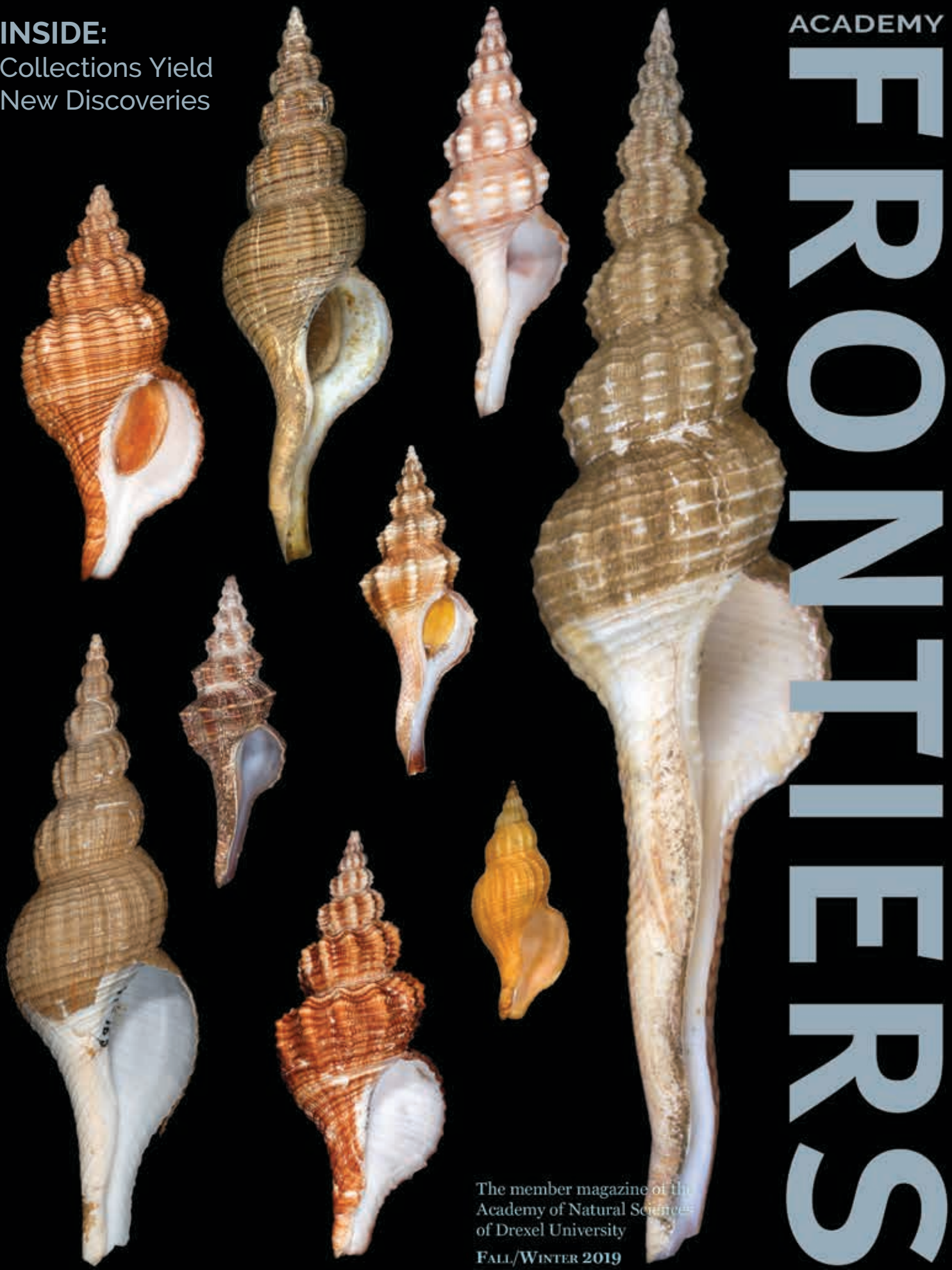
INSIDE:
Collections Yield
New Discoveries



ACADEMY

FRONTIERS

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

FALL/WINTER 2019

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ON THE COVER: A selection of new mollusk species named since 2003 by Academy staff from specimens in museum collections. More on pages 3 and pages 8-10. Photo by Paul Callomon/ANS

ACADEMY GREETINGS

Dear Friends,

Few things are more exciting than a new scientific discovery. For more than 200 years, Academy scientists have been collecting and cataloging scientific specimens, filing them in our extensive library of life. Over time, we have uncovered within those collections species that are new to science — species with distinguishing characteristics that our scientists have recognized as never having been named or described. And sometimes this has significant implications.

In this issue of *Academy Frontiers*, Malacology Collection Manager Paul Callomon writes, "The study of ecosystem-wide effects like pollution and climate change relies on knowing which organisms are where and when, and as species come and go, it is essential that they be reliably identified." His piece details instances in which new species have been found in the collections decades after they were added. In truth, accurate records of all the specimens in scientific collections are the key to understanding how short- and long-term population changes relate to global-scale problems such as extinction and climate change.

What if, for example, the Academy did not have extensive historic collections of Pacific islands snails that were driven to extinction in just a few decades? How would we know what happened and, in turn, what it is we are trying to prevent elsewhere? Or what if we were unaware of diatom species that existed in streams in the 1930s and beyond, when Dr. Ruth Patrick was collecting and identifying species new to science and preserving them in the Academy's collection? Lacking those specimens for comparison, Academy scientists studying our watersheds today would be hard pressed to trace how our ecosystems have changed over time.

The Academy's collections are vital, not only for the knowledge that they provide about our changing world, but also to the multitude of scientists around the globe who consult them for their own research. We rely on the generosity of supporters like you to help us continue this critical work. As you prepare to greet the new year, please consider making a gift to the Academy as part of your end of year giving. In addition to providing critical support for collections care, environmental research, education and public programming, you will be helping to support our scientists as they investigate the ways in which the earth is changing at an alarming rate. Thank you for your stewardship of our rapidly changing planet.

With thanks and best wishes,

Scott Cooper, PhD
President and CEO

Jeff Fusco for ANS

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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BIRTHDAY PARTIES

Jeff Fusco for ANS

Your membership helps you save big on Academy parties, plus we make it easy for you by taking care of all the details! We offer basic parties and theme parties for kids who love dinosaurs, butterflies, bugs and animals. Add an encounter with fossils, live animals or bugs or even a story time with the Academy's famous storyteller, Marty the Moose! Visit ansp.org for more details.

OPEN THROUGH JANUARY 20, 2020

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!

produced by imagine exhibitions

OCTOBER

National Fossil Day
Wednesday, October 16, 10 a.m.–4:30 p.m. (M)

Members' Night
Friday, October 18, 5–9 p.m. (M) (phone)

Scientist Saturday: Fossils
Saturday, October 19, 1–4 p.m. (M)

Door 19: Death and Taxidermy
Thursday, October 24, 6–9 p.m. ($) (phone)

Access to Science: Opening Doors to Autism
Sunday, October 27, 9 a.m. (M) (phone)

Dinos After Dark
Thursday, October 31, 4–8 p.m. (M)

NOVEMBER

Access to Science: Opening Doors to Autism
Saturday, November 9, 9 a.m. (M) (phone)

Veterans Day: Museum Open Until 5 p.m.
Monday, November 11, 10 a.m.–5 p.m. (M)

Scientist Saturday: Regional Mollusks
Saturday, November 16, 1–4 p.m. (M)

Academy Town Square: 24 Hours of Reality
Thursday, November 21, 6:30 p.m. (M) (phone)

WILD WIZARDING WEEKEND

Mike Servedio/ANS

Friday through Sunday, November 29–December 1
10 a.m.–5 p.m. (M)

Explore the magical world of the Academy's phenomenal live beasts with a weekend of spellbinding, hands-on activities! 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. Wear a costume — witches and wizards are welcome. More at ansp.org.

