

Journal of NATURAL SCIENCE ILLUSTRATION

GUILD OF NATURAL SCIENCE ILLUSTRATORS



A Note From...

Gail Guth, Senior Consulting Editor, JNSI

Welcome to the first issue of 2020, a year that has certainly not had an auspicious beginning, and definitely not one that any of us expected. The Covid-19 pandemic has upended our daily lives, and this issue is a bit delayed as a result. Indeed, we are all doing the juggling act of reaching out to family and friends while staying physically apart.

The GNSI Board and Utah Conference Committee have wisely decided to postpone the in-person conference until 2021; more information on future plans and possible interim events will undoubtedly be provided, but in the meantime, the GNSI family continues to stay in touch via social media. We are pleased to do our part by bringing you a collection of excellent articles filled with information and visual delights. Please don't hesitate to offer us your ideas for future articles on any topic related to science illustration; we welcome all suggestions.

This issue's topics range from the challenges of illustrating a gynandromorphic caterpillar, the science behind iridescence in fish, and teaching yourself science illustration—to a review of Inktober 2019 (the GNSI version), and a review of Aqua Black paper from Stonehenge. We end with a glimpse of Frances Topping's lovely sketches.

It is heartening to see the immediate and unscripted response of support, information, endless humor, and activities that our GNSI community, and in fact our entire human community, have generated on all our social media platforms. It's ironic that the very connectedness that threatens us all is also vital in keeping us upbeat and hopeful. Let's keep our spirits up and continue to share our creativity, talent, and joy of this world with our fellow artists.

— Gail Guth
journal@gnsi.org

CONTENTS

Editor's Note, by Gail Guth	2
Member Spotlight: MaryBeth Hinrichs	3–6
Drawing a Menacing Male-Female Caterpillar for a Scientific Journal, by Diana Marques	7–9
RRRRIPPED from the List: Teaching Myself Scientific Illustration? edited by Britt Griswold	10–12
The Allure of Ichthyological Structural Color, part 1: The Science Behind the Art, by Stephen DiCerro	13–15
Inktober 2019, by Carol Creech	16–20
Stonehenge Aqua Black, product review by Gail Guth and Camille Werther	21–22
Sketchbook: Frances Topping	23

Cover: Lake Champlain
black crappie group,
Pomoxis nigromaculatus.
Chokusetsu-ho Gyotaku.
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CORRECTION TO JNSI 2019-3:

In our last issue, we mistyped
Madison Erin Mayfield's name as Erin
Mayfield. We apologize for this error.

N A T U R A L
S C I E N C E
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The Guild of Natural Science
Illustrators is a nonprofit organization
devoted to providing information
about and encouraging high standards
of competence in the field of natural
science illustration. The Guild offers
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or genuinely interested in natural
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MARYBETH HINRICHS

My journey into scientific illustration has taken many unexpected twists and turns, detours of all kinds and sometimes flat-out halts, but I've learned along the way that any journey of value is worth the patience.

Born and raised in St. Louis, MO, I was the youngest of three kids, much younger than my siblings. My dad was an electrician and my mom stayed at home with me until I started junior high and then went back to work as a salesperson in a local department store. Loving animals and learning of all kinds were always encouraged and both of my parents enjoyed creative pursuits in different ways. Dad loved to paint and draw when he had the chance (which, unfortunately, was not very often) and Mom expressed her artistic side more in 3D, sewing clothing for many special occasions—how many kids get to go out for Halloween as Bullwinkle's buddy Rocky the squirrel with a very furry and realistic tail? Childhood memories included Dad reading the comics to me, pointing out how things were drawn, as well as peppering his reading with the most wicked Woody Woodpecker imitation ever, and trying to explain proportion to a very frustrated young artist who wanted to draw her beloved horses so they looked "real." Luckily, I was always given plenty of paper and art supplies, so I had the opportunity to draw as much as possible.

I discovered science in grade school and loved learning about most of it, maybe physics not so much. High school found me on the science and math college track, which did not include any art courses. But two liberal arts courses were required to graduate, so in addition to a music literature course, I took a one semester art history course with many of my fellow science nerds. There were a few sporadic chances to draw in class with very little encouragement. I still remember the instructor informing us that "realistic, detailed illustration was just used for newspaper stories and *National Geographic* and was not true art—abstract was the true work of value." As a result, I left any ideas of drawing in the dust and majored in chemistry and biology in college in Kansas City with an eye toward pursuing a medical degree. Big detour number one: I delved into biochemistry for graduate school instead (Georgetown University; my husband was in

the Navy and worked in Washington, DC for Naval Sea Systems Command). After completing my master's, I started working on the PhD program. The same organism that had flourished for me during the master's research absolutely refused to grow for me any longer. After one particularly trying day when my mentor and I had discussed this puzzling development for the umpteenth time and I was feeling very trapped in the lab, my mentor sent me to the graphics department to pick up a conference poster for him. I vividly remember staring down at the illustrations there beneath the glass-covered countertop and thinking, "I so want to do this, and I think I can!"

At about this time, my husband and I were starting to look into moving back to the Midwest to be closer to family. While waiting to find work and a place to move, I started to take small art commissions with projects ranging from pen and ink laboratory manual illustrations (my first "real" scientific illustration assignment and introduction to tighter deadlines: 90 spot illustrations in two weeks) to acrylic decorative art and portraits.

After moving to Minnesota in 1989, I knew I needed more instruction in art, but after starting a family, decided to attend a tech school two-year graphics program instead of pursuing a four-year degree. I soaked up as much information from the program as possible, including printing requirements and



Above: Cascading geranium (*Pelargonium peltatum*).
Watercolor on Arches
hot-press, © 2004.



Above: MaryBeth sketching
at Assateague National
Seashore, October 2019.

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unless otherwise noted.



Above: (Left) Milkweed (*Asclepias syriaca*) done on paper with 4x0 and 6x0 Rapidograph pens, © 1999. (Right) Orchid (*Tulumania* sp.) done in watercolor on vellum, © 2010.



"Trying to balance work while raising a family can get interesting at times."

beginning digital layout and illustration (command-Z was a pretty new concept back then—yes, I’m that old), and equally as much from working part-time as a framing assistant for a professional framer. I was able to attend the 1990 GNSI conference in Minneapolis, commuting each day from our home. There I met Vera Ming Wong and Kris Kirkeby and was completely fascinated by a presentation from Nancy Halliday. I remember thinking, “I love these people!!” while watching her physically demonstrating how birds stroke their wings in flight.

Another turn in the road: I found an announcement in the local paper about Vera giving a botanical drawing class at what is now Como Zoo and Marjorie McNeeley Conservatory. How cool—I could learn to draw something that didn’t move as fast as my kids did! Ultimately, this class segued into a certificate

program in Botanical Illustration at Como. For a new twist, I started teaching as well as taking classes. I was fortunate to take classes from Don Luce and Marilyn Garber (before she started her own school for Botanical Art). The certificate program at Como did not flourish for long, but I was hooked on botanical illustration. I have been a part of the Great River Chapter of the American Society of Botanical Artists (ASBA) here in Minnesota, serving on the board for a couple of years.

More minor sporadic twists and turns are familiar to many GNSI members. Trying to balance work while raising a family can get interesting at times. Our kids do respect what I do, maybe after surviving experiences like Mom bringing home several 6-foot-long glass-front sample cases to illustrate prairie grasses’ root structure for a U of MN graduate student and having to walk *very slowly*—not run as usual—through the living room. And I never

Next page: (Top left) Sketch of a newborn foal in graphite on paper, © 2012. (Top right) Oil sketch of horses in wetland, © 2019. (Middle) Sketchbook spread of Riverfront Park in Salem, OR, rendered in watercolor and pen on paper, © 2018. (Bottom) Concept sketch of Furnacetown, MD, in watercolor and pen on paper, © 2018.





saw one poor neighbor kid again after our youngest screeched at him, “Don’t touch anything on that table, those are my mom’s art supplies!” But on the other hand, Mom also had to learn how to entertain a three-month-old while completing assignments (thank heaven for baby gyms), and to later on exercise a great deal of creativity explaining how some “toddler enhancements” in big black marker appeared sprinkled throughout a sketch.

Several years ago, I experienced a few unexpected health issues that clarified for me how I wanted to move forward in my life and career. I reassessed where I was, pulling back from many volunteer positions I had accumulated while our kids were young and started to focus on enhancing my skills in both traditional and digital media as well as evaluating what mark I wanted to leave with my work. I also finally took to heart that sketching as much as possible would not only help me improve



my work, but had become vital to me just being me. I've become a devotee of *No Excuses Art Journaling* by Gina Rossi Armfield and several GNSI Great Plains members will be happy to tell you I may have a slight or not-so-slight addiction to washi tape.

Volunteer opportunities in GNSI are another matter. Over the years, I've been fortunate to work on the courses and books list, the membership brochure, and recently with Karen Ackoff on the most recent revision of the GNSI *Technique Sheets*.

