ACADEMY

FRONTIERS

INSIDE:
Students Digitize Collections

The member magazine of the
Academy of Natural Sciences
of Drexel University

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Academy membership includes a subscription to *Academy Frontiers*, free general admission to the museum, discounts in the Academy Shop and Academy Café, invitations to special events and exhibit openings, and much more.

For information about Academy membership, call 215-299-1022 or visit ansp.org/membership.

On the cover: *Allegheny College senior Rebecca Anderson photographed 100 scallop shells from the Michael Cahill Collection, donated to the Academy in early 2015. She combined 100 separate images into a plate showing the shells at their correct relative sizes. Anderson is following in the footsteps of her grandfather, George Davis, and her step-grandfather, Robert Robertson, both of whom are former Academy malacology curators.*

Academy Greetings

Katie Clark/ANS

Dear Friends,

The Academy's affiliation with Drexel University has prompted countless interactions between scientists and students, enriching the experiences of Drexel scholars while driving our research forward. Many of these relationships are a direct result of the Drexel cooperative education program, known as Drexel Co-op, which offers students experiences in their chosen fields and opportunities to contribute to the everyday operations of their workplaces. We have benefitted tremendously from inviting Drexel's brightest young minds into our museum, scientific collections, and laboratories. From caring for our live animals to helping test samples from the Delaware River Watershed, students are demonstrating their talents and dedication to our work.

Drexel Co-op has made it possible for Academy scientists to meet more students interested in natural history, and these eager learners have become wonderful resources for work focusing on the digitization of our scientific collections. Digitization, the act of creating a digital record of a specimen complete with relevant data, has opened doors to students in fields ranging from biology and systematics to information systems and the arts. Through the creation of digital records, students help the Academy place our specimen data at the fingertips of scientists worldwide. Making this information accessible helps prevent the accidental destruction of irreplaceable specimens in transit and preserves them for future research.

Students constantly push us to challenge our assumptions, keeping our museum and research enterprise young and innovative. Your gift to the Academy helps us to inspire the next generation of scientists through internships, field trips, lessons, and museum programming. Thank you to our generous supporters who have already contributed to the Academy's annual fund. There is still time to make a contribution that will help us advance research, education, and public engagement in biodiversity and environmental science. Your gift makes a significant difference in our work.

All the best,

George W. Gephart, Jr.
President and CEO

FOUNDED IN 1812, the Academy of Natural Sciences of Drexel University is a leading natural history museum dedicated to advancing research, education, and public engagement in biodiversity and environmental science.

Contents

TERAMACHI'S SLIT SHELL
Bayerotrochus teramachii (Kuroda, 1955)
This is a slit shell, one of fewer than 30 surviving species in an ancient family that was abundant in all oceans from the Cambrian to the end of the Cretaceous era. The slit is a natural feature; it forms a duct that channels water out of the animal's gill cavity. Slit shells have long been known as fossils but were thought extinct before a living one was found for the first time off the West Indies in 1879. They have since been found in South Africa, Australia, Japan, and elsewhere.

Paul Callomon/ANS

Tarantulas: Alive and Up Close

Special Exhibits Gallery
January 30–May 30, 2016

Tarantulas have a reputation that precedes them—terrifying, fast, hairy, scary—the biggest, baddest, and most fearsome of all spiders. In the Academy's newest hands-on exhibit, *Tarantulas: Alive and Up Close*, you will come face-to-face with a stunning array of live tarantulas—fangs and all. Play a guessing game to learn about speedy tarantulas that dwell in the highest treetops and others that live underground, only emerging under cover of darkness to ambush their prey. Find out why certain species prefer the desert and the rainforest, and learn how tarantulas may play an important role in human medicine. Get the facts on why tarantulas are so hairy. Explore a tarantula burrow, see live feedings, check out arthropods under a microscope, and dress up like an eight-legged beast to get your photo taken!

NEW ARTIST

Drawn to Dinosaurs

Art of Science Gallery
Open Now

Drawn to Dinosaurs delves into the science and art of visualizing a living animal based on fragmentary fossils. This intimate exhibit illustrates what scientists can deduce from the fossil record when creating a reconstruction of a skeleton or model and what they must look to artists to interpret. The centerpiece is a full cast of the plant-eating dinosaur *Hadrosaurus foulkii,* discovered in 1858 in Haddonfield, NJ. The Academy created a full cast of this duck-billed dinosaur and put it on display in 1868, becoming the first place in the world where the public could go to see a dinosaur. In March 2016, artist David Zinn offered his own interpretation of *Hadrosaurus foulkii*. Check out the time-lapse video at ansp.org/drawntodinos.

Mike Servedio/ANS

Dinosaurs Unearthed

DINOSAURS UNEARTHED®

Special Exhibits Gallery
June 25, 2016–January 16, 2017

Back by popular demand—roaring, moving, life-size animatronic dinosaurs invade the Academy of Natural Sciences of Drexel University for a multi-sensory experience for the whole family. State-of-the-art and scientifically accurate—down to the feathers on *T. rex*—*Dinosaurs Unearthed* features more than a dozen realistic, full-bodied dinosaurs, as well as skeletons, fossil casts of skulls, claws, and horns, real specimens of mosasaur and spinosaurus teeth, an *Oviraptor* egg, and the ever-popular coprolite (dino poop). Visitors will experience brand-new interactives, such as a multi-touch table and a scale that tells you how you measure up to different dinosaurs. A Dino Detective touch-screen quiz, chances to control dinosaur movements, and other activities encourage exciting hands-on exploration.

MISS CHRIS: THE HAPPIEST CAMPER

By Mary Alice Hartsock

Mike Servedio/ANS

You may know her as the voice behind Marty the Moose, the hand puppet and captain of quips you often meet at the Academy's special story times. When she's not talking your ear off as Marty, she transforms into Miss Chris. And if anyone can compete with Marty's sidesplitting act, it's Miss Chris in full summer camp mode—blue shirt, sleeves rolled up, hair pulled back, and ready for anything.

As camp coordinator, Miss Chris (or Christine Danowsky, as her colleagues know her) is determined to make your kids love science as much as she does. That takes more than just showing up on weekdays in July and August. Planning summer camp is a yearlong operation behind the scenes. She develops themes based on topics that will be exciting and up-and-coming for kids, arranges field trips where kids can dig for fossils or meet live animals, and figures out how to make the activities suitable for all learning styles and personalities.

"It's summer, so you have to make sure everyone's having fun all the time," she says. "We are making memories that I hope will last a lifetime."

Danowsky came to the museum as a Girl Scout for overnights, and she grins as she tells me about sleeping next to the Tiger diorama. She knows how to create memorable experiences both for kids who are obsessed with all things science and for children who aren't sure how they feel about science. She used to be part of the latter group.

