

A close-up photograph of a butterfly with black and white wings feeding on a yellow flower. The butterfly is positioned in the center-left of the frame, with its wings spread. The flower is a cluster of small yellow buds and open flowers. The background is a soft, out-of-focus green. The text 'ACADEMY' is in the top right, 'FRONTIERS' is on the right side, and the magazine's name and date are at the bottom right.

ACADEMY

FRONTIERS

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

SUMMER 2012

Greetings From the Academy

PRESIDENT AND CEO: George W. Gephart, Jr.

VICE PRESIDENT FOR INSTITUTIONAL

ADVANCEMENT: Amy Miller Marvin

EDITOR: Mary Alice Hartsock

GRAPHIC DESIGNER: Stephanie Gleit

CONTRIBUTING WRITERS: Michelle Chikaonda,

Clare Flemming, Megan Gibes, Roland Wall

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ON THE COVER: *The butterfly* *Idea leuconoe*, one of the most frequent visitors to the milkweed relative *Parsonsia alboflavescens*, is helping Botany Assistant Curator Dr. Tatyana Livshultz learn more about milkweed pollination. Turn to page eight to learn more about her research. Photo by Tatyana Livshultz.



THE ACADEMY'S BICENTENNIAL IS OFFICIALLY IN FULL SWING, and I am thrilled about the natural science opportunities we have in store for you this year. Since we launched our 200th anniversary celebration on March 21, we have hosted four activity-packed special weekends and offered behind-the-scenes tours highlighting several of our amazing collections. Through February 2013, we will continue to bring you these unique opportunities to meet our scientists, learn about their research, and see some of the celebrity specimens that make our collections so important. Every month we're introducing a new theme: insects in August, diatoms in September, shells in October, and more. We will even help you start your very own collection. Turn to page four to learn more about these exciting opportunities.

We are especially eager for you to see our bicentennial exhibit, *The Academy at 200: The Nature of Discovery*, which already has received recognition in *The Wall Street Journal*, *The New York Times*, and *The Philadelphia Inquirer*. Open only during our Bicentennial, this exhibit showcases extraordinary specimens—some that you can touch—and offers real opportunities to be a part of our science. On an 80-foot-long wall of some of our most remarkable specimens, you'll see everything from an enormous skeleton of an Irish elk to the 215-million-year-old jaw of an ancient crocodile-like reptile. You can also try on scuba diving gear, assemble a dinosaur skeleton, and learn about climate change.

In this issue of *Academy Frontiers*, we bring you important information on the Patrick Center's studies of potential impacts of Marcellus Shale drilling in Pennsylvania and botanist Dr. Tatyana Livshultz's research on pollination biology in Taiwan. We hope learning more about our work will inspire you to begin or continue your own exploration of the natural world. The Academy certainly is the place to be this year to experience the thrill of scientific innovation!

I look forward to seeing you here at the Academy during our 200th anniversary celebration. I hope you will consider supporting our Third Century Fund, which will enable us to continue to bring you this level of superior programming in the future. Thank you for your tremendous support.

All the best,

A handwritten signature in black ink, appearing to read 'Gephart'.

George W. Gephart, Jr.
President and CEO

ACADEMY FRONTIERS

Summer 2012

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JOIN US FOR THESE UPCOMING EVENTS!

AUGUST

- ENTOMOLOGY COLLECTION BEHIND-THE-SCENES TOURS
Thursdays through Mondays, 11 a.m.
Ages 8 and up 
- ACADEMY EXPLORERS CAMP
Weekdays through August 24, 9 a.m.–4 p.m.  
- 5TH ANNUAL BUG FEST
Saturday and Sunday, August 11 and 12, 10 a.m.–5 p.m.
- 2ND ANNUAL GEEK AWARDS
Friday, August 17, 6:30 p.m.  