Two volunteer opportunities that I wouldn't/won't give up at this point are being on the Education Committee for GNSI as long as I'm needed and the chance to continue to foster development of the GNSI *Drawing Portal* (formerly the *Drawing Kit*). After much research and reflection, this project has evolved into two components. The quick-start portion consists of a "Get started drawing as quickly as possible" how-to program, available at this point as steps on the under-construction website, as well as lesson plans for ages two to infinity shared by several very generous GNSI members. This part of the program is geared toward adults, kids in school, after school programs, community programs, nature centers, etc. I'm hoping that eventually we can have YouTube tutorials and materials for downloading to better serve the public, especially those who are home-schooled. The second component is a recognition that many of our members are already heavily involved in teaching all ages of people how to draw and keep nature journals to better appreciate science and the natural world. In this portion we will regionally list contact information (no ads or endorsements) for those GNSI members who either at least partially make their living by teaching or who volunteer in different venues to do so. I've learned so much from being a member of GNSI; I hope this will be a way to give back and let more of the public know of this great organization and the possibilities for careers for interested youth. Work on this project so far could not have happened without input and hard work from fellow GNSI members Bethann Garramon Merkle, Liz Lockett, Kris Kirkeby, Gretchen Halpert, Lesley Switendick, Andrea Lofthouse-Quesada, Gail Guth, Sara Taliaferro, Mary Ellen Carsley, Jane Neroni, Sue Burrus, Suzan Wallace and the very patient and dedicated Kathleen Marie Garness. If I've forgotten to mention anyone else, please forgive me.

"I finally took to heart that sketching as much as possible would not only help me improve my work, but had become vital to me just being me."

Oh, by the way, if any of you have the opportunity to join a group or GNSI chapter, do it. That's the best way to interact with "your kind of people." I even did a stint as Treasurer for the Great Plains chapter. They put up with my number ineptness and I had opportunities to take great workshops, experience new things (I can tell just how windy it is and how lousy the weather is by how the wind farms in western Iowa look) and make life-long

friends. I've been told that I will remain a member of the chapter even after we move soon to Washington state. I've already subjected the Pacific Northwest chapter there to my first attempt at a techniques blog. End of advertisement for chapters, for now.

What's in the future? Besides the move mentioned above and subsequent discoveries to make in our new area, I hope to continue my eclectic slate of projects (the classic ADOS approach to work: Attention Deficit, Ooh: Shiny). Right now I have the privilege to illustrate the first of several books about a wonderful state park near our new home, design and illustrate a handout for horseback riding students about the bone structure of horses, illustrate a nonscientific children's book, and hopefully finish a life-size botanical plate about the endangered silversword plant of Hawaii (the subspecies of *Argyroxiphium sandwicense* found on Maui), plus maybe finally get a chance to illustrate a prairie rose (*Rosa arkansana*). Work also continues on the *Drawing Portal*, of course. I've also been trying to stretch my skills by field sketching semiwild horses in oils—wait, not botanicals?!—and playing with animation and 3D rendering digitally.

I also hope to continue to improve my marketing skills. I've got a ton of work there, although I am making progress in finding out what works for me and what doesn't. My husband is planning to retire before we move, but I feel I'm just getting warmed up, so no retirement for me. Speaking of husbands, I would be very remiss not to publicly thank him for all of his support of my less-than-conventional job! I could not have done any of this without him.

There's just so much to learn and try to pass on about the natural world through illustration and venues like the *Drawing Portal*. My biggest goal is to do my best to pass on my excitement about the cool organisms and processes I get to learn about and draw.



Above: My sketching buddy. Pastel on Pastelmat, © 2013.

Drawing a Menacing Male-Female Caterpillar for a Scientific Journal

— Diana Marques

Last year I was asked to make an illustrated plate for an article to be submitted to the *Journal of the Lepidopterists' Society*. Having worked extensively in moth and butterfly anatomical illustration for different scientific publications, I thought this request would fit the same bill: line drawings of tiny and inconspicuous caterpillars, focused on the position and length of their hairs. In a few projects, all I had to draw from was a molted skin, barely visible with naked eyes, so I was mentally preparing myself and taking deep breaths.

Imagine my delight when I saw the photographs of the subject to feature—a gynandromorphic hickory-horned devil caterpillar (*Fig. 1a*)! They would have had me at “hickory-horned devil” but throw in an extremely rare specimen that is simultaneously male and female and I drop everything else to stare at the colors, complexity, and uniqueness of this animal. I learned then not to confuse gynandromorphism with hermaphroditism, the latter being organisms that possess complete and fully functional male and female reproductive systems, which the specimen under study did not.

Hickory-horned devils are the caterpillar of the regal moth, also known as royal walnut moth, and they're native to eastern and southern deciduous forests of the United States. Given their appearance and size (an adult's wingspan can reach 6.1 inches and caterpillar's length can be up to 5.9 inches), they have become a popular species raised in captivity to display in zoos and nature centers. It was at a rearing facility that the gynandromorph caterpillar was spotted, the result of a hybrid cross between individuals of *Citheronia*

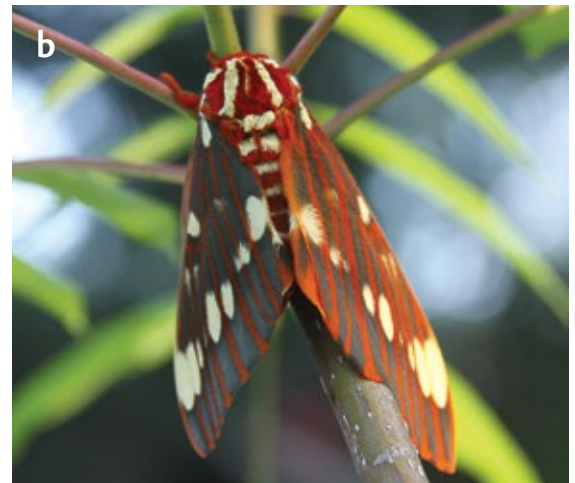


Figure 1: (a) Photograph of the gynandromorph hickory-horned devil caterpillar, showcasing male *Citheronia splendens* features on left side of the body and female *Citheronia regalis* features on the right. (b) Photograph of the gynandromorph regal moth, showcasing male *C. splendens* features on left side of the body and female *C. regalis* features on the right. Both photos courtesy of the Smithsonian's National Museum of Natural History.

regalis (regal moth) and the closely-related *Citheronia splendens* (splendid royal moth). It was recognized as an oddity for the difference in its bilateral anatomy. The last stage of maturity of the caterpillar showcased male *C. splendens* features on the left side of the body and female *C. regalis* features on the right side.

Even though insects are among the organisms where gynandromorphism is most observed, it is still a rare occurrence and has never been reported in larval stages, only in adults. There was then great interest in documenting the observation. For that purpose, multiple photos were taken during the larval development. After the caterpillar pupated, the shed skin (exuviae) was saved. The adult, which also had distinct features of both species (*Fig. 1b*) was sold to an anonymous collector.

"Imagine my delight when I saw the photographs of the subject to feature—a gynandromorphic hickory-horned devil caterpillar!"

Figure 2: *Citheronia regalis* and *Citheronia splendens* specimens (inflated dry and preserved in liquid) from the entomology collection of the Smithsonian's National Museum of Natural History.
© 2019 Diana Marques



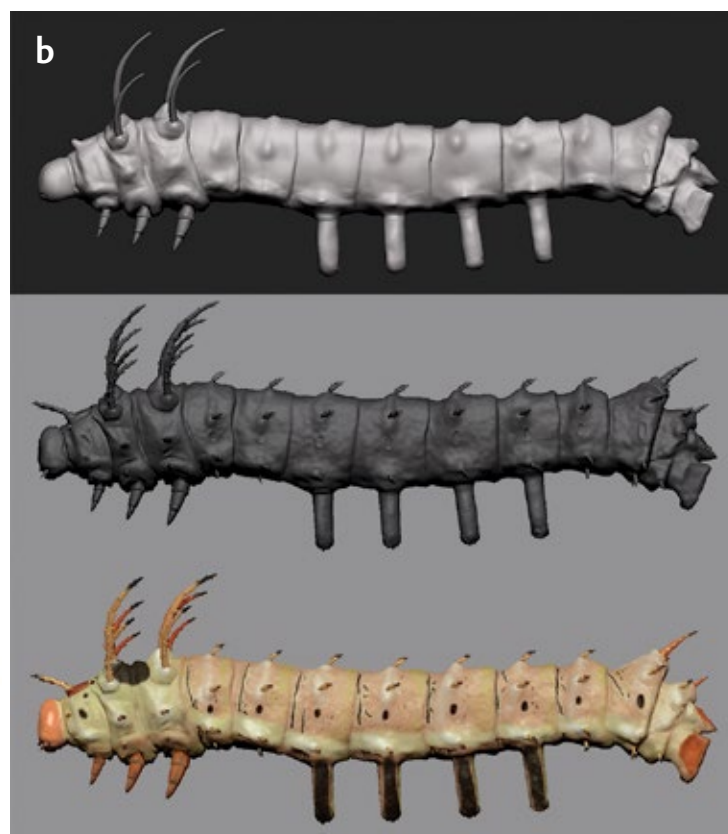
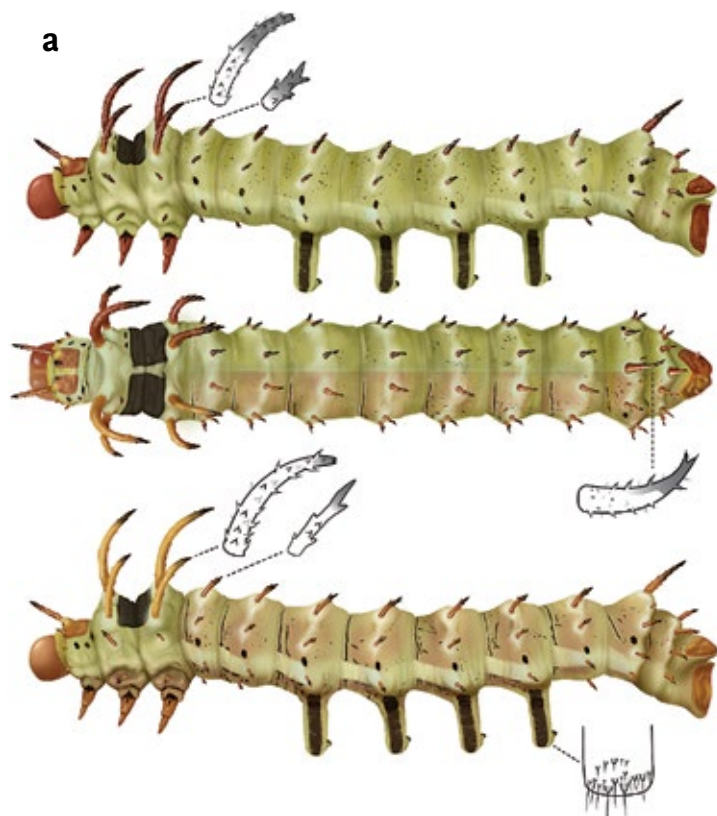
size of the modified hairs (scoli). Magnified black and white details of some structures would complement the information (Fig. 3a). After some preliminary freehand sketches done in pencil looking at the collection specimens and gynandromorph photos, I scanned them in and continued working in Photoshop*. Realizing that the photos had some information gaps for certain parts of the body, I referred to online photos of living *Citheronia* specimens. Luckily, being such a popular and large animal, there is an abundance of them!