"At school, we did science from a textbook," she says. "I got interested because my mom was really into doing experiments with us at home. As a teacher, I want to make sure kids have real-life experiences they can use every day."

Danowsky became head of summer camp at the Academy three years ago after being an Academy camp group leader since the program started in 2009. In addition to summer camp, she's in charge of spring and teen camps, Tiny Tot Explorers, overnights, birthday parties, and scout programs. She has taught toddlers and watched them grow into teens, and she has worked with just about every learning ability and style.

That includes kids who aren't sure they are ready to be away from home (even for day camp) and kids who are shy and reserved. While bringing all the kids out of their shells with dinosaur jokes and dance breaks, she also encourages kids to write letters home to share what they've learned each day. Danowsky checks in regularly with the quiet observers in the group, asking them what they noticed about experiments to encourage participation. She and her camp counselors also are trained to work with children with autism and other learning challenges.

After a few hours or days, most kids forget about their worries and get wrapped up in the excitement of science adventures such as behind-the-scenes experiments and off-site field trips. Campers have discovered mosasaur teeth and sea urchins while digging for fossils, and a few have even met stingrays at a local aquarium.

Back at the museum, Danowsky emboldens kids to move around, call out answers to questions, and get their hands dirty during experiments. With her encouragement, kids regularly share their opinions and guide their own learning, making connections between science and their everyday experiences. By the end of a camp week, she will, without a doubt, have inspired a few future scientists.

"Kids often ask me why scientists have called newly discovered species by certain names," she says. "When I explain where a scientific name came from, kids think it's awesome, because they realize they can do the same thing."

Mike Servedio/ANS

By Mary Alice Hartsock

Mary Bailey says she has a "healthy respect" for tarantulas. In other words, she's terrified. But she's determined not to be.

Her jitters have become a favorite topic of conversation among Academy staff, and today at least 15 of her colleagues are squeezed into a narrow area behind the scenes where Bailey is about to take the plunge. With *Tarantulas: Alive and Up Close* taking up residence in the Special Exhibits Gallery, Bailey has decided, once and for all, to come to terms with her fear of the hairy, eight-legged beasts. Today she is going to pick up and hold a tarantula.

Bailey wants to be able to handle tarantulas herself and to move them into special enclosures for outreach lessons. During the run of the exhibit, educators are doing regular live animal shows with tarantulas, and live tarantulas are sometimes out for visitors to examine up close at the Academy's Carts of Curiosity. As manager of public engagement, she is in charge of all activities on the museum floor, so Bailey feels she must be as adept at handling tarantulas as her bravest staff and volunteers.

As she approaches the tarantula enclosure, her wide-eyed expression is priceless, equal parts concern and tenacity. "I'm just trying to overcome my natural disinclination to touch something that scares me," she says.

Protectively observing the scene, Academy invertebrate specialist Karen Verderame isn't going to let anything go wrong. She is an expert at handling all kinds of invertebrates, including tarantulas, and she is giving her colleague instructions. To ensure that Bailey has a good experience, Verderame has chosen the rose-hair tarantula, which often is the first tarantula to be handled by new keepers because of its docile nature. Like other tarantulas, the rose-hair does have venom, but its venom is designed for small prey and is unlikely to severely harm a human.

Even though the rose-hair has ½-inch fangs and barbed hairs on her abdomen, Bailey isn't really afraid of a bite or scratch.

There's something about the seemingly haphazard, confused movements of tarantulas' appendages that makes her skin crawl. "It's their legs … the way that they move, tip-toeing through things," she says.

Bailey is fidgety. Her eyes crinkle as she gingerly reaches into the enclosure to touch the top of the tarantula's mid-section. "Awful kitten," Bailey says, laughing as the tarantula touches her hand. "This animal is so cognizant of its surroundings, and as I'm experiencing her, she's experiencing me."

On her second try, Bailey barely flinches, and the rose-hair crawls into her palm. She's soft and lightweight but dense, Bailey says. She can feel the tarantula's hooks in her palm, but in the moment she is more worried about harming this fragile beauty than she is about the spider hurting her.

The tarantula starts to walk, and Verderame gives instructions on how to use two hands to keep the tarantula safe. Bailey soon wonders out loud whether she's ready to handle a tarantula on-the-go. She gently returns the rose-hair to her enclosure.

Now Bailey is smiling, knowing she has crossed a major barrier.

"When I am standing here holding this creature, I can feel each of her legs and how deliberate her movements are, and I am reminded how incredible evolution is," Bailey says. "It resulted in an animal that is so foreign but so perfectly adapted to its environment that my appreciation outweighs my fear."

WALKING INTO SPIDERWEBS

By Mike Servedio

Almost every weekend when the weather is tolerable, you can find me hiking, most often in some of the most remote parts of eastern Pennsylvania. I have also traveled to distant locales including the deserts of Southern California and Nevada, the rugged mountains of Montana and Alberta, and the alpine areas of the Sierra Nevada Mountains. While each location contains its own specific flora and fauna, one resilient animal shows up in almost all of my hiking adventures: the spider.

Over the last few years, my hikes have become strenuous. I hike through challenging terrain and very often without following a concrete trail system. One thing I've noticed as I have left trails behind is that I end up walking into a lot of spiderwebs. They stick to my hat, hair, and glasses. They end up in my mouth. Sometimes accidentally bringing down webbing brings a spider with it.

And while I pride myself on being an animal lover, I can definitely say that it took some time for me to warm up to spiders. They are a bit creepy looking, they have set up small silk clotheslines throughout the forest, and their bite can be painful if you are unfortunate enough to be bitten. But after almost a decade of working at the Academy and attending eight Bug Fests, I think I've finally learned to appreciate our arachnid friends.

WHY SHOULD YOU LOVE SPIDERS?

THEY HOLD AN IMPORTANT PLACE IN THE FOOD CHAIN. Most notably, they kill and feed on insects such as flies and mosquitoes, helping to control insect populations. While a mosquito might cause an itchy bite and a fly might buzz around you while you try to eat, a spider will often avoid human interaction. Spiders are also a food source for birds, lizards, toads, wasps, and other spiders!

THEY CAN BE REALLY BEAUTIFUL. Blues, greens, reds, pinks—almost any color you can think of can be found in spiders. The pinktoe tarantula looks as if it has freshly painted pink nails. The greenbottle blue and cobalt blue tarantulas both have beautiful blue colorations.

