ACADEMY

FRONTIERS

INSIDE:
Freshwater Mussels:
Why They Matter

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

Fall 2018

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ON THE COVER: Once plentiful in the Delaware River watershed, mussels help keep our rivers, streams and ponds clean by filtering particles out of the water column. More on pages 8-11. Photo by Roger Thomas/ANS.

ACADEMY GREETINGS

Dear Friends,

As I approach my one-year anniversary as CEO of the Academy, I am working alongside our Board and staff to bring renewed energy to our work. We have embarked upon a strategic planning process in which we are asking essential questions about how the Academy can better engage with our community and help our neighbors connect with the nature that surrounds and supports them. As we tackle this challenging issue, we continue to consider how to make Philadelphia a sustainable place to live.

One way we are doing this is by strengthening our reputation as a trusted source for information on a universally relevant issue — water. Supplying clean water is one of the most critical resource issues of our time. Yet even locally, the quality of our water is in flux. Knowing that our rivers are a primary source of drinkable water for Philadelphians, our Patrick Center scientists regularly monitor various indicators to learn more about our water quality. One of our teams is focused on what an aquatic animal, the freshwater mussel, can tell us about water quality.

Once plentiful in the Delaware River watershed, freshwater mussels help keep our rivers, streams and ponds clean by filtering particles out of the water column. Alongside several local collaborators, scientists Roger Thomas and Kathryn Longwill are working to understand how to increase the numbers of mussels in our waterways. They also are raising mussels in-vitro — right inside the walls of the Academy. In this issue of *Academy Frontiers*, you can learn more about why freshwater mussels are so important and how the Academy is collaborating with local partners to return them to our waters.

As we approach year's end, I ask you, our loyal members, to consider how much more of an impact you could make on our environment by making a gift to the Academy's Annual Fund this holiday season. You can ensure that we continue conducting our groundbreaking environmental research and sharing our scientific breakthroughs with our community through your contribution. You are vital members of our community, and we could not do what we do without your support.

With thanks and best wishes,

Scott Cooper, PhD
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.

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Roger Thomas/ANS

Scientists are raising freshwater mussels in hopes of returning them to our local rivers, streams and ponds. To ensure that the baby mussels thrive in their new homes, project team researchers place the babies in protected, sand-filled plastic baskets attached to cinder blocks to keep them anchored in the water. More on pages 8–11.

DECEMBER

Xtreme Science Days
Thursday–Sunday, December 27–30, 10 a.m.–5 p.m. Ⓜ

Museum Closed
Monday and Tuesday, December 24–25

Access to Science
Friday, December 28, 9–11 a.m. Ⓜ

JANUARY

Museum Closed
Tuesday, January 1

Night in the Museum
Saturday, January 5, 6:30 p.m.–Sunday, January 6, 9 a.m. $

Xtreme Bugs Closing Weekend *
Saturday–Monday, January 19–21, 10 a.m.–5 p.m. Ⓜ

Access to Science
Sunday, January 20, 9–11a.m. Ⓜ

Dinos After Dark
Friday, January 25, 4–8 p.m. Ⓜ

Scientist Saturday
Saturday, January 26, 1–4 p.m. Ⓜ

ON EXHIBIT

THROUGH JANUARY 21, 2019

Special Exhibits Gallery

Come face-to-feet with nearly 20 massive, colorful, moving bugs! From a fluttering oversized monarch butterfly and a fluffy tri-colored bumblebee to a gigantic Madagascar hissing cockroach and a blood-sucking bedbug, these towering animatronics tell a rarely seen story of the behaviors and intricacies of extreme bugs. Get a bug's-eye view of the world, explore critter calls, dig for ancient arthropods and play an extreme bug facts game. Each day, meet a live critter during bug encounters, and find out what makes these critters so incredible.

PRESENTING SPONSOR:

WESTERN PEST SERVICES

Xtreme Bugs is also supported by a generous donation from VWR Charitable Foundation.

COMING SUMMER 2019

Special Exhibits Gallery

Embark on a globetrotting expedition around Pangea, where dinosaurs reign throughout the land. *Dinosaurs Around the World* introduces visitors to more than a dozen animatronic dinosaurs on a voyage from the ferocious plains of Africa and the tropical beaches of Antarctica, to the inland seas of North America and the polar darkness of Australia. Find out how continental drift, sea level fluctuations and volcanic activity allowed dinosaurs to disperse to all corners of the globe. Learn about paleontological research, touch fossil casts, discover and name your own dinosaur, investigate what dinosaurs may have looked like in life and find modern-day dinosaurs right in your own backyard!

FEBRUARY

Mythic Creatures Member Preview
Friday, February 15, 5:30–9 p.m. Ⓜ 📞

Mythic Creatures Opening Weekend *
Saturday, February 16–Monday, February 18, 10 a.m.–5 p.m. Ⓜ

Night in the Museum
Saturday, February 16, 6 p.m.–Sunday, February 17, 9 a.m. $ 📞

Door 19
Thursday, February 21, 6 p.m. $ 📞

Dinos After Dark
Friday, February 22, 4–8 p.m. Ⓜ

Access to Science
Saturday, February 23, 9–11 a.m. Ⓜ 📞

Scientist Saturday
Saturday, February 23, 1–4 p.m. Ⓜ

MARCH

Paleopalooza
Saturday–Sunday, March 2–3, 10 a.m.–5 p.m. Ⓜ

Scientist Saturday
Saturday, March 16, 1–4 p.m. Ⓜ

Night in the Museum
Saturday, March 16, 6 p.m.–Sunday, March 17, 9 a.m. $ 📞

Founders' Day
Thursday, March 21, 10 a.m.–4:30 p.m. Ⓜ

Dinos After Dark
Friday, March 22, 4–8 p.m. Ⓜ

APRIL

Animal Superhero Weekends
Saturday and Sunday, April 6, 7, 13 and 14, 10 a.m.–5 p.m. Ⓜ

