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Cover Page Footnote

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Abstract

The fields of art and science have always been in a tempestuous relationship, sometimes inspiring one another, other times completely opposing the other. Botanical knowledge of native plant species is disappearing as human development expands, and how this knowledge is obtained is just as equally becoming scarce. With the combination of jewelry-making techniques and plant identification, the properties of native Virginia plants and what medicinal benefits those plants have on the human body are showcased through aesthetic pieces of jewelry and botanical imagery that correspond to specific points on the human form. These pieces include each plant's anatomy that frames an image of the plant. These images are fused to enameled metal, which is achieved through a technique of decal application on the enameled glass. The decal application process highlights an underexplored technique in metalsmithing that combines photographic images embedded into enameled metal. Choosing the medium of metalsmithing elevates each piece to a higher caliber of traditional interaction between artwork and viewer. This project asks the viewer to engage with each piece beyond the typical veil of artisanship, for each piece binds to the wearer in a naturalistically, intimate quality unseen before and tells the viewer to consider it without the constrains of conventional expectations. This series of wearable pieces incorporates the aesthetic appeal of the arts and the biological knowledge of the sciences that creates a bridging space that explores both artistic vision and scientific curiosity.

Keywords: Botany, Metalsmithing, Botanical Photography, Studio Art

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Context

Much of the medicine society depends on are primordial, and sometimes, ancient sources: the natural world, and more specifically, plants. According to Veeresham (2012), somewhere between 35,000 – 70,000 plants species have been identified for their medicinal properties, and Fabricant and Farnsworth (2001) found 122 compounds within 94 plant species that could serve in drug development, and that 80% still retain their original medicinal properties before laboratory involvement. The drugs that are instrumental to the field of healthcare are directly dependent on plant species and their medicinal benefits. But how do we know this? Why are we still developing drugs and constantly searching for and discovering new plants, and thus new drugs, if we already know how plants can assist in the production of medicine? The short answer to this question is that the knowledge trapped within plants is elusive, and with ever evolving and newly emerging diseases, the healthcare field is at a disadvantage in combating these threats when trying to apply old practices to new problems; however, by looking to new plants, and even a new perspective on well-known practices and plants, these species can be gateways to new drug development and a more advanced understanding of the medicinal value of plants, past and present. This understanding of how medicine is derived from plants and the natural world has an unexpected co-author, a field of expression that has not only helped inform the understanding of plants for scientific study, but that of which has literally illustrated plants to aid in scientific research, in addition to countless other fields of study and pillars of society: The visual arts. While obviously divorced at first thought, the sciences and the arts have always been intrinsically bound to one another. This is evident by modern examples, be it textbook

illustrations and the software that facilitates the making of digital art, and even historical examples.

Anna Atkins was one of the first photographers to publish a book entirely by photographic means (Saska 8). Her book, *Photographs of British Algae*, demonstrates a photographic technique of creating blue photograms, early predecessors to photographs. Atkins created this book, which would take form in three volumes (Saska 8), for the primary purpose of documenting her subject for scientific observation, and her work mostly reflects this approach. Atkins' work, however, has been reconsidered in terms of art and photography. Photography has always been at the crossroads of science and art, and Atkins echoes this duality in her cyanotypes. The scientific quality of Atkins work speaks for itself, meticulously arranged specimens are seen in beautiful detail, with their Latin names taped to the bottom of each cyanotype (Saska 11). These carefully crafted compositions also highlight Atkins' own eye for detail and the overall artistic undertones that breath beneath the white forms of the algae. While not directly challenging the boundaries of art and science, Atkins contributes an early example of how art and science not only emphasize one another but are naturally inclined to each other. Atkins uses her work to both elevate her subject matter's value through a medium that is tied to both fields of art and science and communicates her specimen's importance by creating images that speak to and illustrate the specimen's shape and anatomy. Artistic renderings of plants for the purpose of communicating medicinal benefits, or otherwise natural qualities, for scientific reasons are seen primarily in iconic botanicals, but the depiction of plants via botanicals for the purpose of communicating a species' worth, or in other terms, financial gain can also been seen throughout history as a way of connecting a plant's medicinal properties outside of the realm of science. Early maps of Spanish-colonized South American territories, illustrated by Chilean