THEY HAVE SOME AMAZING ADAPTATIONS. Spiders have learned to live just about everywhere. They exist on nearly every continent and in almost every habitat, from deserts to aquatic environments. Spiders can hunt in a number of ways, from sitting and waiting in their orb webs to ambushing prey via a trapdoor in the ground (Ctenizidae) or spitting sticky silk at prey (Scytodidae). Some use camouflage to attack unsuspecting prey and others can dive underwater to capture a meal. Spiders have developed sophisticated defense mechanisms as well. Some tarantulas can kick off their tiny hairs when threatened. Others, including the golden orb-weaver, use chemicals to deter would-be attackers.

SPIDER HIKES

You can encounter spiders along almost any hiking trail in the warm months. But two Pennsylvania hiking destinations where you can almost always count on encountering spiders are Ringing Rocks County Park in Bucks County and Hickory Run State Park, located about a two-hour drive north of Philadelphia near White Haven, PA.

Both parks have large boulder fields. Hickory Run's is almost 17 acres while Ringing Rocks' is about 7 acres. If you look closely between the boulders, you can almost always find spiders. I have seen huge wolf spiders walking among the rocks at both parks. By streams, you may find fishing spiders with distinct stripes that run down their entire bodies.

You can also see spiders—live tarantulas, that is—at the Academy through May 30 at our special exhibit, *Tarantulas: Alive and Up Close*. Get the facts on why tarantulas are hairy, explore a tarantula burrow, try on costumes, and more. Join us Saturdays and Sundays at 11:45 a.m. for special tarantula talks to meet a keeper and get just a little bit closer to a live tarantula.

Greenbottle blue tarantula

Mike Servedio/ANS

STUDENTS MAKING HISTORY

How Digitization Is Changing Students' Experiences Working in Natural Science Museums

By Mary Alice Hartsock

Paul Callomon/ANS

If you have been a student, you've probably struggled to decipher the handwriting of a teacher or professor. When you're truly stuck, you can usually follow up with your instructor in person. But what if you couldn't ask the writer about their bewildering scribbles, and your ability to decipher their notes could shape a part of scientific history?

Drexel University students Nicholas Blase and Valerie Coghlan faced this problem while working in the Academy's Botany Collection. Their job was to examine images of printed or handwritten labels and packets holding lichens and bryophytes and enter information from these labels into a searchable database. Part of a larger process known as digitization, this work puts Academy specimen data at the fingertips of scientists around the world.

Each day, Blase and Coghlan worked to database 200 specimens using software that "reads" typed images of specimen labels.

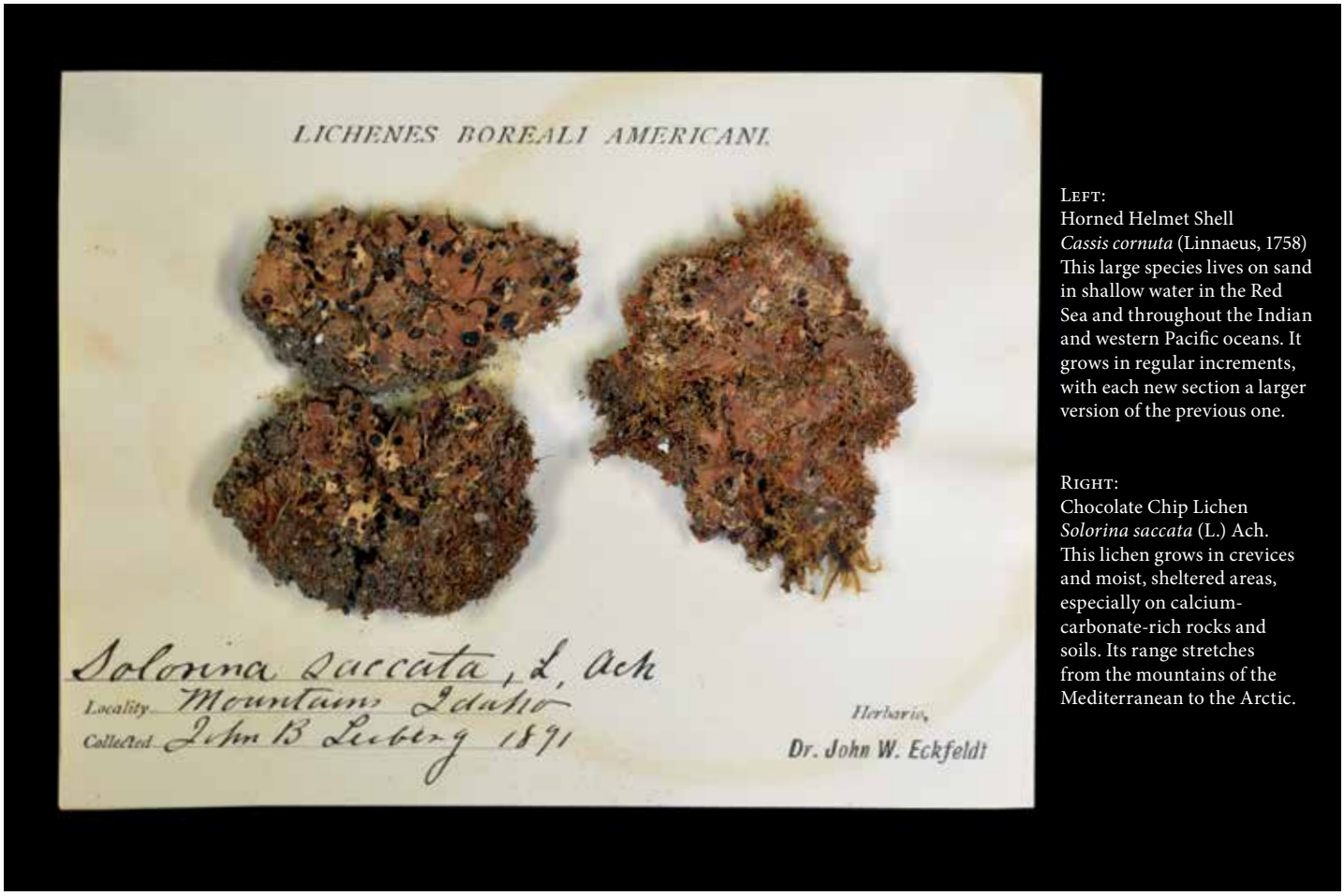
"This goal was often met as long as there were no troublesome labels," says Blase. "But common slowdowns included getting caught up on deciphering handwriting for a large string of specimens."

In most cases, Blase and Coghlan couldn't just pop into the label writer's office to ask questions, because they were databasing tags that were decades or centuries old. Sometimes finding the correct answers required researching historical records and venturing into the collection to investigate the specimen packets in person—exciting work for students never before exposed to millions of cataloged specimens in a natural history collection.