Dragons After Dark
Friday, November 29, 4–8 p.m. (M)

CALENDAR OF EVENTS

DECEMBER

Scientist Saturday: Pyroentomology
Saturday, December 21, 1–4 p.m. (M)

Access to Science: Opening Doors to Autism
Friday, December 27, 9 a.m. (M) (phone)

MineFaire: Museum Closed (Special Ticket Required)
Saturday and Sunday, December 28 and 29, 10 a.m.–5 p.m. ($) (phone)

JANUARY

***Outside In* closed for refresh**
Wednesday through Friday, January 1–10

***Dinosaurs Around the World* Final Weekend**
Saturday through Monday, January 18–20, 10 a.m.–5 p.m. ($) *

Martin Luther King Jr. Day
Monday, January 20, 10 a.m.–5 p.m. (M)

Dinos After Dark
Friday, January 24, 4–8 p.m. (M)

Scientist Saturday
Saturday, January 25, 1–4 p.m. (M)

Access to Science: Opening Doors to Autism
Sunday, January 26, 9 a.m. (M) (phone)

FEBRUARY

***Survival of the Slowest* Member Preview**
Friday, February 14, 5 :30–9 p.m. (M) (phone)

***Survival of the Slowest* Opening Weekend**
Saturday through Monday, February 15–17, 10 a.m.–5 p.m. ($) *

Night in the Museum
Saturday, February 15, 6:30 p.m.–9 a.m. ($) (phone)

Scientist Saturday
Saturday, February 22, 1–4 p.m. (M)

Access to Science: Opening Doors to Autism
Sunday, February 23, 9 a.m. (M) (phone)

Door 19: Slow Jams
Thursday, February 27, 6–9 p.m. ($) (phone)

Dinos After Dark
Friday, February 28, 4–8 p.m. (M)

SURVIVAL OF THE SLOWEST

Special Exhibits Gallery
February 15–September 20, 2020

Do animals always need to be the strongest, the biggest and the fastest to survive? Or can it sometimes be advantageous to be small or slow? Just ask a tortoise! In *Survival of the Slowest*, meet animals that have survived for millions of years despite being very slow, and learn about the puzzling sides of evolution and adaptation. Meet live animals, including a two-toed sloth, tarantula, chameleon and horned frog. Touch a tortoise, iguana, snake, hedgehog or gecko, catch live animal feedings and more! ($) *

MARCH

Paleopalooza
Saturday and Sunday, March 7–8, 10 a.m.–5 p.m. (M)

Founders Day: Pay-What-You-Wish
Saturday, March 21, 10 a.m.–5 p.m. (M)

Night in the Museum
Saturday, March 21, 6:30 p.m.–9 a.m. ($) (phone)

Dinos After Dark
Friday, March 27, 4–8 p.m. (M)

APRIL

Save the Date
Philadelphia Environmental Film Festival
SPECIAL TICKET REQUIRED
Thursday through Sunday, April 2–5 ($) (phone)

Unless otherwise noted, all events held at the Academy are free with museum admission. Visit **ansp.org** for more information or to register.

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

* Fee for *Dinosaurs Around the World* and *Survival of the Slowest*. Family Plus members and above see these exhibits for free.

(M) Free for members | ($) Fee | (phone) Registration required

In the Field With the Algae Crew

Academy scientist Amanda Chan always knows the weather forecast. As field team leader for the Academy's Patrick Center for Environmental Research, she is responsible for coordinating algae field crew members, logistics between groups of scientists, hiring, and, yes, the weather. The field crew ventures toward streams wearing thick rubber waders for long hours under the sun, a no-no in dangerously hot weather. For algae collection, the weather must also be dry — and it must have stayed that way for almost two weeks.

It simply didn't in June and July 2019.

"Rain events raise the stream water levels and flow speed to a point where the algal communities are washed away. This is called a scouring event," Chan says. "When this happens, we have to wait 10 days after a big rainstorm for algal communities to regrow in order for us to sample the stream. That waiting period hasn't given us a big window to sample this season."

Algae are a diverse group of aquatic organisms that use photosynthesis to grow and survive. They thrive either suspended in the water column or on rocks when sunlight, water temperature conditions and nutrients within the stream fuel their growth.

Algae are common in streams in the Delaware River watershed, which are often surrounded by agricultural fields, fertilized grass lawns or industrial sites. During a rainfall or flooding event, nutrients from nearby crop and plant

ANS


Amanda Chan/ANS


Hayley Oakland/ANS

fertilization, along with manure from livestock, flow into nearby streams, prompting increased algae growth.