SEPTEMBER

- DIATOM HERBARIUM AND PHYCOLOGY
BEHIND-THE-SCENES TOURS
Thursdays through Mondays, 11 a.m.
Ages 8 and up 
- BICENTENNIAL SCAVENGER HUNT
Saturday, September 8, 10 a.m.–2 p.m.  
- FOSSIL HUNT FAMILY FIELD TRIP
Saturday, September 8, 10 a.m.–2 p.m.
Ages 7 and up  
- MEMBERS' NIGHT
Friday, September 14, 5–9 p.m. 
- DIATOM DISCOVERY WEEKEND
Saturday and Sunday, September 22 and 23, 10 a.m.–5 p.m.
- ADULT CLASS: ARCHIVES AND EXPEDITIONS
Thursday, September 27, 6:30–8:30 p.m.  
- ADULT FIELD STUDY: PINE BARRENS FISH
Saturday, September 29, 9:30 a.m.–1:30 p.m.  

OCTOBER

- MALACOLOGY COLLECTION BEHIND-THE-SCENES TOURS
Thursdays through Mondays, 11 a.m.
Ages 8 and up 
- HOMESCHOOL SERIES: FASCINATING FOSSILS
Wednesdays, October 3 and October 10, 2–4 p.m.
Ages 4–7  
- HOMESCHOOL SERIES: FOSSIL FUNDAMENTALS
Thursdays, October 4 and October 11, 2–4 p.m.
Ages 8–13  
- BICENTENNIAL SCIENTIFIC SYMPOSIUM
Thursday, October 11–Friday, October 12
Events held at the Academy and Drexel University  
- SPILLOVER: ANIMAL INFECTIONS AND THE NEXT HUMAN PANDEMIC, WITH AUTHOR DAVID QUAMMEN
Tuesday, October 16, 6:30 p.m.  
- PHILADELPHIA SHELL SHOW AND FESTIVAL
Saturday and Sunday, October 20 and 21, 10 a.m.–5 p.m.

 Fee  Registration required

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

Visit ansp.org for more information and to register.

On Exhibit



Greg Benson Photography

The Academy at 200: The Nature of Discovery

SPECIAL EXHIBITS GALLERY
OPEN THROUGH MARCH 2013

A toothy Freshwater Vampire Fish skull. A Burmese python. The 215-million-year-old jaw of an ancient crocodile-like reptile. Come face-to-face with these amazing specimens and more in a one-of-a-kind exhibit at the Academy. Experience science as you never have before by dressing up like a scientist, assembling a dinosaur skeleton in the bone lab, and learning about climate change. Step into our shoes (literally!) and experience your favorite natural history museum in a whole new way at *The Academy at 200: The Nature of Discovery!*

Flirtatious Feathers: A Colorful Collection of Academy Bird Photographs

ART OF SCIENCE GALLERY
OPEN THROUGH SEPTEMBER 23, 2012

Whether in flight or in song, many birds display vibrant plumage that charms mates and photographers alike. This kaleidoscope of colored feathers is the subject of a stunning exhibit featuring images from the Academy's Visual Resources for Ornithology (VIREO), the most comprehensive bird image bank in the world. Built by the Academy in collaboration with exhibit design students from Drexel University's Antoinette Westphal College of Media Arts & Design, *Flirtatious Feathers* provides a bird's-eye view into the intimate world of winged creatures.



Doug Wechsler/ANSP



James Prosek

James Prosek: Ocean Fishes

OCTOBER 13, 2012–JANUARY 21, 2013
ART OF SCIENCE GALLERY

Dubbed “the Audubon of the fishing world” by *The New York Times*, Connecticut artist James Prosek is known for his detailed and arresting watercolor paintings, which primarily feature fish and other ocean creatures. He showcases his personal impressions of marine beauties such as a 15-foot blue marlin through life-size paintings from his new book, *Ocean Fishes* (Rizzoli New York, October 2012). Through direct observation and imagination, Prosek reveals the subtle colors and forms of fishes often hidden from our view beneath the water's surface.

TIMSHEL PURDUM: “GEEKING OUT” FOR NATURAL SCIENCE

ACADEMY SENIOR MANAGER OF EDUCATION TIMSHEL PURDUM HAS ALWAYS BEEN CRAZY ABOUT SCIENCE.

Though her fellow fifth graders wanted to become doctors, writers, and firefighters, she boldly announced to her classmates that she planned to become a herpetologist.

“My first pet was a snake!” she exclaims. “I always wanted to do something with science, but I wasn’t sure what it was.”

Like many people who become informal science educators, Purdum stumbled into her career. While in graduate school for aquatic toxicology, she took a part-time teaching job at a nearby aquarium. Much to her surprise, she was captivated by teaching in a way that she wasn’t by her graduate studies. So she took a bold step: leaving graduate school for an environmental education position that involved leading kids through the woods in search of salamanders, birds, and other animals.

