UV Box exposed for forty-five minutes
Staedtler 100% Rag Vellum Paper

Following my initial success with variations #1 and #2 of the chromatype processes, I went back to *A Manual of Photography* and moved on to the next variation. The following is a continuation of Hunt's text describing the chemical make-up of the third variation on the chromatype.

> *"A pleasing variety may be made by using sulphate of indigo along with the bichromate of potash, the colour of the object and of the paper being then different shades of green. In this way, also, the object may be represented of a darker shade than the ground."*

Variation #3 calls for a mixture of potassium dichromate with sulphate of indigo. The closest modern-day chemical equivalent to this is called indigo carmine, however it was not clear whether these chemicals are comparable for this variation. The text from Hunt quoted above described the results in varying shades of green, which I concluded would be caused by the mixture of the yellow potassium dichromate solution and the blue indigo carmine. Instructions for mixing these chemicals together were not expressly stated in the text and no amount of testing with varying ratios met with success. Both the potassium dichromate and indigo carmine go into solution when mixed with water, but when mixed together at any ratio of strengths, resulted in what you would expect when mixing oil and water. The dichromate solution soaked readily into the paper when immersed as in the previous variations, but the indigo beaded up and rolled off, never fully mixing or absorbing into the paper.

At this time, I have no working results with this particular variation. One problem was the fact that there was no recipe listed in the text, so there was no way of knowing precisely how these solutions were mixed and in what ratio. Additionally, the purity of the chemicals used in the days Hunt and his contemporaries were working cannot accurately be compared to the guaranteed purity of the chemicals purchased today. Sulphate of indigo may have been a different chemical than what is currently called indigo carmine. While no mention was made in the text about the possibility of sizing the paper before attempting this variation to the chromatype process, it is possible that doing so might have aided in producing the desired effect. While the first attempts failed, I continue to work on solutions to this problem. When I begin testing this variation again, my next group of tests will be made using the solutions separately;

the paper will be coated with the saturated solution of potassium dichromate and allowed to dry and then coated a second time by immersing the same paper into the solution of saturated indigo carmine. I hope to include successful examples of the chromatype, variation #3 in a future edition of similar experiments into forgotten photographic processes. On an interesting note, I was told by Mark Osterman, Photographic Process Historian for the Advanced Residency Program at George Eastman House, that papers exposed using just the potassium dichromate solution have been known to change to a green color over time, but I have not had this experience with any of my tests or final prints of chromatype variations #1 or #2.

In addition to my difficulties in attempting to recreate chromatype variation #3, I was unsuccessful with variations #4 and #5, described below in a continuation of Hunt's text. When testing the methodology described in the first paragraph below, I had difficulty dissolving the iodine and I did not get any color shift. It is likely that the information given in the second paragraph regarding the starch sizing needed to be implemented initially. I hope to be able to resolve the problems I had and recreate these variations for a future edition as well.

> *The most interesting photographic paper prepared with the bichromate of potash is a kind described by M. E. Becquerel. He states, -It is sufficient to steep a paper prepared in Mr. Ponton's manner, and upon which there exists a faint copy of a drawing, in a solution of iodine in alcohol, to wash this paper in alcohol, and then dry it; then the parts which were white become blue, and those which were yellow remain more or less clear.*
>
> *M. E. Becquerel has pursued his investigations into the actions of the chromic acid on organic compounds, and has shown that the mode of sizing the papers influences their colouration by light, and that with unsized paper colouration is effected only after a long time. Perceiving that the principal reaction resulted from the chromic acid contained in the bichromate of potash, on the starch of the paper, it occurred to M. E. Becquerel, that, as starch has the property of forming with iodine a combination of a very fine blue colour, it should produce deep shades of that tint, whilst the lights still remained an orange-yellow.*

His method of proceeding is to spread a size of starch very uniformly over the surface of the paper. It is then steeped in a weak alcoholic solution of iodine, and afterwards washed in a great quantity of water. By this immersion, it should take on a very fine blue tint. If this is uniform, the paper is considered fit for the experiment; in the contrary case it is sized again. It is then steeped in a concentrated solution of bichromate of potash, and pressed between folds of blotting paper, and dried near the fire. To be effective, it should be very dry.

It is now fit for use. When the copy is effected, which requires in sunshine about five minutes, the photograph is washed and dried. When dry, it is steeped in a weak alcoholic solution of iodine, and afterwards, when it has remained in it some time, it is washed in water, and carefully dried with blotting paper, but not at the fire, for at a little below 100° Fahr. the combination of iodine and starch discolours.

If it be considered that the drawing is not sufficiently distinct, this immersion may be repeated several times; for by this means may be obtained the intensity of tone that is desired, which intensity can be changed at will by employing a more concentrated solution of iodine.

When the paper is damp, the shades are of a very fine blue, but when it is dry the colour becomes deep violet. If while the drawing is still wet it be covered with a layer of gum arabic, the colour of the drawing is greatly preserved, and more beautiful when it is dry. When a paper is thus prepared it loses at first a little of its tone, but it afterwards preserves its violet tint.

One of the most fascinating of the chromatype variations is the process invented and described by Robert Hunt. This variation not only worked immediately, but also produced some curious changes that were not mentioned in the text below. Here is how Hunt describes Variation #6 and #7.

> *THE CHROMATYPE PROCESS. -This process, devised by the author, is a pleasing one in its results: it is exceedingly simple is its manipulatory details, and produces very charming positive pictures by the first application.*
>
> *The chromatype is founded on the above process of Mr. Ponton's, but it was found in practice that the bichromate of potash alone would not produce the desired effect: the following method was therefore adopted: -*
>
> *One drachm of sulphate of copper is dissolved in an ounce of distilled water, to which is added half an ounce of a saturated solution of bichromate of potash; this solution is applied to the surface of the paper, and, when dry, it is fit for use, and may be kept for any length of time without spoiling. When exposed to sunshine, the first change is to a dull brown, and if checked in this stage of the process we get a negative picture, but if the action of the light is continued, the browning gives way, and we have a positive yellow picture on a white ground. In either case, if the paper, when removed from the sunshine, is washed over with a solution of nitrate of silver, a very beautiful positive picture results. In practice, it will be found advantageous to allow the bleaching action to go on to some extent; the picture resulting from this will be clearer and more defined than that which is procured when the action is checked at the brown stage. To fix these pictures it is necessary to remove the nitrate of silver, which is done by washing in* ***pure*** *water; if the water contains any muriates the picture suffers, and long soaking in such water obliterates it, or if a few grains of common salt are added to the water the apparent destruction is quite rapid. The picture is, however, capable of restoration; all that is necessary being to expose it to sunshine for a quarter of an hour, when it revives; but instead of being a red colour, it becomes lilac, the*

shades of colour depending upon the quantity of salt used to decompose the chromate of silver which forms the shadow parts of the picture.

While still employing the use of potassium dichromate, Hunt added copper sulfate, described here in modern measurements and terminology. I began by following the instruction given by Hunt and mixed the solutions as indicated below.

Chromatype Formula, Variation 6

Solution A

19.45 g Copper Sulfate

142.5 ml Distilled Water

Potassium Dichromate (saturated solution)

Copper sulfate was measured out as indicated above and added to 142.5 the distilled water. Once dissolved, a saturated solution of potassium dichromate was added to the copper sulfate solution in the ratio of 2:1 copper sulfate solution to potassium dichromate solution. Hunt indicated in the preceding text that this mixture is to be applied to the surface of the paper and dried. He also stated that when exposed, the paper will first change to a dull brown and if stopped in this state, a negative image will be the result. During my experiments, at no time did a test result in a brown color of any sort. Hunt also stated that if the exposure is continued, the browning gives way to a positive yellow image on a white background. This latter result was the case in all the tests I have done, though the image was very faint. To bring the image out as a positive required washing the paper with a mixture of silver nitrate, which I mixed using the recipe below. In order to have enough solution, the chemical ratios may be multiplied according to the size of the paper and tray.

