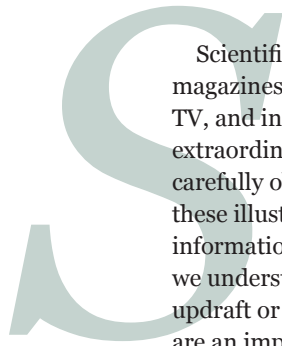




# Art in the

By Meredith Holmes, SWE Contributor

The purpose of scientific illustration is to educate — to explain, clarify, and engage the viewer in new information and ideas. Closely allied with our expanding knowledge of the natural world, the profession is one that women have been involved in for centuries.



Scientific illustration is all around us — in books, magazines, posters, on websites, in films and TV, and in museums. Most of us don't notice the extraordinary technical skill, the precision and carefully observed detail, or even the beauty of these illustrations because we're busy extracting information from them. Maybe for the first time, we understand just how a hawk navigates an updraft or a T-cell engulfs a retrovirus. Visuals are an important part of the way we absorb new information. That's why textbooks are peppered with them, and why exhibits at museums, zoos, and aquariums are so lushly illustrated. Visuals can draw us into a topic we might otherwise ignore. When people — scientists and nonscientists — confront a text-heavy article, they read the headline and glance at the subheads. Then they look at the illustrations, and that's what frequently determines whether or not they read the article.

### A niche for illustration

Drawings can convey information that photos can't. Illustration techniques enable artists to show multiple perspectives, depth, cross sections, and interiors to illuminate a subject. Photographs aren't selective, but illustrations can summarize, isolate, and highlight important elements of a subject for a specific purpose. Medical illustrators, for example, have the opportunity to stand behind surgeons in the operating room, watching and drawing. The finished illustration is a blend of firsthand observation and a focus on a specific procedure. It's informed by a thorough

understanding of anatomy and physiology and conveys the information with more clarity than a photograph would.

Illustrations can show us things we can't see,



© SALLY J. BEINSUSEN, COURTESY OF NATIONAL WILDLIFE FEDERATION.

Above image: Anna Lister, copperplate engraving. From the 1685-1692 edition of *Historiae Conchyliorum*, Linda Hall Library of Science, Engineering and Technology.

# Service of Science

from the interior of a specialized human cell to the trajectory of a comet. Illustrations can also be narrative — describing visually the dynamics of large systems, such as the worldwide effects of El Niño or how greenhouse gases interact with solar radiation. Science illustrators also use data to imagine phenomena of the distant past or the future. We owe our visual impression of the age of the dinosaurs to science illustrators who study plant and animal fossils and geologic data and base their artistic reconstruction of ancient landscapes on these findings.

## Truth and perfection

Some science illustration is geared to public education — murals at an aquarium, for example, enabling visitors to understand at a glance, the

structure of a coral reef. Much science illustration, however, has a scholarly audience, and scientists and science illustrators collaborate very closely. Researchers behind the scenes at the aquarium might be investigating the geology of the ocean floor or evolutionary clues in the fossils of certain fish. When they publish their findings, they need illustrators to tell the story visually and to create perfectly accurate images for their colleagues to study. These images not only communicate research, but they also help amplify and refine it. Because scientific illustrations are the product of careful observation and scrupulous evaluation of data, they stand up to peer scrutiny, generating discussion and further analysis, in much the same way papers and panel discussions do.

Carol Abraczinskas, a graduate of the School

Sally J. Bensusen, "Dead Log," appearing in *Ranger Rick* magazine, shows 33 life forms in and around this rotting Pacific Northwest Douglas fir.



of the Art Institute of Chicago, is principal scientific illustrator and illustration instructor in the University of Chicago's department of organismal biology and anatomy, part of the team working with Paul Sereno, Ph.D., noted dinosaur paleontologist. Abraczinskas has the laser-like

eye for detail that makes science illustrators so valuable to the scientists they work with. Once, when she was teaching a graduate class, she asked a student about a tiny structure on the shell he was studying. The student had not noticed the structure and had to revise his research paper.

## Lifelong Learning in the Sciences

The Linda Hall Library of Science, Engineering and Technology in Kansas City, Mo., is a member of the 19-member Independent Research Library Association. It is the only privately funded research library devoted to science, engineering, and technology in the United States. Although privately funded, it is open to the public.