DIGITIZATION DEFINED

Digitization is the act of creating a digital record of a specimen that includes scientific names; dates and locations of its collection; the collector's name; and other relevant data. Each record functions just as a 3x5 card in a catalog, helping researchers locate a single record among millions of similar ones. Digitized specimen records make the search process quick and efficient while enabling researchers to identify patterns and spot anomalies within a collection. With the application of certain formulas, databases can support scientists' efforts to track species diversity and abundance over time, potentially helping us understand how changing environmental conditions have affected survival and distribution for certain species.

As scientific collections go online in our increasingly digital world, students are taking advantage of the growing digital landscape to broaden their career options. Often funded by grants (the Academy's botany project is supported by the National Science Foundation), digitization projects may offer openings for students in a number of different fields, including systematics, biology, geology, environmental science, information systems, life sciences, museum studies, and the arts. Already more than comfortable with technology, students can conduct research, compile and input data, learn about best practices in curation, and even take photographs. They don't need a ton of background to learn the role. Blase had taken one class on natural history museums (with Academy Assistant Curator of Botany Tatyana Livshultz) in which the students practiced taking digital measurements of plant specimens.



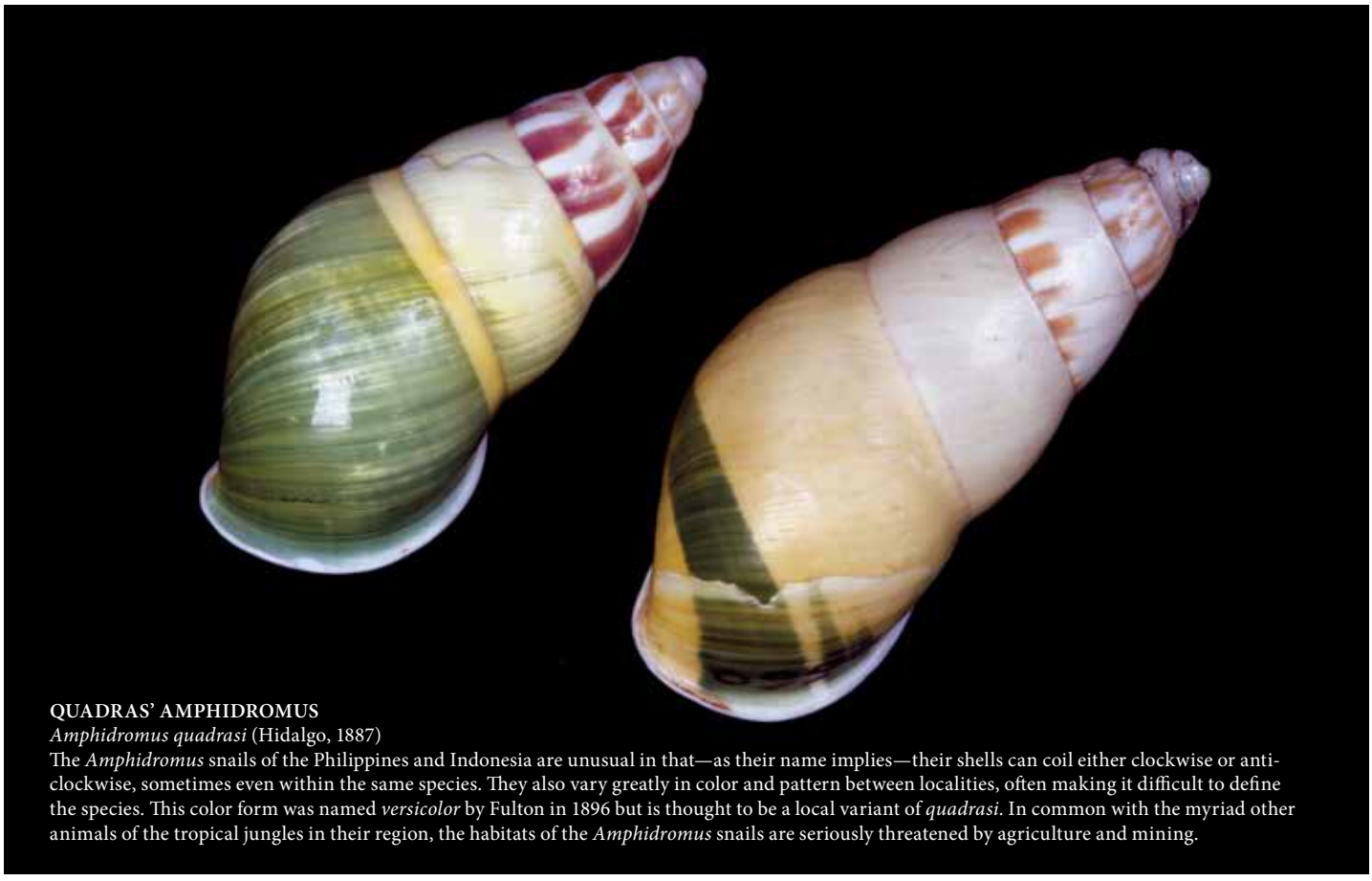
Xinyi (Amber) Lu/ANS

Left:
Horned Helmet Shell
Cassis cornuta (Linnaeus, 1758)
This large species lives on sand in shallow water in the Red Sea and throughout the Indian and western Pacific oceans. It grows in regular increments, with each new section a larger version of the previous one.

Right:
Chocolate Chip Lichen
Solorina saccata (L.) Ach.
This lichen grows in crevices and moist, sheltered areas, especially on calcium-carbonate-rich rocks and soils. Its range stretches from the mountains of the Mediterranean to the Arctic.

Paul Callomon/ANS

VENUS COMB SHELL
Murex pecten (Lightfoot, 1786)
This shallow-water marine species has built a shell that is as large and hard to bite as possible. The animal creates the spines by forming its flesh into long, narrow tubes and filling them in with shell material. It was first scientifically named in the auction catalog of the collection of the Duchess of Portland in 1786, though it was known in China and Japan as "fish-bone shell" long before that.



Paul Callomon/ANS

QUADRAS' AMPHIDROMUS
Amphidromus quadrasi (Hidalgo, 1887)
The *Amphidromus* snails of the Philippines and Indonesia are unusual in that—as their name implies—their shells can coil either clockwise or anti-clockwise, sometimes even within the same species. They also vary greatly in color and pattern between localities, often making it difficult to define the species. This color form was named *versicolor* by Fulton in 1896 but is thought to be a local variant of *quadrasi*. In common with the myriad other animals of the tropical jungles in their region, the habitats of the *Amphidromus* snails are seriously threatened by agriculture and mining.

Being affiliated with Drexel University has enabled Academy scientists to meet more students who are interested in natural history and may already have attributes that make them a great fit for digitization work. Through the Drexel cooperative education program, students interview for six-month positions in their fields. Co-op positions, some of which are paid, enable students to try out real-world job functions and make measurable contributions within their places of employment. Many positions offered at the Academy involve digitization of our scientific collections.