“The world is fascinating,” she says. “When I share it with people, I always find something they don’t know about—or I don’t know about! With this career, I

can learn about all the different types of science and never stop.”

Purdum’s second graduate venture, an environmental education program that prepared teachers for careers in nonprofit management and nature centers, was the perfect fit. Years later, with two long-term positions at natural history museums on her résumé, Purdum accepted a weekend face-painting gig at an Academy event—and it led to a permanent job. She became a supervisor in the Academy’s hands-on discovery center for children, *Outside In*, and the rest is natural history.

Purdum is now a senior manager who oversees all Education Department activities, including teacher trainings, special programming, curriculum development, and grant writing. She stays up-to-date with science advances through conversations with Academy scientists so that she is prepared to engage visitors at programs and festivals.

“You’re touching visitors briefly and you need to get your message across as efficiently, accurately, and interestingly as possible,” she says. “What can they touch,

see, do, hear, smell? You have to engage them on multiple levels of learning.”

Purdum’s sense of how to help visitors connect with science aids her in conceptualizing educational events such as collection-themed Bicentennial Discovery Weekends and festivals that attract thousands of visitors each year. Even though that’s a lot of work, her team makes it easy.

“How cool is it to be surrounded by others who are just as passionate and geeked out about sharing science as I am?” she says.

Purdum’s excitement about the Academy’s 200th anniversary is contagious. She can’t wait to inspire visitors with the amazing opportunities to interact with natural science at the Academy this year, and she is just as eager to wow them with hilarious anecdotes about scientists past and present.

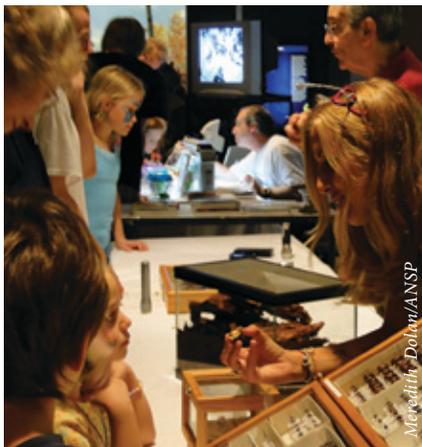
“We’re 200 years old. How could you not be excited about that?” she wonders. “The history of science is alive, and we’re celebrating it for an entire year. It’s seriously cool.” ~*Mary Alice Hartsock*

Academy Abbreviated

DISCOVERY WEEKENDS AND TOURS

In celebration of our 200th anniversary, the Academy is in the midst of a full year of special events and activities highlighting our work. Each month we're hosting a collection-themed Discovery Weekend with activities, games, and chances to meet scientists. We are also offering limited-time, behind-the-scenes tours of our world-renowned collections—normally only open to researchers by appointment. Held Thursdays through Mondays at 11 a.m. except on festival weekends, the tours are fantastic opportunities to see some of the amazing, spectacular, and unusual items in our collections.

August is Bug Month at the Academy, so come celebrate at our 5th Annual Bug Fest on August 11 and 12! See amazing butterflies, eat creepy-crawly cuisine, get up close and personal with some of our live insects, and meet a real entomologist. Throughout the month, behind-the-scenes tours showcase dazzling pinned insects in



Meredith Dolan/ANSP

a variety of sizes, shapes, and colors. You may even see the world's rarest insect.

Diatoms, single-celled algae, take the stage in September. On September 22 and 23, meet our experts, make a craft, and see live diatoms move! Take our behind-the-scenes tours to see impressive diatom library "treasures" dating back to the 1800s and marvel at colorful algae. ~M.C.

BICENTENNIAL CELEBRATION BEGINS



Dennis Murphy/ANSP

The Academy kicked off its bicentennial celebration in March with a full week of special events. The opening ceremony featured presentations by Michael Nutter, mayor of the City of Philadelphia; Eva J. Pell, under secretary for science at the Smithsonian Institution; and Dawn Timmeney, anchor for NBC 10. We premiered a special video, produced by Professor Gerard Hooper of Drexel's Antoinette Westphal College of

Media Arts & Design, which describes the Academy's rich resources and groundbreaking research. You can watch it anytime at ansp.org.

