

## ESSAY:

### *Drawing as a Way of Looking at the Natural World*

The best way to study an arthropod or plant is to draw it. That is the opinion of Barrett Klein, who combines his training in both art and entomology in his work as a preparator and display maker in the Exhibition Department at the American Museum of Natural History.

“I think the best way for any scientist to understand his or her science is through visualization,” Barrett told us. “Close observation is the first step in any scientific inquiry, and to my mind, there is no better way to observe than to try to draw what you are looking at.”

Barrett described an experience in college to explain what he means. “One of my favorite studies is morphology—the shape of a creature. A college course in insect morphology perfectly fused science and art for me. We each were assigned to choose an organism—mine was a species of longhorn beetle—and to do everything we could to understand its anatomy, its morphology, its external and internal structures. That meant we had to do a lot of collecting, dissecting, and viewing under a 3-D microscope.” For Barrett, the process was one of discovery. “What I saw when I looked at these beetles under a ’scope, or even when I held them in my hands, was so beautiful. But it was even better when I began to draw. Even if you are a poor artist, when you take pencil to paper and just draw the line—not even the shading—you begin to appreciate each structure and understand it better.”

Barrett regards drawing as an important tool for learning. “I will memorize anything better if I write it down or, better yet, if I draw it. A single sketch is more important to me than a page of notes. Even if it’s just a scribble, when I look at

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it later, what I was seeing at the time will click back into my mind three dimensionally.” Try it and see if the same thing happens for you, he suggests.

Sally Goodman, who does highly detailed and realistic drawings of arthropods as part of her job as a curatorial assistant in the Entomology Department at AMNH, agrees with Barrett on the importance of observation.

“The basic materials of scientific illustration are paper and pencil,” she said, “but a good eye is the most important tool of all. Some people think that drawing is just about using your hands, but it is really about using your eyes. You need to look and you need to really see. Sometimes people who have trouble drawing are not really seeing things that are there.”

We asked Sally how to solve that problem. “The best way is to learn what to notice, to learn about the thing you are drawing—a plant, an arthropod, whatever it is—so you know what you should be looking for and what, when you see it, you are looking at. For example, the organism could have legs in a very particular place. Learning the parts of the organism and how it is put together is the first step. If you know that, you’ll look for it, and if you see it, you’ll be able to draw it.”

Aside from studying the organisms you are most likely to encounter, Sally thinks it is a good idea to study the drawings other people have made. “One of the best ways I know to learn how to do something is to observe how others have done it.” Art students study the work of other artists; students who want to illustrate plants and arthropods should do the same.

Sally also suggests taking the time to observe. “In the beginning, pay a lot of attention. Don’t even draw until you have observed and thought about the details of what you are studying.”

Both Sally and Barrett recommend beginning simply with paper and pencil. Barrett uses various leads, ranging from hard to very soft. Pen and ink, and even colored pencils and watercolors, can be added later, but many beautiful and informative scientific illustrations are all in black and white. A stereomicroscope (which has two viewing lenses and offers a three-dimensional view of the specimen) is a wonderful tool for drawing, they said, but if you do not have access to one, a strong magnifying glass and a bright light are helpful.

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They both agree that a good and useful drawing can be done even if you do not think you have the talent or skill. “I think people get hung up on their fears,” Sally said. “I believe everyone can draw, and that it’s really a matter of patience and practice. Begin that practice by rendering what you see as best you can.”

Barrett suggests starting with the form of the organism, a quick line drawing of the outline. “Pay attention to proportion,” he advised. “If you want to represent something accurately, the size of the various parts in relation to each other is important.”

Sometimes drawings are done of specimens viewed under a microscope; sometimes they are done in the field. Some stereomicroscopes have a grid in one lens. “When you look with both eyes, the images fuse so you see the grid over the organism, and then you can draw the specimen square by square,” Barrett explained. When drawing in the field, he suggested using your thumb as a portable measuring stick: “Hold up your thumb and sight along it with one eye to the thing you are looking at. Say the bee resting on that flower is as long as the tip of your thumb to the knuckle, and the wings are about the size of your thumbnail. You can translate those proportions to your sketch pad.”

When drawing a preserved specimen viewed under the microscope, you have time and the opportunity to focus on the tiniest details. In the field, the best approach depends on the circumstances, Barrett said. “Is your subject stationary, or is it in motion? If you’re looking at something that will be there for a while—a flower in the middle of the field, for example—I’d take some time. First do a quick overall sketch, then firm up the outline, and then fill it in. You can add color, if you want, and the finer details later, when you get back inside.” If there happened to a bee on the flower, Barrett noted, “I’d quickly draw its position, or any other thing that represented its behavior, so I could fill in that detail later, too.”

If conditions in the field are changing—if the sun is setting or an ant is rushing past, for example—you need to be fast. “Just do a quick sketch—it might be little more than a scribble—and make a note about color in terms you will understand later. Say it was a sort of a burnt umber or an egg yolk color,” Barrett said.

Speaking of the setting sun, Barrett told us that it is customary in scientific illustration to draw specimens as though the source of light is coming from

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the upper left. “If you use shadows or techniques such as stippling to give your specimen a three-dimensional look, be sure to imagine light coming from that direction so everyone will understand what he or she is seeing,” Barrett advised.

Taking a photograph in the field often helps, especially if your subject is fleeting, but Barrett says it is no substitute for a detailed drawing. “Photographs have a very narrow depth of field, especially with small objects,” he explained. “One plane will have high resolution—you’ll get clear details—but the rest will be a blur.” The best thing is to have both a sketch and a photograph to take back with you.

In Barrett’s opinion, “Illustration beats photography because you can pick out important details and make all the key points visible.” These points can be emphasized in many ways: with darker or bolder lines, with arrows, or even with circles to highlight important features.

Barrett gave us a fascinating example of how a drawing can show a plant-insect interaction in a way that a photograph never could.

“There is a species of fly that lays a single egg inside the stem of the goldenrod. As the larva develops, it starts eating the stem. But instead of weakening and dying, the plant has a defense. It creates a huge stable structure called a gall, a bulbous swelling on the stem. The gall strengthens the stem, but it also serves as a protective home and food source for the insect until it pops out as an adult.

“Now, there is no way you could show that effectively with a single photograph, but in an illustration you could draw a composite that shows what the plant looks like on both the outside and the inside. You would draw a ragged edge to divide the illustration, with a cross section revealing the insect larva inside the gall.”

Drawings like that offer a unique experience: a way to look at, and into, the natural world.