Figure 3: (a) Illustrated plate of the gynandromorph caterpillar included in the article of the *Journal of the Lepidopterists' Society*. (b) Composite of three screenshots of the ZBrush* user interface at different stages of development of the digital 3D model of the gynandromorph caterpillar.
© 2019 Diana Marques

The photos and exuviae were valuable references when I started working on the illustration plate, as was having access to caterpillar specimens (inflated dry and preserved in liquid) of *C. regalis* and *C. splendens* from the Smithsonian's National Museum of Natural History Entomology collection (Fig. 2).

It was important for the plate to include three views—dorsal and two laterals—given the difference in color on each side of the body, and the color and

Knowing that the article, at the time still unpublished, would be presented at The Lepidopterists' Society annual meeting, I made a proposal to create a digital 3D model of the gynandromorph caterpillar to be animated in an explanatory video (Fig. 3b). It seemed to be the right visual tool to take an expert audience in an anatomical exploration of the singular animal. I used ZBrush*, a powerful digital sculpting software, to create the model. It's like working with clay but keeping your hands clean. Considering the fair amount of time I spent on the illustrated plate, I



was prepared to recreate the animal from every angle. Nevertheless, there was information I hadn't had to think about before, particularly in the ventral part of the body, which took me on a search for additional references.

ZBrush allows an artist to project a 2D image onto a 3D model with the goal of colorizing the model or creating texture on its surface. I did try to use the plate illustrations to colorize the model but rapidly concluded there were too many missing parts and that it would be a longer process than simply painting from scratch in ZBrush. The resulting model is austere; intentionally I kept a formal and stiff body posture in order to create different angles of rotation in the animation and allow for verbal narration in a conference presentation setting.

Accounts from conference participants were enthusiastic about the quality of the visuals in the presentation, so much so that the editor of the *Journal of the Lepidopterists' Society* was swayed to feature the article on the cover. It would be one of the rare instances that a commissioned illustration rather than a photograph was used on the cover of the publication. That meant I had further work to do and carte blanche to take a more naturalistic approach. Nostalgia crept in as I thought of beloved GNSI member John Cody and his lifelong affair with Saturniid moths, the family of moths that *Citheronia* sp. belongs to.

In the tradition of representing insect species and host plants, the gynandromorph caterpillar was to be depicted on a sweetgum branch (*Liquidambar styraciflua*) doing what it does best, eating leaves. This is when living in a city where every tree is identified and laid out on an open access map comes in handy—I discovered there is a sweetgum just around the corner from my place! At this point I had all the resources one could hope for. I took the 3D model and repositioned it to appear standing on a branch; stepped outside to sketch, photograph and collect sweetgum branches and leaves that were later digitized on a flatbed scanner; and took all the references into Photoshop to develop the final illustration (Fig. 4).

All in all, it was an enjoyable project involving a charismatic and not-so-menacing caterpillar that advanced insect science a little further and gave me an opportunity to combine multiple illustration techniques and styles to fit different contexts and purposes.



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Editor's note: When Diana wrote this story for JNSI, the article featuring her illustrations and animation was freely available. The Lepidopterists' Society now requires a subscription or purchase of the article. You can download the digital PDF here: bioone.org/journals/the-journal-of-the-lepidopterists-society/volume-73/issue-3

Figure 4: Cover of the *Journal of the Lepidopterists' Society* featuring the illustration of the gynandromorph hickory-horned devil caterpillar feeding on sweetgum. Artwork © 2019 Diana Marques; journal cover design © 2019 The Lepidopterists' Society.

DIANA MARQUES has a background in biology and scientific illustration and has been an illustrator and animator for 15 years, working on a variety of scientific subjects and techniques for museums, publishers and researchers. Diana completed a PhD in Digital Media researching augmented reality technology and visual science communication at the Smithsonian's National Museum of Natural History, and is currently the Associate Manager of Graphic Production at *National Geographic*. Diana has been a GNSI member since 1998 and has served on the GNSI Board as the Membership Director, Outreach Director, and Lead of the Website Committee.

Website: dianamarques.com



Art © Stephen DiCerbo

Teaching Myself Scientific Illustration?

This conversation on self-teaching is taken from the GNSI Sciart-Listserv. It is lightly edited for readability and clarity. Enjoy!

— Britt Griswold, RRRRipped Guest Editor

ORIGINAL POST

TEACHING MYSELF SCIENTIFIC ILLUSTRATION?

From: Erin Avery

Is it possible to teach myself Scientific Illustration rather than going the university route? I have an undergraduate degree in Archaeology and I have basic drawing skills. I have put together a curriculum for myself and I'd appreciate any advice on the feasibility of my plan and anything I should add to this list:

- Learn Photoshop®, Illustrator®, InDesign®
- Study principles of design
- Improve watercolor/pen skills
- Read through the *Guild Handbook of Scientific Illustration*
- Become more familiar with different scientific fields (botany, etc.)
- Put together a portfolio and put it online
- Develop connections with local illustrators and scientists

Any advice is appreciated!

RESPONSES

From: Julie Johnson

I am self-taught. It can be done! I recommend getting high-quality art supplies, practice every day, and find out what medium, style, subject you are best at. Make connections in your Archaeology field, if those are the people you want to work with. See if some of your friends in the field will commission some work from you to get you started. Once they have seen what you can do, they will recommend you to other people they know. That is how it has worked for me. I got a Masters in Biology and most of my early work was for friends in the field. Now I get work

from people who recommended me to a colleague who recommended me to another colleague, etc. Also, making connections in the illustrator world is key. There is so much to learn from other science illustrators and artists!

From: Mieke Roth

It's absolutely possible, but you have to be very determined. I've got a MSc in Animal Sciences and officially no background in illustration. But I have to say that I did go to art class for 4 years given by a classical painter in my teens (where I learned the techniques of illustration/painting) and was admitted to the MSc Scientific Illustration in Maastricht. I stopped after 3 weeks because most of what they taught at that time I knew already. It was in agreement with the teachers that I stopped. Keep in mind that you aren't a scientific illustrator overnight and that it takes a lot of hard work. But that said, I think the most important knowledge for a scientific illustrator is the sciency part. For the rest you can make your style as complex or simple as you want. There is room for a lot of styles luckily.

From: Kelly Finan

I've heard good things about these education options, which you can do from home:

- www.edx.org/course/drawing-nature-science-culture-natural-newcastlex-nhi101x-1 (free, but I don't know too much about it)
- www.gretchenhalpert-distanceprogram.com (Gretchen is on this listserve, too! She's great.)

Might be easier than going it alone! Hope that helps.

From: Emily S. Damstra

Sure, it's possible. Looks like a good list of goals you've put together. To that list I'd add: Become

THESE POSTS are from the GNSI's SciArt-L Listserv, a friendly place where members can e-mail questions and share ideas about science illustration. If you have not yet subscribed to the Listserv, please visit gnsi.org/resources/reviews/sciart-l-listserve for instructions on how to sign up. We would love to hear from you!

familiar with intellectual property rights and licensing practices. More details about that and additional advice here: emilydamstra.com/resources/a-career-in-science-illustration

.....
From: Dorie Petrochko

I suppose so, but having interactions with professionals is also very important. How will you get feedback on your work? It is precise work and no wiggle room for mess-ups. Please feel free to call me if you want to discuss this.

.....
From: Natalya Zahn

It is totally possible to become a successful self-taught scientific illustrator! It is a lot of work, but if you're dedicated to it—and enjoy the process—you have a good shot. The fact that you already have an undergrad degree in a science field is a big plus.