Access to Science
Sunday, April 7, 9–11 a.m. Ⓜ 📞

Door 19
Thursday, April 11, 6 p.m. $ 📞

Scientist Saturday
Saturday, April 20, 1–4 p.m. Ⓜ

Dinos After Dark
Friday, April 26, 4–8 p.m. Ⓜ

ON EXHIBIT

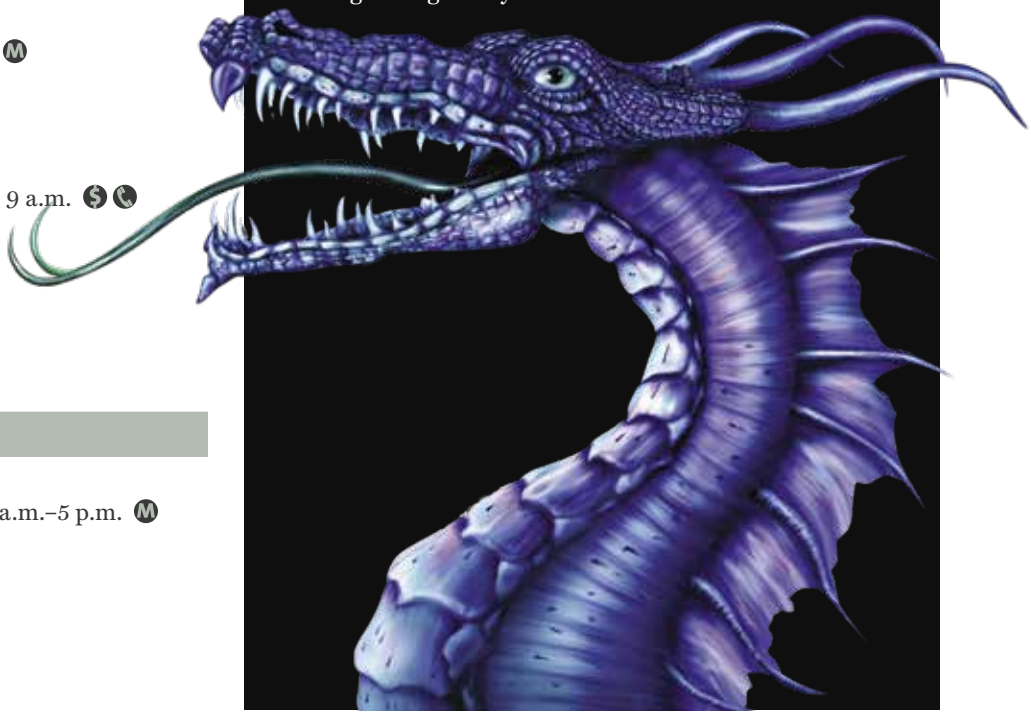
MYTHIC CREATURES

Dragons, Unicorns, & Mermaids

FEBRUARY 16–JUNE 9, 2019

Special Exhibits Gallery

For thousands of years, people have brought mythic creatures to life through art, stories and songs. Even as scientific discoveries have drawn distinctions between myth and reality, these beasts of the land, air and water have maintained an enduring hold on the human imagination. Discover how real animals such as dinosaurs, mammoths and narwhals may have stirred tales of griffins, giants and unicorns. Learn why so many legendary water spirits look like mermaids. Touch fossils, explore winged mythological creatures, build your own dragon and come face-to-face with a giant legendary sea monster.



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

Visit ansp.org for more information or to register.

* Fee for *Xtreme Bugs*, *Mythic Creatures* and *Dinosaurs Around the World*. Family Plus level members and above see these exhibits for free.

Purchase, upgrade or renew your membership today at **ansp.org/membership**.

Ⓜ Free for members

$ Fee

📞 Registration required

The Freshwater Mussel Collection: Care and Conservation

The freshwater mussels (Unionoidea) form the largest single section of the Academy's vast collection of roughly 10 million shells. They are found in rivers, streams, lakes and ponds all over the world, with particular richness in North America.

The Academy's founders were all enthusiastic collectors, and several of its early scientists — most prominently Thomas Say, Isaac Lea and Timothy Conrad — were very interested in freshwater mussels. The collection they created has continued to grow to the present day through contributions from field collectors, environmental scientists and state biodiversity surveys, reflecting the importance of these animals to many different scientific communities.

Over their lifetime of many decades, mussels rarely move far, but they continually add layers to their shells. The rate at which they grow can be measured in these layers down to individual days and reflects factors such as water temperature and food availability. At the same time, mussels incorporate into their shells and tissues substances in the surrounding water, such as metals and chemical compounds. Unlike their counterparts in the salty ocean, however, these pearly shells are quickly dissolved by the water once the animals that make them die. With their dates of collection known, therefore, the shells in our collection form a priceless and irreplaceable archive of environmental conditions stretching back into the 18th century.

The last major overhaul of the mussel collection took place in the 1950s, when the shells were moved into closed cabinets. Starting in March 2017, we implemented a large-scale upgrade program, placing the shells in archival trays within the Academy's new cabinets and updating their systematic order to current standards. Volunteers and students in Drexel University's Cooperative Education Program have supported this work by cleaning individual shells and labels to remove thick layers of soot.

Many of the older mussels were on display in glass cabinets or open trays for up to a century. In the days before air conditioning, windows remained open from spring to fall to counter the summer heat, and particles coated the surfaces of these significant shells. A few blocks from the Academy's location on the Benjamin Franklin Parkway was the gigantic Baldwin Locomotive Works, which ran coal-fired foundries day and night. A short distance in the other direction lay the Reading Railroad tracks, where dozens of steam trains passed through each hour. Cheap Pennsylvania coal also powered steam tractors, ferries, ships and cranes. For more than two centuries, houses and buildings throughout the city were heated with it. The air was black with fine soot, which oozed through the tiniest gaps in cabinets and doors to settle on the exhibits.

Volunteers and students have used special pads to clean the specimen labels and display boards, and they have used paper wipes soaked in distilled water to clean the blackened mussels. The process releases the distinctive odor of anthracite coal. In most cases the thick coating has caused little damage to the shells. *~Paul Callomon, Malacology Collection Manager*

BACKGROUND: Academy member and volunteer Jane Heintz and Drexel co-op student Scarlet Janes in part of the mussel collection. The cabinet doors have been detached to make removing and replacing individual drawers easier.