Chromatype Formula, Variation 6

Solution B

3.9 g Silver Nitrate

28.4 ml Distilled Water (1 British fluid ounce)

Below are the results of the first experiments using this recipe and instructions. Figures 17 and 18 show chromatype variation #6 and the results when the paper was coated with the copper sulfate / potassium dichromate solution. The tests were exposed and then developed out with the silver nitrate solution. These images were coated with both the copper sulfate / potassium dichromate and silver nitrate solutions only on the surface using a cotton ball. Figure 17 was exposed for fifteen minutes and Figure 18 exposed for thirty minutes.

Figure 17
Chromatype Variation #6 test
UV Box, exposed for fifteen minutes
Potassium dichromate with copper sulfate
Developed in silver nitrate
Staedtler 100% Rag Vellum Paper
Hand-coated and air-dried

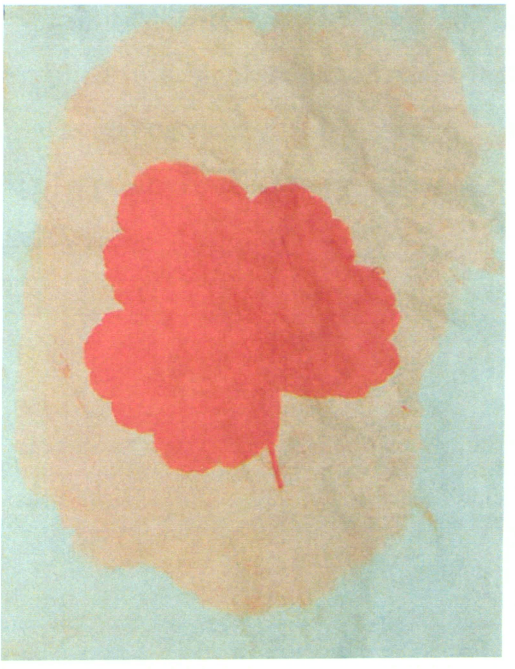

Figure 18
Chromatype Variation #6 test
UV Box, exposed for thirty minutes
Potassium dichromate with copper sulfate
Developed in silver nitrate
Staedtler 100% Rag Vellum Paper
Hand-coated and air-dried

I found that merely coating the surface of the paper, I had done in the first batch of chromatype tests, did not give the depth, clarity, or smooth appearance I desired. To remedy this, I initiated another series of tests. This time I immersed the paper into the copper sulfate / potassium dichromate solution before exposure and then immersed the paper once again into the silver

nitrate solution after the exposure. This eliminated the obvious coating marks and brought out a greater saturation of color in the resulting image after an exposure of forty-five minutes, as seen in Figure 19. While variations #1 and 2 retained the yellow coloring from the potassium dichromate, the addition of copper sulfate caused the resulting prints to take on a bluish-green cast. This was not evident right away, but happened over time especially in the background area.

Using a final print from chromatype variation #6, a new variation can be made by immersing the final print into a solution of salt water as indicated by Hunt. To do this, I made a solution of salt water containing 0.18 grams of salt dissolved into 400 ml of distilled water. This completely obliterated the image after about five minutes and resulted in a blank sheet of paper that was slightly off-white. This former print, when dried, was exposed in the UV box for fifteen additional minutes and the image reappeared. Instead of a positive red image where the fern had been placed, it became lilac in color, as seen in Figure 20.

Figure 19
Chromatype Variation #6, Final Print
Immersed and air-dried, UV Box exposed for forty-five minutes
Staedtler 100% Rag Vellum Paper

Figure 20
Chromatype Variation #7, Final Print
Immersed in sodium chloride solution, UV Box exposed for fifteen minutes
Staedtler 100% Rag Vellum Paper

In addition to the two variations made from prints utilizing the same original chemicals, I have found that if papers are coated with the copper sulfate / potassium dichromate mixture from variation #6 and are left to sit without being exposed for a period of three weeks or so, they take on an entirely new coloring as well. The following images utilized identical chemistry and exposure times, however their color shift came about through spontaneous degradation. The only difference was with the amount of time between coating and exposure. The following examples were originally coated, but not exposed for a period of three weeks. After a thirty-minute exposure and development in the silver nitrate solution, Figure 21 was kept in the dark for a 24-hour period and Figure 22 was exposed to bright sun by being placed against a window screen facing south in the late afternoon for three hours. Figure 23 was exposed to normal room light from one afternoon to the next and having deteriorated no further, is included in the teaching collection as a final print. There was no indication in Hunt's text of any similar phenomena occurring and he states that once developed in the silver nitrate and washed, the objects were fixed against further changes. All of the chromatypes were immersed in the silver nitrate for thirty seconds, so this consistency precluded the possibility that the images were not fully developed.

Figure 21
Chromatype Variation #6 deterioration

Figure 22
Chromatype Variation #6 deterioration

Figure 23
Chromatype Variation #6a (deterioration in room light), Final Print
Immersed and air-dried, UV Box exposed for forty-five minutes
Staedtler 100% Rag Vellum Paper

Continuing with the description of the next variation to the chromatype process, Hunt writes:

> *Mr. Bingham remarks on this process, that if we substitute sulphate of nickel for the sulphate of copper, the paper is more sensitive, and the picture is more clearly developed by nitrate of silver.*

In chromatype variation #8, the copper sulfate is replaced by nickel (II) sulfate, which makes the paper more sensitive and more clearly developed by the silver nitrate. When testing this variation, I made my first two tests at five minutes and fifteen minutes, but the surface image took on a muddy orange appearance and was not more sensitive than the copper sulfate according to my results. When returning to the forty-five minute exposure in the UV box that was used to make the final print of chromatype variation #6, the results were similar to what was seen in that variation, but with a darker and redder tone, as seen in Figure 24.

Figure 24
Chromatype Variation #8, Final Print
Immersed and air-dried, UV Box exposed for forty-five minutes
Staedtler 100% Rag Vellum Paper

While I currently have no finished images made of the three remaining chromatype variations, I have included Hunt's descriptions of them below because I still hope to undertake their chemical experimentation for a future edition of this project.

> *The following modification of this process possesses some advantages. If to a solution of the sulphate of copper we add a solution of the neutral chromate of potash, a very copious brown precipitate falls, which is a true chromate of copper. If this precipitate, after being well washed, is added to water acidulated with sulphuric acid, it is dissolved, and a dichromatic solution is formed, which, when spread upon paper, is of a pure yellow. A very short exposure of the papers washed with this solution is quite sufficient to discharge all the yellow from the paper, and give it perfect whiteness. If an engraving is to be copied we proceed in the usual manner; and we may either bring out the picture by placing the paper in a solution of carbonate of soda or potash, by which all the shadows are represented by the chromate of copper, or by washing the paper with nitrate of silver. It may sometimes happen that, owing to deficient light, the photograph is darkened all over when the silver is applied; this color, by keeping, is gradually removed, and the picture comes out clear and sharp.*
>
> *If the chromate of copper is dissolved in ammonia, a beautiful green solution results, and if applied to paper acts similarly to those just described.*
>
> *The chromatype pictures, under certain conditions, afford a beautiful example of the changes which take place, slowly, in the dark, from the combined operations of the materials employed.*
>
> *If we take a chromatype picture after it has been developed by the agency of either nitrate of silver, or of mercury, and place it aside in the dark, it will be found, after a few weeks, to have darkened considerably both in the lights and shadows. This darkening slowly increases, until eventually the picture is obliterated beneath a film of metallic silver or mercury; but, while the picture has*

been fading out on one side, it has been developing itself on the other, and a very pleasing image is seen on the back. After some considerable time, the metal on the front gives way again, the paper slowly whitens, and eventually the image is presented on both sides of the paper of equal intensity, in a good neutral tint upon a grey ground. These results, it will be remembered, are of a very similar character to those already described as peculiar to the amphitype process of Sir John Herschel.

Chapter Five
The Energiatype Process

The energiatype was discovered by Hunt and originally published under that name. However, since Herschel persuaded other practitioners to group photographic processes under the name of the main chemical used in their make-up, in this case iron salts, the process was renamed the ferrotype. This process uses iron (II) sulfate as a developing agent to bring out a latent image when the process is used in-camera. Later in the evolution of photographic processes came the tintype, which was also referred to by the term ferrotype. For the purposes of this research, the original name of energiatype is used.