In addition to the other suggestions, I'd recommend seeking out any stand-alone classes or workshops in illustration technique that you might be able to attend—these would get you a taste of going the university route, but at a fraction of the cost. Composition and layout principles can be learned from reading and studying other's work, but something like watercolor layering, masking, working with gouache, or even digital processes can be MUCH easier to absorb by watching a professional work in front of you.

And YES to attending a future GNSI conference!! You'll learn so much from meeting others in the field, and plugging into a like-minded community is incredibly energizing and inspiring.

.....
From: Elizabeth Morales

I definitely recommend attending a national conference, if you haven't already done so. Also, if there is a chapter in your area, you might get involved with that. The Guild is made up of wonderful, friendly, and supportive people who would be glad to talk to you in person about all of these issues regarding starting up in the field.

.....
From: Marjorie Leggitt

I 100% agree with all that has already been written in this thread:

- The more science you have behind you, the better.
- Start building business relationships with the science community you already know as these will most probably be your first clients
- Take independent art classes and workshops to learn the skills and eventually develop your style and focus
- Draw every day!!
- BECOME A GNSI MEMBER, if you're not already, and take advantage of the amazing professional camaraderie, expertise, and incredible workshops!!!

Have fun in your adventure!

DID YOU KNOW?

The GNSI has some incredible self-teaching resources available to members and nonmembers, including *The Guild Handbook of Science Illustration*, which has been dubbed the "bible" of scientific illustration. It's available for sale at gnsi.org/gnsi-handbook. GNSI has also produced two beautiful brochure-style publications, including the 32-pg *Techniques Sheets* and 12-pg *Careers in Scientific Illustration*. These brochures are free to members and offered at a nominal cost to nonmembers. To download, visit gnsi.org/gnsi-brochures.



Left: *The Guild Handbook of Science Illustration*, 2nd Edition, edited by Elaine R.S. Hodges. © 2003 GNSI

Right: *Technique Sheets, Introductory Techniques*, 3rd Edition, edited by MaryBeth Hinrichs and Karen Ackoff. © 2015 GNSI

From: Liz Lockett

Erin you have a great plan, the only other thing I would suggest is to go to museums and collections and ask to see the illustration collections. Looking at the work of earlier artists can really give you a good feel for a lot of different ways of presenting information and what types of information is important to capture for the type of specimen you have.

From: Kathleen Garness

Ditto everything already said; I would only add that if you can find a mentor in the field it will help you immeasurably, especially if they are an acknowledged science expert in the area of your heart's choice.

From: Gretchen Halpert

Everyone has given you good advice, which tells you what a supportive group science illustrators are! I would add graphite to your list of traditional skills. It is, perhaps, the best traditional medium for developing value and form and is entirely forgiving (erasable).

Along with the GNSI, join organizations of your special interests. Not only will you learn more about the science, you can begin developing a network of contacts for future freelance work. Once you've built a portfolio and want feedback, share it with us. Many of us on this Listserv will be happy to advise you further.

From: Laura Sohl-Smith

I hope it's okay if a lurker pops in. Someone else mentioned Gretchen Halpert's Scientific Illustration Distance Program, and I wanted to chime in about that. I have completed Sessions I and II, and plan to take Session III this fall. I am learning a great deal in this program, and I would absolutely recommend it if

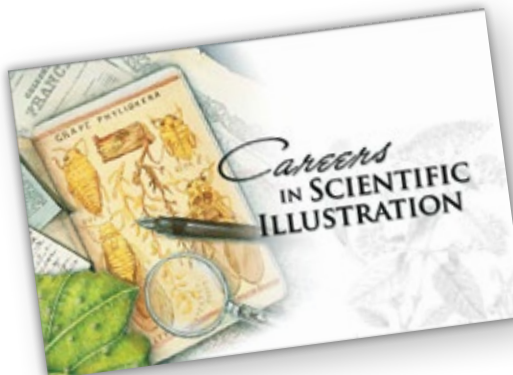
that can be an option for you. The instructor and class critiques of assignments are particularly invaluable. I'm hoping to join this field as well, so I have been paying particular attention to your query and am really glad you are asking about these things—it's such helpful information!

From: Linda Feltner

The new GNSI website has a page www.gnsi.org/education that may add to the fantastic advice that everyone has provided. There are links and ideas that may be of help to you.

I include my voice in suggesting that you join the Guild; it is an amazing group of people.

Above: This 12-page brochure, *Careers in Scientific Illustration*, is available on the GNSI website at gnsi.org/gnsi-brochures. © GNSI



From: Britt Griswold

Among your digital tools you will need a 3D program for rendering. There are a number of them out there, but you should start with a free one like Blender. Here is a page with several possibilities: www.easyrender.com/rendering-software/free-3d-modeling-software

From: Erin Avery

Thank you so much everyone for all the feedback. It's encouraging to know that it can be done! I'll definitely check out the online classes mentioned and try to make next year's GNSI conference.

I'm going to go through all the responses and make a new list based on your advice. I really appreciate the responses and encouragement. Knowing this is such supportive group makes the field even more appealing!



Figure 1: Landlocked Atlantic salmon study, *Salmo salar sebago*. Pen and ink and wash.

All illustrations © Stephen DiCerbo, unless otherwise noted.

The Allure of Ichthyological Structural Color

— Stephen DiCerbo



PART 1: THE SCIENCE BEHIND THE ART

One of the more intriguing places you can find color in nature is in the world of fish. The seemingly unlimited plethora of patterns, pantones, and purposes for fish coloration is a principal reason that I find myself enticed to try and recreate these creatures on paper and canvas.

Fish use color to communicate, camouflage themselves, and contrast gender differences. Color can be used to warn predators and enemies, to attract attention, or to blend into the surrounding environment.

Color tints and hues—along with their patterned arrangements—can vary in different subspecies and strains of the same fish species (genetic) or in response to differences in habitats (environmentally-induced). Color can differ in the same individual at different life stages or during specific engagements and activities. These color variations can change rapidly to suit immediate need or may progress along a more decided timeline.

Understanding the source of color and mechanisms that create color in a fish can substantially help an illustrator's efforts to replicate that color. Physical differences on the macro, micro, and nano levels

vary widely across orders and classes of fish. For the most part, the following information applies to scaled teleost fish.¹

Three known sources of color in fish are (1) pigmented color, (2) structural color, and (3) bioluminescence. The most common and familiar coloration systems are pigmental and structural.

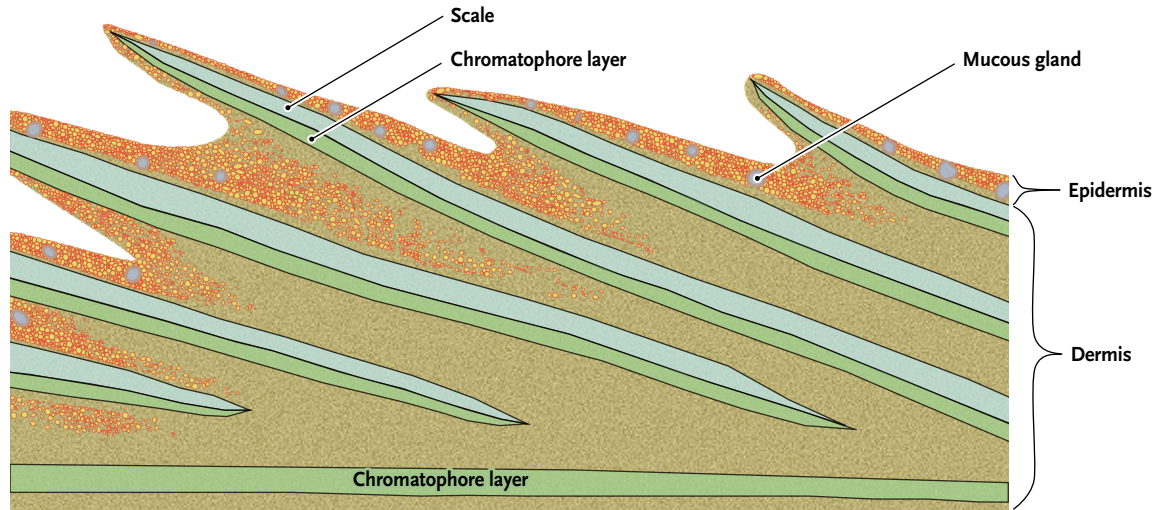
PIGMENTED COLOR IN FISH

Pigmented color originates from a fish's specialized cells known as chromatophores. They are located in the dermal unit of the skin (*Fig. 2*) and may be found in two types of chromatophore layers: (1) those with color-filtering chromatophores and (2) those with color-absorbing chromatophores.

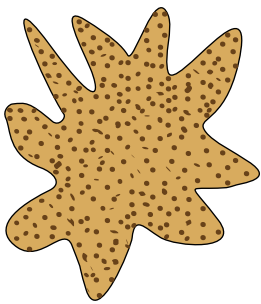
Pigmental chromatophores contain pigment granules that absorb or filter light wavelengths, to the exclusion of the one color we see. Pigmental chromatophores

¹ Teleosts are ray-finned fishes that make up 96% of all fish species.