The Linda Hall Library (LHL) opened its doors in 1946. It was housed in a Georgian mansion on the 21-acre estate of grain tycoon Herbert Hall and his wife, Linda. The Halls, who had no children, placed the house, grounds, and a \$6 million endowment in trust for the establishment of a library that would benefit the people of Kansas City. The first library board of trustees decided that a library specializing in science and technology would benefit the city economically by attracting research and industry. Since 1946, the LHL has been enlarged three times and continues to provide the business community, scholars, students, and city residents with information about science and technology.

The general collection was started from scratch, with an emphasis on journals, monographs, conference proceedings, and technical reports. The LHL is very strong in mathematics, astronomy, physics, and

chemistry. There are extensive holdings in geology and biology, a large patent collection, and a history of science collection that covers the mid-15th to the late 19th centuries.

Three major acquisitions significantly enlarged the LHL collection. In 1946 LHL purchased the collection of the American Academy of Arts and Sciences, which included journals, rare books, and an international

exchange program with scientific organizations. In 1985, LHL purchased 600 titles from the Franklin Institute in Philadelphia. In 1995, when LHL acquired the library of the Engineering Societies, "Engineering" was added to the name.

"Lifelong learning in the sciences" is the mantra of Lisa Browar, president of the LHL. She has been at the helm for three years, after working for some of the best research libraries in the country, including the Beinecke Library at Yale and The New York Public Library's Central Research Library. She has a bachelor's and a master's in English and American literature, an MLS, and an executive master's in philanthropic studies.

"Until now, my career has been centered in the humanities," said Browar. "The collection at LHL was a departure for me. One of the hardest things at first was learning the acronyms for all the engineering societies!" Kansas City is home to many big engineering firms and Fortune 500 companies, all of which use the LHL. Engineers, architects, lawyers, and geologists are frequent visitors.

"The technical community knows we're here," said Browar. The library's collection of paper-based historic building codes, which are not available electronically, are used by architects and engineers, for restoration and repair work. Browar predicts that as the nation repairs its infrastructure, the LHL will be an important resource for civil engineers. The library has codes, specs, and standards for bridges, buildings, and roads going back 200 years.

Browar wants to convince nonscientists that science is fun and useful. She has expanded LHL's public programming to include special events, such as the 2009 Climate Change Symposium, exhibits, lectures, seminars, and multidisciplinary presentations. All programs are videotaped and posted on the library website.

"There is a well-educated public in Kansas

City, and a big appetite for information about aerospace and cosmology," said Browar. The LHL organized a lecture series to mark the 50th anniversary of Project Mercury and got several former astronauts to come and give talks. When former U.S. astronaut Scott Carpenter discussed the early (pre-lunar landing) days of the U.S. space program, the library was packed.

"Using this library is more than taking out a book, or studying a rare book in our history of science collection," said Browar. "Attending a lecture or looking at an exhibit on the website is also

using the library." She believes that as more information becomes available electronically, the LHL will emerge as a strong history of science library. She said, "There will come a point in time when all the books in the stacks will be regarded as 'historic.'"

For more information on the Linda Hall Library, please visit [www.lindahall.org](http://www.lindahall.org).



**Lisa Browar is president of the Linda Hall Library of Science, Engineering and Technology.**



**Nancy Green is head of the digital projects unit of the Linda Hall Library of Science, Engineering and Technology, and co-curator of the "Women's Work" exhibit.**



**Linda Hall Library of Science, Engineering and Technology**

## A suitable occupation

Scientific illustration in the west traces its origins to “herbals,” which flourished in Europe from the 15th to the 17th century. These began as handwritten descriptions of medicinal plants supplemented with illustrations. Other properties of the plants, such as medicinal and culinary toxicity, were usually included, since herbals were used by physicians. With the advent of the printing press, herbals found a wider audience. As the Renaissance opened into the age of exploration, books with illustrations of systematically collected and presented specimens of plants, shells, insects, and birds were used to identify and classify objects from a widening natural world.

Nancy Green is head of digital projects at the Linda Hall Library of Science, Engineering and Technology in Kansas City, Mo. One of her department’s responsibilities is digitizing books, and Green has become familiar with the library’s history of science collection, which includes rare books and original art. She was impressed with the meticulous and beautiful work of early women illustrators. When she discovered the Missouri Botanical Garden Library owned similar works by other women artists, Green decided the two institutions should collaborate on an exhibit.