The following chemicals are necessary for making the energiatype. The chemicals are listed below on the left as they were named originally and then in their contemporary terminology on the right.

Common Salt	Sodium Chloride
Hypo-Sulphite of Soda	Sodium Thiosulfate
Mucilage of Gum Arabic	Gum Arabic
Nitrate of Silver	Silver Nitrate
Protonitrate of Iron	Iron (II) Nitrate
Protosulphate of Iron	Iron (II) Sulfate
Succinic Acid	Same
Sulphuric Acid	Same

As with the chromatype, in order to fully describe my working method, the description for each variation given by Hunt in his text is recorded first in italics, followed by my methodology with reproductions of the finished prints.

From *A Manual of Photography*, by Robert Hunt, Chapter six, pages 76-78

SECTION II. - The Ferrotype

This process, which is of remarkable sensibility, was discovered by the author, and published in the Athenaeum, under the name of the Energiatype; but from a desire to group all those pictures under a general head into which iron salts enter as an element, the present name is preferred. The preparation of the paper is as follows: -Good letter paper (Whatman's is the best) is washed over with the following solution, viz.: Five grains of succinic acid (it is important that succinic free from any oil of amber, or adventitious matter, should be obtained) are to be dissolved in one fluid ounce of water, to which are added about five grains of common salt, and half a drachm of mucilage of gum arabic. When dry, the paper is drawn over the surface of a solution of sixty grains of nitrate of silver in one ounce of distilled water. Allowed to dry in the dark, the paper is now fit for use, is of a pure white, retains its colour, and may be preserved for a considerable time in a portfolio, until wanted for use.

The preparation of this paper is by no means difficult, but requires care and attention. The solutions must be applied very equally over the paper, which should be immediately hung upon a frame or clothes' horse to dry, Extreme care must be taken that the paper be not exposed to light, after the nitrate of silver solution has been applied, until required for use. Many of the disappointments experienced by the experimenters on the energiatype are occasioned by a neglect of this precaution; as, although no apparent effect may have been produced by the exposure, the clearness of the subsequent picture will be seriously injured. The succinic acid must also be very pure. We shall now briefly describe the method of applying this process to the different purposes for which it is best adapted, premising that the varying circumstances of time, place and light, will render necessary such modifications of the following directions as the experience of the operator may suggest. As a general rule, an open situation, sunshine, and, if

possible, the morning sun, should be preferred, as the image is sharper, and the colour produced more intense, and less affected by the subsequent fixing process.

In the camera, for a building or statue, an exposure of half a minute in strong sunshine is usually sufficient; for a portrait, taken under ordinary conditions, two or three minutes are required.

When the paper is taken from the camera, nothing is visible upon it; but by attending to the following directions the latent picture will quickly develope itself. Having mixed together about one drachm of a saturated solution of ***protosulphate of iron*** *and two or three drachms of* ***mucilage of gum arabic****, pour a small quantity into a flat dish. Pass the prepared side of the paper taken from the camera rapidly over this mixture, taking care to ensure complete contact in every part. If the paper has been sufficiently impressed, the picture will almost immediately appear, and the further action of the iron must be stopped by the application of a soft sponge and plenty of clean water. Should the image not appear immediately, or be imperfect in its details, the iron solution may be allowed to remain upon it a short time; but it must then be kept disturbed, by rapidly but lightly brushing it up, otherwise numerous black specks will form and destroy the photograph. Great care should be taken that the iron solution does not touch the back of the picture, which it will inevitably stain, and, the picture being a negative one, be rendered useless as a copy. A slight degree of heat will assist the development of the image where the time of exposure has been too short.*

The picture should be carefully washed to take off any superficial blackness, and may then be permanently fixed by being soaked in water to which a small quantity of ammonia, or, better still, hyposulphite of soda, has been added. The paper must again be well soaked in clean water, to clear it from the soluble salts, and may be then dried and pressed.

The papers to be prepared for this process must be coated twice before exposure, using the following solutions.

Energiatype

Solution A

3.25 g Succinic Acid

284 ml Distilled Water

3.25 g Sodium Chloride

17.75 ml Gum Arabic

Solution B

39 g Silver Nitrate

284 ml Distilled Water

For solution 'A', 3.25 grams of succinic acid were dissolved into 284 ml. of distilled water, to which was added 3.25 grams of sodium chloride and 17.75 ml of gum arabic. For solution 'B', 39 grams of silver nitrate were dissolved into 284 ml of distilled water. The paper was first coated with solution 'A', allowed to air dry and then coated with solution 'B'. The first tests indicated that it was irrelevant whether solution 'A' was coated only on the surface of the paper, or if it was immersed. For ease of application, I chose to immerse the paper. When applying solution 'B', any amount of the chemical that seeped onto the back of the paper from the coated surface blackened upon exposure and ruined the paper. This prevented it from being used as a negative in future exposures. I attempted two different methods of coating the papers with solution 'B'. The first, which involved taping the edges down to a piece of glass, was time consuming but worked well in keeping the solutions only on the front surface. The second method involved floating the test sheet on the surface of solution 'B' once it had been poured into a tray. There was no difference in the resulting exposure between the two coating methods.

Hunt indicated in the text that a third solution was needed to bring out the latent image following exposure.

Energiatype

Solution C

Iron Sulfate (saturated solution)

35.5 ml Iron Sulfate (saturated solution)
88.75 ml Gum Arabic

Solution 'C' was made by preparing a saturated solution of iron (II) sulfate, then mixing 35.5 ml of that solution with 88.75 ml of gum arabic. When first testing this process in-camera, solution 'C', which was meant to develop the image, did little more than blacken and slowly congeal in the tray when left out in the air. Subsequently, two days after mixing all three solutions, both solutions 'A' and 'C' had begun to mold. Thinking the gum arabic was responsible, both solution were remixed, eliminating the gum arabic altogether. I was able to use solution 'A' and keep it for over a week before mold took over again. This led me to the realization that it was better to mix fresh solutions every time I wanted to coat new sheets of paper.

When I first began experimenting with the energiatype, there was not enough light in the studio to form an image in-camera and my exposure times were at an hour before capturing the faintest image from a still life I had set up.

In order to gain an understanding of this process, I decided to utilize the UV box. The following description from Hunt is the continuation of the previous text in which he describes alternative ways of image making if not done in-camera.

> *Exact copies of prints, feathers, leaves, &c., may be taken on the succinated paper by exposing them to the light in the copying-frame, until the margin of the prepared paper, which should be left uncovered, begins to change colour very*

slightly. If the object to be copied is thick, the surface must be allowed to assume a darker tint, or the light will not have penetrated to the paper.

Positive copies of the camera negatives are procured in the same manner as the copies of the prints, &c., just described. Instead, however, of using the iron solution, the paper must be exposed to the light, in the frame, a sufficient time to obtain perfect copies. The progress of the picture may be observed by turning up the corner of the paper, and, if not sufficiently done, replacing it exactly in the same position. They should be fixed with hyposulphite, as before directed.

At the meeting of the British Association at York in 1844, I showed, by a series of photographs, that the ***protosulphite of iron*** *was most effective in developing any photographic images, on whatever argentiferous preparation they may have been received. Every subsequent result has shown that with proper care it is the most energetic agent for developing with which we are acquainted. The difficulty of obtaining, and of preserving, the salt free of any peroxide, or a basic salt which falls as a brownish-yellow powder, has been the principal cause why it has not been so generally employed as the gallic acid; this can be insured by adding a few drops of sulphuric acid to the solution of the protosulphate of iron, and some iron filings. Mr. Robert Ellis has recommended the use of the protonitrate of iron as a developing agent.*

In light of the problems I initially encountered with mixing and coating, I went about making my tests in the UV box and confirmed that what was supposed to be a latent image in-camera, was actually a developed-out image in the UV box. This meant that solution 'C' was unnecessary for those objects exposed in the UV box and all that was required to preserve them was to fix them. This method is still described by Hunt under the heading of energiatype, though no iron is utilized in its preparation.