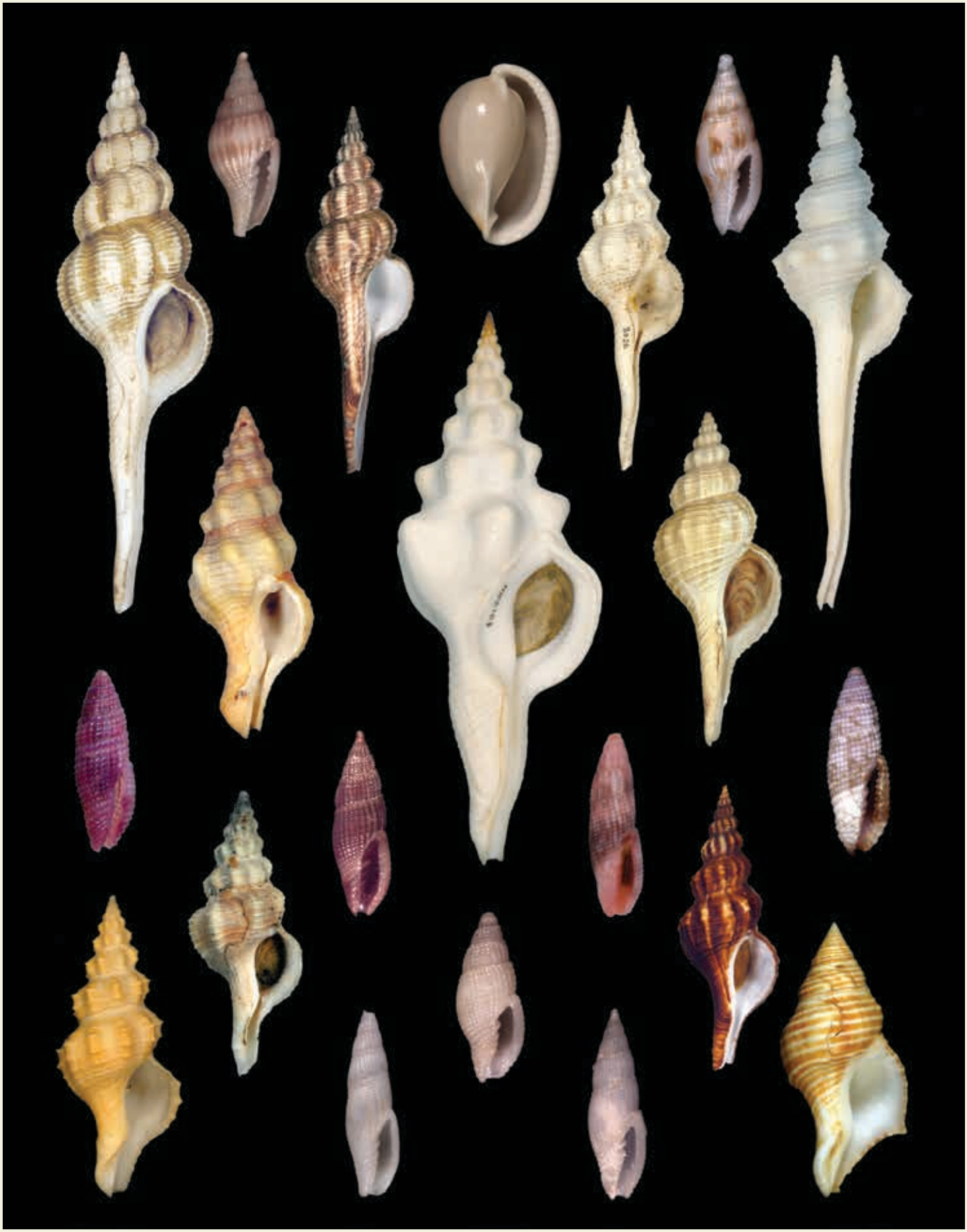
As a key member of the coordinating committee of the Delaware River Watershed Initiative, a partnership of 50 environmental organizations funded by the William Penn Foundation, Academy scientists strive to monitor, protect and restore conditions in the streams, rivers and landscapes in targeted regions within the watershed. They study communities of various aquatic organisms in streams to monitor water quality in suburban Philadelphia, North Jersey, South Jersey, counties of Montgomery, Berks, Chester, Carbon and Monroe and the Poconos. Alongside other factors, sampling algal communities enables our scientists to gauge how human influences are affecting natural systems.

That's why Chan so carefully plans the timing of algae sampling.

Algae sampling needs to be done within the same time period each year for the Academy to make year-to-year comparisons and monitor any stream health changes, says Chan, and the Academy's crew collects data every year between late June and mid-October. They try to collect all the samples before the leaves begin to fall from the trees in autumn, she says. If they wait, the rocks will be exposed to additional sunlight or will be covered by leaf fall that will promote or hinder algal biomass growth. In turn, their measurements will not reflect the algal communities' true health within these streams. With summer rains washing algae off the rocks and not enough time between storms for algae to regrow, this year's field crew was literally running out of time to collect valuable data by early August.

When they finally made it into the field in late summer, our scientists used a tool called a scumgetter to remove and "scrub" algae from rocks. Using the top of a toothbrush glued to the end of a syringe's plunger, our scientists placed the syringe's cylinder on a rock and twisted the brush around in circular motions, noting the amount of area scrubbed to collect a biomass measurement of the algae living on the rocks. With very little time to spare, they were able to collect the necessary samples for year-to-year comparison.

When rain prevents the field crew from measuring algae, Chan directs the team to conduct habitat surveys within the same areas where algae will later be collected. The team notes the characteristics of the riparian barrier, or the vegetation zone around the stream, including the presence or absence of invasive species, native trees, diversity in vegetation types and heights and any human influences on the riparian barriers. They also note in-stream habitat, including wood debris (such as logs or brambles), rock size (pebbles, sand or boulders) and aquatic plants that can provide habitat for fish and other aquatic organisms like insects. Taken together with data from these habitat surveys, as well as data on the fish and aquatic invertebrates in these areas, algae help provide a holistic and ecological approach to understanding the health of a stream. *~Mary Alice Hartsock*



Paul Callomon/ANS

TOP ROW: *Fusinus marisinicus* Callomon & Snyder, 2009; *Thala gloriae* Rosenberg & Salisbury, 2003; *Fusinus juliabrownae* Callomon, Snyder & Noseworthy, 2009; *Prionovolva melonis* Rosenberg, 2010; *Fusinus teretron* Callomon & Snyder, 2008; *Mitromica cosmani* Rosenberg & Salisbury, 2003; *Fusinus stannum* Callomon & Snyder, 2008
UPPER MIDDLE: *Hemipolygona lamyi* Snyder, 2007; *Fusinus mauiensis* Callomon & Snyder, 2006; *Fusinus amadeus* Callomon & Snyder, 2008
LOWER MIDDLE: *Thala lillicoi* Rosenberg & Salisbury, 2007; *Mitromica calliaqua* Rosenberg & Salisbury, 2003; *Thala hilli* Rosenberg & Salisbury, 2007; *Thala gorii* Rosenberg & Salisbury, 2003
BOTTOM ROW: *Hemipolygona honkeri* Snyder, 2006; *Fusolatirus higoi* Snyder & Callomon, 2005; *Mitromica oryza* Rosenberg & Salisbury, 2003; *Mitromica dicksoni* Rosenberg & Salisbury, 2003; *Mitromica williamsae* Rosenberg & Salisbury, 2003; *Fusinus emmae* Callomon & Snyder, 2010; *Dentifusus deynzeri* Vermeij & Rosenberg, 2003

MUSEUM COLLECTIONS:
A constant flow of new discoveries

By Paul Callomon, Collection Manager, Malacology and General Invertebrates

Beyond the Academy's dioramas and dinosaurs lie its vast scientific collections. Rows of gleaming metal cabinets hold millions of shells, birds, insects, fossils, fish, plants and everything in between. In darkened rooms, the bodies of squids, lizards, eels and crabs are suspended in stable fluid for all time on shelf after shelf of tanks and jars. These collections represent one of the world's great archives of nature and are a vital key to understanding changes in our environment.

The collections are arranged according to principles of *taxonomy* — the art of distinguishing and naming separate species and grouping them based on their relatedness — and are presided over and inhabited by people known as *taxonomists*.

Everything in the collections is carefully labeled, but not every label has a full scientific name. Some simply give the broad group to which the specimens belong, followed by the term "sp." or "undet.," meaning that the species name has not been established. This might just mean that no-one has yet gotten around to identifying it, but in many cases a full examination will reveal that the animal or plant is a new species to science.

The discovery of new species in museum collections is a surprisingly common event. Every year, roughly 20,000 new organisms are named in the scientific literature (over half of them insects). This enormous number of species is termed the earth's *biodiversity* and reflects hundreds of millions of years of evolution. Few new discoveries are recognized as such in the field during an expedition, however. They must first be cleaned, preserved and sorted before the fine work of identifying species can begin.

A Knowing Eye

Discovering a new species requires the happy union of two things — the specimens themselves and an experienced pair of eyes. Those eyes are scarce, however, and they only occasionally enter the same space as unnamed specimens. Once expedition material has been brought back from the field and placed in a museum's collection, therefore, it may yet be many years — hundreds, in some cases — before the two meet.