The result was “Women’s Work, Portraits of 12 Scientific Illustrators from the 17th to the 21st Century,” co-curated with Douglas Holland, library director of the Missouri Botanical Garden. “Women’s Work,” which was on view at the LHL from January to May 2005, featured the work of six early and six contemporary scientific illustrators. (To see the exhibit online, visit: [http://www.lindahall.org/events\\_exhib/exhibit/exhibits/womenswork/index.shtml](http://www.lindahall.org/events_exhib/exhibit/exhibits/womenswork/index.shtml). Three of the six contemporary artists in the exhibit are profiled at the end of this article.)

Green chose the six historical artists in part because their work was signed. “We have many pieces of unsigned botanical art in our collection. I guess ‘anonymous’ really was a woman,” said Green. During the time covered by the early half of the exhibit (1671 to 1903), most women lived restricted lives. Anna Lister, Maria Merian, Elizabeth Gould, Sarah Drake, Anna Maria Hussey, and Sarah Price, however, were able to get around these restrictions. All were educated, and all showed an early talent for art and an interest in the natural world. Painting and drawing were considered suitable diversions for women, and this provided a kind of cover, although most worked under the direction of fathers, husbands, or mentors. Merian’s first published work, three



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volumes of plant and insect illustrations, were intended to be embroidery patterns.

Despite poor health, shaky finances, and collaborators who sometimes took credit for their work, these six artists garnered respect for their expertise in natural history illustration. All were amazingly prolific. Gould, who died when she was only 37, completed illustrations for a 20-part series, *Birds of the Himalaya Mountains*, and a five-volume series, *Birds of Europe*. She also spent two years in Australia drawing birds and animals and completed 50 illustrations for Charles Darwin’s *Zoology of the Voyage of the H.M.S. Beagle*. Darwin’s close study of Gould’s finches and the variety of their beaks led him to formulate the theory of evolution.

The botanical artist Sarah Drake completed more than 1,000 illustrations for one periodical alone. Merian traveled to Surinam in 1699 to continue her research on insect metamorphosis and to paint tropical plants and wildlife. The 72 plates she produced from her fieldwork there were studied by many scientists, including the influential botanist and taxonomist, Carl Linnaeus, who cited her many times.

“The job of the science illustrator has changed since the end of the 19th century,” said Green. “Historically, it was documenting and classifying new species. Illustrators today are making a different point. It’s all about research and communicating advances.”

## At ease in both worlds

Twenty-first century illustrators have sophisticated computer graphics programs and instant electronic reproduction and distribution at their fingertips. Advances in all scientific

Jessa Huebing-Reitinger’s “Phyllis, the Golden Tortoise beetle,” Oil on Canvas 48” x 36.”

Ann Caudle, far right, director of the Science Illustration Program at California State University, Monterey Bay, with students. Caudle is also the principal illustrator at the Monterey Bay Aquarium.



science communication program and the science communication program at the University of California, Santa Cruz, the CSUMB program is 28 years old. It's an intense, one-year certificate program and accepts 15 students each year. "I wish there had been a program like this when I was in art school," said Caudle, who has been with the Science Illustration Program for 25 years. "I started my career freelancing in science illustration, but I basically learned by doing."

Students at CSUMB are trained in both traditional and digital media. "The single biggest change in the profession in the last 20 years has

and technical disciplines have increased our understanding of everything from quarks to quasars, greatly expanding what science illustrators can observe, imagine, and draw. Ann Caudle, director of the Science Illustration Program at California State University, Monterey Bay (CSUMB), said, "Advances in science and science illustration are joined at the hip." And the field has increasingly attracted women, with an interest and aptitude in both art and science, looking for a profession that gives them flexibility and autonomy. Women are often a majority in the program.

While there are quite a few medical and botanical illustration programs, the Science Illustration Program at CSUMB is one of just a handful that focuses on illustrating general science. Established by John Wilkes, founder of MIT's

been the shift to digital media," said Caudle. This was alarming at first, she recalled, but now graphics software is standard equipment in every illustrator's toolbox. "The downside is that a digital image can be endlessly corrected, which puts pressure on the artist," she said. But this also encourages artists to be braver and to experiment more, since a digital mistake is easier to fix than an ink or watercolor error.