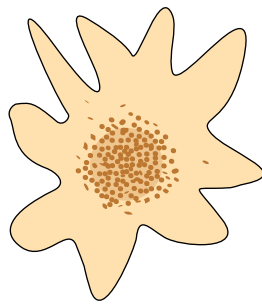
Figure 2: Cross section of typical fish skin.



also have the ability to concentrate or disperse their pigment granules throughout the cytoplasm of the cell, allowing the fish to change the intensity of that visible color (Fig. 3). Somewhat rapid changes in color that involve this alteration of pigment granule concentration are called physiological color changes. They are effected ionically, and can occur in a relative short amount of time, anywhere from seconds to several days.



Widely-dispersed pigment granules result in a darker pigmental chromatophore.



Aggregated granules yield a pigmental chromatophore lighter in appearance.

Figure 3: Physiological color change. Pigmental chromatophores can change the concentration of pigment granules to affect the intensity of perceived color. Dispersed granules in pigmental cells results in a darker cell.

Slower morphological color changes in fish are due to the amount of pigments present within the chromatophores, or the number of the chromatophores present

in the fish. These changes can be initiated by a fish which is adapting to the colors of its surrounding environment, can take months to accomplish, and can be more or less permanent.

Pigmented chromatophores include *melanophores* with melanin pigment (black and brown); *xanthophores* with pteridine and carotenoid pigment (yellow, orange); *erythrophores* which have pteridine and carotenoid pigments (red, orange); *leucophores* (white); and *cyanophores* (blue). Combinations of these chromatophores can create many intermediate colors.

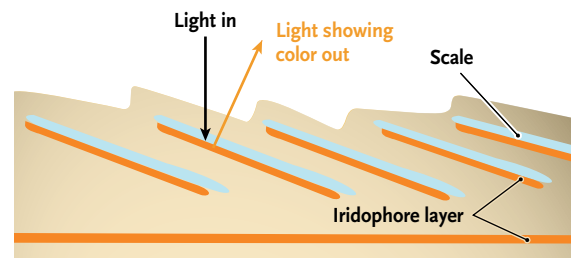
STRUCTURAL COLOR IN FISH

Structural color is achieved with chromatophores called *iridophores*, which lack pigment, and refract and reflect selective wavelengths of light (Fig. 4). This magical coloration in nature is commonly known as iridescence.

Iridescence in fish living in shallow depths seems to serve the purpose of protection by creating a colorful metallic shine that dazzles or confuses predators. The origin of this phenomenon can be found in the iridophoric chromatophores, which contain photonic crystals made of guanine. Guanine crystals are made of an organic compound belonging to the purine molecular group. The growth of guanine crystals located in iridophores is controlled by a mechanism wherein the fish orchestrates the shape of the crystals as they develop. They form as platelets instead of the prisms found in normal crystal growth. This is apparently exceptional and specialized in nature.

Fish can alter the hue of the iridescence (pink, blue, green, bronze, yellow, etc.) by tilting the angle of the stacked guanine crystal platelets within the cytoplasm of the iridophores. When the angle of the platelets changes, the wavelength of the visible light that is reflected back to the observer's eye changes through constructive and destructive interference. This effectively alters the perceived hue of the iridescence (Fig. 5). It is likely fish do this to optimize their shallow water "camouflage".

Figure 4: Locations of iridophores in dermal unit of fish.



NEXT ISSUE: Look for the second part of this article, *Iridescence in the Studio—Techniques that Imitate Nature*.



Figure 6: Spotted seatrout, *Cynoscion nebulosus*, exhibiting both pigmental and structural color. Photo © Rob Choi

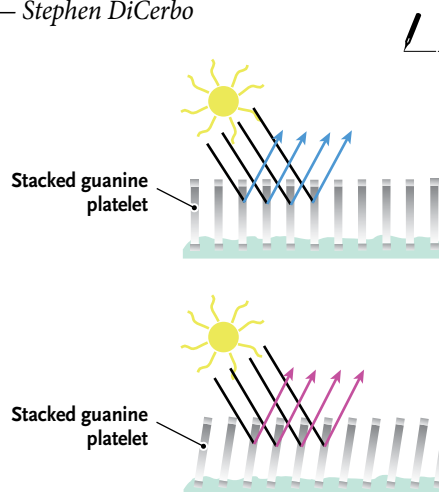
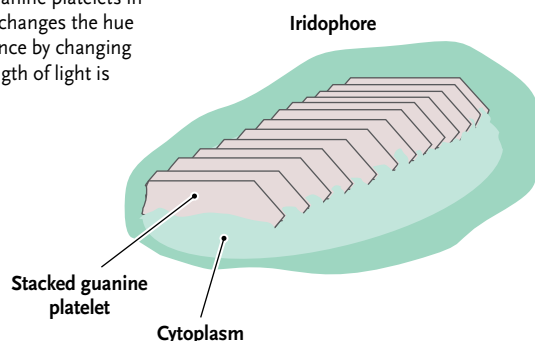
WHAT IS AN ARTIST TO DO?

It is quite an intriguing challenge for an artist trying to mimic the beauty and phenomenon of iridescence. Marveling at the specter of iridescence, we study and observe and try to deconstruct it in an attempt to reassemble it upon our mediums of paper and canvas. It's a struggle. It seems as if it must be an attainable goal but it's baffling. At some point we succumb to the temptation to add metallic paints to our palette. We mix Mica dust in our dye-based inks and colors. Unfortunately, the efforts often result in something that resembles a youngster's glitter-laden craft project.

In the second part of this article, we'll look at art that imitates nature, and explore some techniques and materials for rendering structural color using pigments on paper or canvas.

My thanks go out to Rob Choi, an illustrator with MediVisuals, Inc., and an Old Town Canoe Kayak pro staffer who contributed the photograph of the spotted seatrout (Fig. 6). Rob is also an accomplished Gytaku printmaker. Recently, he teamed up with the Virginia Marine Resource Commission to learn more about a voracious predator by collecting snake head DNA samples. — Stephen DiCerbo

Figure 5: Changing the angle of the stacked guanine platelets in an iridophore changes the hue of the iridescence by changing which wavelength of light is reflected.



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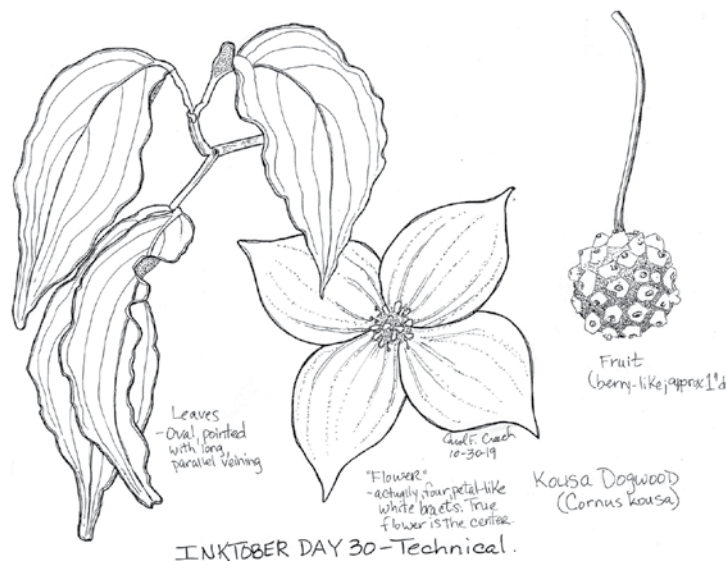
Inktober 2019

— Carol F. Creech

What exactly is an Inktober? A newly-discovered cephalopod? Not quite!

Inktober is an art challenge created in 2009 by artist Jake Parker (see mrjakeparker.com). The challenge was initially intended to help Jake improve his own inking skills and develop positive drawing habits, but has grown into a worldwide affair with thousands of participating artists during the month of October.

Right: Inktober Day 30, Technical. Kousa Dogwood.
© 2019 Carol Creech



INKTOBER DAY 30-Technical.

Many artists, like GNSI members, who specialize in a particular field prefer more specific prompts. SciArtNow created one such prompt list this year.

I have been following Inktober off and on since its creation, but never felt motivated to participate. The prompts always a bit vague to me, and I was never quite sure where to start. The SciArtNow list (*below*) was interesting to see, but very much a medical illustration focus.

When GNSI member Tig Beswick posted to the GNSI Members Facebook page and suggested some sciart-specific prompts, I was intrigued! She asked if anyone wanted to fill out the rest of the list. I let the idea ruminate for a few days and when I saw that no one else responded, I thought, why not? I compiled a list, starting with Tig's prompts, and using the categories found on the GNSI Facebook page to fill in the full 31 days.

The "rules" of Inktober are simple and to the point. From the inktober.com site:

1. Make a drawing in ink (you can do a pencil underdrawing if you want)
2. Post it
3. Hashtag it with #inktober and #inktober2019
4. Repeat

Some people post daily, some every other day, and some once a week. The goal is to be consistent in whatever you choose to do.

Jake provides an official list of prompts to help focus the work, but artists can and do choose their own prompts. The official 2019 Inktober prompts are shown below.

Left: Official Inktober 2019 prompts from @JakeParker.

Right: Modified prompts for medical illustrators created by @SciArtNow.

Next page: Prompts for natural science illustrators curated by GNSI member Tig Beswick.