The method for fixing the energiatype was described in the text as only utilizing sodium thiosulfate, but no recipes were given. Knowing that standard black and white commercial papers were generally fixed by mixing sodium thiosulfate with water in a 1:4 ratio, I erroneously assumed that the thinner vellum would not require as concentrated a solution and began my fix tests with a 1:10 ratio. While this fix ratio seemed to preserve the image initially, it did not fix the energiatype, which quickly faded in light. Subsequent tests in fixing at a ratio of 1:6 seemed to work, but two problems surfaced. First, the image deteriorated slightly by fading when fixed and second, after a month, the images had faded out again, even in dark storage. My final solution to these problems was to go back to the 1:4 sodium thiosulfate to water ratio and combat the fading by initially overexposing. Figure 25 shows the resulting energiatype and Figure 26 shows a positive made from the example shown in Figure 25. Both were exposed in the UV box for thirty minutes.

Figure 25
Energiatype Variation #1, Final Print
UV Box exposed for thirty minutes
Staedtler 100% Rag Vellum Paper

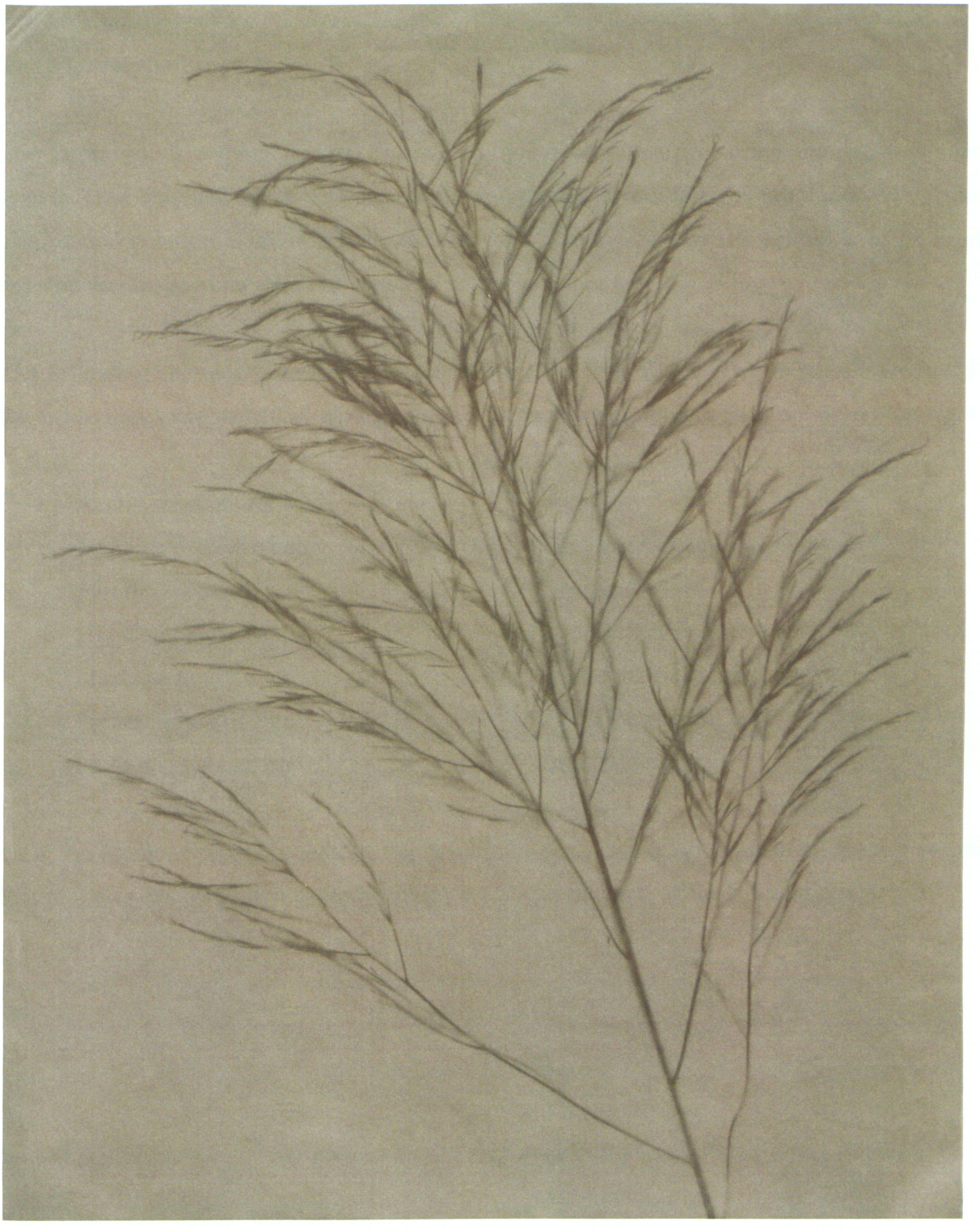

Figure 26
Energiatype Variation #2, Final Print
UV Box exposed for thirty minutes
Staedtler 100% Rag Vellum Paper

Chapter Six
The Fluorotype Process

The fluorotype is another process discovered by Robert Hunt, also using the two-step coating system. The only difference between the fluorotype and the energiatype is solution 'A', (below). The second solution is silver nitrate and the third solution of iron (II) sulfate is again used to develop the image out if taken in-camera.

The following chemicals are necessary for making the fluorotype. The chemicals are listed on the left as they were named originally and then in their contemporary terminology on the right.

Acetic or sulphuric acid	Same
Bromide of Potassium	Potassium Bromide
Fluoride of Sodium	Sodium Fluoride
Hypo-sulphite of soda	Sodium Thiosulfate
Muriatic Acid	Hydrochloric Acid
Protochloride of Tin	Tin (II) Chloride
Proto-sulphate of Iron	Iron (II) Sulfate

As in the previous process chapters, the description for each variation given by Hunt is recorded first in italics, followed by my methodology with reproductions of the finished prints.

From *A Manual of Photography*, by Robert Hunt, Chapter six, pages 84-85

SECTION V. - The Fluorotype,

So called from the introduction of the salts of fluoric acid, consists of the following process of manipulation: -

{Bromide of potassium, 20 grains.
{Distilled water... 1 fluid ounce.
{Fluoride of sodium...5 grains.
{Distilled water... 1 fluid ounce.

Mix a small quantity of these solutions together when the papers are to be prepared, and wash them once over with the mixture, and, when dry, apply a solution of nitrate of silver, sixty grains to the ounce of water. These papers keep for some weeks without injury, and become impressed with good images in half a minute in the camera. The impression is not sufficiently strong when removed from the camera for producing positive pictures, but may be rendered so by a secondary process.

The photograph should first be soaked in water for a few minutes, and then placed upon a slab of porcelain, and a weak solution of the proto-sulphate of iron brushed over it; the picture almost immediately acquires an intense colour, which should then be stopped directly by plunging it into water ***slightly*** *acidulated with muriatic acid, or the blackening will extend all over the paper. It may be fixed by being soaked in water, and then dipped into a solution of hypo-sulphite of soda, and again soaked in water as in the other processes.*

Mr. Bingham has the following remarks in this process, and he gives a modified form, into which a new photographic element is introduced,

"We find it is better to add to the proto-sulphate of iron a little acetic or sulphuric acid; this will be found to prevent the darkening of the lights of the picture to a great extent, and it will be found better not to prepare the paper long before it is required for use, this being one reason why the picture often becomes dusky on application of the proto-sulphate.

"Reasoning upon the principle that the action of light is to reduce the salts of silver in the paper to the metallic state, and that any substance which would reduce silver would also quicken the action of light, we were led to the following experiment: - The protochloride of tin possesses the property of reducing the salts both of silver and gold: a paper was prepared with the bromide of silver, and previously to exposing it to light it was washed over with a very weak solution of the chloride of tin; the action of light upon the paper was exceedingly energetic; it was almost instantaneously blackened, and a copy of a print was obtained in a few seconds."

The use of fluorides has been recently introduced as a novelty by some French photographers, but reference to the author's RESEARCHES ON LIGHT, published in 1844, will distinctly show that he was the first to employ these salts, which were, however, first suggested by Sir John Herschel.

The problems I had encountered using the camera for energiatype testing led me to approach the fluorotype tests by using the UV box, even though nowhere in the text does it mention exposing in a print frame in sunshine as opposed to the camera.