Students assemble a portfolio, put together an exhibit, and work with writers in the University of California, Santa Cruz Science Communication Program to produce an online research journal, *Science Notes*. She observes that science illustrators and scientists share many traits and abilities: They are curious, observant, detail-oriented, good at research, and able to absorb and integrate a lot of information rapidly. "Most of our students have undergraduate degrees in science; they love science and are passionate about communicating it," said Caudle. "Illustration is a powerful tool for reaching people, especially with an issue like climate change, where it's crucial for people to really see it, understand it, and care about it."

Marlene Hill Donnelly, "Dicynodon Lacerticeps," an ancient mammal-like reptile, in graphite and carbon dust, illustrates a monograph. A model based on fossils was sculpted and fired, then fleshed out with soft clay. Plants were reconstructed from models made of metal foil and wire.



© MARLENE HILL DONNELLY

### About the artists

The scientific illustrators featured here all had strong interests in both art and science from an early age. Conventional wisdom says art and science occupy different worlds — even different spheres of the brain. These artists prove that a creative/analytical divide is artificial. Two have science training and gravitated to art; one has art training and was drawn to science. None wanted to choose between art and science, and all were delighted to discover scientific illustration. All three artists were open to making sharp career

turns to have a profession that integrated their interests and abilities.

### Living large: Jessa Huebing-Reitinger

The director of Project InSECT, educator, and performance painter, Jessa Huebing-Reitinger knew at age 3 she was going to be an artist. She has a BFA in painting from the Kansas City Art Institute, and for 17 years she was a successful freelancer, doing photo-realism-style paintings for some of Kansas City's biggest corporations. Now, with her husband, she travels all over the



Sally J. Bensusen,  
science illustrator,  
owner, Visual  
Science Studio

*“Science art is a means to an end; it has to teach something.”*

Planetarium. Bensusen has an undergraduate degree in astronomy and was an astronomer and a computer programmer at the NASA Goddard Space Flight Center and for the U.S. Naval Observatory. She has operated her own scientific illustration studio since 1981. Bensusen currently works for a NASA contractor, designing outreach materials about Earth science and space exploration.

### Reconstructing the past:

#### Marlene Hill Donnelly

Except for a one-year hiatus, Marlene Hill Donnelly has worked continuously for the Field Museum in Chicago since 1979. She began as a general illustrator, working for the departments of anthropology, geology, zoology, and botany. She has done freelance work for the Belle Isle Aquarium, the Brookfield Zoo, Defenders of Wildlife, and The Smithsonian Institute. She is active in the Guild of Natural Science Illustrators and has illustrated three science-related children's books for HarperCollins Publishers. For the last eight years, Donnelly has been engaged in reconstructing landscapes from the Triassic and Jurassic eras for the geology department at the Field Museum. She studies analogous landscapes in Hawaii, Washington state, and Chicago. She then combines data about rivers, flood plains, and water flow with the fossil evidence in her illustrations. ■

Marlene Hill Donnelly,  
scientific illustrator, Field  
Museum, Chicago



*“An important part of what illustrators do is visual thinking for scientists. The interaction of the scientist and the illustrator is part of the scientific thinking process.”*



Jessa Huebing-Reitinger, director,  
Project InSECT

*“I want to emphasize the individuality of the subject. I name the insects, not to anthropomorphize them, but to chip away at people's phobias and to increase understanding of the web of life.”*

United States talking to children and adults about insects and demonstrating her painting techniques. Huebing-Reitinger sets up in a public space and over the course of a one- to six-month residency, paints a gigantic portrait of an insect.

### A means to an end: Sally Bensusen

Although she has little formal art training, Sally Bensusen's illustrations are published regularly in *National Geographic*, *Smithsonian*, *Scientific American*, and *Nature Conservancy*. For many years her work appeared on every cover of the National Science Foundation magazine, *Mosaic*. As a child she divided her time between drawing, roaming the Museum of Natural History in New York, and learning about astronomy at the Hayden

By Meredith Holmes, SWE Contributor

Observation is at the heart of both representational art and science. Jenny Keller, a science illustrator and author of the chapter “Why Sketch?” in a new collection about field observation techniques, *Field Notes on Science and Nature*, suggests that scientists try sketching while they’re doing fieldwork: “Careful observation makes you a better scientist, and drawing is a great way to observe.” Of course, it works the other way, too. The more informed illustrators are about their subject, the more clearly they will see, and the more accurate and informative the resulting illustration.