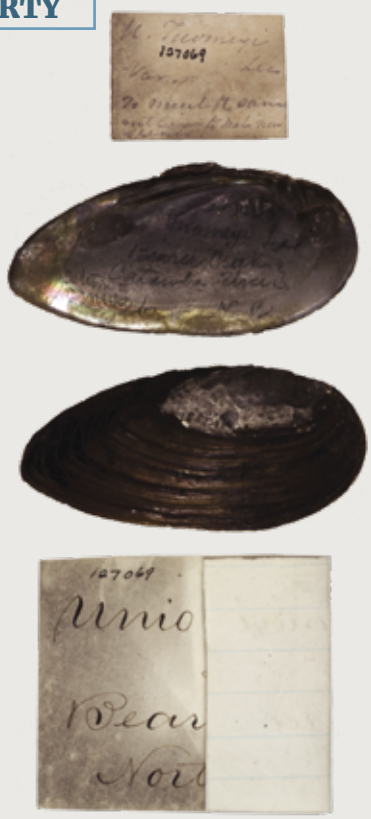
RIGHT: Some mussels before and after cleaning.

Paul Callomon/ANS

DIRTY

CLEAN

DIRTY

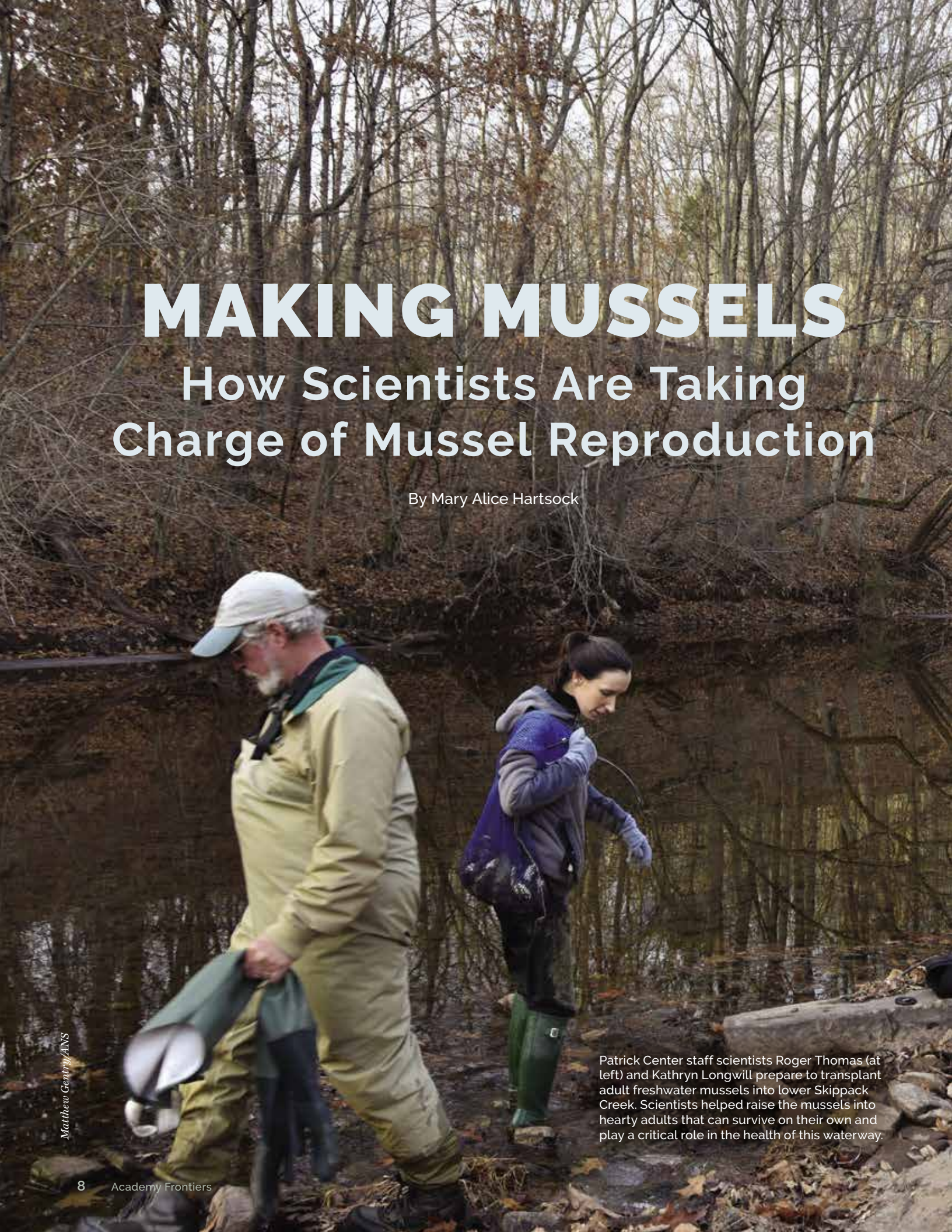


CLEAN

MAKING MUSSELS

How Scientists Are Taking Charge of Mussel Reproduction

By Mary Alice Hartsock



Matthew Gentry/ANS

Patrick Center staff scientists Roger Thomas (at left) and Kathryn Longwill prepare to transplant adult freshwater mussels into lower Skippack Creek. Scientists helped raise the mussels into hearty adults that can survive on their own and play a critical role in the health of this waterway.

Kathryn Longwill spends a lot of time under fluorescent lights, surrounded by coolers and a whitish contraption that looks like an oversize refrigerator. The walls of her chilly lab are beige, the cupboards are brown and the graying floor is spotted with decades of spilled chemicals. But deep within this laboratory of drab neutrals, lives are taking hold.

Staff scientist Longwill draws some watery solution into a plastic pipette, squirting it in a petri dish and placing it under her microscope. Then she beckons me over for a look. "Do you see them?" she asks me, her face equal parts excitement and pride.

I set my glasses aside and take a look. Coming into focus are wiggling, translucent baby freshwater mussels just the size of dust specks. A tongue-shaped foot pops out from several of the tiny bodies. And they are incredible, these miniscule versions of the adult bivalves they'll someday be. Their shape reminds me of kernels of corn, or minute fingernails, and I can see their hinged shells beginning to take shape.

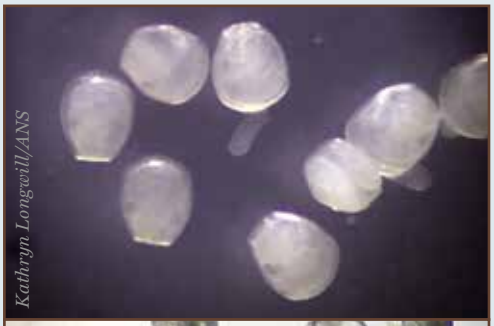
Longwill explains that these animals spent their early days inside a CO_2 incubator, where they fed on a growth medium as their organs began to take shape. Raised at the Academy through in vitro methods, they are most likely destined to live out their lives in a real freshwater mussel bed. But first, she and her colleague and principal investigator, Project Support Section Leader Roger Thomas, will help them grow from fragile babies into hearty juvenile mussels that can survive and thrive in a river, lake or stream.