OFFICIAL 2019 PROMPT LIST

1. RING	11. SNOW	21. TREASURE
2. MINDLESS	12. DRAGON	22. GHOST
3. BAIT	13. ASH	23. ANCIENT
4. FREEZE	14. OVERGROWN	24. DIZZY
5. BUILD	15. LEGEND	25. TASTY
6. HUSKY	16. WILD	26. DARK
7. ENCHANTED	17. ORNAMENT	27. COAT
8. FRAIL	18. MISFIT	28. RIDE
9. SWING	19. SLING	29. INJURED
10. PATTERN	20. TREAD	30. CATCH
		31. RIPE

@JAKEPARKER @INKTOBER #INKTOBER #INKTOBER2019



Inktober

ART PROMPTS FOR A MEDICAL ILLUSTRATION
THEMED INKTOBER, "HEAD TO TOE" EDITION

1. SKIN	16. TEETH
2. HAIR (OR SCALP)	17. FACE
3. SKULL	18. NECK
4. BONE	19. LUNGS (OR ALVEOLI)
5. OSTEOCLASTS	20. HEART
6. MUSCLE	21. BLOOD
7. BRAIN	22. KIDNEYS
8. NERVES	23. GLOMERULI
9. SYNAPSE	24. STOMACH
10. CELLS	25. INTESTINES
11. MITOSIS	26. BACTERIOPHAGE
12. CELL MEMBRANE	27. APOPTOSIS
13. EYES	28. PELVIS
14. TASTE	29. HAND
15. EAR (INNER OR OUTER)	30. FOOT
	31. FULL FIGURE

@SciArtNOW Use #SciArtInk



The GNSI prompt list was sent out on social media, and we were off and running!

Since this was my first Inktober, I really wanted to challenge myself to think of and draw something for

each and every prompt. I am pleased to say that I met the challenge and was thrilled to complete all 31 days! Some days were better than others, but I enjoyed pushing my own creative boundaries beyond my usual botanicals. I was very careful to work from my own reference photos or from public domain images. A few favorites from my month of drawings were:

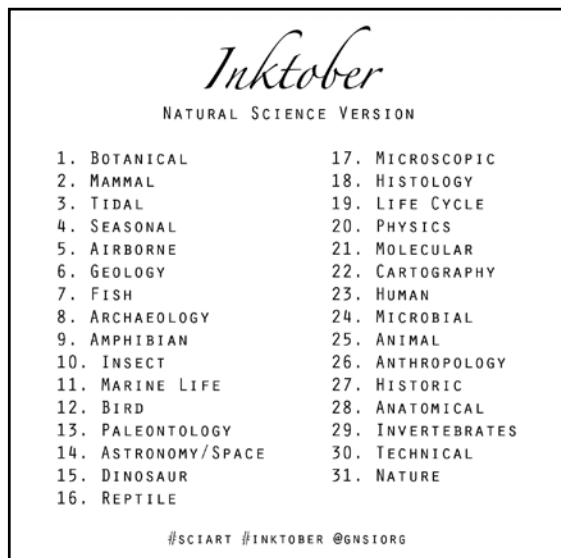
- Day 11, Marine Life: leafy sea dragon
- Day 15, Dinosaur: plesiosaur fossil
- Day 30, Technical: kousa dogwood (a not-quite-traditional botanical plate.)

As the month progressed, I enjoyed following other artists as they posted their work, including a number of GNSI folks. There were many creative interpretations of the various prompt lists. Posting each day really created a sense of community not just among the participating artists, but among other like-minded individuals on social media (Facebook, Instagram, and Twitter.) I made sure to tag my drawings with #inktober, #inktober2019, #GNSI, #sciart, and sometimes a prompt-specific tag like #botanical or #mammal.

Top left: Pattern: ginkgo leaves. © 2019 Mattias Lanas

Top right: Lizard. © 2019 Jennifer Landin

Left: Toad. © 2019 Amy Maltzan



Below: *Othnielia rex*. © 2015 Amanda Zimmerman





Left: Physics. © 2019 Tierney Brosius

Right: Beetle. © 2019 Amy Yaeger



Above: Rhododendron. © 2019 Amelia Janes

Jenn Deutscher, GNSI Social Media Coordinator, provided the following stats on what Inktober looked like for the GNSI social media sites:

Facebook:

- 24,000 reaches (number of unique people the post was delivered to)
- 4,600 engagements (number of times the image was actually interacted with—clicked, liked, etc.)
- 270 reacts (likes, etc.—counts only off the GNSI page, posts shared on other pages don't count towards our likes)
- 217 shares

Twitter:

- 3,900 impressions (= reaches)
- 408 engagements
- 33 likes
- 15 retweets

So how many GNSI folks took up the Inktober challenge? Fourteen members, including myself, responded to the survey I posted to the GNSI Members Facebook page, although I am sure there were many more who participated to varying degrees. I was curious to hear about their impressions of the challenge and what they might do differently, so I asked each of them a set of questions and have included a summary of their responses (*see sidebar at right*).

SUMMARY OF LIKES/DISLIKES

Overall, the response to Inktober was very positive. Most people enjoyed the daily drawing discipline, challenge of the different prompts, and the sense of accomplishment seeing the month's results. Also, viewing social media feeds flooded with new work from other participants and seeing how other artists approached the prompts and rules (black

SURVEY QUESTIONS AND RESPONSES

Q: Was this your first time participating?

Nine out of fourteen participated for the first time.

Q: How many days were you able to complete?

Four of us completed all 31 days, with three others very close to that. Some were only able to complete a few days or a couple of weeks.

Q: Did you use a prompt list? If so, which one? (the official Inktober, the sciart one from GNSI, your own, something else?)

Five of us worked from the GNSI prompt list; five used the official Inktober list; three did not use any prompt list, but created their own theme or used their own inspiration, and one combined the official prompt list, GNSI, and SciArtNow lists.

Q: Do you think you will do it again next year?

All said yes! Some might mix it up and use different media.

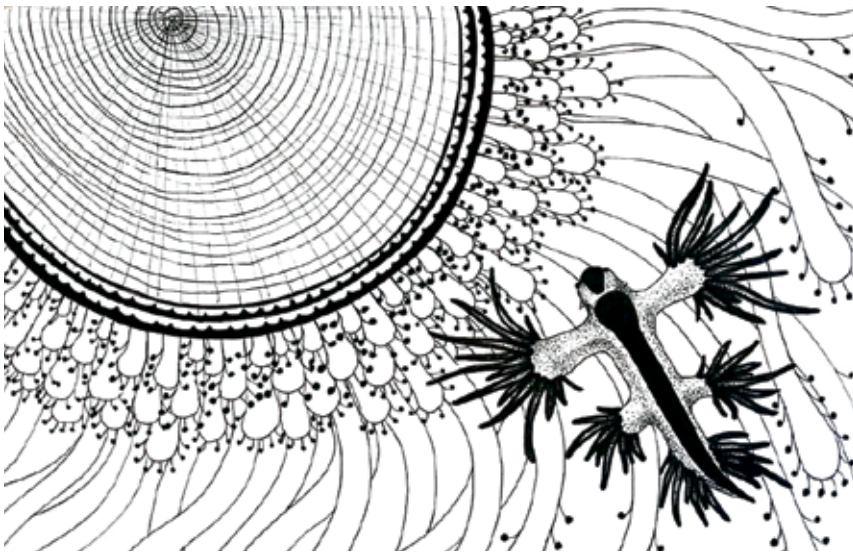
Q: Would you like to see a different prompt list next year? Ideas?

Eight thought the GNSI prompt list is fine as it is; four indicated that some revisions or even a whole new list might be nice for next year to freshen it with new sciart topics; and one indicated a desire to see the broad word prompts with suggestions including "furry" or "endangered" so that artists can interpret that more broadly within a scientific illustration context; and one had no preference regarding the prompt list.

GNSI SURVEY RESPONDENTS

Check out examples of their Inktober entries throughout this article!

- | | |
|-------------------|--------------------|
| • Tierney Brosius | • Jennifer Landin |
| • Carol Creech | • Amy Maltzan |
| • Stephen DiCerbo | • Dino Pulerà |
| • Amelia Janes | • Deborah Shaw |
| • Julie Johnson | • Camille Werther |
| • Ikumi Kayama | • Amy Yeager |
| • Mattias Lanas | • Amanda Zimmerman |



Inktober
Natural Science

5. Airborne



C. Werther '19



21. TREASURE
Happy Tree fruit
Cotoneaster acuminata
Huntington parking
lot - collected 9 Oct - mixed 21 Oct

and white only, time limits, themes, etc.) was really energizing. Many of our GNSI artists appreciated the daily drawing outside the normal pressures of specific projects, with Inktober allowing for a looser, less-finished approach that was very freeing and encouraged creativity. Finally, the focus on technique and consistent practice was invaluable to all participants.

Some downsides to the challenge included carpal-tunnel flare ups, the challenge of the prompts (especially in areas outside of an artist's experience), and the length of the challenge. A month is definitely

a marathon of consistent effort! Sometimes, life gets in the way and the overwhelm takes over. Other artists struggled with their materials or underestimated the time needed to address their desired theme/approach. At least one felt quite drained from keeping up and lost the energy for other projects. However, even with some difficulties, everyone agreed that they would love to try again and have learned from the experience, already thinking of tweaks and ways to make it work better for themselves next year.