General Alonso de Ovalle, and later botanicals by Ovalle were explicitly made at the request of Philip IV as part of cataloging and even promoting the exotic New World flora, that of which Spain would later utilize as a major component of commerce coming out of South America (Burdick 317). Ovalle's early renderings of, to name a few, *Larrea divaricata*, also known as Jarilla (Burdick 320), and *Culén saluberrima*, now known as *Psoralea glandulosa*, or Trapilawen (Burdick 321), in his maps of Chile would go on to provide Europeans with the images of plant life that native Chileans applied to early medicine, and even lead to other botanicals being created, providing a medium for these traditions to find written permanence and a resource for future botanists to explore in the development of medication based on these written accounts of medical traditions. These renderings would provide a potential and attractive economic tender for Europeans, but more importantly, these early images allowed for Ovalle to show and even elevate the importance of these plants through an artistic form. Even earlier are the botanical images on architecture, textiles, ceramics, and currency of Anatolian culture that show a heavy emphasis on the poppy plant. The poppy plant in early Anatolian culture was used in the medicinal form of opium, as well as in a number of other treatments across the varied and changing cultures of early Mesopotamia. The care taken to emphasize how these early cultures valued the poppy plant is also seen in its use as decoration elements in needles, architecture, rugs, and even gravestones (Erol and Yanik 205, 209). Most interestingly of how these depictions of the poppy plant manifested themselves in Anatolian culture is in their appearance on coins in the cities of Synnada, Ankyra, and Elaia (Erol and Yanik 207). The importance placed on the poppy plant in these early cultures, and even later in the Ottoman empire (Erol and Yanik 208) again shows that the medicinal properties of a single plant species can ignite entire cultures to depict it through nations and time. Depicting and communicating medicinal plants in

fine art is another avenue that has been used to examine the significance of a plant species. Examination of Joseph Wright's *Portrait of Brooke Boothby* reveals not only the conflicting philosophy of natural history and pharmacology (Graciano 366) but opens the conversation for fine art to incorporate science back into its expression of the subject. By painting an aristocratically dressed man in a natural setting, surrounded by specific medicinal plants, Wright is calling into question the legitimacy of his subject's comfort, and thus asking the viewer to both consider the interplay of the natural world and how it's applied to the human demand of the natural world, and if the figure in the painting should truly be considered a part of the natural setting he finds himself in or separate, further questioning the boundaries of the natural world and human society. Another artist who has challenged the notion of human involvement with the natural world and how humans define themselves in natural spaces and ecological systems, Ann Shelton's 2019 exhibition "jane says," explores the history of botanical knowledge within the context of colonialism, the association of botanical knowledge as a women's expertise, and the human tendency to control and castrate the natural world for nothing more than human benefit and manipulation. Shelton's exhibition includes botanical arrangements, each centered around a specific plant species, related female archetype, the medicinal history of that plant species, and how it relates to the female archetype presented. Shelton's arrangements offer a glance into the interconnected realms of botanical knowledge and women's experiences. Historically, herbalism and botany have been labeled as a women's practice and has equally been consequential to the sexist classification of "witchcraft" (White 84). This association and history have long been persecuted, and thus lost to time and because of this divorce of modern understanding, plants have been simply relegated to mere decoration or at bare minimum, a simple necessity for humans. Shelton's pieces highlight the historical suppression of botanical knowledge, either

because of its history rooted with Indigenous peoples or its link with women (White 84-85). These pieces ask the viewer to reflect on these associations and stereotypes, while also forcing them to consider the power that these labels have. Even the name of the exhibition itself, *jane says*, refers to the "names" given to women in autopsy reports of failed abortions (White 86). Every part of *jane says* encourages the viewer to not only reconsider the long-held notions of botany and plant knowledge in how it relates to our modern use of plants, but also reveals how our history of suppressing women's voices has suppressed the medicinal possibilities of plants, thus partly responsible for the global environmental crisis we find ourselves in today.