Only a few researchers have attempted to raise mussels in vitro, and Patrick Center scientists began this delicate process just last spring. To date, we have cultivated 1,400 baby mussels, and nearly a third of those have already grown from microscopic specks to tiny, 1 millimeter mussels. Through this work, along with other major efforts to raise mussels, our scientists and their collaborators are hoping to replenish a diminished mussel population that plays a vital role in the health of our local waterways.

Why Mussels Matter

Mussels live on every continent except Antarctica, and nearly 300 of the approximately 650 species of freshwater mussels worldwide live in North America. Once plentiful in the Delaware River watershed, mussels help keep our rivers, streams and ponds clean by filtering particles out of the water column. They excrete bio-deposits that serve as a natural fertilizer for aquatic vegetation.

Various mussel species commonly live together on stream bottoms, creating concentrated communities



Kathryn Longwill/ANS

Lance Butler

called beds. These beds often provide microhabitats for other macroinvertebrates and fish and can even help decrease erosion by stabilizing stream bottom sediments.

"Mussel reproduction is complicated, and conditions need to be just right," Longwill says. A female mussel becomes pregnant when she siphons in sperm released by a male mussel. Stored in her gills, the female mussel's fertilized eggs develop into microscopic larvae known as glochidia. She expels her larvae into the water, where they attach to the gills or fins of specific fish hosts, almost like temporary parasites.

When freshwater mussel larvae parasitize fish, the process enables mussels to spread upstream instead of drifting down to the ocean. This extraordinary adaptation often involves the mussel — a mollusk — luring a fish by shaping parts of its body to mimic fish prey, such as worms or smaller fishes. The mussel then blasts its larvae into the fish's open mouth. This amazing trick has allowed mussels to survive since at least the breakup of Pangaea.

Mussels must stay with their fish host until they develop into still-microscopic juveniles. Then they drop off and eventually burrow into the sediment, where they grow into adults, some of which can live for up to 100 years.

Thomas has been studying mussels at the Academy since the late 1970s, when he was brought in to assist noted Academy malacologist Sam Fuller with a three-year study on the distribution and diversity of the endangered Higgins eye pearlymussel throughout the Upper Mississippi River. Several years ago, while working on a sediment study on the Delaware River, he and his team unexpectedly found quite a few mussels in their dredge samples. This discovery was followed by several large-scale mussel surveys in collaboration with Danielle Kreeger, PhD, and staff from the Partnership for the Delaware Estuary (PDE), Lance Butler from the Philadelphia Water Department (PWD) and members of the EPA Region 3 Dive Team.

"Mussels were common within the lower Delaware River watershed before the 1900s, but now they are few and far between," Thomas says. In fact, mussels are now the most imperiled taxa in North America.

What is behind this dramatic drop-off?

"There are many reasons why freshwater mussel species declined so drastically from this part of the country," says Thomas. Since the late 1800s, new dams have limited the upstream movements of aquatic life, including the fish hosts mussels rely on for reproduction. In the decades following the 1950s, conditions such as pollution, habitat destruction, industrial development and predation hindered mussel reproduction. Acid rain fell to the ground, bonded with

calcium from the soil and deprived mussels of a key element they needed to build their shells, Thomas says.

In the last half century, water quality has changed, partly due to conservation efforts and increasing regulations surrounding emissions. In response to a growing national movement, many states, including Pennsylvania, have begun to remove dams, thereby restoring natural stream flows and opening habitat for fish and wildlife, including the fish hosts mussels need.

With improved water quality, mussels have an increased chance of survival, and we need the help of these filter feeders. Still, we have a lot of work to do to restore mussels back to historic numbers. As water quality gets better, Academy researchers and their collaborators are doubling down on efforts to raise more mussels, both through hands-on work and through allying with like-minded local organizations working for change.

Partnerships for Clean Water

For years, the Academy has collaborated with the Partnership for the Delaware Estuary and the Philadelphia Water Department to restore the health of the Delaware River and Bay. The most recent focus of the partnership is on rebuilding mussel populations in our rivers, lakes and streams.

In the past three years, the partnership has expanded to include the Independence Seaport Museum, the John Bartram Association and the Philadelphia Department of Parks and Recreation. Together the partners established the Aquatic Research and Restoration Center, which is working to propagate freshwater mussels and various fish species, establish green infrastructure in urban waters and provide educational opportunities for students at all levels.

At the center of this work is The Mussel Hatchery at Fairmount Water Works, made possible by generous support from the Pew Center for Arts & Heritage and the Philadelphia Water Department, with additional support from the McLean Contributionship and the Pennsylvania Department of Conservation and Natural Resources. As the world's first city-owned hatchery, it was built to demonstrate the extent to which mussels can be propagated and help to contribute to the restoration of degraded freshwater ecosystems.

Nearby, scientists collect female mussels that have mated in early spring, as well as the fish species most likely to serve as hosts for the larval-stage mussels. The mussels and fish are placed in tanks together. When each mussel releases her glochidia, they attach to the fins and gills of the fish, where they will live for several weeks. When they eventually get big enough to live on their own, they drop off and are collected and placed in 5 gallon buckets. They are fed a special algal diet until they are big enough to be transplanted outdoors in one of our local "grow out" facilities, such as Green Lane Reservoir, Winterthur Gardens and Longwood Gardens. These locations provide ideal conditions to raise mussels.

To ensure that mussels thrive in their new homes, project team researchers place the mussel babies in protected, sand-filled plastic baskets attached to cinder blocks to keep them anchored

Academy staff scientist Chris Vito (left) and section leader Roger Thomas chop through ice to get to their floating freshwater mussel baskets. When temperatures drop, they sink the baskets to protect the mussels from the crushing effects of the ice.

in the water. In the winter, Academy staff sink the baskets in Green Lane Reservoir to protect the babies from freezing surface water and ice. For the next year or more, the babies siphon water, filtering out particles until they are large enough to be released into local waterways.

Thomas and Kreeger have documented where certain species thrived in years past and are working to return mussels to some of these local streams. To determine where to place their first generation of propagated mussels, they will take into account the conditions that particular mussel species prefer, including stream flows, the types of sediments present and physical shape of the stream.