INTERESTING POSTSCRIPT ADDRESSING INTELLECTUAL PROPERTY

In late December 2019, controversy arose on social media suggesting that Jake Parker was limiting artists' ability to sell their own drawings from Inktober. He clarified the situation about his recent trademarking

Top left: Animal. © 2019 Julie Johnson

Top right: Owl. © 2019 Ikumi Kayama

Bottom left: Airborne. © 2019 Camille Werther

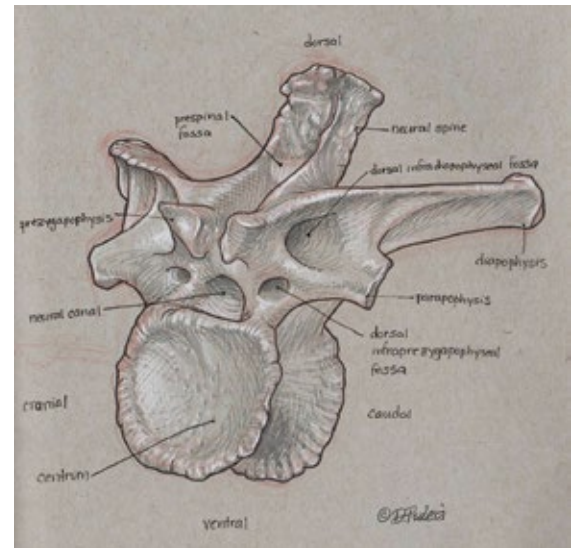
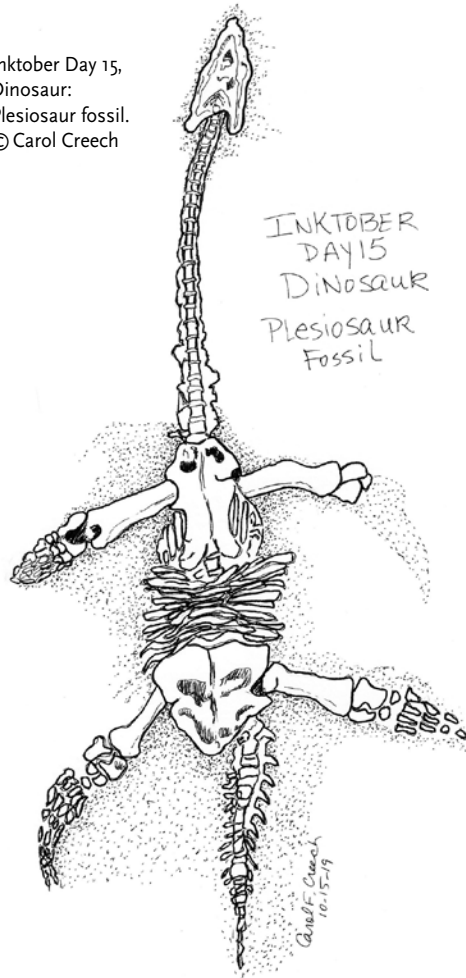
Bottom right: Treasure. © 2019 dbShaw

Left: Inktober Day 15,
Dinosaur: Plesiosaur fossil.
© 2019 Carol Creech

Top right: Paleontology.
© 2019 Dino Pulerà

Bottom right: Pileated
woodpecker. © 2019
Stephen DiCerbo

Inktober Day 15,
Dinosaur:
Plesiosaur fossil.
© Carol Creech



of the Inktober brand and put out a statement on Dec. 20, 2019 addressing this. The statement can be found on his website www.mrjakeparker.com/blog/2019/12/20/inktober, and I encourage you to read it in full, though a relevant excerpt is below:

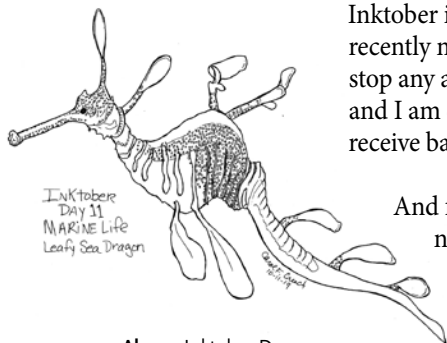
"Inktober is and will always be free to participate in. The hashtag is free to use (as are all hashtags). Every artist is free to sell the drawings they made during Inktober if they want to. Contrary to misstatements recently made on social media, I am not trying to stop any artist from profiting from their own artwork, and I am certainly not trying to steal your work, nor receive back payments from work that has been sold."

And further: "It is not my intention (and never was my intention) to hinder the very artists that made Inktober so popular or marginalize the creators that Inktober was intended to support. I did ask my lawyers to take action against those wrongfully profiting off the Inktober brand. I did so to protect the integrity of the brand, and to protect the investments made by my sponsors, which help make Inktober possible year after year. And in that spirit, I encourage all artists to protect their creativity."

Certainly, intellectual property protection is something all artists can relate to and which many GNSI members have dealt with over the years. It can be a tricky business to navigate without causing some friction.

I hope that if you participated in this year's Inktober that you will continue to challenge yourself to create, imagine, and pursue further development of your skills whenever you have the chance. And if you are just learning about this creative challenge, maybe we will see your work next Inktober?

Please feel free to send your suggestions for prompt list ideas or revisions! E-mail me at carol@ccreechstudio.com.



Above: Inktober Day 11,
Marine Life: leafy sea dragon.
© 2019 Carol Creech

Product Review: STONEHENGE

— Gail Guth and Camille Werther

GAIL'S COMMENTS

I'm not sure where or when I first saw reference to this new paper, but I knew I had to try it out as soon as possible. Legion Paper® introduced Stonehenge Aqua Coldpress Black® in 2019, as "the world's first black 100% cotton paper sized for watercolor." It is designed primarily for metallic and iridescent paints, but I wanted to try it out with colored pencils and other media I have on hand.

Camille Werther has also been experimenting with this new surface, and we decided to join forces for this review.

Our almost yearly excursions to visit my sister-in-law always include a trip to the Blick store nearby, and I was happy to see the stack of Aqua Black pads (Fig. 1a), among all the other goodies (I am lucky to drag myself out of there with minimal damage to my credit card).

The first thing I noticed about the paper is the color: it is a beautiful, deep, rich black—much richer than Canson® Mi-Tientes® or Strathmore® Artagain® black papers (Fig. 1b), both of which almost look like dark charcoal gray in comparison. The paper is quite thick and heavy (140 lb), and has a very even, toothy finish, almost like felt. It seems rougher to the touch than the textured side of Mi-Tientes.

I experimented with a variety of media (Fig. 1c). Prismacolor® pencils behaved much like they do on Mi-Teintes, and I didn't see a great deal of difference, although the color seems to snap a bit better on the Aqua Black. Predictably, the differences became more apparent with wet media. Casein and acrylics just popped off the Aqua Black. Even transparent watercolor looked more lively on this paper. I also tried watercolor ground, then transparent watercolor, which—again predictably—looked great against the black background. A quick, light sanding with 600-grit wet sandpaper smoothed out the watercolor ground even more before applying the transparent

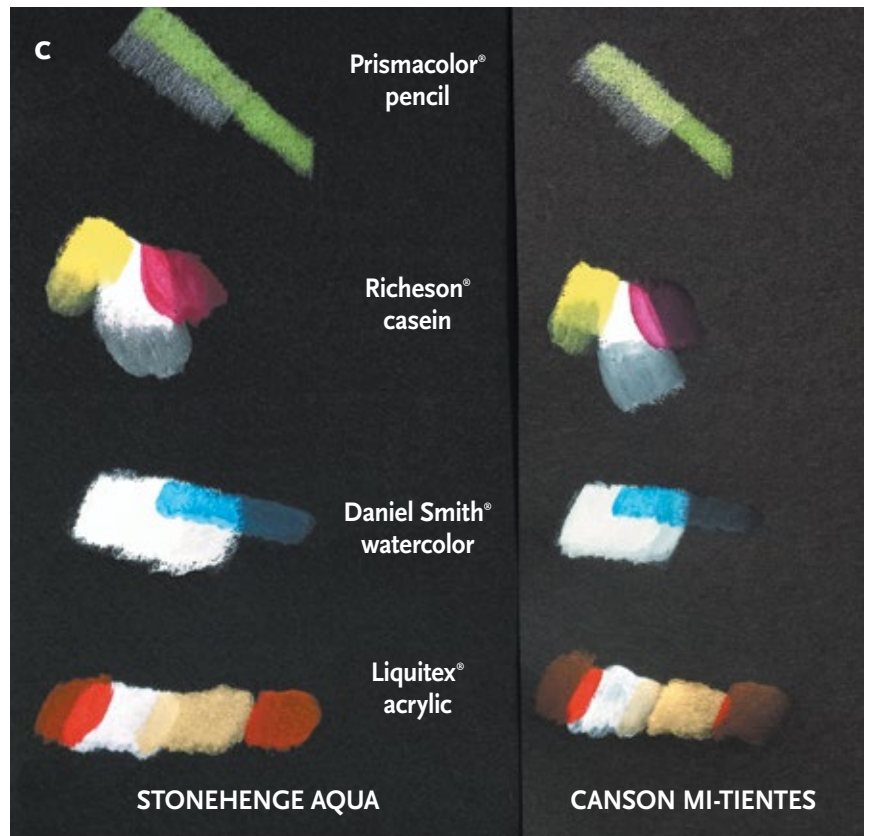
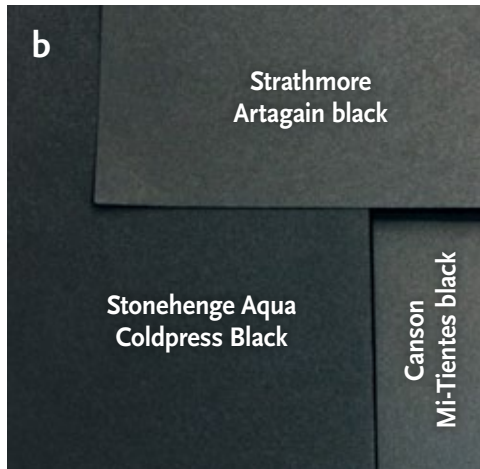


Figure 1: (a) A pad of Legion Paper Stonehenge Aqua Coldpress Black. (b) Comparison of paper color. (c) Comparison of media on Stonehenge Aqua Coldpress Black (left) and Canson Mi-Tientes black (right). (Top to bottom) Prismacolor pencil (white base and without); Richeson casein (solid colors, overlapping color on multiple white coats, and washed colors directly on the paper); Daniel Smith transparent watercolor (directly on paper and over two coats of Daniel Smith watercolor ground); Liquitex acrylics (single coats of red, double coats of white and metallic gold).

watercolor and may help with later applications.