We can nevertheless be sure from their sheer size alone that the Academy's collections contain many new species just waiting for someone with the right expertise to discover them. That expertise

What is a species?

Although we often use the word, in talking about an "endangered species" for example, nature's huge complexity means that it has no simple definition. Simply put, though, it's a unique kind that does not successfully mate with others. For example, in all the world, there is only one species of domesticated dog. Different though they look, dachshunds, pit bulls and whippets are just artificially bred combinations of size, shape and color. Left unsupervised, they will happily mate with each other, or at least try, and will produce thriving offspring. Similarly, there is only one species each of domesticated cat, pig — and human.

Elsewhere in the animal world, however, the number of species in a given group is usually much higher. There are at least 35 named species of crow, almost 500 of shark and, dismayingly, around 3,500 of mosquito. Among the invertebrates, the numbers get really big. There are so far roughly 75,000 named species of mollusk and a staggering 1 million named insects.

Mike Servedio/ANS

Marty Snyder: Shell Expert

Martin Avery Snyder, PhD, is a true taxonomist, despite the fact that his doctorate is in mathematics. His daily business is in the construction and conversion of large houses and other buildings in the Philadelphia region. During his boyhood, he received a gift of a shell collection that he began building again in the 1970s, purely out of personal interest.

Snyder soon focused solely on the family Fasciolariidae, the Tulip and Spindle Shells. He also began to collect, read and file all the published literature on the group. A deep enthusiasm was born and his collection and library soon became large and comprehensive enough to allow him to distinguish new species from among shells that arrived at his home from dealers and collectors all over the world. To help with his work, Snyder became a research associate at the Academy, allowing him free access to the collections and the impressive Malacology Department library. Since 1984 he has described 72 new species to science based entirely on shells in museums and private collections.

has two parts. The first is a knowing eye, what some call the "Grand Central Station effect." From the balcony in Grand Central Station, you could easily pick out your friend or relative among the vast sea of people below. Likewise, when a dredge full of mixed sea life, sand and rubble is spread onto a boat's deck, a mollusk person can immediately spot the shells in the jumble, a worm person the worms and so on. It is more than just spotting things; it's recognition. The second element is a deep knowledge of the literature — what species have already been named, where they are from and what they look like.

Taxonomists are famously born, not bred. The urge to classify things is universal to humans and takes many forms; accountants, doctors and trash pickers, for example, all classify the things they work with. Natural scientists, however, usually also engage personally with a particular kind of thing. If you ask specialists in birds, worms, shells or palm trees, most will say that their attachment to their chosen organism is emotional and hard to justify in logical terms and that it started at a young age. The happiest taxonomists work in areas with high rates of unresolved classification and undescribed species, such as mollusks and insects, where they can make frequent discoveries and help reveal more of nature's gigantic and ever-changing mechanism.

> Before the word "scientist" was coined by William Whewell in 1833, everyone in the field was an "amateur" — someone who does something for the love of it.

Vital though their work is, professional taxonomists are so few in number that they are themselves often described as an endangered species! More than half the new species descriptions in scientific literature each year are written by private enthusiasts. This has been the case since Victorian times and is unlikely to change given how much work remains to be done. The rate of new discoveries in the mollusks, for example, has not slowed since 1850, and probably more than half the living species remain to be named.

R. Tucker Abbott

In 1963, Academy mollusk curator R. Tucker Abbott flew to Thailand to join the International Indian Ocean Expedition. With some time to spare before the ship sailed, he visited one of the huge tin dredging barges anchored off Phuket in the company of a local doctor. From the sand being dredged up for its tin content they collected

hundreds of Spindle Shells, a sea snail. Abbott sent them back to the Academy and on his return labeled them as a known and common species. As he had found so many, he divided them up and sent some to the Smithsonian Institution, the Delaware Museum of Natural History and Harvard University in exchange for other shells.

Gizelle Batomalaque, PhD

Abbott was a well-known taxonomist and his identification was adopted without question by those other museums. It was not until 2008 that Academy Research Associate Martin Avery Snyder, PhD, and I, both specialists in Spindle Shells, went through the Academy's collection and recognized Abbott's shells as representing a separate and as yet undescribed species. That no one at any of these museums had spotted this in 45 years is no reflection on their staff, however; there are perhaps six Spindle Shell specialists in the world, and two of them are at the Academy.

There is a strong difference between fields of science such as medicine, physics and chemistry that create profitable technologies and involve strict qualifications and career structures, and slower, less pressurized fields that involve discovery and description, such as zoology and botany, where many workers earn a living elsewhere. Nevertheless, correct identification and the naming of new things are the foundations of all natural science, from geochemistry to genetics and pharmacology.

The study of ecosystem-wide effects like pollution and climate change relies on knowing which organisms are where and when, and as species come and go, it is essential that they be reliably identified. This makes it even more remarkable just how few opportunities there are for young people to get experience as taxonomists and, as a result, how scarce experts are, even in fields that are vital to human health and agriculture such as insects and parasites. Students in Drexel's department of Biodiversity, Earth & Environmental Science (BEES) have an opportunity to study taxonomy with world leaders in various fields and get hands-on experience with identification and classification working in the Academy's vast collections. In the Malacology Department, Gizelle Batomalaque recently completed her PhD in BEES, studying the land snails of her native Philippines.

Natural history museums play a vital role in taxonomy, both as a forum where professionals and amateurs work together to produce knowledge and as a showcase of nature where children encounter their first bugs and shells, perhaps sparking that lifelong involvement with one particular kind. A recent survey revealed that the length of time between a new species being collected in the field and its description being published is, on average, 21 years, so it's vital that they all be sorted and kept ready for those experienced eyes to find.