When considering art and science, it is easy to assume their differences before their similarities. As shown, however, art and science have a long history of involvement that is hard to ignore. Whether their connections are found in the early photograms of blue algae, or debated in the portrait of philosophies, or the early maps of the New World, or even the earlier decorations that withstood the transitions from culture to culture to culture, or to even the modern examination of our historically sexist and oppressive treatment of women and plants, art and science are the forbidden lovers of academia. The hope of the research presented here is to bridge the glaring gap between the sciences and arts. The forging of pathways and connective consciousness about both fields of study, as seen in the sources included above, will ultimately encourage the challenging of both how academia considers fields of study separate, when in reality they're more closely related, and the joining of those fields of study, internally. The research shown here is a union of two-dimensional photography and three-dimensional jewelry, the mediums themselves split because of dimensionality and a connotation of individualism over collaboration. The varying disciplines of studio arts have seen the same historical divide that plagues the parceling of science and art. Artists are encouraged to specialize in a singular

discipline rather than explore the deep avenues of learning and understanding that comes with each practice of visual art. The novel metalsmithing technique utilized in this research highlights the expressed goal of inclusive education in scientific study and boundaryless, creative expression of art.

Photo Water-Slide Decal Introduction

Photo water-slide decal is the process of transferring a digital image onto a piece of enameled metal. Enamel is a layer of fused glass, which can be colored, opaque or transparent, sifted onto the metal and bound to the metal with a clear binder, like that of Klyr-fire. This technique is achieved by exposing the enameled metal and bound image layer in a kiln at a degree range of 1240º F or 1420º F for roughly a minute and a half to three minutes. The resulting pieces provide a clear image of the photograph, that can then be included or incorporated into a piece of jewelry or large metal piece, as seen fit by the artist. What allows the enamel to imprint into the glass layer is a high level of iron oxide, often producing a reddish hue on the final image. This technique reflects the marriage of photography and metalsmithing/jewelry-making to create a body of work that primarily uses this technique and further resonates my goal of unifying not only these two specializations but also the overall goal of communicating how the merging of fields can enhance the meaning of works of art and enrich the biological study of plants, since this body of work relies on scientific observation yet requires the joined art mediums to amplify those observations through aesthetic vision.

It is important, that while this contribution to this metalsmithing technique is unique and novel for this research and studio practice, that the inspirations and other novel uses of this technique are cited to show the differences this research aims for, while showcasing what has come before and is being explored alongside this artistic project. Firstly, Andrew Kuebeck,

metalsmith and photographer, utilizes this technique in his *Still Life* series, which explores the relationship between the iconic photographic portrayal of the male form in the 1980s and the hypermasculine narrative which this form is told in, often appealing to a homosexual audience, despite the heavy homophobic portrayal of the gay community during the 1980s. One of his pieces, *Joey with Balloons*, 2018 (see fig. 1), supports this visual commentary, while also asking the viewer to consider their personal notions of masculinity, which effects the viewership of male metalsmiths creating art traditionally associated with femininity.

Fig. 1. Joey with Balloons from Andrew Kuebeck; sterling silver, fine silver, enamel, decal on enamel (8.3 x 3.8 cm), 2018

Christina Lemon, professor of three-dimensional studio art at Georgia Southern University, utilized this technique in her *Let Sleeping Dogs Lie* (see fig. 2). Lemon presents the physical manifestation of the titled phrase and asks the viewer to regard what the piece visually conveys and how that phrase influences the piece, such as has the subject been wounded or is the

subject sleeping? How does a viewer even approach the piece, with curiosity or adhering to the piece's stern warning? Lemon presents how a piece of jewelry meets conceptualization using the method of photo water-slide decal.

Fig. 2. Let Sleeping Dogs Lie from Christina Lemon

Both Kuebeck and Lemon use the photo water-slide decal technique in their work, in similar and different ways, but overall demonstrate the flexibility, creativity, and conceptual potential that this novel technique brings to metalsmithing and jewelry-making.

Photo Water-Slide Decal Process and Results

The photo water-slide decal process used in this research evolved and took different forms, so this section will break down the phases of progression that this technique took until we arrived at our final, and mostly finished technique.

Firstly, each form of this technique and its process starts with the cutting of 20-gauge copper into roughly 2x2 inch (5.08x5.08 centimeter) square test tiles. The enameling portion, as illustrated earlier, sees the cut square test tile coated evenly with a layer of Klyr-fire, then small sifters are used to apply the powdered glass, or enamel, onto this layer. The test title is dried for 10 minutes on a trivet, then placed in a kiln which is heated to 1500º F and allowed to heat between a minute and a half to three minutes, depending on the thickness of the enamel layer and

the color of the enamel used. Once heated for the appropriate amount of time, the enamel is removed from the kiln and cooled, creating a glassy layer. Then this procedure is repeated on the other side of the test tile and again on the original side, done an equal number of times on each side of the test tile, in a process called counter-enameling. Multiple layers are usually applied until the enamel creates a solid, opaque layer of color and counter-enameling is used to prevent warping of the metal and avoid the enamel from actually breaking. Once the enameling process is completed, the test tile is then ready for the photo water-slide decal application.