### The world around her

Growing up on an Arabian horse farm in Wisconsin, Jessa Huebing-Reitinger drew constantly. She was captivated by the natural world and very particular about drawing what was around her — animals, leaves, flowers, and trees. Encouraged by her parents, Huebing-Reitinger took an adult community college class in pastel portrait drawing. Putting her newfound skill right to work, she accepted her first paid commission for a horse portrait when she was 12.

She had her pick of colleges, but chose the Kansas City Art Institute because it offered a Disney



The discipline of science illustration offers a unique pathway of expression.

# It's All about

internship for illustration majors, and she was determined to be a Disney animator. Enter Wilbur Niewald, painting instructor. “His class changed my career path,” said Huebing-Reitinger. “Right teacher, right time; I fell in love with painting.” She ditched the Disney idea and graduated with a BFA in painting.

Fresh out of art school, Huebing-Reitinger launched a successful freelance business doing commissions for big companies like John Deere, GE, and Sun Microsystems. For 17 years she honed her photo-realism technique, producing enormous paintings of industrial equipment.

“I did things like cherry pickers and tractors in a hyper-real style, kind of floating with shadows,” she said. “They were very metallic and mechanical — very masculine.” Some of these paintings were so big they had to be done on-site in the lobbies of office buildings. “That’s when I got used to painting in

public. People would talk to me and ask questions, and I found I liked interacting with people while I was working.”

Eventually Huebing-Reitinger became dissatisfied with machine parts and decided she wanted to return to painting nature and wildlife. After many brainstorming sessions with her husband, she hit on the idea of painting gigantic portraits of insects in public spaces, and Project InSECT was born. Now the couple travels all over the United States, taking Project InSECT educational programs to schools, museums, and community centers. Huebing-Reitinger and her husband did extensive entomological research before embarking on Project InSECT, and Huebing-Reitinger consults with local entomologists for each residency. While her husband handles most of the outreach in schools, Huebing-Reitinger sets up in a public space and

*"Agnes the Cicada,"* © Project InSECT LLC. Dog Day Cicada, Oil on canvas. Jessa Huebing-Reitinger  
[www.projectinsect.com](http://www.projectinsect.com)

paints an insect portrait. She talks about painting techniques and about the specimen sitting for its portrait in a nearby stereoscope.

Noting that many people loathe and fear insects, and that this aversion can be contagious, especially among young children, she said, "People come to my presentations hating insects and leave swearing they'll never step on another one."

### Orders of magnitude

Sally Bensusen's father was an art director, and when she was a child, her parents allowed her to draw and paint as much as she wanted. She recalls an early insight that arose while drawing. "Little girls are supposed to love drawing horses. I loved drawing *parts* of horses, and I also liked looking at anatomy books to see how people and animals are put together," Bensusen said. "I figured out that a horse foot is remarkably like a human foot with the parts rearranged. I think this was the beginning of my understanding of conceptual art."

Bensusen's other favorite thing was science. She grew up in New York City and spent most of her free time at the Museum of Natural History and the