Coming Up Next

The work of the hatchery has been so successful that the partners, led by Kreeger and the Partnership for the Delaware Estuary, are in the process of completing a nearly $8 million grant agreement from the Pennsylvania Infrastructure Investment Authority to construct a commercial hatchery and create the associated rearing programs.

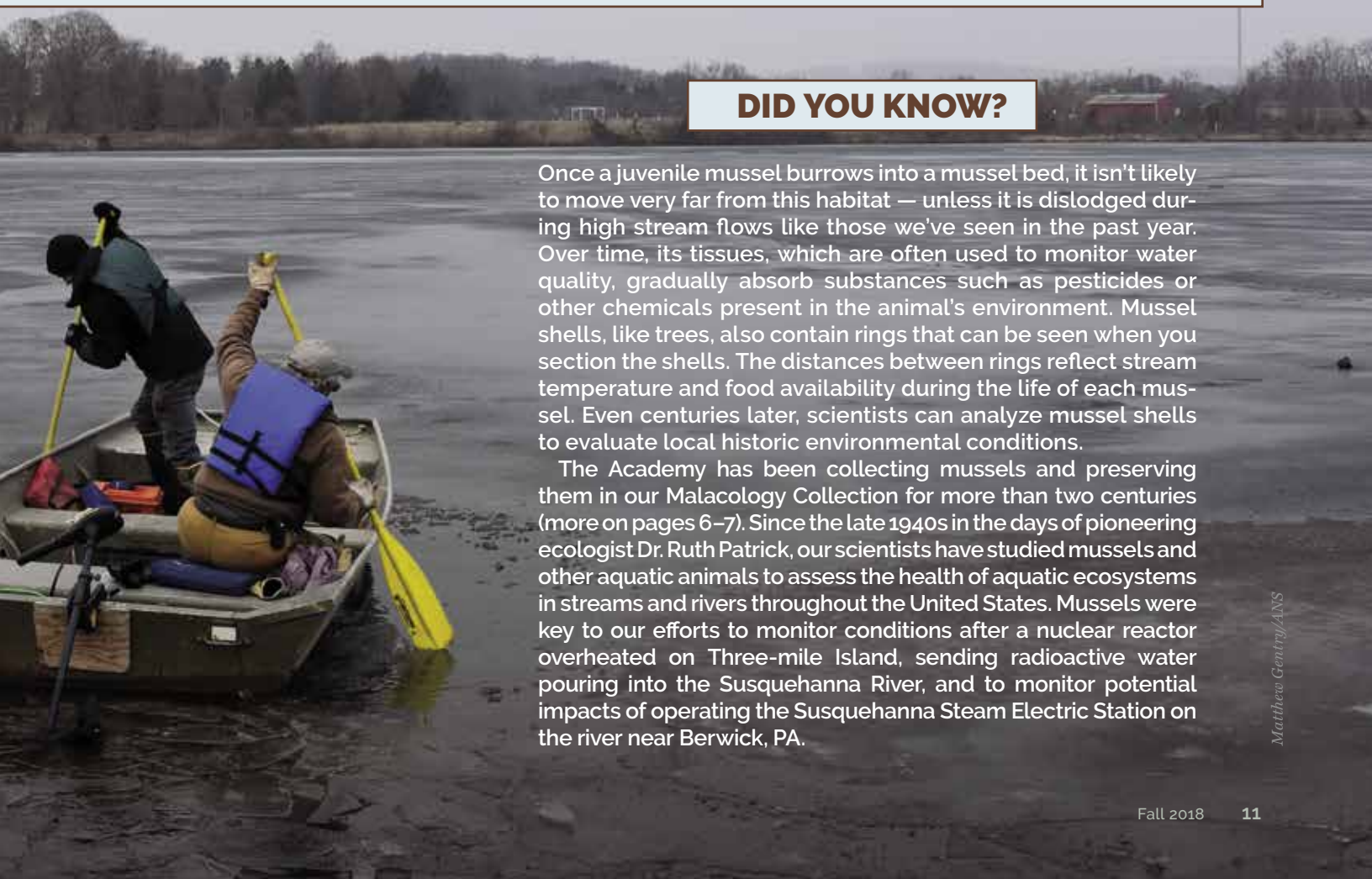
"This is a dream come true to apply our decades-old research on the clean water benefits of mussels to garner support for restoring these underdog workhorses of the freshwater aquatic world," says Kreeger, who also has been on the Academy's staff for 25 years.

Located at Bartram's Gardens, the hatchery will work to restore the once-abundant mussel populations throughout the Delaware and Susquehanna River basins. In full operation, it could produce up to 1 million baby mussels a year.

In addition, plans are underway through the Aquatic Research and Restoration Center for a Floating Water Workshop designed by Victoria Prizzia of the Philadelphia firm Habithèque on behalf of the Fairmount Water Works Interpretive Center and the Philadelphia Water Department. Thomas, Kreeger and Butler have contributed to the conceptualization and design process of the 5,400-square foot collaborative lab and classroom, which was made possible through the support of the William Penn Foundation. With large tanks of water onboard, this innovative floating classroom will be instrumental in educating countless visitors each year.

"My dream is that this facility would allow students to walk over from the Academy to the The Mussel Hatchery and the Floating Classroom, hop onto one of our research vessels and boat to Bartram's Gardens and the Independence Seaport Museum and eventually out to the students' research sites on the Delaware River," Thomas says.

Meanwhile, inside the Academy, Thomas and Longwill are discussing the future of the Academy's in vitro mussel work, still very much in its early stages. We know that in vitro may help reduce the cost and space required to help mussels reproduce, and there are infinitely more variables we could tweak to make this work more productive. Time will tell what type of impact these tiny babies will make on the waters that sustain us, habitats we are trying to preserve and protect for future generations.



Matthew Gentry/ANS

DID YOU KNOW?

Once a juvenile mussel burrows into a mussel bed, it isn't likely to move very far from this habitat — unless it is dislodged during high stream flows like those we've seen in the past year. Over time, its tissues, which are often used to monitor water quality, gradually absorb substances such as pesticides or other chemicals present in the animal's environment. Mussel shells, like trees, also contain rings that can be seen when you section the shells. The distances between rings reflect stream temperature and food availability during the life of each mussel. Even centuries later, scientists can analyze mussel shells to evaluate local historic environmental conditions.