The actual application of the photo decal stayed consistent as well, having the images printed on specific iron oxide rich decal paper. When this paper is exposed to warm water for about 45 seconds, the image is lifted from the base paper, becoming a decal. This decal is immediately pressed to the enameled surface of the metal test tile and squeegeed to make sure that no water or air was trapped under the decal. The decal is allowed to dry for 3 to 5 hours, or overnight, before firing in the kiln.

The first version of our firing of the test tile after the photo decal is applied, was performed by firing the test tile at 1400º F and held in the kiln for one minute (see fig. 3). This test tile was then fired again twice, the second time at 1430º F and the third time at 1450º F (see fig 4), both held for one minute. Figure 3 & 4 show that using this early ink would require additional firing to fully develop the image. Another test tile was fired using this early method once at 1450º F, held for one minute (see fig. 5). Figure 5 shows the complete development of the image, but small marks litter the surface of the layer and break-up the image. These marks are characteristic of water or air bubbles being trapped under the decal before firing. Similar results are seen in another test tile, fired in the exact method as Figure 5, with the exception of

being held five seconds longer (see fig. 6). This text tile not only shows those water or air bubble marks, but the image has also begun to lose stability because of the prolonged heat exposure.

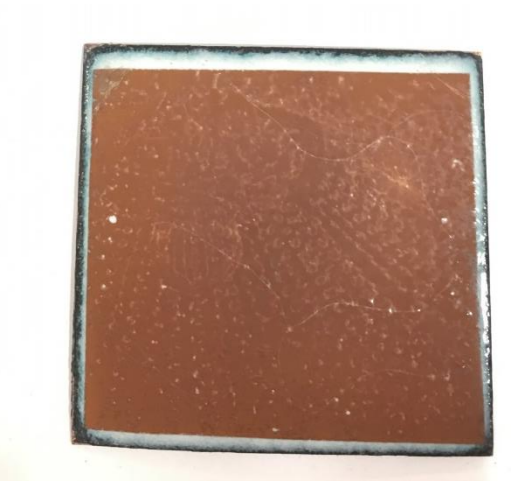

Fig. 3. First firing of test tile during early method of firing.

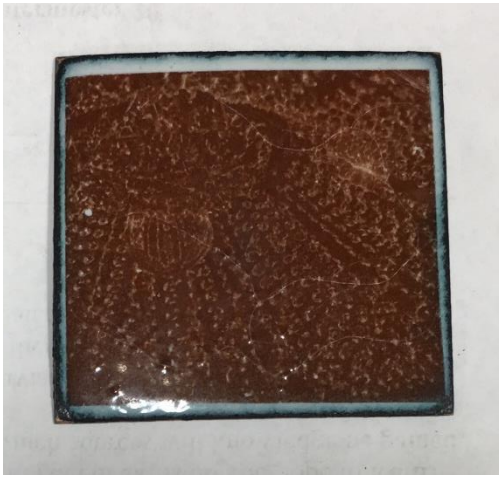

Fig. 4. Third firing of test tile during early method of firing.

Fig. 5. Single firing at 1450º F with evidence of water/air bubbles.

Fig. 6. Single firing at 1450º F with evidence of water/air bubbles and dissolving of the image due to prolonged heat exposure.

Seeing the consistent appearance of water/air bubble marks on the final product and the image quality of the final product being less-than-desirable, the second version of this process

reevaluated the paper and ink quality and firing time. The paper and ink that was being used was changed to a different brand. This brand was commercial outsourced. The firing time adjustment reflected the understanding and use of color vs. black-and-white images, which for the above three test tiles, only black-and-white images were used. In the second version of this process, we began to experiment with color images. Additionally, a pre-firing at 900º F for approximately ten seconds was added to destroy any organic matter that might have gathered on the test tile during drying. By using the adjusted methods (see fig. 7 & 8), these test tiles were fired at 1420º F, held for one minute. These test tiles used black-and-white photo decals and it was discovered that using the 1420º F firing temperature was still too hot for black-and-white photo decals. While the images in Figures 7 & 8 are clearer than the previous test tiles, the images on Figures 9 & 10, which were fired using the 1240º F temperature, are even sharper (see figs. 9 & 10). This variation in the firing times reflects the temperature exposure for black-and-white photo decals is optimal at 1240º F. Additionally, the pre-firing at 900º F was revealed to reduce the amount of marks caused by trapped water/air bubbles or organic matter present on the test tile.