At the March 23 member preview for our bicentennial exhibit, *The Academy at 200: The Nature of Discovery*, members marveled at the exhibit, viewed the Academy's Mineral Collection, and tried out Academy scientists' field research tools. Throughout the week, animated light and laser shows on the Academy's façade featured colorful depictions of collection items.

Open to the public, Bicentennial Weekend featured family activities, educational programming, music, games, and crafts. Visitors enjoyed balloon animals, face painting, specimen-juggling demonstrations, and a game show! Attendees signed the Bicentennial Birthday Book, to be kept and archived in perpetuity for future birthday celebrations. ~M.C.

WINS TURNS 30



Sean Corbett

On Tuesday, June 5, the Academy celebrated the 30th Anniversary of Women In Natural Sciences (WINS), a free mentoring and science enrichment program for young women in grades 9-12, particularly from economically disadvantaged families and schools. The Academy marked this milestone with a fundraising luncheon at the Union League of Philadelphia. Chaired by Congressman Chaka Fattah and Mrs. Renee Chenault-Fattah, the luncheon recognized the work of Judith M. von Seldeneck, founder, chairman, and chief executive officer of Diversified Search, the largest woman-owned executive search firm in the United States. For 35 years, von Seldeneck has been a search industry pioneer and a leader in placing women and diversity candidates.

At the luncheon, Ninette Cooper, a 1989 WINS alumna, spoke of the incredible impact WINS has had on her life. Dr. Donna Murasko, Dean of Drexel's College of Arts and Sciences, discussed the importance of creating a population that is science literate. Attendees interacted with current WINS students who were seated among them and learned about their future plans. Contributions raised from the event will help provide paid employment at the Academy to WINS graduating seniors. ~M.C.

Academy Abbreviated

EVENT SPACE AVAILABLE

Tired of resorting to the same hotels and conference centers for important occasions? Consider making the Academy your next event venue. We have a wide range of spaces available, including Dinosaur Hall, the Ewell Sale Stewart Library, and the main auditorium, as well as exhibit spaces such as *Butterflies!* and our Special Exhibits Gallery.

Host your next birthday party, wedding, high school prom, major

corporate function, or other event for groups of 25 to 1,400 people. We'll provide event support and offer options ranging from caterers to DJs, live bands, and performers. We also offer talks by Academy scientists and appearances by our famous live animal ambassadors.

For more information, visit ansp.org/visit/groups/event-rentals/ or email events@ansp.org to begin planning your event! ~Michelle Chikaonda



Carly Valentine Photography

Get Connected

THE RETURN OF THE PURPLE MARTIN

Anyone can be a naturalist. In each issue of *Academy Frontiers*, our scientists share their knowledge to help you explore the natural world. In this issue, Doug Wechsler, director of Visual Resources for Ornithology, recommends a summer detour that may help you spot a phenomenal bird.

The purple martin (*Progne subis*), named for the coloration of the sheen atop its feathers, is the largest swallow in North America. Growing up to 7.5 inches long, it feeds on flying insects such as beetles, dragonflies, and moths. The purple martin is entirely dependent on human-built birdhouses for nesting. Vigilant landlords evict house sparrows and starlings to prepare for the martins' arrival.

Human interaction with purple martins dates far back into American history, Wechsler explains. Native Americans hung gourds with holes cut in the sides for nesting birds. John James Audubon (1785–1851) once said there was one purple martin box for every country tavern. Purple martins nest in birdhouses in open areas and migrate to South America for the winter; they return to North America in spring to breed and raise their young.

For a remarkable sighting, Wechsler recommends a visit to south Jersey between late July and late August. For a short time each year, tens of thousands of purple martins roost atop the reeds adjacent to the Maurice River near Mauricetown. They depart each morning before sunrise, and their return at sunset is an event to watch, especially from areas near the Mauricetown Bridge. The birds return in small, unremarkable numbers at first but then rapidly multiply until the sky is filled with a cloud of purple martins, all flocking back to the reeds for the night. If you're traveling to the shore this summer, you won't want to miss this spectacular detour.