"The six-month co-op gives a set of mental tools and introduces people to what a research museum does," says Collection Manager of Malacology Paul Callomon. "Students get to ask why we do certain things the way that we do, and that helps staff to constantly reexamine our assumptions."

DIGGING INTO DATA

As scientists digitize specimens with handwritten labels, they often spot gaps in the recorded information. The missing details must be identified for a specimen record to be comparable to others within a database. Often collection managers rely on students to fill in these blanks by parsing data into fields and standardizing geographic data from different countries.

Accuracy is essential, as many digitization projects, including the Academy's Malacology Digitization Project (funded by the National Science Foundation from 2012–2015), focus solely on type specimens. Designated as the name-bearing specimens when a new species was described, these specimens are used to identify members of their species.

Even before data is entered, scientists must dig into the historical records to confirm that they have the type and investigate whether anyone has reconsidered the specimen's classification since its naming. Students are trained in this painstaking process, called "forensic reading," which requires them to apply today's naming standards to yesterday's scientific specimen names. Being good at forensic reading requires determination and keen attention to detail.

"We look for students who can recognize patterns and spot anomalies," Callomon says. "We're looking for a naturalist with a sharp eye for authenticity."

Callomon saw this quality in Ellen Wildner during her first interview at the Academy. As a junior studying biology at Drexel University in 2015, Wildner applied and was chosen for a six-month co-op that involved verifying the type status of specimens to be digitized and carrying out the imaging and data entry for each specimen.

Prior to her co-op, Wildner worked in a Drexel lab where she practiced handling and identifying insects. When the opportunity arose to work with specimens at the Academy, Wildner jumped at the chance to explore one of the largest malacology collections in the world. After her co-op, she returned to the Academy as a weekly volunteer and eventually began working in the collection as a full-time employee.

Wildner starts a typical day in the library examining journals that contain descriptions of new species often authored by scientists working in close association with the Academy's Malacology Department. She notes whether the Academy has the specimens and retrieves them from the collection.

"Once I have the specimens it takes a bit of time to go through the publication and determine whether these were the exact specimens observed at the time of designation," she says. "I need to verify their status and search for additional publications if necessary."

After Wildner completes her research, she goes into a camera room to photograph the specimens, returning them to the collection tagged with notes that indicate they've been digitized.

"Anything I can do to prevent the destruction and potential loss of type specimens is incredibly important to me," Wildner says. "By providing images, we are not only making it easier for people around the world to study our specimens, but we are preserving them for future scientific work."

TAKING PICTURES

Adding images to the data, a task of increasing priority within the past two decades, enables the public and scientists around the world to search for and view specimens online. Researchers around the world quickly and efficiently consult specimens to determine whether to visit the Academy for additional study. The high-quality images also offer curious amateur naturalists the chance to view the specimens as many times as they like.

"Natural history tends to present itself to the world in books, documents, and scholarly publications," Callomon says. "We need to be mindful of that and to present collections to people who had no idea about them."

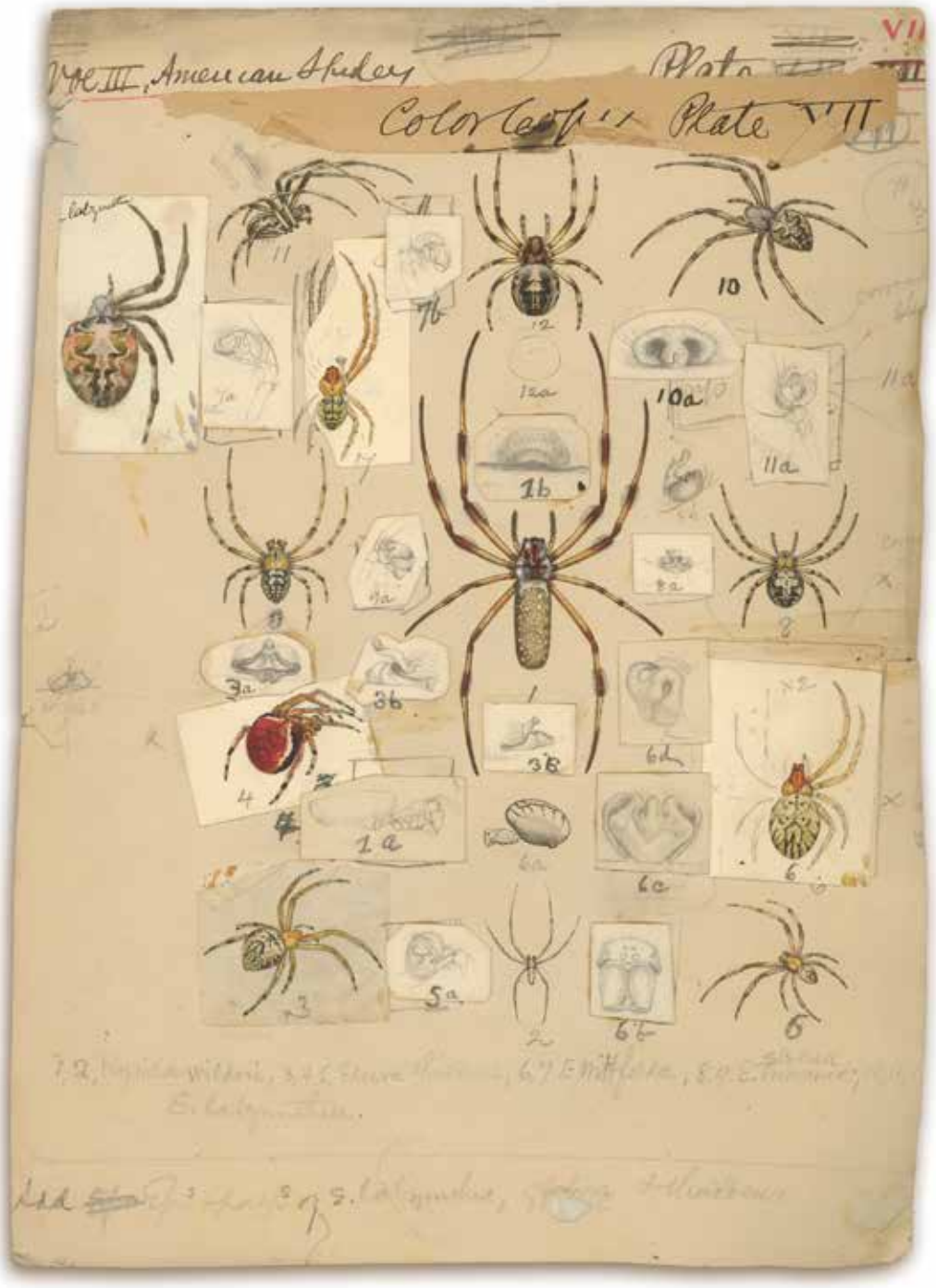
Most Academy collections are participating in ongoing digital imaging projects. Academy ichthyologists use high-resolution micro CT (computerized tomography) scans to create 3-D images that can be rotated and sliced into sections digitally, making the images especially useful for examining small specimens. Many departments take high-resolution photographs of specimens using a digital camera and special lighting, while others use flatbed scanners.