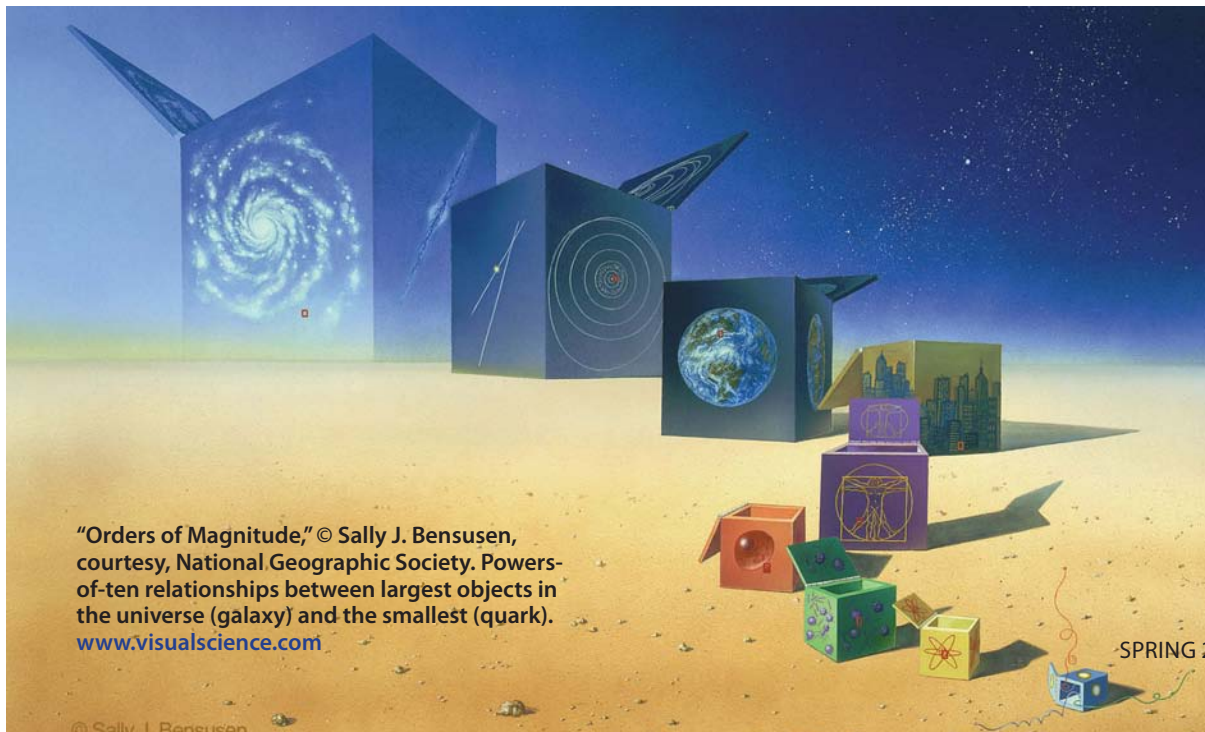
Hayden Planetarium. "The museum was my second home," she said, "and I went to the planetarium show every Saturday. My father would fall asleep, and I was completely enraptured. That's what got me interested in astronomy."

She spent summers with her grandparents in California, where she could experience nature firsthand. "I loved insects, too," she recalled. "I rescued bees from the swimming pool, and observed them in a jar until they recovered. Microcosm to macrocosm — it was all fascinating to me."

Bensusen has an undergraduate degree in astronomy and was an astronomer and a computer programmer at NASA Goddard Space Flight Center and for the U.S. Naval Observatory. She was beginning to think about a career change, when she discovered the Guild of Natural Science Illustrators and took many of the classes they offered. "I was delighted to find that people were making art in the service of science, and getting paid for it," she said. Smitten with the idea of combining her two strong interests in one career, Bensusen left her job at the observatory to do freelance science illustration.

Her favorite freelance job was illustrating the "Biomechanics" column in *Natural History* magazine, a feature she developed that showcased the research of a different scientist every month. She collaborated closely with the scientist, discussing the best way

# Paying Attention



*"Orders of Magnitude,"* © Sally J. Bensusen, courtesy, National Geographic Society. Powers-of-ten relationships between largest objects in the universe (galaxy) and the smallest (quark).  
[www.visualscience.com](http://www.visualscience.com)



to convey the idea, then reviewing and revising sketches. “It was all about illustrating the science creatively, accurately, and clearly so the readers could grasp it.”

Bensusen currently works for a NASA contractor, designing outreach materials about Earth science and space exploration. She describes it as “teaching at a glance.” She creates lenticular cards, posters, and other novelty items to grab children’s attention and make them want to learn more. She has not painted traditionally for several years; she does all her work electronically, working with satellite data, figuring out how to make it move and how to make it three-dimensional. It’s a challenging genre of conceptual science illustration, but Bensusen was reminded recently that it’s worth the effort. She was representing NASA at a conference, when a 10-year-old girl walked up to the NASA table with her mother and announced that she wanted to analyze satellite data when she grew up. “It was great,” said Bensusen. “I gave her every puzzle, ruler, and poster we had. Sometimes you get the response you’ve been hoping for. All scientific illustration is conceptual. It is art to help people understand an idea.”