Fluorotype

Solution A

13 g Sodium Fluoride

284 ml Distilled Water

3 g Potassium Bromide

284 ml Distilled Water

Solution B

39 g Silver Nitrate

284 ml Distilled Water

Solution 'A' is comprised of two solutions. These must be kept separate until coating the papers, at which time they are mixed together in equal quantities. The first part of the solution is 13 grams of sodium fluoride dissolved into 284 ml of distilled water and the second solution is 3 grams of potassium bromide dissolved into 284 ml of distilled water. The solutions were applied by immersing the papers into the sodium fluoride and potassium bromide mixture comprising solution 'A' and the papers were allowed to air dry on the clothesline. The paper was then floated onto the silver nitrate solution, as in the energiatype.

The fluorotype only required half the exposure time that the energiatype did and the final prints were made in fifteen minutes. Once exposed, the paper was immersed into the fix solution of sodium thiosulfate at the same 1:4 ratio and rinsed to remove any residual chemicals. The resulting fluorotype photogram is seen in Figure 27.

Figure 27,
Fluorotype Variation #1, Final Print
UV Box exposed for fifteen minutes
Staedtler 100% Rag Vellum Paper

Chapter Seven
Hunt Objects in Museum Collections

Having researched both Robert Hunt and his various processes with which I experimented, I only found three museums in the world that had prints by Hunt in their collections. These included George Eastman House in Rochester, New York, the Harry Ransom Humanities Research Center in Austin, Texas and the National Museum of Photography, Film and Television in Bradford, England. One of the goals of this project, following completion of the chemical experimentation, was a comparison the objects I had created alongside some of the objects by Hunt located in the museum archives. Since I had not located any books in which these processes had been reproduced, such a comparison was the only way for me to mark the similarities and differences between the objects recreated by me during the course of this project and the authentic objects made by Hunt.

The Hunt objects in the archive at George Eastman House were an ideal place to begin. The four prints in this collection had never been photographed and were too fragile to be displayed. Low lighting conditions were required to view them and arrangements had to be made in cooperation with both the conservation staff and collection managers to handle and photograph them in a safe environment. Two of the objects were catalogued as experimental prints. The other two were labeled as energiatypes and signed by Hunt.

Working alongside Jiuan-jiuan Chen, Assistant Director for Conservation Education at GEH, we made images of the recto and verso sides of the objects using a *Canon EOS 20D* digital camera with a 60 mm lens. It was set on manual exposure with an aperture of F/8 and ISO 200. Lighting for the exposures was provided using a 144-watt *Interfit/Paterson DigiLite* dimmed to its lowest setting with no UV light. The lights were set up on either side of the shooting space and further dimmed by hanging sheets of opaque parchment paper and spun-polyester between the lights and the objects, reducing the light near the objects to 1.3 foot-candles. The exposure time for the two listed as experimental prints was six seconds. The energiatypes were photographed at four seconds, with the verso side of the first energiatype shown below photographed for six seconds as well. All objects were photographed against a black

background and I chose to keep the black border to increase the clarity of the edges when viewing the objects. There was no indication on the prints indicating their orientation, so I arranged them below in a way that seemed right to me. This way the writing on the back was at the bottom and readable.

The first object by Hunt, shown in Figures 28 and 29 was not made in camera. My guess is that it was made using a print frame in sunshine. Even though the image was described as an experimental print and the exact process with which it was made was not specified, based on the coloring of the background and the positive botanicals, I would assume this is an example of a chromatype, variation #6. The yellow background is similar to the coloring I experienced when working with potassium dichromate. The positive red leaves are similar to what occurs when working with either chromatype variation #6 or variation #8. However, the use of copper sulfate in variation #6 was Hunt's own addition to the evolution of the chromatype, rather than the use of nickel sulfate that was put forth by Bingham.

Similar to the verso sides of the prints I made using this process, the image comes through on the back when developed out by silver nitrate. The background coloring is redder than the front, which also happened with the prints I made. This object is an excellent example of a print that has withstood the test of time, its coloring remaining vibrant over 160 years after it was made.

Figure 28
Robert Hunt, Experimental Print, 1844 (Recto)
Image courtesy of George Eastman House

Figure 29

Robert Hunt, Experimental Print, 1844 (Verso)

Image courtesy of George Eastman House

The coloring of the second experimental print is somewhat between chromatype variation #6 or #8 and variation #7. Variation #7 was made using a print from chromatype variation #6 and immersing it in sodium chloride to destruct it, then reviving it as a lilac color when re-exposing it to the sun, or UV light.

However, the color is not as intense as in the first example from the George Eastman House collection and it is possible that it has faded over time. While my example of chromatype variation #7 shows the image on both sides of the paper, the use of sodium chloride bleaches the yellow of the potassium dichromate out of the background and when revived, the background looked more off-white or grey. Because of this and the fact a pale yellow background can still be seen on the front and back of the Eastman collection object, my guess is that it is again, an example of chromatype variation #6, though more faded than the first. See Figure 30 showing the front of the object and Figure 31 showing the back.

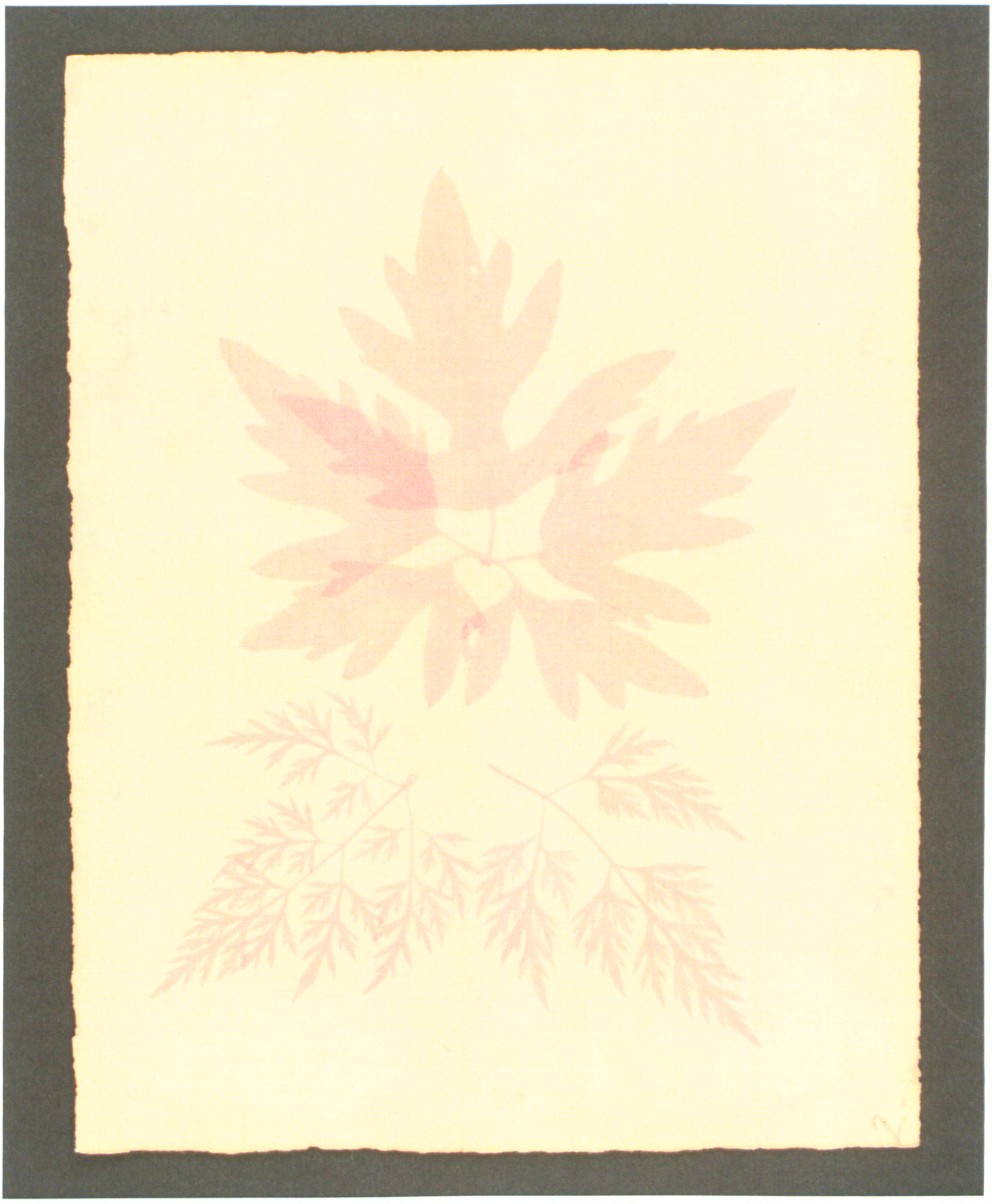

Figure 30

Robert Hunt, Experimental Print, 1844 (Recto)