The Academy has been collecting mussels and preserving them in our Malacology Collection for more than two centuries (more on pages 6–7). Since the late 1940s in the days of pioneering ecologist Dr. Ruth Patrick, our scientists have studied mussels and other aquatic animals to assess the health of aquatic ecosystems in streams and rivers throughout the United States. Mussels were key to our efforts to monitor conditions after a nuclear reactor overheated on Three-mile Island, sending radioactive water pouring into the Susquehanna River, and to monitor potential impacts of operating the Susquehanna Steam Electric Station on the river near Berwick, PA.

Portrait of Thomas Say by Charles Willson Peale, ANS Archives 2011.46

American Conchology

What's a naturalist to do after spending a decade creating the authoritative work on American entomology?

Start composing the authoritative work on American conchology, of course.

Thomas Say — entomologist, conchologist and one of the founders of the Academy of Natural Sciences — is known for two amazing works on entomology (the study of insects) and conchology (the study of mollusk shells). Like many naturalists of his day (1787–1834), Say did not confine himself to one scientific discipline. When he completed his three-volume *American Entomology, or Descriptions of the insects of North America* in 1828 (the first of its kind published in the United States), he turned his sights on shells.

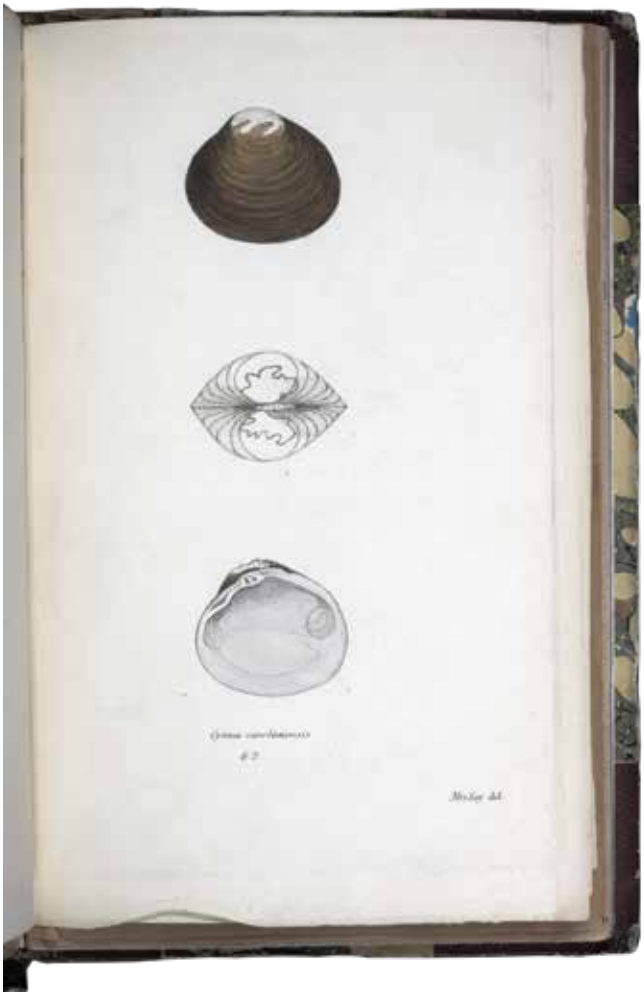
Though trained as an apothecary, Say was far more interested in, and successful with, pursuing the natural sciences. He participated in several expeditions across North America, served as a curator for the American Philosophical Society and taught at the University of Pennsylvania — all while describing new species and working on his books.

Around the time he was nearing the completion of the publication of *American Entomology*, Say became interested in a new settlement out in Indiana called New Harmony. The settlement was attracting several scientists associated with the Academy, including William Maclure and Titian Ramsay Peale. On the way to his new home he met Lucy Way Sistare, who had trained under scientific illustrators in Philadelphia. She would

DID YOU KNOW?

The Malacology Department database, which has over 470,000 records and is one of the largest online mollusk databases in the world, is called "Lucy" after Lucy Say.

Original illustration for American Conchology by Lucy Say, ANS Archives Coll 433



American Conchology: or, Descriptions of the Shells of North America, Plate 62, ANS Library QL411.S27

become not only his wife but also his collaborator on his next major scientific work, *American Conchology, or Descriptions of the shells of North America*.

In New Harmony, Thomas Say began writing what would become a seven-part book on conchology, and Lucy Say, an exceptional illustrator, created most of the figures found in the book. While Thomas Say researched, organized and wrote, Lucy Say spent hours drawing and coloring the illustrations to accurately depict each specimen.

The first six volumes of the book were published between 1830 and 1834 out of New Harmony. Unfortunately, 1834 marked the deaths of both Thomas Say and the engraver responsible for transferring Lucy Say's illustrations to copper plates, which were needed to reproduce multiple copies of the book. Lucy Say moved back east and trained in engraving so that she could complete the seventh and final volume of *American Conchology*, which came out around 1838.

In addition to Lucy Say's original drawings and the first edition of the completed text, the Academy also holds the copper plates used to create the finished book. This treasure trove allows us to see each stage of the creation of this important scientific work.
~Jennifer Vess, Brooke Dolan Archivist

Lucy Say, c. 1863, ANS Archives Coll 457

Karen and Wayne Lattuca: Members on a Mission

Every year on Father's Day, Karen and Wayne Lattuca go fossil hunting with Wayne's daughter and son-in-law, Adrienne and Kevin Franklin. Most often, they head to Big Brook Preserve in Monmouth County, New Jersey, where Cretaceous fossils such as sharks' teeth are easy to find.

This year, an email from the Academy's Membership Department popped into Wayne's inbox describing an opportunity to go on a members-only fossil hunting expedition in Montana in mid-summer. Instead of panning a stream for plentiful marine fossils, the expedition would involve digging for dinosaur fossils from *Suuwassea* and *Stegosaurus*. He immediately contacted his family to reschedule their Father's Day trip.

In July, the four trekked into the Morrison Formation of the Big Horn Basin, where the Academy of Natural Sciences and the Bighorn Basin Paleontological Institute have been leading dinosaur digs for years. These expeditions focus on finding, collecting and documenting Jurassic, Cretaceous and Paleogene fossils on the border of Wyoming and Montana, a site where dinosaurs flourished 145 million years ago.