On August 10 and 11, the Purple Martin Festival in Cumberland County, NJ, offers opportunities to learn about the birds from interpretive naturalists, get a closer look from free viewing platforms near the Mauricetown Bridge, and take purple martin-watching boat cruises offered by reservation through Citizens United to Protect the Maurice River and its Tributaries. For more information, visit mauricertown.org/purplemartin.html. ~Michelle Chikaonda



© Tom Vezo/VIREO



UP CLOSE WITH NATURE: Understanding Biodiversity Through Pollination Biology

By Mary Alice Hartsock, Editor

Under the scorching sun and a very big hat, Assistant Curator of Botany Tatyana Livshultz sits eye to eye with nature. She has slowed down to the pace of the plants that surround her to watch flowers open, observe insects as they remove and deposit pollen, and look on as the flowers change color subtly before they close.

Livshultz isn't alone, and she isn't exactly in the middle of nowhere. Just meters from where she sits, tourists visiting the Shedding Park area of Taiwan's Kenting National Park bustle along a path, look quizzically at Livshultz and her team, and sometimes stop to ask why the researchers are sitting in a sunny field on this hot July morning.

Livshultz's collaborator, Research Assistant and Entomologist Ching-Wen (Karen) Tan of National Chung Hsing University, explains why she and her colleague have risen at 6 a.m. to study the park's plants. They are working to understand the complex relationships between a member of the milkweed family, *Parsonsia alboflavescens*, and the animals that pollinate it, she explains.

The partnership began when Livshultz, who studies the evolution of the milkweed family, traveled to Taiwan to finalize an agreement that would allow National Taiwan University scientists to include images of Taiwanese plants housed in the Academy's Philadelphia Herbarium in a national digital herbarium.

Since Taiwan is home to a wide variety of species in the mostly tropical milkweed family, Livshultz decided the country was the perfect place to investigate the evolution of milkweed pollination. This process of pollen transfer among a species' flowers allows the species to reproduce and endure.

"Most flowering plants are pollinated by animals, yet the animals are inefficient at getting pollen from one plant to another, with less than 1 percent of the pollen

removed being delivered to flowers of the same species," Livshultz explains. "In one lineage of the milkweed family, which includes the common milkweed, about 25 percent of the pollen removed is ultimately delivered to flowers of the same species."

What makes pollination so efficient in this lineage of the milkweed family? Livshultz hypothesizes that floral structures unique to this lineage securely attach pollen to insect visitors so that they can't lose it before they reach another flower of the same species. She is testing her hypothesis by studying pollen transfer in *Parsonsia*, which shares many floral characteristics with the common milkweed but lacks these unique floral structures. Tan identifies insect visitors that enable pollen transfer.

"For 10 minutes every hour, we observe, count, and identify the animal visitors," Livshultz says. "I also observe how the flowers are behaving, when they are opening, closing, and when the insects are taking nectar."

Livshultz trained Tan to check the plants morning and evening and trace the development of buds into blossoms.

"In Taiwan, we don't have many people studying pollination biology," Tan says. "I wanted to learn to do the experiments and gain the knowledge and background for pollination studies."

Livshultz and Tan caught insects for identification, checked them for pollen, and preserved them as specimens. They also conducted experiments to see which visitors removed and deposited pollen.

In the lab, Tan dissected flowers and counted pollen grains to determine the amount deposited and removed. She examined insects caught on the flowers to find out which visitors carried *Parsonsia* pollen. She received an Academy McHenry Fellowship, awarded to researchers conducting advanced botanical studies, to conduct this work.

Livshultz and Tan will return to Taiwan for more information, but their early observations about one of *Parsonsia's* most common visitors, the butterfly *Idea leuconoe*, have led them to propose a hypothesis about *Parsonsia's* pollen transfer strategy.

While most caterpillars avoided *Parsonsia*, *Idea leuconoe* fed on its leaves. Other butterfly species avoided *Parsonsia* flowers as adults too, but *Idea leuconoe*



Assistant Curator of Botany Tatyana Livshultz, pictured here in the field in Taiwan, began studying the milkweed family nearly 15 years ago.

frequently took nectar from the flowers and carried *Parsonsia* pollen.

Livshultz and Tan posit that the chemical in *Parsonsia's* leaves that deters other caterpillars may also be in *Parsonsia's* nectar, preventing other butterflies from visiting. Tan will test *Parsonsia's* nectar for the chemical.