Image courtesy of George Eastman House

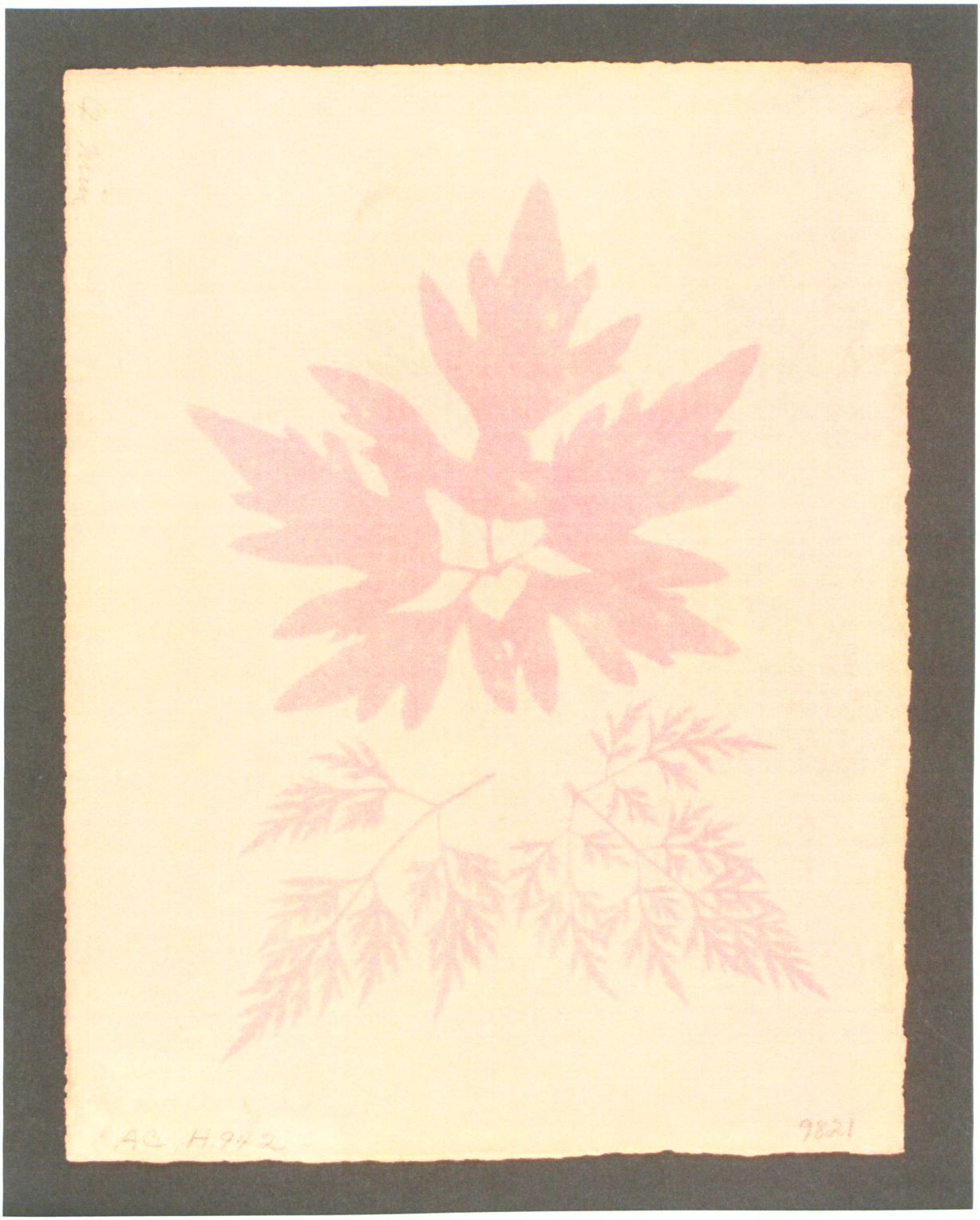

Figure 31

Robert Hunt, Experimental Print, 1844 (Verso)

Image courtesy of George Eastman House

The other two objects by Robert Hunt at George Eastman House are energiatypes and are named as such, signed and dated on the verso side. While the first image, seen in Figures 32 and 33, is still visible, the second has faded quite dramatically as seen in Figures 34 and 35. Based on what is still visible in Figure 32, this is a positive image, which cannot be made with an in-camera energiatype. It is possible that an energiatype negative was made and then exposed in the sun to create a positive. Supporting this theory, a border can be seen where the negative most likely was placed on top of another sheet of paper coated with energiatype chemicals to be exposed. In this way, the exposure could be monitored as it developed out and the borders darkened. Since the first object is faded and the second almost completely faded, it is possible that Hunt also experienced troubles with fixing ratios, or it could just be that time has taken a toll on these particular objects.

On the back of the energiatype shown in Figure 33, the watermark is clearly visible showing the paper Hunt used was indeed *Whatman's*, as he claimed in his text. However, this same watermark is not visible on the back of the second energiatype object seen in Figure 35. When I was testing paper, I chose to use paper that did not contain a watermark and my attempts to locate the particular type of paper Hunt used were not successful. While the two energiatypes from George Eastman House are signed, dated and their process indicated, it is unfortunate that the first two objects, the experimental prints, do not contain any markings or descriptions by Hunt. It leaves us uncertain as to the exact process and chemical make-up of the first two.