The prioritization of imaging has opened doors for photographers and science students looking to make their way into the field of natural history. Xinyi (Amber) Lu was the first co-op to work on the Botany Digitization Project. She photographed lichens and bryophytes, focusing specifically on specimen labels, which were then analyzed by imaging software so that students such as Blase and Coghlan could input and edit the captured data. Along with database development and maintenance, imaging is now part of Lu's skill set that will help her deliver better work as a research assistant.

WORKING FOR A CAUSE

Without a doubt, parsing specimen data and making sure to avoid typos can be tedious, but students consistently describe their passion for their work. Whether their goals were to explore careers in the sciences or natural history, become better researchers, build their resumes, or learn new skills relevant to future employment, they feel their work is meaningful.

Most college students do not have the opportunity to work within one of the top natural history collections in the world. Not only do Drexel students get to view and handle specimens at the Academy, but they also are helping to safeguard these collections through the creation of digital records. In many cases, scientists will rely on the data students input, the research they conduct, and the photographs they take for years—and even decades—to come.



This original pencil and watercolor plate appears in Henry McCook's *American Spiders and their Spinningwork* (1889–1893). The Reverend Doctor Henry McCook (1837–1911) became a member of the Academy of Natural Sciences in 1875 and vice president in 1882. As a naturalist and a minister, he spent much of his free time observing ants and spiders and studying their scientific classifications. He authored a number of scientific and popular science books and published his research in *Proceedings of the Academy of Natural Sciences of Philadelphia* and *Transactions of the American Entomological Society*.

From 1889 to 1893, McCook published his most extended work, *American Spiders and Their Spinningwork: A Natural History of the Orbweaving Spiders of the United States with Special Regard to Their Industry and Habits*, in three illustrated volumes. A total of only 250 sets were printed by the author, 150 of which were "Author's Editions." The book represented one of the most comprehensive accounts of the habits of spiders of its time. *American Spiders and Their Spinningwork* is on display in the Academy's current special exhibit, *Tarantulas: Alive and Up Close*, open through May 30.

Volume Three, Plate Seven, images pasted onto a sheet, with notes. Illustrator: probably Elizabeth Fearne Bonsall (1861–1956). ANS Archives Coll. 478

ACADEMY ANNOUNCES $5 MILLION IN GRANTS TO RESEARCH WATER QUALITY OF THE DELAWARE RIVER

By Carolyn Belardo

How is climate change affecting the Delaware River and its surrounding forests and lands?
What new contaminants are flowing off farms and into streams?
Are current technologies sufficient to deal with these issues or are more sophisticated tools needed?

These questions are among the major environmental challenges that will be addressed through the Delaware Watershed Research Fund, a new $5 million research initiative announced in December 2015. Administered by the Academy and financed by the William Penn Foundation, the fund is geared toward supporting major questions related to watersheds, especially the Delaware River Basin, which flows from the Catskill Mountains in New York to the Atlantic Ocean.

Amanda Chan/ANS

The Delaware Watershed Research Fund is an outgrowth of the Delaware River Watershed Initiative, a multi-year effort of more than 50 environmental nonprofits and numerous public and private partners to monitor, protect, and restore conditions in the streams, rivers, and landscapes in eight targeted geographies within the watershed.

Through the initiative, the Foundation has been a lead funder and provided more than $40 million over three years to 50 nonprofit organizations, including the Academy, that are working cooperatively to protect high-quality waterways and restore damage to watersheds from stresses such as urban stormwater and agricultural runoff. This aligned work, in places ranging from the Poconos and Upstate New York to the Brandywine Valley and New Jersey's Delaware Bayshore—is complemented by a significant water quality monitoring program designed and led by the Academy.

With more than 70 years of national leadership in using science to inform the protection of environmental quality in both aquatic and terrestrial ecosystems, the Academy's Patrick Center for Environmental Research is more than qualified to provide scientific oversight for this work. The Academy's watershed research uses field and laboratory studies to analyze and simulate the functioning of aquatic systems, integrating mapping with hydrologic, bioenergetic, ecological and other methods of measurement and analysis at multiple spatial scales.

ABOUT THE WATERSHED

The Delaware River Watershed (the region that drains into the river) covers more than 13,500 square miles spanning Pennsylvania, New Jersey, Delaware, and New York. In addition to being a major source of drinking water for 15 million people, the watershed supports an array of water-related economic enterprises valued at $25 billion per year, and it serves as a significant habitat for wildlife.

Although river conditions have improved greatly since the 1960s thanks to the regulation of industrial and municipal discharges, many of the streams and rivers flowing into the Delaware River remain impaired by agricultural runoff, municipal storm water, erosion, sediment, and a variety of other contributors.

"The study of watersheds and their function is one of the most important ways to understand issues like water pollution and the health and resiliency of our natural systems," said Academy President and CEO George W. Gephart, Jr. "We are very pleased to enter this new phase of commitment with the William Penn Foundation to restore and protect the Delaware Watershed and improve water quality."

There are a variety of scientific questions that remain unanswered in understanding the relationships between watersheds and waterways. Last year Academy scientists met with scientists and researchers in a variety of fields and developed a list of major research questions related to the Delaware River Basin and watershed studies in general. The $5 million Delaware Watershed Research Fund will be awarded through a competitive process to researchers and institutions working on topics related to these major research themes.

"Conservation organizations in our region have been using science to inform their work for decades, and we are excited to partner with the Academy of Natural Sciences to significantly increase access to applied research and promote evidence-based approaches to watershed protection," said Andrew Johnson, program director for watershed protection at the William Penn Foundation. "By integrating research in the areas where the work is taking place, it ensures the most immediate connection between what we're learning and what we're implementing on the ground."

The Academy will work with expert reviewers to identify the most qualified applicants. The awards will be announced in spring 2016.

JOE BAKER AND BILL MULHERIN: CELEBRATING TWO DECADES OF ACADEMY SUPPORT

Joe Baker likes the quiet afternoons at the Academy better than any other time of the day. After the school groups board their buses and toddlers head home for naps, he often spends a contemplative afternoon gazing at the dioramas. Walking the hallways, he says he can imagine himself in another place on the planet. Perhaps that is why he has chosen to make this local institution part of his everyday life.