"Plants have different ways of increasing their pollination," Livshultz says. "One way is by limiting the spectrum of potential visitors to the most efficient pollinators."

Idea leuconoe adults seek out *Parsonsia* plants as egg-laying sites. This behavior might make them better pollinators than butterfly species that target other plant species for egg-laying.

What kinds of ecological conditions might have allowed *Parsonsia* to develop this possible pollination strategy? How efficient is this strategy compared to that of the common milkweed, which has floral structures that make many insect species into efficient pollinators?

Natural scientists like Livshultz and Tan immerse themselves in nature to answer these kinds of questions about the relationships between plants and animals.

"About 90 percent of plant species rely on animals for pollination, and for the vast majority of those plant species, we don't know who their visitors are, how they pollinate, and what their ecological relationship to the flowers is," Livshultz says. "Discovering the interactions of plant and animal species as we document their diversity and distribution is part of our mission as a natural history museum." 🍷



Research Assistant Karen Tan provides essential entomological expertise for Livshultz's study.

Opposite page: The fly *Biomyoides cyaneus* is one of the most frequent visitors to *Parsonsia alboflavescens*, a member of the milkweed family.

THE PATRICK CENTER AT WORK: Investigating the Potential Ecological Impacts of Drilling in the Marcellus Shale

By Mary Alice Hartsock, Editor

Academy watershed and systems ecologist Frank Anderson grew up in northeastern Pennsylvania, just 15 miles away from an area where gas companies are drilling in the Marcellus Shale, the largest known source of natural gas in the United States. As a graduate student in the University of Pennsylvania's Department of Earth and Environmental Science in 2009, Anderson knew that his aunt and uncle, who reside in one of the highest density drilling areas in Pennsylvania, had leased the mineral rights on their property to a gas company. He also heard about concerns that extensive drilling in the area might impact their local stream. So it wasn't a surprise that when he began his graduation research project, Anderson wanted to investigate whether drilling in the Marcellus Shale could affect the environment.

Stretching underground from New York and Pennsylvania to Ohio and West Virginia, the Marcellus Shale was formed during the Devonian period (about 390 million years ago). At the time, fine-grained and clay-like black shale eroded from mountains into a semi-enclosed marine basin located in what is now Pennsylvania and New York.

This shale was deposited as mud along with organic matter into the marine basin. Deprived of oxygen, the organic matter in the shale decomposed slowly, meshing with other elements such as strontium, barium, bromide, and uranium. Pressure and heat eventually transformed the organic matter into the natural gas (methane) that is now tightly embedded throughout the shale.

Though scientists have known about the existence of the Marcellus Shale for decades, recent technological developments such as horizontal

drilling and hydraulic fracturing (fracking) have made it possible to extract the embedded natural gas.

Workers first drill vertically down into the shale and turn horizontally away from the vertical cut. They then set off explosives to fracture the rock, and they pump in a pressurized mixture of water, chemicals, and sand to hold the fractures open and liberate the gas.

When the injected water returns to the surface, it carries a mixture of waste materials, including chemicals from the fracking process and dissolved sediments from the ancient shale. Many of these substances are dangerous to environmental and human health. Operators must collect and properly dispose of the waste, posing a risk to surface waters.

Aware of these developments and curious about how they could affect local water supplies and terrestrial ecosystems, Anderson, with help



Sylvan Klein/ANSP

Frank Anderson examines the contents of a kick-net sample. These samples help scientists assess the diversity and abundance of insect communities, which are indicators of watershed health.

from the Academy's Patrick Center for Environmental Research, began a project that would eventually prompt a major Academy surface water study related to shale gas development in Pennsylvania.

"Shale gas is a global resource that has the potential to change the future of energy development around the world," Anderson says. "It's already had a tremendous effect on the United States and Pennsylvania specifically.

"If you poll Pennsylvanians in areas with active drilling, almost everyone knows a person who has gotten a job, side work, or opportunities, indirectly or directly, from the drilling industry," he says. "But people also want to know what the potential risks are."

Working with Jerry Mead, leader of the Patrick Center's Watershed and Systems Ecology team, and University of Pennsylvania Professor of Earth and Environmental Science Fred Scatena, Anderson conducted a pilot study in

2010 to examine the relationship of the intensity of natural gas drilling, measured by the density of drilling wells in a watershed, on local stream health. With training from Academy scientists, he surveyed headwater streams in areas with low, medium, and high densities of well pads and compared the water quality and indicators of stream health (such as algae and abundance of animal populations) in these streams.