I was surprised at how well regular gouache held up (Fig. 2); the color was strong and clean, without any ground or white background added. But again, application was more by building up color than smooth brushing.

All of the wet media I tried did apply smoothly without the streaking evident on Mi-Tientes, which is more of a dry media substrate.

My biggest issue with this stock is that it's difficult to achieve fine detail due to the fuzzy surface. With a LOT of patience and work, you can apply solid areas of color, but soft brushing doesn't work and achieving fine details with a stroke of the brush is a challenge. It seems better suited to an impasto technique, where you can build up color.

Still, with planning and patience, and for particular images and styles, Aqua Black could be a welcome addition to your substrate arsenal.

CAMILLE'S COMMENTS

I have been using Stonehenge Aqua Hotpress for my botanical colored pencil work and enjoy using the paper. I also use it for acrylic gouache work. Recently, I came across a little (2.5" × 3.75") block



Figure 2: Acryla® white gouache and Winsor & Newton® Designers' Gouache doodles. The Acryla® is the white leafy spray at the lower right, the rest are Winsor & Newton®. The color pops beautifully but you can see the fuzzy edges. Fine details are difficult to achieve.

of Stonehenge Aqua Coldpress Black. I purchased it as an inexpensive way to test the paper for dramatic botanicals.

This paper has a cold-press surface and is very soft, so it is best reserved for water media. I found that aggressive erasing and use of hard colored pencils can mar the surface. However, I was able to use the softest brands of colored pencils to achieve a loose botanical cone sketch. The surface accepted multiple layers and worked up very quickly. In the example here, I used Derwent® Coloursoft®, but I found that their Lightfast line and Caran D'Ache® Luminance® pencils gave similar results (Fig. 3a). Fine details are not easy to add in, so I would

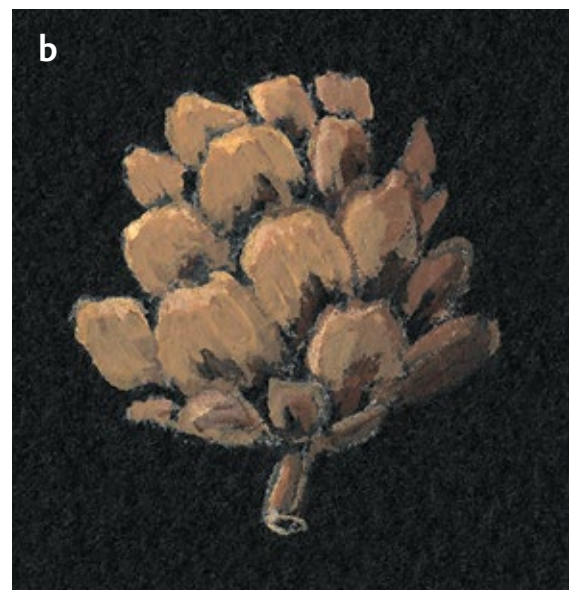
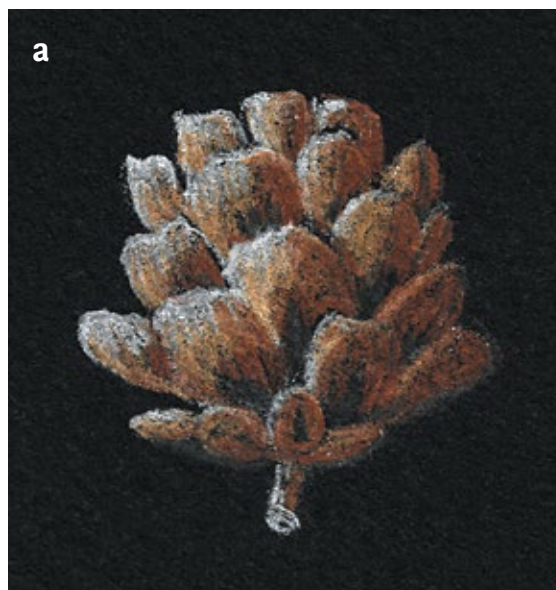
reserve this paper for when a sketchy look is wanted.

I also tried pastel pencils but was less happy with my results.

My favorite test, though, was with the Holbein® Acryla® gouache sketch I did of a conifer cone (I believe it is *Larix* sp.) (Fig. 3b). It responded well to the water media and there was no visible buckling.

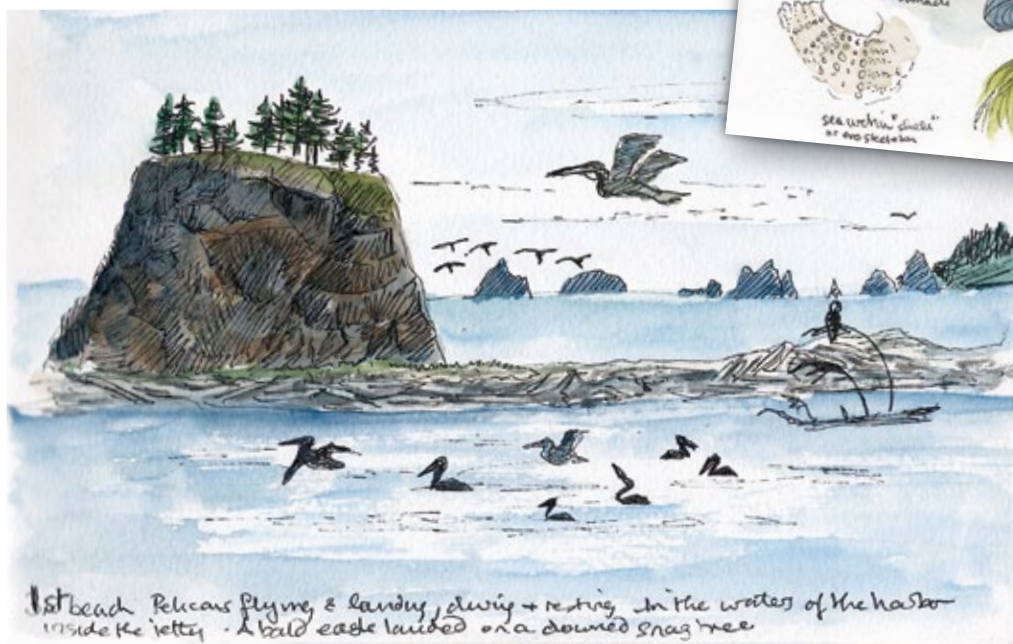
Overall, I would use this paper again for acrylic gouache or quick soft colored pencil sketches.

Figure 3: (a) Larch cone on Aqua Black, rendered in Coloursoft pencils. (b) Same cone rendered in Holbein Acryla gouache. Both images © Camille Werther, 2019



Sketchbook

Frances Topping



Above: I did not expect to see a flotilla of pelicans in Washington state. We watched from a waterfront restaurant while our meal was prepared. Gliding, diving, slowly flapping, they conveyed by. The rock seastacks off the coast are quite striking formations, especially emerging from the mist. Eroded from the mainland they stand like sentinels along the coast.



Above: Sitting at a tide pool sketching mussels, barnacles, anemones and chitons. I thought the chitons were part of the rock—a fossil perhaps—till I realized they were living. I had never seen one previously. It is always exciting to make a new find.



Left: Twinflowers are a favorite of mine. They're not found in southern Rhode Island where I live, but in northeastern New England, and also in the northwestern USA. Banks of it overflowing mossy logs were a treasure. Their delicate flowers were named for Carl Linnaeus, *Linnaea borealis* being their scientific name.



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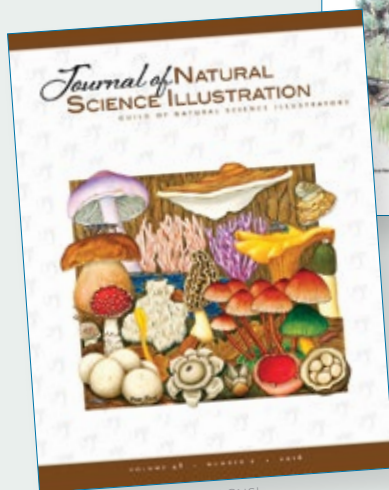
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