Always interested in natural history, Baker purchased an Academy membership almost as soon as he moved back to Philadelphia in the late 1990s. Having spent 23 years traveling the world as a merchant seaman, he was excited to put down roots in his local community, where he met his husband, now-retired law librarian Bill Mulherin.

Mike Servedio/ANS

In addition to a growing interest in the Academy, Baker and Mulherin were active in their community park, where Baker was a volunteer gardener and Mulherin managed the website. With Baker serving for 10 years as President of the Independence Branch of the Free Library of Philadelphia and Mulherin an active member of his parish community, their friends may have wondered whether their schedules allowed for another charitable commitment. But Baker and Mulherin felt something "click" on their first trip behind the scenes at Members' Night, and since then they have been loyal supporters of the Academy's work.

"We were blown away by Members' Night," Baker says. "It was the first time I talked with our scientists. I immediately came home and wrote a check to the Academy upping my membership!"

"It was the first time I had seen the Academy's specimen collections, and seeing them hit my reference librarian hot button," Mulherin says. "I could see the extent of the collections and knew all the work that went into making them available."

Baker and Mulherin have been donating to the Academy for nearly two decades. In 2010 Baker joined the Academy's Leadership Circles of Giving, making yearly contributions through stock. As a member of the Academy's Leadership Circles, he receives regular invitations to receptions at the Academy, including a dinner hosted by President and CEO George Gephart.

Through these evening events, contributors get intimate access to the Academy's collections and chances to meet researchers and curators. Baker and Mulherin toured the Academy Archives, where they saw Joseph Leidy's pointer and John James Audubon's field jacket. They were impressed by the amount of time Archivist Jennifer Vess spent talking with them about the objects in the collection.

Baker and Mulherin also enjoy meeting scientists and staff at events such as Back from the Field, the Academy's annual reception welcoming scientists returning from expeditions. The couple has encouraged their friends to attend lectures and learn about the Academy's scientific work.

"There are a lot of deserving projects," Baker says. "It's important to know that I can help support the work the Academy is doing."

Baker has done just that as a volunteer for the Pennsylvania Flora Project, an Academy collaboration with the Morris Arboretum to digitize and assign geographic coordinates to all Pennsylvania vascular plants in the general collection. He is transcribing data for specimens, some of which date back to the 1800s.

As a member of the 1812 Society, Baker has made the Academy part of his life's legacy by remembering the institution in his will. Through a bequest, the most popular type of deferred gift, Baker has designated a percentage of his estate to support the Academy's future.

"There's a continuity of scientific importance that should go on long after I'm gone," he says. *~Mary Alice Hartsock*

FIVE THINGS YOU SHOULD KNOW ABOUT LIVING TRUSTS

What is a revocable living trust? A revocable living trust is a written agreement designating someone to be responsible for managing your property. During your lifetime, you can change or dissolve the trust at any time and for any reason. Typically, a living trust cannot be changed after your passing.

A living trust can provide you with the peace of mind that comes from knowing that your assets and your heirs will be protected in the event that you unexpectedly become unable to handle your own financial affairs. It eliminates the need for your estate to pass through probate court before it can be passed on to your heirs. Properly worded, a trust can also be used as a substitute for powers of attorney.

Your trust can be written in a way that will pass your assets on to your loved ones or to a qualified charity, like the Academy of Natural Sciences, immediately upon your death, or you can designate that they be portioned out over time in amounts that you specify. Your attorney can include clauses that may help to reduce state and federal estate taxes.

What is the difference between a living trust and a will? Both a will and a living trust contain your inheritance instructions. A trust may be preferred by people concerned with privacy and avoiding probate. A living trust will not become part of the public record unless a trustee or a beneficiary demands court approval of accounts. Probate records are always open to the public.

Who are the trustees? A trust involves three parties: you as the creator, the trustee or trustees who agree to manage your assets as directed by the terms of the trust, and the beneficiaries. Any mentally competent adult may be named trustee. In most cases, you would name yourself and your spouse as trustees in order to retain full control of the property while you're alive. As trustee, you will have the power to sell, exchange, or invest your assets in any way. If you become too ill or disabled to manage your property, your co-trustee or successor trustee will do this for you.

Many people name their children as successor trustees. Another popular option is to name a professional fiduciary, such as the trust department of a bank, a professional trust company, or a private fiduciary. If you have chosen a charity such as the Academy of Natural Sciences as a beneficiary of the trust, you may choose to make the charity a successor trustee.

Do I have to put a lot of money in a living trust at the start? A trust can be established with a small amount when it is created or with as much as every asset you own. You can even specify in your will that your trust is to be funded only upon your death. There are advantages to each choice, depending on your needs and concerns.

Do I need an attorney to prepare a living trust? It is important to seek the counsel of a legal professional when creating a trust. The cost for setting up a living trust will depend upon the attorney used, the complexity and size of the assets, and the geographic area. The fee could be as little as a few hundred dollars but more typically runs several thousand or more.

If you are thinking about including the Academy in your estate plans and would like more information, please don't hesitate to contact Amy Marvin, vice president of institutional advancement, at marvin@ansp.org or 215-299-1013. She would be delighted to assist you. Thank you for your support!

On behalf of the Academy's Board of Trustees, we wish to recognize and thank those who have contributed to the Academy between **December 1, 2015 and February 29, 2016**. Your generosity helps to fund our many programs of research and education, and we are tremendously grateful for your support.

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WINTER BRINGS NEW TRUSTEE TO ACADEMY BOARD

Jeffrey Beachell is a partner and investment officer at Veritable LP, where he serves on the firm's Executive, Investment, and Operations Committees. He serves on the advisory board of the Honickman Foundation and is a director of the Lenfest Foundation. Prior to graduating magna cum laude from Drexel University with a BS from the LeBow College of Business, he studied at the University of Oxford. At Drexel, Beachell joined the President's Leadership Council in September 2014, and he served in this capacity until joining the Board of Trustees in May 2015. He is a member of the Community Partnership and Investment Committees. The Beachell Family Learning Center located in The Dana and David Dornsife Center for Neighborhood Partnerships is named in honor of Beachell and his family. He is a member of the Anthony J. Drexel Society.

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Dinosaurs Unearthed

DINOSAURS UNEARTHED PREVIEW

Back by popular demand—roaring, moving, life-size animatronic dinosaurs invade the Academy in summer 2016. State-of-the-art and scientifically accurate, down to the feathers on *T. rex, Dinosaurs Unearthed* features realistic, full-bodied dinosaurs, as well as skeletons, fossil casts of skulls, claws, and horns, real specimens, and the ever-popular coprolite (dino poop). Experience brand-new interactives, such as a multi-touch table and a scale that tells you how you measure up to different dinosaurs. Take a Dino Detective touch-screen quiz, control dinosaur movements, and greet a new three-horned special guest on the Parkway. You can be the first to see this blockbuster exhibit at our Member Preview on June 24 from 5:30–9 p.m. Visit ansp.org in late spring to sign up!