Fig. 7. Firing with adjusted paper and ink at

Fig. 8. Firing with adjusted paper and ink at

new temperature of 1420º F for black-and-white photo decal.

new temperature of 1420º F for black-and-white photo decal.

Fig. 9. New firing time for black-and-white photo decals reveals sharper images with minimum water/air marks.

Fig. 10. New firing time for black-and-white photo decals reveals sharper images with minimum water/air marks.

With the introduction of color photo decals, the test tiles were fired at 1420º F. This temperature is optimal for color photo decals and produces the sharpest images for these photo decals (see figs. 11 & 12). One aspect of the color decals is that the texture of these test tiles is a matte finish, while the black-and-white test tiles produce a glassy finish. Since these are the only test tiles produced using color images, it is unclear if this is a trend with color photo decals because of the color pigment, but since all of the black-and-white photo decals share the same texture finish, it is reasonable to say that all future color photo decals will produce the same texture finish. Figure 11 reintroduces more water/air marks, but speaking from an aesthetic point, the automatic, "randomness" of the marks present another layer of possible conceptualization that artists can work with in their future designs and pieces. While it does break-up the image, as it did in the images seen in Figures 5 & 6, these water/air marks are found to be aesthetically promising.

Fig. 11. Color photo decal, fired at 1420º F.

Fig. 12. Color photo decal, fired at 1420º F.

The photo decal application has more developing to do, as seen in Figure 11, the amount of water/air marks can be reduced, and this is being considered in the squeegee method. Currently, the squeegee method being used is done by using small paintbrushes to push water and air bubbles from under the decal. The squeegee method in the future will use an actual squeegee and depending on the amount of marks then seen will determine which method is best for minimizing the amount of water/air marks that appear on the finished product. While these early test tiles demonstrate and aid in refining our process, they have been most instrumental in showing how a future series of jewelry will be made. Seen in Figures 8 & 11, the ability to cut out solid shapes from the photo decals opens the prospect of using more complex, abstract shapes. These test tiles were all 2x2 inch squares, but a sheet of copper can be cut to fit the silhouette of the image used in Figure 8, producing a sharper, more exact piece of jewelry, in the form of a brooch or pin. These complex shapes will help elevate the meaning behind a piece within an art series. The proposed series of jewelry directly tied to this research is the best example of how this technique combines two disciplines within visual arts, photography and

metalsmithing, but also the broader fields of art and science. The pieces will be made to not only pronounce and highlight the image on the piece, but also interact with the wearer in such a way to further emphasize the subject in the image. The plants chosen for this series will be medicinal native Virginia plant species, confirmed by either historical accounts of how the plant was used medicinally or by oral traditions gathered from surrounding regions in Virginia.

Creating uniting spaces within academia can help reform the standard in which subjects are taught in both higher education and middle education. Introducing topics as separate entities reinforces the idea of division that keeps the fields of art and science apart in the eyes of academia, and this research reveals that when these fields are reconnected, the resulting product can uncover a long history of innate cooperation and inclusion; and, dare even say, necessary coupling. Underexploring these topics of art and science, or the disciplines of visual art, only helps in perpetrating exclusion and creating voids of creativity in science and complex experimentation within art. This novel metalsmithing practice shows that joining the disciplines of art can bring forward stronger pieces of art that cultivate layers of conceptualization, as well as extending a pathway for creative realizations of scientific topics. The properties and identities of medicinal plants serve as the key focus of this research because of their importance in our everyday lives. Giving these plants emphasis in this bridging project of art and science simply acknowledges their significance and inherent ubiquity, noticed or not, in our society. Medicinal plants aid as a reminder of the integral connectedness of all the aspects of our lives; nothing sprouts, blooms, or buds in a closed system. We thrive best when we demolish the arbitrary barriers that attempt to stunt our growth and erasure our kinship to all things under the sun.

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