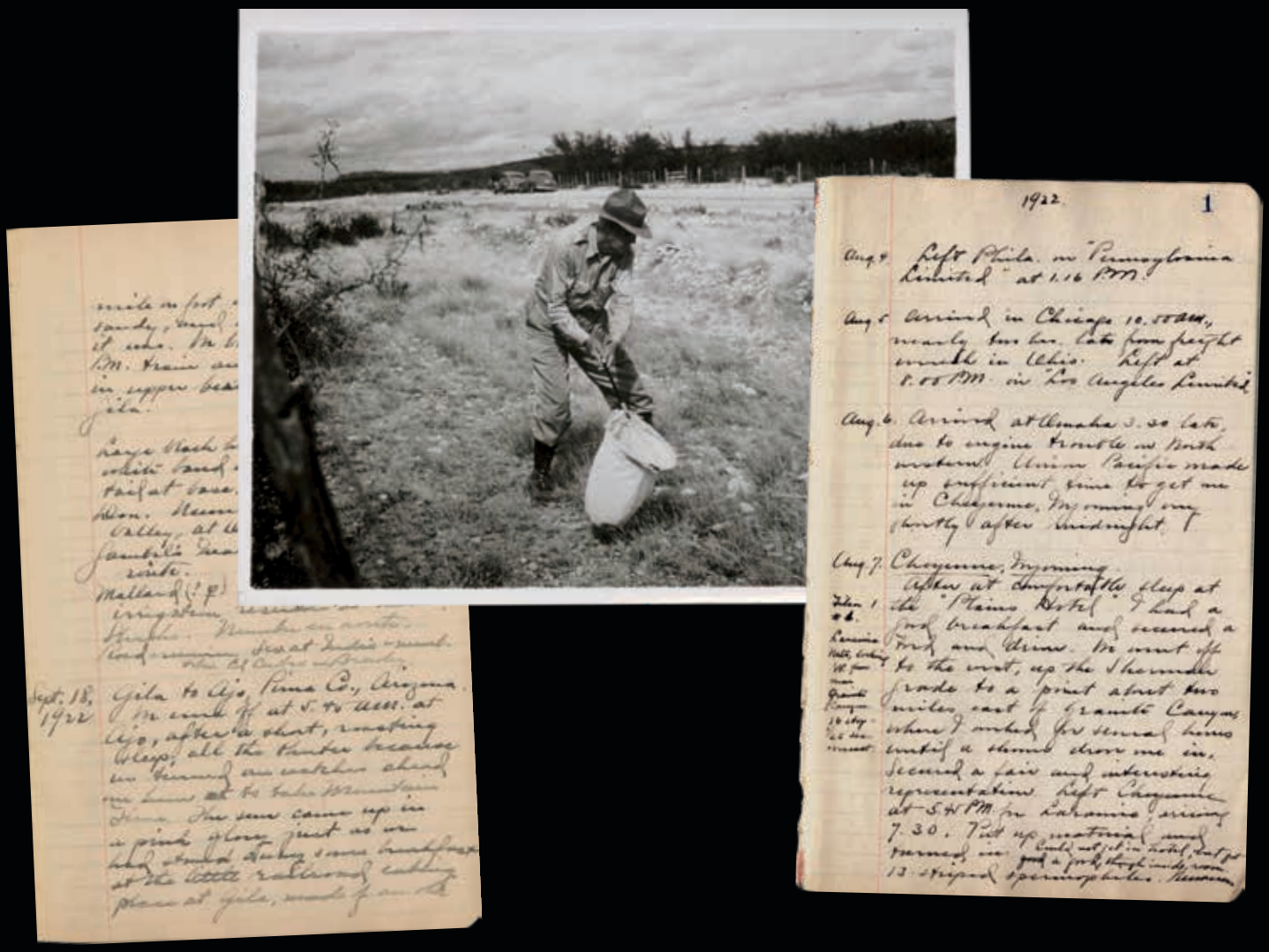
Paul Callomon/ANS

False Alarm

At one point it seemed that we might have found a new species of Giant Clam in the Academy's collection. It was found in the remote Cocos-Keeling Islands during the Academy's Indian Ocean Expedition of 1963, and our three specimens looked different to any of the four species known from that area. Even after 55 years, however, a team of Academy and Smithsonian scientists were able to extract DNA from tiny residues of dried muscle tissue remaining on the shells. By comparing it to gene sequences for the other species published online, we established that our unusual shells represented a form, though a distinctive one, of the Southern Giant Clam (*Tridacna derasa*).

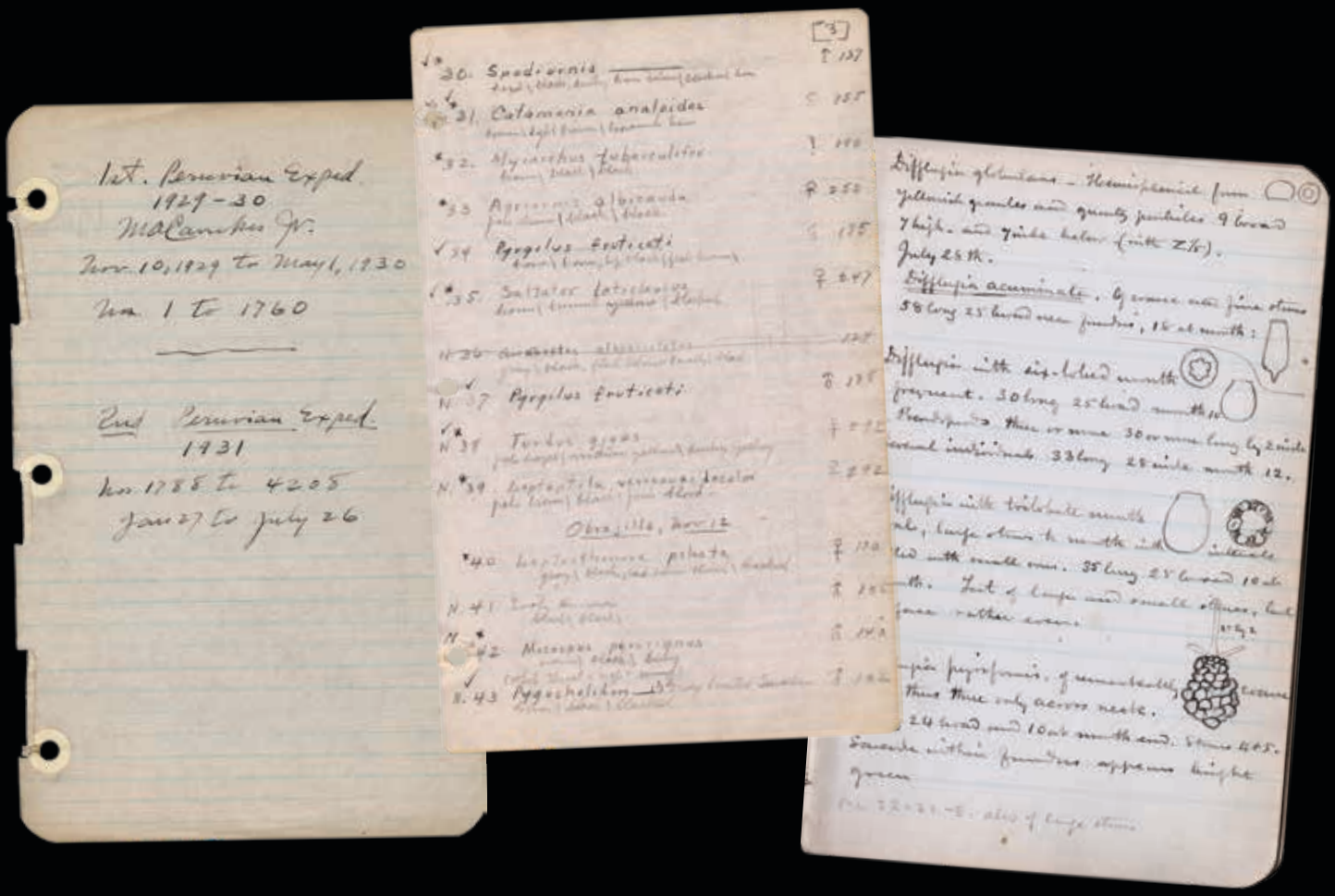
Field Journals: Past and Present

By Jennifer Vess, Brooke Dolan Archivist



When you work at a museum, the word "digitization" pops up in a lot of conversations. It can have subtly different definitions, but in the Archive, when we say "digitization" we usually mean creating a digital copy of an object that can be displayed online. Digitization has been happening for decades, and every year we see more and more content — letters, photographs, diaries, newspapers, films, audio recordings, objects and more — all on our computer screens.