Jeff Fusco for ANS

BIRTHDAYS AT THE ACADEMY

Celebrate your child's special day at a museum you love, and let us take care of all the details. Birthday parties at the Academy include a private party room, a birthday party host to guide you on a tour of our hands-on exhibits, all-day museum access, and invitations and thank-you cards. Make it a theme party to get a personalized birthday cake, decorations, and even more experiences the party guests will talk about all year long. We offer theme parties for kids who love dinosaurs, butterflies, bugs, and animals. Plus, you can add encounters with fossils, live animals, or bugs. Members get special discounts! Visit ansp.org or call 215-299-1060 for more details and to book.

Mike Servedio/ANS

BUG FEST

Mark your calendars on August 13 and 14 for our annual celebration of insects! Hundreds of live invertebrates will be on display throughout the museum. You'll see beetles, true bugs, millipedes, centipedes, scorpions, stick insects, cockroaches, caterpillars, tarantulas, and more. Talk with real scientists, learn about insects from all over the world, and see specimens from the Academy's collections. Eat bugs, get your face painted, and relax as you enjoy a buggy show. More at ansp.org.

Mike Servedio/ANS

TEEN CAMP

We're introducing a brand-new summer camp for kids ages 13–16! Academy Explorers Husbandry Camps invite teens to learn about entomology and animal handling in a fun and engaging way. Participants of our Invertebrate Husbandry Camp (July 11–15) will meet live insects and learn about basic handling and care, venture into invertebrate-rich local parks in Pennsylvania and New Jersey, and help prepare live invertebrate displays. Animal husbandry participants will learn the basics on handling and caring for live animals, attend a wildlife rehabilitation-inspired field trip, help prepare a naturalist presentation for Academy guests, and more. Sign up online or call 215-299-1060 for more information.

Jeff Fusco for ANS

SUMMER CAMP

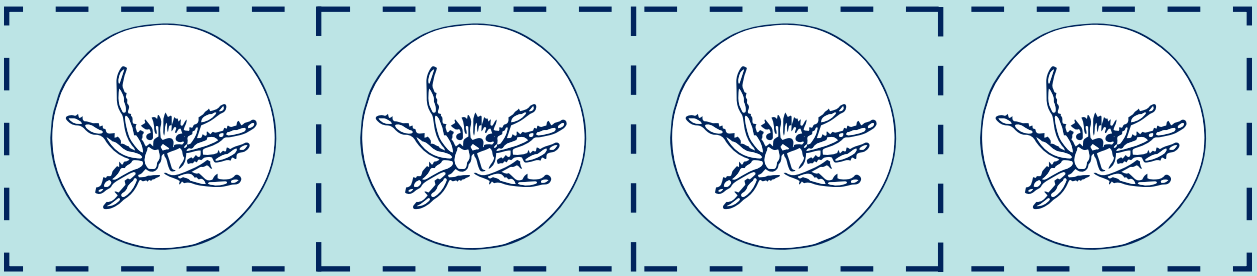
It's not too late to sign up for Summer Camp at the Academy! Each week of camp explores an exciting new theme and features an off-site field trip! From fossils to our extreme earth to amazing animals, check out our camp themes to find the best fit for your child's interests. Summer Camp is appropriate for children ages 5–12. This year the famous camp coordinator Miss Chris (p. 5) will guide you on an exploration of ooey gooey science, bizarre animals, dinosaurs, art, animal myths and legends, and more. Members get special discounts. Get more information and register at ansp.org.

JUST FOR KIDS

Welcome to the *Academy Frontiers* page for kids, one of the many great ways you can participate in the Academy's Kids Club!

BE A JUMPING SPIDER!

Use a crayon to make each spider token a different color. Borrow a die from a board game. Take turns rolling as you try to be the first spider to eat the grasshopper!



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CALENDAR OF EVENTS

APRIL

Tiny Tot Explorers
Wednesdays through May 18, 11 a.m. $ 📞

Neighborhood Science After School
Monday, April 25
Fox Chase Library Ⓜ

Science on Tap:
Gaffes on Tap With Jason Poole
Monday, April 25, 6–8 p.m.
National Mechanics Bar Ⓜ

Cheryl Beth Silverman Memorial Lecture
Tuesday, April 26 Ⓜ 📞

Expo 1866: Philadelphia Science that Changed the World With Jennifer Vess
Wednesday, April 27, 6 p.m.
Wagner Free Institute of Science Ⓜ

Science of Fear
Wednesday, April 27, 7 p.m.
The Franklin Institute Ⓜ

Philadelphia Science Carnival at Penn's Landing
Saturday, April 30, 10 a.m.–4 p.m. Ⓜ

MAY

Town Square:
What's in Our Water?
Tuesday, May 3 📞

Science on Tap With Jennifer Anne
Monday, May 9, 6 p.m.
National Mechanics Bar Ⓜ

Final Day of
Tarantulas: Alive and Up Close
Monday, May 30 $*

JUNE

Totally Turtles Weekend
Saturday and Sunday, June 4–5 Ⓜ

Dinosaurs Unearthed
Member Preview
Friday, June 24, 5:30–9 p.m. Ⓜ 📞

Dinosaurs Unearthed
Opening Weekend
Saturday and Sunday, June 25–26 $**

JULY

Academy Explorers Camp
Weekdays, July 5–September 2 $ 📞

Tiny Tot Explorers
Wednesdays, July 6–August 24 $ 📞

Academy Teen Camp:
Invertebrate Husbandry
Monday–Friday, July 11–15 $ 📞

AUGUST

Academy Teen Camp:
Animal Husbandry
Monday–Friday, August 8–12 $ 📞

Bug Fest
Saturday and Sunday, August 13–14 Ⓜ

The Philadelphia Geek Awards
Saturday, August 20, 7 p.m. $ 📞

SEPTEMBER

Members' Night
Friday, September 30, 5–9 p.m. Ⓜ 📞

OCTOBER

Philadelphia Shell Show
Saturday and Sunday, October 22–23,
10 a.m.–5 p.m. Ⓜ

Ⓜ Free for members $ Fee 📞 Registration required

Unless otherwise noted, all events held at the Academy are free with museum admission.

*$3 Individual and Family level member fee for *Tarantulas*; Family Plus level members and above receive free admission.

**$4 Individual, Family, and Family Plus level member fee for *Dinosaurs Unearthed*; Partners' Club level members and above receive free admission. Purchase or renew your membership today at ansp.org/membership.

Visit ansp.org for more information and to register.

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