Anderson's data (summarized at ansp.org/research/environmental-research/projects/marcellus-shale-preliminary-study/) suggested that as well pad density increased, there were fewer types of macroinvertebrates (insects and other animals without backbones) and fewer salamanders, possibly indicating that pollution had disrupted these animals' life cycles and habitats.

Increasing well density also showed an overall decline in water quality and an increase in total dissolved solids, the amount of dissolved material in the water, again suggesting the presence of pollution. Though Anderson's sample size wasn't large enough to make definitive generalizations about the impacts of drilling across the state, "Frank had just enough data to show that we needed to investigate more," says Mead.

Already invested in Anderson's project, Academy Patrick Center scientists and Anderson, now an Academy staff member, used Anderson's pilot data set and obtained funding for a larger study that would require more staff and involve more testing sites, indicators, and supplemental projects.

"We realize drilling is going to occur," says Patrick Center Vice President Dr. David Velinsky, who coordinates fundraising and leads the chemistry portion of the project. "We hope to potentially determine if there is a relationship between the amount of drilling activity in a watershed and the environmental degradation of a stream system within that watershed.

"If we find no impacts, we find no impacts," Velinsky says. "If we do, we could make recommendations for



In a section of Painter Run in Tioga County, Pennsylvania, Andrea Kreit (left) electrofishes while David Keller nets fish to assess fish diversity and abundance. As field manager for the Marcellus project, Keller makes sure all aspects of the field research are completed safely and according to industry standards.

science-based management strategies to make sure drilling is done in a way that is environmentally sound."

In June 2011, the Patrick Center implemented a multifaceted research program to investigate potential thresholds at which the intensity of mining may affect water quality, explains Mead, co-director of the project with Anderson and Ruth Patrick Chair in Environmental Science Dr. Richard Horwitz. Mead designed a computer program that helps scientists select streams for analysis. The program identifies sites with similar forest cover, agricultural and urban development, and other characteristics to ensure that the intensity of drilling is the only variable among sites.

Now in the midst of the summer 2012 field season in the Susquehanna and Delaware River basins, the Patrick Center is extending previous sampling of public lands to private lands, which are not as closely regulated, often have a variety of drilling operators, and can have higher well pad densities.

On public and private lands, scientists are sampling streams for water chemistry; recording the diversity of fish species,

continued on page 15

SPOTLIGHT ON CHEMISTRY

Academy biogeochemist Paula Zelanko filters, tests, and performs data analysis on the water samples scientists gather in the field. She tests samples for total dissolved solids (the amount of dissolved material in the water), chlorine, alkalinity, and hardness. Then she sends samples to an external company for elemental analysis.

Zelanko is treating her analysis as a blind study, so she doesn't know where the samples come from; instead, she organizes the data to see how the samples compare with known characteristics drawn from reference sites and drilling sites. Her data, in combination with data on the aquatic insects, fish, amphibians, algae, and stream composition, may provide important information on how well pad density affects stream ecology.

From the Library and Archives

ACADEMY ARCHIVES BRING DIORAMA HISTORY TO LIFE

Clare Flemming, M.S., C.A., Interim Director of the Library and Archives and Brooke Dolan Archivist



EACH YEAR, HUNDREDS OF RESEARCHERS FROM AROUND THE WORLD, INCLUDING OUR SCIENTISTS AND STAFF, ACCESS THE ACADEMY'S ARCHIVAL MATERIALS ON-SITE. The most consulted collection in 2011 was the Archives collection "Exhibits Department Records" (Coll. 2010-004). At 50 boxes, this collection is a veritable cache of the institution's historical treasures; researchers will find a range of materials that span the better part of the 20th century.