LEFT TO RIGHT: *James A.G. Rehn field journal, expedition to the American Southwest, 1922, Coll 739; Photograph of James A.G. Rehn in the field in Texas, 1951, coll 457; Joseph Leidy field journal, 1877-1887, Coll 482*



LEFT TO RIGHT: *Melbourne Armstrong Carriker field journal for the 1st Peruvian Expedition, November 1929-May 1930, Coll 54*

Cultural institutions are using digitized records to connect with researchers all over the world, many of whom never would have been able to travel to see certain research materials in person. Those of us who take care of these precious items love that digitization enables countless people to access the same fragile document without wear and tear from handling. And once an archive is online, we can start making connections to other collections within our institution and even to collections at other institutions around the globe. Our field journals are one of the best examples of this.

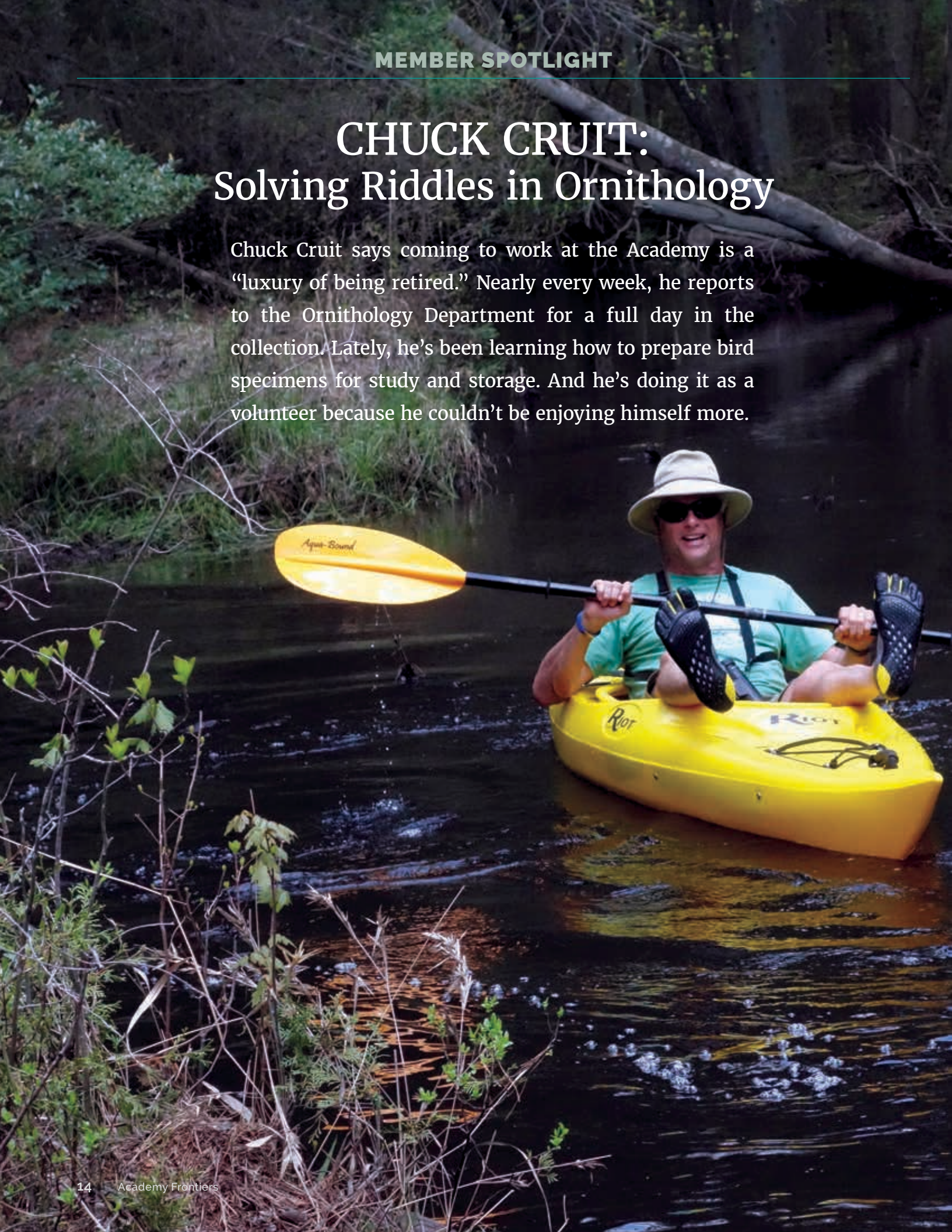
Field journals are often the first documents created by scientists when they are out in the world making observations or collecting specimens. Our Archive is full of these books dated from 1802 to the present. Field journals follow all sorts of formats: some document observations of the same area over years or decades, some offer detailed information about collections housed in our museums, some are filled with regimented data that can be compared over time and space and others provide a narrative of the history and culture of a field location alongside the science. They are documents rich with potential that could serve many needs and reach many audiences if they are digitized and available online.

The first project that really dug into the potential of digitized field journals was OrthopNet. OrthopNet consists of specimen records from Orthoptera, Phasmatodea and Mantodea in the Academy Entomology Collection. Many of those specimens were collected on trips to the United States southwest by James A.G. Rehn, who left us with many journals of his travels. Through the work of Academy entomologist Greg Cowper, a number of Rehn's journals were digitized, placed online and are being linked directly to the specimen records. Now, a researcher looking at the record of a grasshopper collected by Rehn can click on a link that takes them to an image of the page in his journal in which he describes collecting that very grasshopper!

We also have added field journals to Biodiversity Heritage Library related to botany, Joseph Leidy and ornithology, and we are working on early 20th-century malacology expeditions. We have a long way to go (several hundred volumes), but as more information makes it into databases and more materials are digitized, we can start tying them together. One day, with just a few clicks, you will be able to read a journal from 1934, see film of the collectors, read a record of the specimen they collected and see a photograph of it!

CHUCK CRUIT: Solving Riddles in Ornithology

Chuck Cruit says coming to work at the Academy is a "luxury of being retired." Nearly every week, he reports to the Ornithology Department for a full day in the collection. Lately, he's been learning how to prepare bird specimens for study and storage. And he's doing it as a volunteer because he couldn't be enjoying himself more.



Cruit has always been interested in certain birds — especially egrets, blue herons and members of the Ardeidae family — that he sees while kayaking and spending time outdoors with his family at the Jersey Shore. Upon his retirement from Boeing as director of intellectual property five years ago, Cruit, of Media, received a field guide to birds as a gift. Though he had never truly considered himself a birder, he thought, "Why not start now?" He was intrigued when he found out he could get an even more intimate look at birds from all over the world in the Academy's collections.

"I thought to myself, what better way to get to see the birds in field guides up close?" Cruit says.

In 2015, Cruit met Ornithology Collection Manager Nate Rice, who immediately put Cruit to work. Without a science background, Cruit had a lot to learn about taxonomy, and he spent many hours exploring the collections and consulting field guides to bolster his background knowledge. Soon, he knew the collection well enough to assist Rice in pulling specimens for loan to other institutions. His favorite job has been helping Academy scientists add some of the 2,000 birds a year to the Ornithology Collection.

"It's sometimes a puzzle because we're out of room! If you want to add four snowy owls to the collection, you have to move lots of stuff around to fit them in the proper place."