The Lattucas were in awe of their freedom to work within the site, where paleontologists have been excavating bones for years. They used screwdrivers, picks, brooms and brushes to clear dirt and stone; applied glue to broken pieces; and even jacketed a fossil.

"You get instruction, and then you are trusted — when you find something, they let you continue," says Wayne.

Conditions were rustic and days in the field were eventful. The team encountered biting flies, a scorpion and a rattlesnake. But nothing could take away from the thrill Karen felt when she finally uncovered a dinosaur bone, becoming the very first human to glimpse at the bone, hidden 145 million years in the ground.

"I dug all day the first day without finding anything, and then the next day I saw this reddish bone coming out underneath my brush," she says. "That initial rush I will never forget."

The Lattucas were keen to participate in an expedition of this caliber, having been fans of Academy science for years. Actually getting to know the staff — those fabled paleontologists with brushes in hand — during the dig helped make the Academy's field research tangible.

Karen and Wayne have been Academy supporters for several years, and they recently made a gift of appreciated securities, donating an appreciated stock or mutual fund to a charity to receive a tax deduction for the fair market value of their assets. They distributed their gift over several years of membership, upping their membership to the Lewis and Clark Circle so they could take advantage of the benefits that were right for them. They are considering ways to dedicate more resources to our work, including our programs of education and research.

"You want to support things that are important to you," says Wayne. "For me, that's educating about the natural world, supporting world-class collections across many different disciplines. This institution has been doing that since 1812. My focus is to advance basic research and science, and to truly reinforce trust in the scientific method."

~Mary Alice Hartsock

Year-End Charitable Giving Options

As we approach the end of 2018, you may have already started thinking about your year-end charitable giving. Most people give because they are committed to a charity's mission and because a charitable organization or friend asked for support. Charitable giving can make financial sense as well, because donations are tax-deductible.

Now is a good time to get a handle on your tax liability for 2018. If you had more income and will owe more taxes this year, you may want to increase your giving before December 31. Consider talking with your financial advisor while you still have time to make a tax-deductible gift for 2018.

There are many financially efficient ways for you to give at the end of the year. Here are a few of the most popular:

Gifts of Stock

Gifts of appreciated stock are an excellent way to avoid the capital gains tax you would pay on an appreciated asset if you sold it, and you receive a charitable deduction for the full market value of the stock. If you have stock that has decreased in value, another strategy is to first sell stock — generating a tax loss you can use to offset any capital gains income — and then gift the sale proceeds, which further results in a charitable deduction.

Donor-Advised Funds

The Academy's partnership with Drexel University offers a unique charitable giving opportunity through the Drexel Donor Advised Fund (DAF). Establishing a Drexel donor advised fund is a tremendously effective tool if you're looking to generate a charitable deduction in 2018 but aren't sure where you want your money to go.

You give a gift of cash, appreciated securities and other assets to your donor advised fund, which in turn gifts the value of the assets to the Academy of Natural Sciences of Drexel University and to other charitable organizations of your choice.

A donor advised fund can also be a way to involve your children or other family members in charitable giving, since multiple authorized users are permitted to direct where gifts go. Additionally, a donor advised fund can offer anonymity if you'd like to keep your giving information private.

IRA Contributions

Owners of individual retirement accounts (IRAs) have the unique opportunity to make tax-free gifts to charity. If you are 70.5 or older, you can directly transfer $100,000 per year tax-free to an eligible charity such as the Academy of Natural Sciences. This option is available for distributions from IRAs regardless of whether you itemize your deductions.

To qualify, the funds must be contributed directly by the IRA trustee to a public charity. Amounts transferred are not taxable, and no deduction is available for the transfer. Amounts transferred to a charity from an IRA will be subtracted from your required minimum distribution.

Making an IRA distribution to charity will reduce your taxable income. In situations in which an income tax charitable deduction wouldn't reduce taxes paid, using your IRA distributions for charitable giving will make a difference in income-based tax calculations.

Thinking Ahead

Please don't hesitate to contact our Office of Institutional Advancement to learn more about how to make the most of your charitable giving and which solutions may work best for you. If you have questions about how to support the Academy, please contact Interim Vice President of Institutional Advancement Meg Clifton North at 215-299-3790 or north@ansp.org. She would be delighted to assist you. Thank you for your support!

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On behalf of the Academy's Board of Trustees, we wish to recognize and thank those who have contributed new gifts and pledges to the Academy between **April 16** and **August 15, 2018**. Your generosity helps to fund our many programs of research and education, and we are tremendously grateful for your support.

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A record-breaking 1,300 members attended Members' Night 2018!

Mike Servedio/ANS

WILD WIZARDING WEEKEND

Explore the magical world of the Academy's phenomenal beasts with a weekend of spellbinding, hands-on activities, November 23–25! Meet the Academy's own live beasts and learn about the real animals that inspire your favorite wizarding stories. Take in a Bunny and Broomsticks game, make a magical wand and take home a dragon's egg during this wild weekend. Wear a costume — witches and wizards are welcome. Plus, continue your visit during our evening hours on Friday night, and stop into our beer garden, Dragons After Dark! More at ansp.org.

Jeff Fusco for ANS

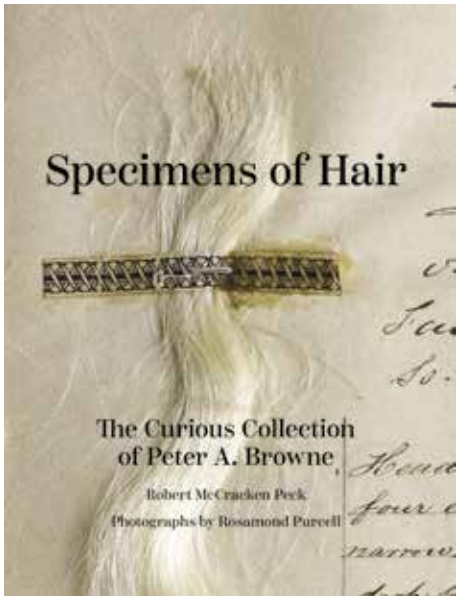
NIGHT IN THE MUSEUM

Experience the Academy's towering dinosaurs — including *T. rex* — after dark! Start your evening with opportunities to enjoy close encounters with free-flying butterflies, dig for dinosaur bones and come face-to-face with the animals in our dioramas. Go on a scavenger hunt, do a hands-on experiment or inspect some not-so-creepy crawlies. Explore every corner of the Academy's famous exhibits, and then sit back and relax as we bring you a fascinating live animal show. When it's finally time for bed, pick your sleeping spot in our galleries. Visit ansp.org for Night in the Museum dates and to learn how you can visit *Xtreme Bugs* and *Mythic Creatures* after dark!