### An unusual family tree

Marlene Hill Donnelly comes from a family of artists. “As a kid, art was just part of my life,” she said. “But my more focused interest was science. Most of the family members who weren’t artists were engineers, and I’m also very interested in what engineers do.”

She received her bachelor’s in zoology from the University of Illinois and then worked in veterinary pharmacology for a while. She had no idea that art and science could be combined in a career until she met the science illustrator at the veterinary school. Donnelly then went to the American Academy of Art in Chicago and earned a graphic arts degree. Before her current position with the Field Museum in Chicago, she worked for about a year and a half at the Brookfield Zoo. There, she illustrated wolves engaged in various behaviors that she put together

from a series of photographs and life sketches. “This is often what an illustrator’s work consists of,” said Donnelly. “We do things that can’t be photographed outright.”

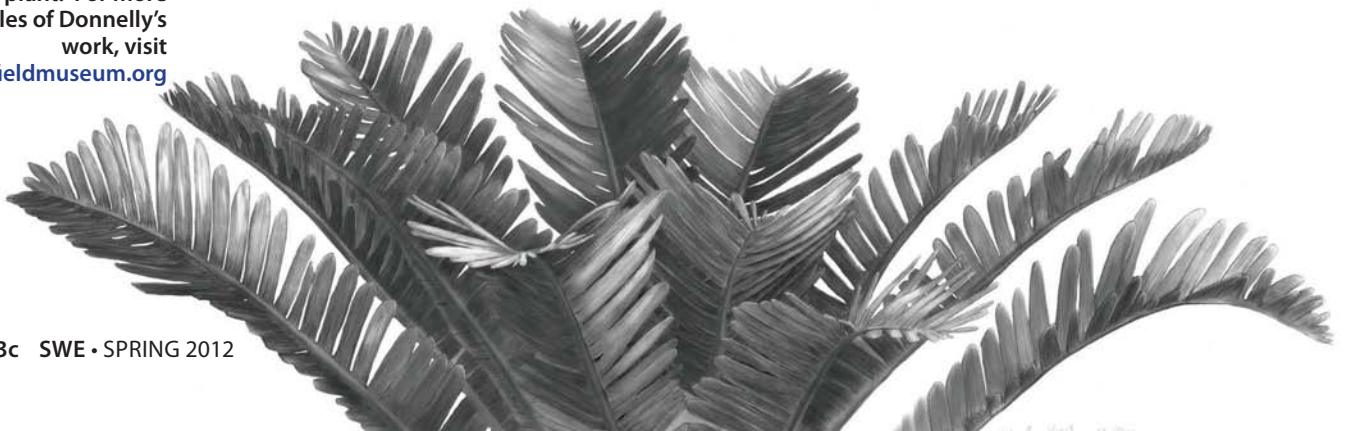
Donnelly has worked closely with Jennifer McElwain, Ph.D., a paleobotanist who is an expert in ecosystems of the past. The interaction of the scientist and the illustrator, explained Donnelly, are essential to moving the project forward. “Dr. McElwain put in writing her understanding of a prehistoric ecosystem, thinking through as much as possible what the features of that landscape were and what it would look like. Then I would bring her a sketch, and she would say, ‘No, that’s not it,’ and explain another aspect of her research.” Donnelly would then integrate the new information into a revised sketch.