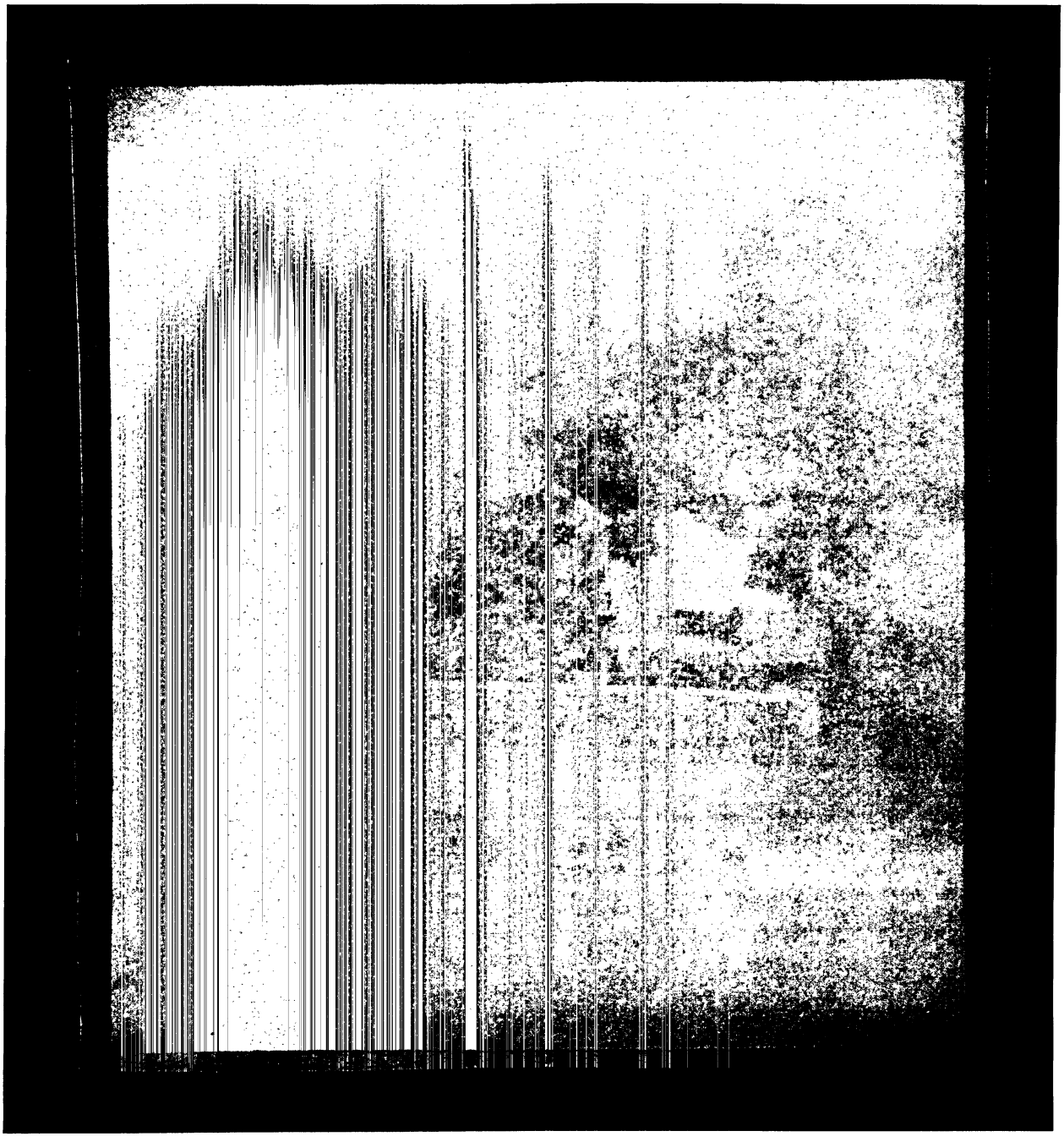

Figure 32

Robert Hunt, Energiatype, 1844 (Recto)

Image courtesy of George Eastman House

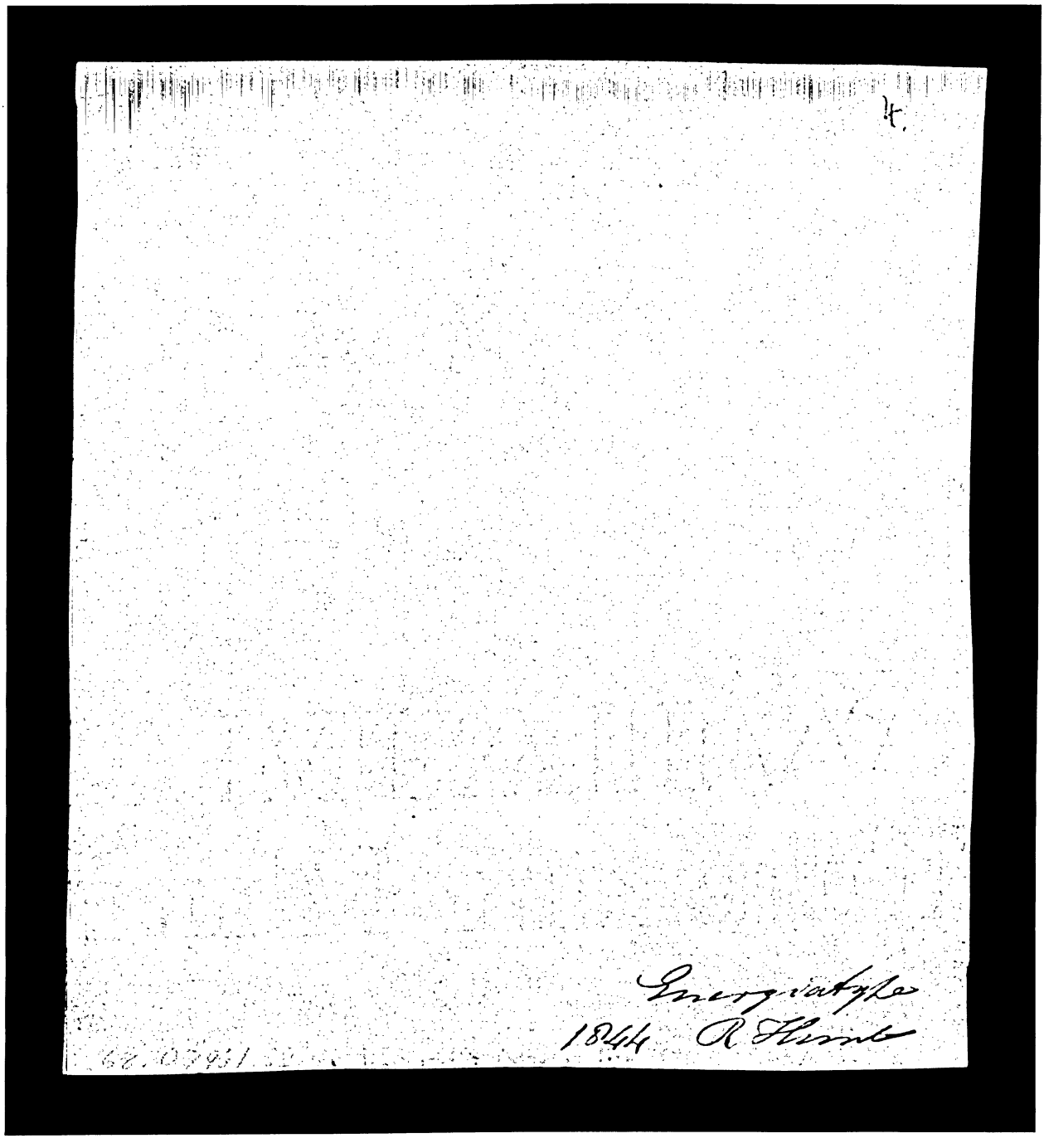

Figure 33

Robert Hunt, Energiatype, 1844 (Verso)