Mike Servedio/ANS

XTREME SCIENCE DAYS

Spend your winter break with us December 27–30! From weird-things-in-jars to the craziest critters that call the Academy home, we've got some Xtreme stuff to share. Explore the larger-than-life animatronics in our special exhibit *Xtreme Bugs* and make some Xtreme slime to take home. Bring the relatives and enjoy a beer under the *T. rex* as your party explores the museum. More at ansp.org.



BOOK ON PRESIDENTIAL HAIR

On November 30, Academy Curator of Art and Artifacts and Senior Fellow Robert McCracken Peck's new book, *Specimens of Hair*, hits shelves in the Academy Shop and your local bookstore. In *Specimens of Hair*, Peck tells the story of Peter A. Browne's remarkable collection of wool, fur and hair, now housed at the Academy. Browne, a Philadelphia lawyer and member of the Academy, assembled this collection in the early 1800s. He hoped, in a pre-Darwinian world, to discover how animals were related to each other and what practical purposes their hair might serve. He also collected the hair of people. In addition to hair from 13 of the first 14 presidents of the United States, the collection includes hair from well-known artists, writers, scientists and signers of the Declaration of Independence.

Dominic Episcopo for ANS

BIRTHDAYS

Want to celebrate your birthday with dinosaurs, bugs, butterflies or live animals? Our birthday parties are fun for kids and easy for parents, because we take care of all the details! Plus, your membership helps you save big! A theme birthday party at the Academy includes a private party room, a birthday party host to guide you on a tour of our hands-on exhibits and experiences the party guests will talk about all year long. We offer theme parties for kids who love dinosaurs, butterflies, bugs and animals. Basic parties and add-on encounters with fossils, live animals or bugs are also available. Visit ansp.org for more details.

THE ACADEMY OF NATURAL SCIENCES

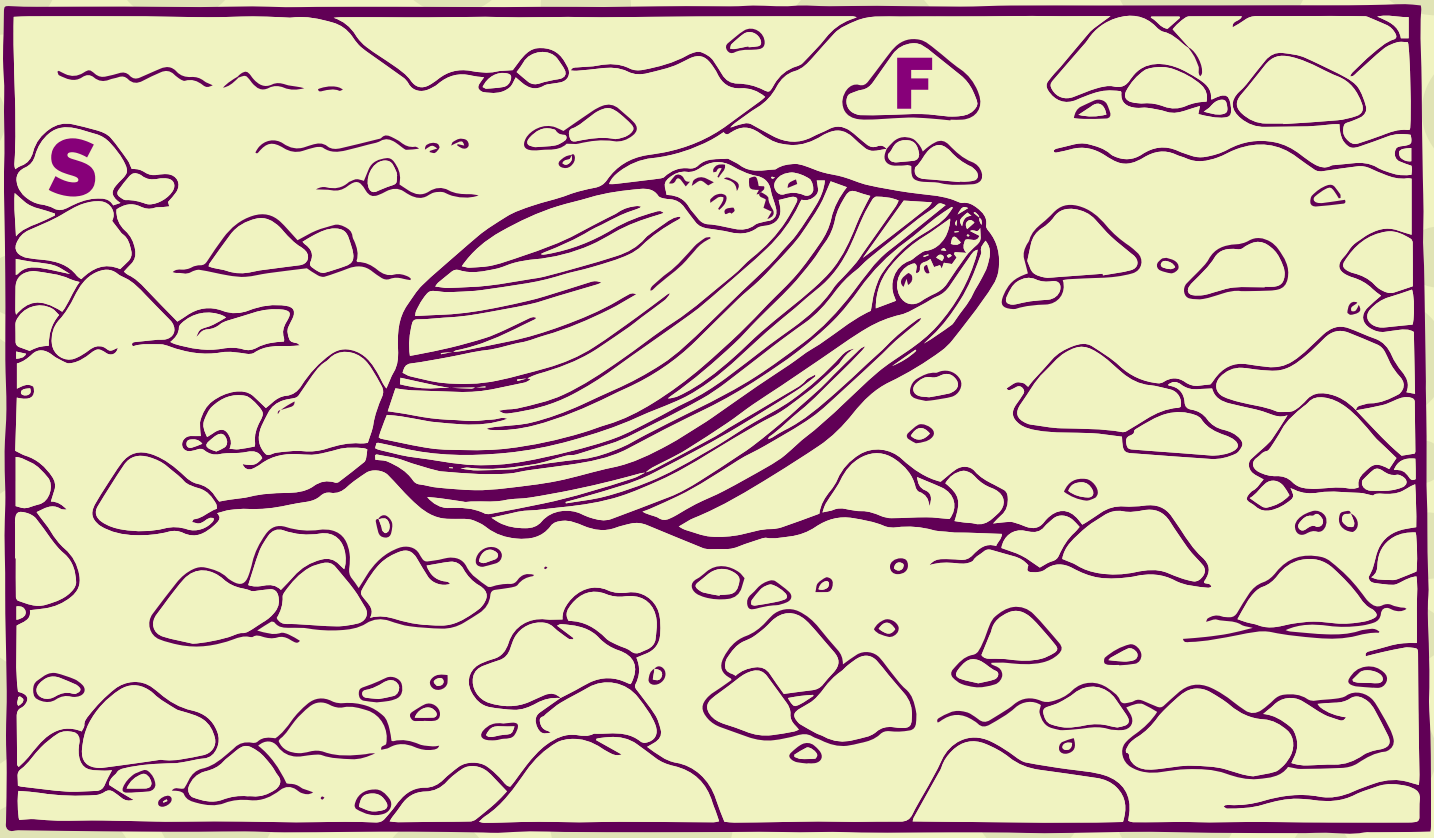
KIDS CLUB

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

MUSSEL MAZE

Mussels are a type of mollusk with two shells enclosing a soft body. Both freshwater and saltwater mussels live in the water and help to filter bacteria, microscopic organisms and other particles out of the water.

Can you find your way through a mussel maze? Start fresh in the freshwater mussel maze at the right, then swim down to the saltwater mussel maze below to see if you're worth your salt as a navigator!



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