Solving riddles like this one keeps Cruit coming back for more each week. He loves to see and learn about many different birds as he adds them to the collection over the course of a single morning's work. Using labels with Latin names, Cruit obtains field guides and seeks out the common names of the birds to further his own knowledge. He then dives deeply into the taxonomy, learning what family the specimens belong to so he can catalog them properly in the collection.

Cruit's work has gone beyond the collections and into the field, where he has traveled locally with Rice to collect specimens. He has also audited Curator of Ornithology Jason Weckstein's undergraduate class, trekking into the field with groups of students to identify birds. At the Academy's annual Members' Night, Cruit can be found in a lab helping members decode subtle differences between hawks, woodpeckers or other common birds that are challenging to observe in the wild. He also helped set up a Brazilian birds unveiling party last spring, enabling Rice and Weckstein to reveal specimens collected over several expeditions to remote areas of the country.

Participation in events like these, plus the Academy's Back From the Field event, has immersed Cruit deeply in the science culture of the Academy, which he says has been "a real departure" from his background in technology licensing.

Over his nearly five years of volunteering at the Academy, the department has undergone a renaissance, with the hiring of Weckstein and several other staff, plus the addition of many students.

"Not only is the work fascinating, but there is a steady flow of postdocs from all over the world, and they are amazing," Cruit says. "And the scientists have a great sense of humor — I'm laughing the whole time I'm here!"

As a Lewis and Clark Circle donor, Cruit is thrilled to see the rapid growth of the Ornithology Department. Last Giving Tuesday, Cruit provided a matching gift for the Laboratory for Molecular Systematics and Ecology, the Academy's genomic lab, where our scientists and students study genetics and use DNA technology to research biodiversity. Thanks to Cruit's matching gift, Academy scientists including Weckstein, who uses the lab to study the evolutionary history and ecology of birds and their parasites, received twice the expected support to process DNA and conduct other molecular work.

With his deep ties to the Ornithology Department, its specimens and its people, Cruit has no intention of stepping aside anytime soon.

"It's one of the best parts of my week," he says.

~Mary Alice Hartsock

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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 **May 16, 2019** and **August 15, 2019**. Your generosity helps to fund our many programs of research and education, and we are tremendously grateful for your support.

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Recycling 101

By Mike Servedio

In January 2019, we learned that over 50% of Philadelphia's recycling was being sent straight to an incinerator in Chester. The problem was part of a larger issue with recycling nationwide — that the market for purchasing recycled goods, with China being the primary buyer, had shifted greatly.

In 2018, China decided to no longer accept recycled materials that didn't meet new stringent rules around contamination and mixed materials. Soon, recycling, which had actually been profitable for Philadelphia, became an expense for the city.

One of the main reasons that much of Philadelphia's and the United States' recycling is so expensive to sell is that it is deeply contaminated. You can help address this problem by knowing what you can recycle and how best to clean your recycling.

How clean should it be?

What does it mean to have clean recycling? Your can of tomatoes, jar of jam or bottle of milk need to be rinsed of visible residue before you put them into the curbside recycle bin. Cardboard boxes (flattened, with stickers and labels included) are almost always ok, unless debris and grease have soaked into the fibers. Pizza boxes, for example, are often greasy, but if the top of the box is clean you can tear it off and recycle it curbside, discarding only the soiled portions. You can recycle glass bottles, but do not include broken glass, window glass, lightbulbs (recyclable at some home improvement stores) and porcelain in your curbside recycling. Don't even consider adding in napkins, paper towels, used paper plates, waxed coffee cups, tissues or straws — they are as off limits as the Styrofoam containers and packing peanuts that often come in shipped materials. Plastic bags, including those air-filled packs that often come in shipping boxes, cannot be recycled curbside, but many grocery stores accept them along with regular grocery store plastic bags if they are clean and dry.

What can you recycle curbside?

- Glass jars and bottles
- Paper (non-metallic)
- Newspaper
- Cartons (milk, juice, broth, wine)
- Flattened cardboard
- Books and magazines
- Egg cartons
- Plastic containers (rinsed, lids and caps ok)
- Aluminum cans and foil
- Metal tins
- Steel cans and lids
- Empty paint cans
- Empty aerosol cans

What can't you recycle curbside?

- Plastic bags
- Disposable takeout containers made from Styrofoam or paper
- Greasy pizza boxes
- Styrofoam
- Disposable plates, coffee cups
- Compostable plastics
- Pet food bags
- Chip bags
- Diapers
- Light bulbs
- Propane tanks
- Garden hoses
- Cassette tapes
- Tissues, paper towels and napkins

What can you recycle by taking to a special facility?

- Chip bags
- Batteries
- Drink pouches
- Shoes
- Candy bar wrappers
- Corks
- Brita filters
- Electronics (computers, radios, etc.)
- Paint
- Light bulbs
- Plastic bags

How can you reduce the amount of recycling or waste you create?

Reduce: You know the phrase reduce, reuse, recycle. It's especially important to remember the first part of it. In a world where almost any item is available to be delivered right to your home or office via the click of a button, being aware of the environmental impact of having that item shipped to you is of utmost importance. If you suspect something will come in unrecyclable plastic or with excess packing material, consider if you really need that item or if you can purchase it in a more sustainable way.

When you need to purchase an item or find yourself with more than you need, Philadelphia is full of consignment shops, thrift stores, used clothing boutiques, children's sales and home goods and electronics resale shops that both accept used goods and offer gently used items at a fraction of the price of purchasing new. Facebook Marketplace, Craigslist and several apps and websites also provide places to buy and sell everything from leftover birthday party swag to shoes and baby gear. You can donate bedding, car seats, prom dresses and even used textiles (including very worn clothes) at a number of locations, listed on Green Philly's website at thegreencities.com/category/recycle.

Buy Bulk: Many supermarkets (including Philadelphia branches of Mom's Organic, Whole Foods, Wegman's and Weaver's Way) allow you to buy items such as laundry detergent, rice, pasta, spices, nuts, beans and more in bulk with your own container. Make sure to note the weight of your container and subtract it from the full weight of your purchase.

Yard Waste and Composting

Yard Waste: Many municipalities, including the city of Philadelphia, have special pickups during the year (particularly in the fall) for yard waste. Instead of throwing your yard waste in the trash, it can be collected separately and used to create compost and mulch. Philadelphia's sanitation centers accept Christmas trees, and many neighborhoods have private events that allow residents to bring their trees for nominal fees for reuse as compost or wood chips.

Composting: Food scraps and yard waste are close to 30% of what we throw away (epa.gov). When thrown into an oxygen-deprived landfill, the very same items break down slowly and produce methane, contributing directly to global warming. Composting enables you to turn your organic waste — items such as fruit peels, food scraps, coffee grounds, leaves and more — into a resource that can help nourish your soil and spruce up your yard.

You can compost at home (learn more at anspblog.org/composting-a-guide/) or with the help of compost collection services in certain communities and markets, such as Mom's Organic in Center City. Philadelphia is currently exploring centralized locations for compost drop off, but as of this writing, the city has not announced those locations.