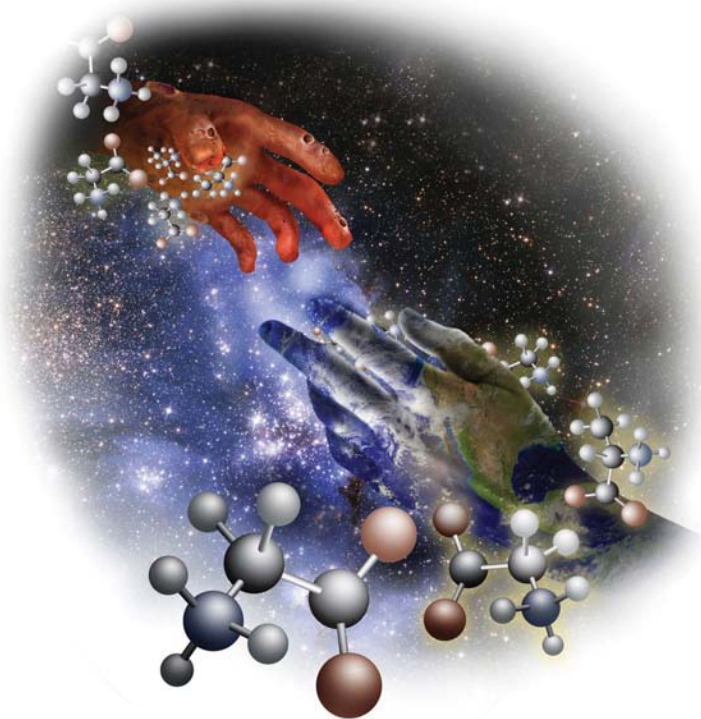
For the geology department at the museum, Donnelly reconstructs landscapes from the Triassic and Jurassic eras, approaching these re-creations in an engineering-like fashion. She builds sculptural models of extinct plants for which there is no modern equivalent. She uses a variety of materials to test elasticity and strength, to determine the probable final posture of the leaves on the branch, and to get an accurate count of the number of leaves on a branch. This gives her further information on which to base her images of prehistoric plants. Donnelly frequently works in the field, studying analogous landscapes in Hawaii, the state of Washington, and in Chicago. All these data inform her illustrations. If she shows a tree submerged in water, that’s because there’s evidence in the fossil to back up such a visualization.

### Learning the discipline

Students enrolled in the California State University, Monterey Science Illustration Graduate Certificate Program (CSUMB) represent the next generation of science illustrators. Under the guidance of Professor Ann Caudle, program director, principal illustrator at the Monterey Bay Aquarium, they have produced outstanding work. Following is a sampling from recent graduates.

“Pterophyllum,” © Marlene Hill Donnelly, courtesy, Jennifer McElwain, University College, Dublin. Carbon dust reconstruction of a Triassic plant. For more samples of Donnelly’s work, visit [www.fieldmuseum.org](http://www.fieldmuseum.org)





### “Shaking Hands With Mars”

© Emily Cooper

Mixed media; photograph, public-domain NASA photos of Earth and Mars, created in Adobe Photoshop and Illustrator.

Emily Cooper — [www.cooperhawk.com](http://www.cooperhawk.com)

Emily Cooper created “Shaking Hands With Mars” in 2005 when she was a student in what was then the University of California, Santa Cruz Science Illustration Program. The image accompanied an article about the search for amino acids on (or from) Mars, and the importance of that investigation to our understanding of life on Earth. Almost all amino acids that make up life forms on Earth have the same chirality (structural characteristic of a molecule that makes it impossible to impose on its mirror image), or “handedness.” The article argued that understanding the relative chirality of martian amino acids could give us clues about life on Mars, and the origin of life forms on Earth.

Cooper graduated from the UCSC (now at CSUMB) Science Illustration Graduate Certificate Program in 2005. She completed an internship with *Scientific American* magazine in New York and then worked with illustrator Bryan Christie. She now does freelance illustration for *IEEE Spectrum*, *Scientific American*, and *SmartMoney*, occasionally taking on larger textbook projects in geology and astronomy. She uses 3-D modeling software for much of her work.

### “Natural Roots of the Urban Landscape”

© Michelle Thomas

Digitally created in Adobe Illustrator

Created in 2011 to represent the inextricable link between the so-called urban environment and the “natural” environment.

Michelle Thomas — [www.michellethomas.com](http://www.michellethomas.com)

Michelle Thomas believes a false dichotomy is created by the use of certain terminology — such as “wilderness” and “society” — that allows us to separate the environment artificially. Seeing the world holistically, she believes, and searching for the natural roots of places would be a great benefit to all. Thomas is convinced that we can restore what occurs naturally in a place by finding ways to blend the human, altered environment with the original natural one.

After graduating from the CSUMB Science Illustration Program in June 2011, Thomas did a three-month internship at the Denver Botanic Gardens, where she worked on flower and seed illustrations. She now freelances on a variety of projects, from package design to illustrating newly discovered species for a botanical research garden.