Image courtesy of George Eastman House

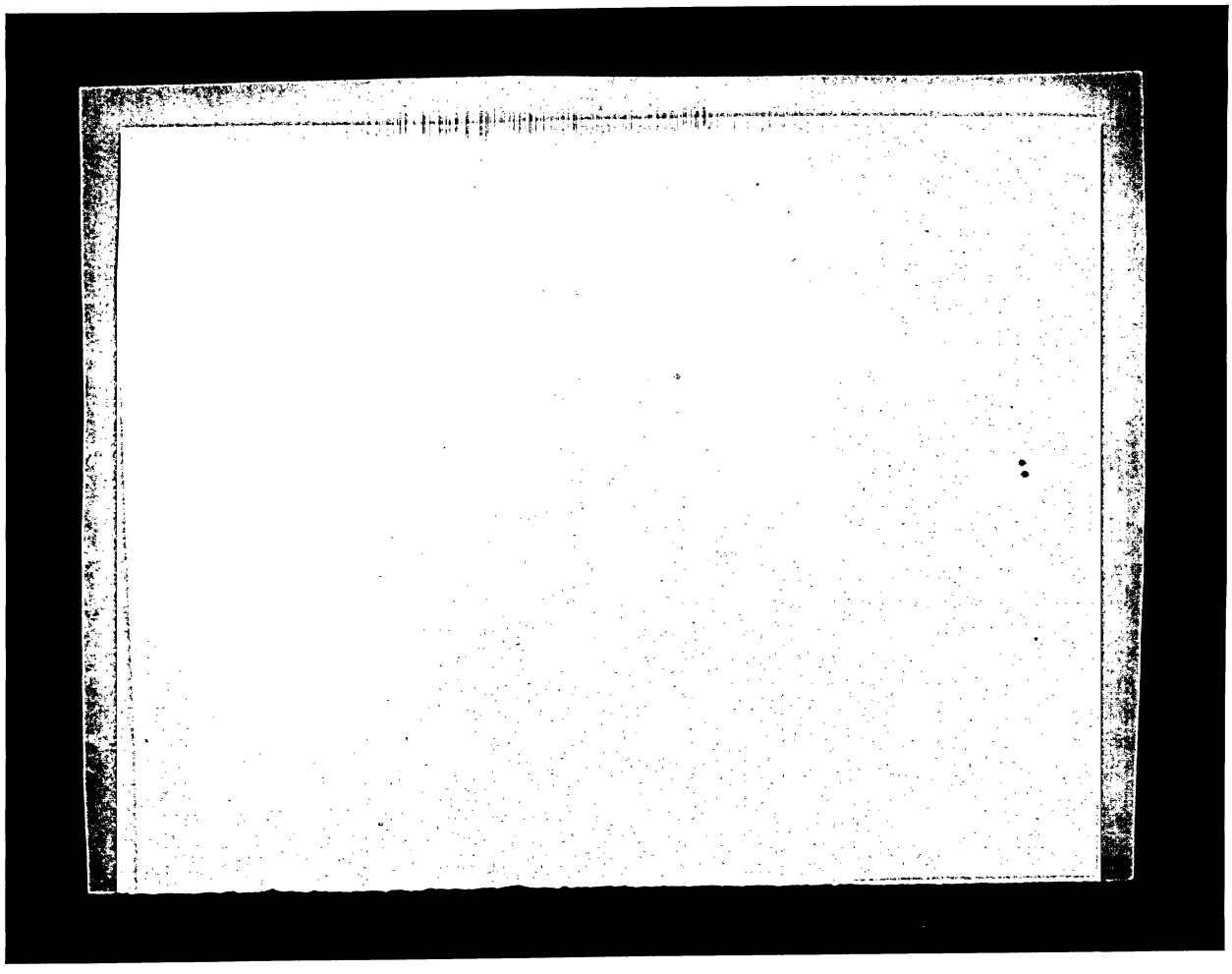

Figure 34

Robert Hunt, Experimental Print, 1844 (Recto)

Image courtesy of George Eastman House

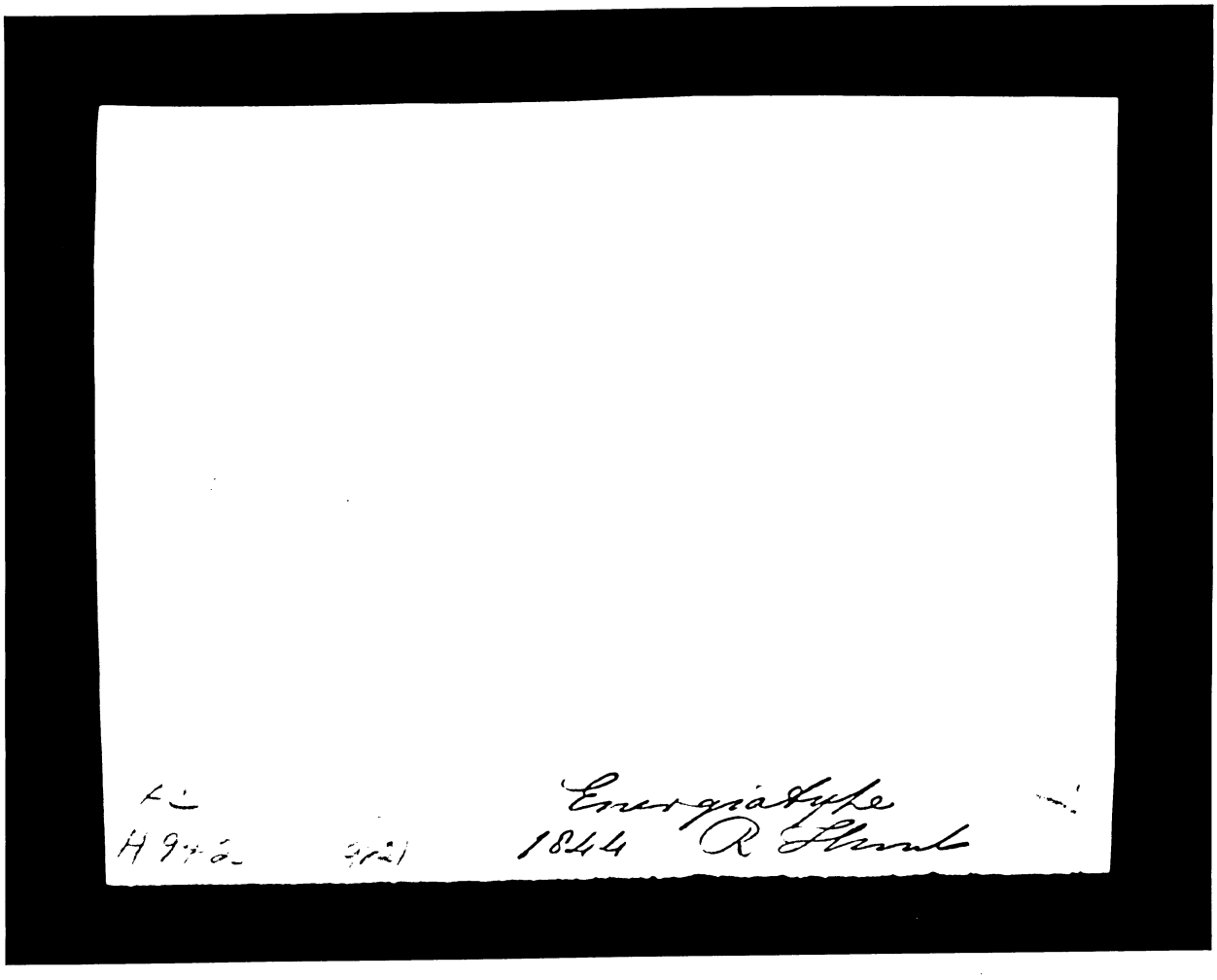

Figure 35

Robert Hunt, Experimental Print, 1844 (Verso)

Image courtesy of George Eastman House

Chapter Eight
Measurement Conversion Chart

The measurements described by Robert Hunt in *A Manual of Photography* are, for the most part, not in use today. As many of the descriptions did not include exact recipes, the measurements listed at the bottom of this page were the only ones given for the three processes experimented with in this project. Using Tong's Appendix B in his introduction to the 1973 reprint of *A Popular Treatise on the Art of Photography*, I was able to convert these units into modern terminology.

As a note, the Hunt texts were written in England and therefore all references to British gallons or fluid ounces are not the same as US gallons or fluid ounces. When translating and converting measurements, it is standard to use figures only to the third or fourth decimal place, even if an exact conversion is longer. When making conversions, it is best to know the accuracy of the measuring instruments being used. For example, if a scale only measures to the nearest tenth, it is not worth translating a figure that goes out to the thousandths, since you will have to round out to the nearest tenth when weighing chemicals with that scale. For purposes of the reader translating his or her own measurements, the exact and total conversion figure is given, regardless of decimal place.

The following conversions are necessary for recreating processes described by Hunt. Please also note that the conversion is for one of any particular measurement and the text must be referenced for amounts necessary to create the process. In many cases, the resulting conversion was then multiplied by a factor of five or ten in order to make enough to fill a tray. That multiple should be retained throughout the chemical formulas in a particular process for ease of operation and clarity.

1 Drachm (British fluid)	=	3.551531 Milliliters
1 Grain	=	0.06479891 Grams
1 Ounce (British fluid)	=	28.41225 Milliliters

Materials and Suppliers

This list contains the companies I used in obtaining materials for this project. It is by no means exhaustive since there are many other companies that have the necessary items.

Chemical Suppliers:

Acros Organics
Fisher Scientific International L.L.C.
(800) 766-7000
Fax: (800) 926-1166
www.fishersci.com

Artcraft Chemicals, Inc.
(800) 682-1730
(518) 355-8700
Fax: (518) 355-9121
www.artcraftchemicals.com

Photographers' Formulary, Inc.
(800) 922-5255
(406) 754-2891
Fax: (406) 754-2896
www.photoformulary.com

Sigma-Aldrich
(800) 325-3010
(414) 273-3850
Fax: (800) 325-5052
www.sigma-aldrich.com

Gloves, Respirators and Dust-Masks

Lab Safety Supply
(800) 356-0783
Fax: (800) 543-9910
www.labsafety.com

Amber Bottles

Industrial Glassware
(856) 327-2688
Fax: (856) 327-0750
www.inglass.com