Recycling in the Philly Suburbs

Recycling requirements differ from county to county, and your municipality may have specific guidelines for your curbside trash and recycling. You can find out more about your municipal requirements online or by calling your local administration building. You may also have access to county-wide recycling events for hazardous waste, electronics, shredded paper or other items that do not comply with municipal guidelines. Here are some county-specific resources to help you and your family start a conversation about recycling:

BUCKS COUNTY:
recycling-bucksgis.opendata.arcgis.com

CHESTER COUNTY:
chestercountyswa.org

DELAWARE COUNTY:
delcopa.gov/recycle/index.html

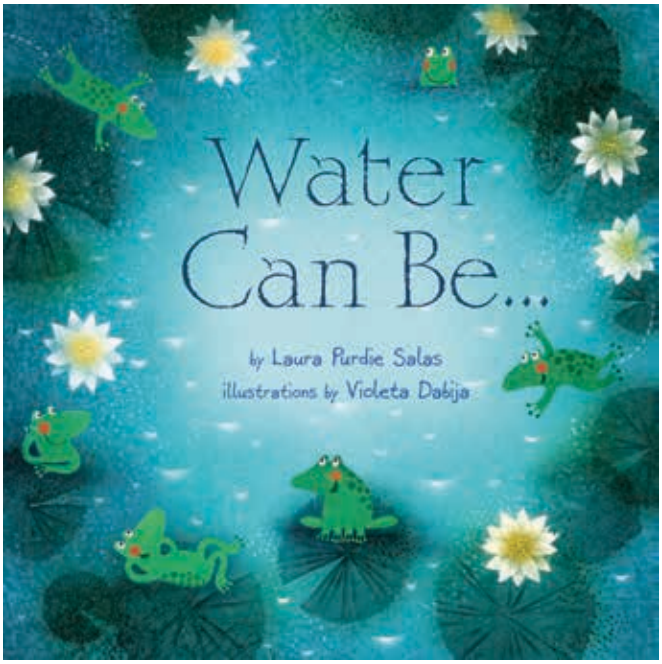
MONTGOMERY COUNTY:
montcopa.org/637/Recycling-Information

BURLINGTON COUNTY:
co.burlington.nj.us/345/Recycling

CAMDEN COUNTY:
camdencounty.com/service/environmental-affairs/recycling

GLOUCESTER COUNTY:
gcianj.com/county-recycling

The Wild World of Water



Water is a powerful natural resource that is necessary for all life. Covering almost 3/4 of the earth's surface, it flows in streams, rivers and oceans and exists in the forms of liquid, solid and gas. It heats and cools our homes, helps our foods grow and provides habitat for all kinds of wildlife.

In the book *Water Can Be...*, author Laura Purdie Salas and illustrator Violeta Dabija take readers on a thought-provoking journey through the seasons, describing the many roles of water. This poetic voyage provides ample opportunities for conversation about water, with a handy section at the end that helps parents delve more deeply into the scientific concepts.

Visit your local library for a copy, and then complete the activities below with your family.

Don't have the book on hand? No worries! You can do most of the activities without it.

Pie Plate Aquarium

Make your own ocean complete with floating jellyfish and wiggling eels. Find a ceramic pie plate, plastic bowl or glass baking dish. Using dry erase markers, draw ocean creatures on the bottom (or use plastic critters if you have them). Add water to the pan to watch your ocean come to life and begin to float. Experiment with warm water and cold water. Experiment with different colors and different ways of drawing (thick lines, thin lines, etc.). You can also try making an ocean diorama out of a shoebox and other supplies you have around the house.

Compare your ocean habitat to the one on the "home maker" page in *Water Can Be*. Would you want to live there? How many animals can you count on this page? What do you think the fish at the top of the page are doing?

Corals that make up this coral reef home are actually animals! They might look like rocks or plants, but corals are considered invertebrates (animals without backbones). Coral reefs are like the cities of the seas, with many different types of animals finding shelter, staying safe, having babies and finding food.

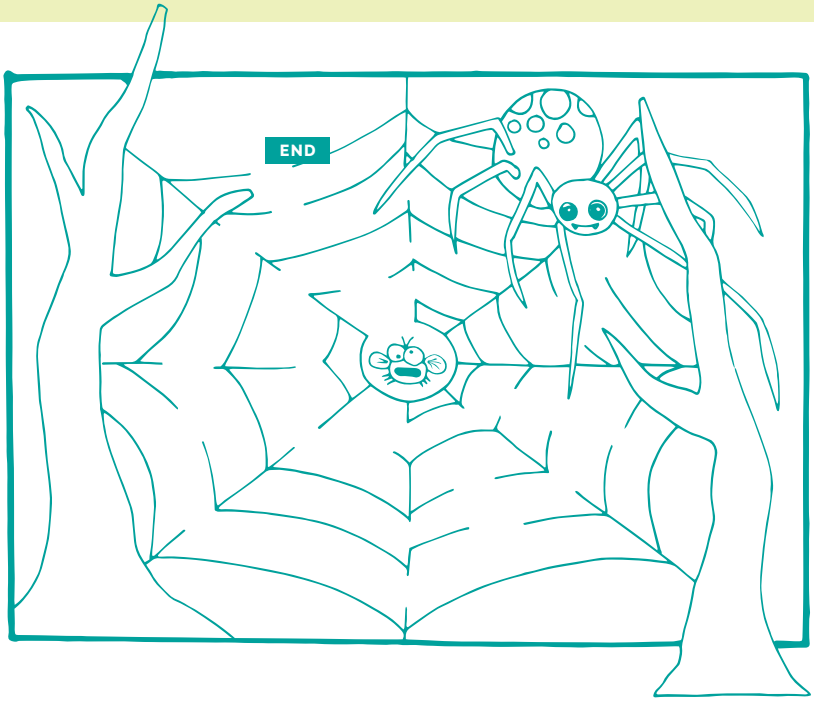
Water Cycle in a Bag

Observe the water cycle in action — even on a sunny day. Find an empty glass jar or bottle (a plastic baggie will also work). Draw the ground on the outside of the jar at the bottom with dry erase markers, and add flowers and trees! Draw the sun at the top. Fill the jar a quarter of the way and add a few drops of food coloring, just so you can see the water better. Set your jar in front of the window and watch the water cycle as it goes around and around. As the water warms up in the sun, you'll start to notice droplets of water up toward the top of the jar. The water has evaporated and condensed into those droplets. As the droplets get fuller and heavier, they'll "rain" back into the bottom of the jar.

Drips and Drops

Explore how water sticks together. Get a cup of water and add a few drops of food coloring. Use different tools to drip water onto wax paper. Try a small spoon, eyedropper, paintbrush, sponge or any other tool you might have around the house. Which gives you the biggest drops? Try dripping the water from high up or just above the paper. Look closely at the drops on the wax paper. Draw pictures of the shapes you see. Wiggle the wax paper. What happens to the drops? Do they join together? Add sand to your water and see how that affects the size and shape of the drops.

Happy fall! Help a bee escape a spider's web, and then count the *Maiasaura* eggs hiding within the pumpkin patch!



The Great Bee Escape

Oh no! The bee is caught in the spider's web. Help her avoid the traps and escape to safety.

Maiasaura Pumpkin Patch

Maiasaura were large, herbivorous dinosaurs. We know *Maiasaura* laid eggs in nests because paleontologists have found fossils of their nests, some with more than 40 eggs!

Illustrations by Christine Danowsky/ANS

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