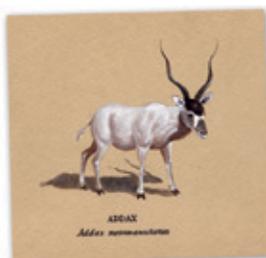
Of note are the papers of Harold T. Green (shown at top left with expedition crates), director of the Academy Exhibits Department in the mid-20th century. This collection includes paintings, plant specimens, color swatches, sketches, photographs, and illustrations taken during Academy expeditions to Africa in the 1930s. Later components include 1930s correspondence between a New York taxidermy studio and Green; telegrams, receipts, and invoices of expenses paid from staff expeditions; reference sketches of foliage in the Belgian Congo that were hand-painted in the field; and loads of black-and-white photographs that document the places featured in the Academy's dioramas and the people and tools of the trade that brought these exhibits to life.

Without question, Collection 2010-004 was essential in providing materials for a stunning new Academy exhibition called *Secrets of the Diorama*, which helps visitors of all ages understand the efforts behind the creation of our dioramas. The Academy has 31 dioramas on display, many erected during the heyday of the diorama in the early 1930s. *Secrets of the Diorama* serves to illustrate the art of the diorama, from field collecting and taxidermy techniques to the making of foregrounds, backgrounds, and the plants and geological elements that tie the components together.

Ultimately 20 archival photographs and eight sketches from Collection 2010-004 are featured in *Secrets of the Diorama*, along with several minutes of archival film (newly restored for that purpose) from an Academy expedition to French North Africa in 1955. Finally, the antique maquette of the Dahl sheep diorama, on view in the exhibit, illustrates how Academy artisans created each diorama at tabletop scale as a model for positioning and assemblage of the real thing.

The Academy Library depends on its catalog and finding aids that describe archival materials to reveal its holdings to researchers and interested individuals throughout the world. Thanks to participation in the Philadelphia Area Consortium of Special Collections Libraries (PACSCL), the Academy is one of 22 local institutions which benefitted from a grant by the Andrew W. Mellon Foundation to hire project archivists. These experts came to the Academy in summer 2010 to professionally describe collections in the Academy Archives, including "Exhibits Department Records." See for yourself! Look for 2010-004 on our list of accessible finding aids here: ansp.org/research/library/archives/. And then, be sure to request your appointment! 🐾

A selection of images from the Academy Archives (Coll. 2010-004) illustrating preparation for an expedition and the art of diorama making.





IN THE MID-19TH CENTURY, WE KNEW VERY LITTLE ABOUT HOW DINOSAURS LOOKED or how they behaved while they were alive. At the time, Academy paleontologist Joseph Leidy and geologist William Foulke assembled the first nearly complete dinosaur skeleton found, which Leidy named *Hadrosaurus foulkii*. Scientists studied fossils and compared them to living animals, hoping to fill in the blanks.

Benjamin Waterhouse Hawkins, an English Victorian artist fascinated by fossils and the creatures they once were, wanted to share dinosaurs' majesty with the public. Working with scientist Richard Owen (who coined the term "dinosaur"), Hawkins created small scale models called maquettes, determining size and proportion by comparing dinosaurs' skeletons to living animals' anatomies. He used these models to create life-size, fully fleshed-out sculptures.

The Academy Archives is the temporary home of more than a dozen "tabletop" dinosaur models, including Hawkins' groundbreaking 1850s masterpieces and other remarkable works from the 1900s to the present. Comparing dinosaur models of different ages reveals striking changes in shapes and forms. Paleontological research and discovery, as well as artisans' tools and techniques, led to revisions in the accepted articulations of these mighty creatures over time.

~Megan Gibes, Archives Assistant

Megan Gibes/ANSP

Sustainability Matters

THINK LIKE A WATERSHED By Roland Wall, Director of the Center for Environmental Policy

Famed explorer and geologist John Wesley Powell (1834–1902) described a watershed as an area of land "within which all living things are inextricably linked by their common water course."

Powell's description of watersheds, the areas of land where all water drains into a single water source, resonates for the Academy scientists who have studied the complexities of watersheds for more than 60 years. We all live in watersheds, and we must consider the ways our activities affect environmental health.

In the mid-20th century, American waterways were so contaminated that rivers caught fire and sewage floated within sight of the U.S. Capitol. Much of this pollution came from single, identifiable sources of contaminants called "point sources," such as industrial discharge outlets. The Clean Water Act, passed in 1972, has helped to limit pollution from these larger sources.

Controls over point sources have brought attention to "nonpoint source" pollution, in which stormwater picks up pollutants from many sources as it moves across the watershed.

Pour water on the ground or waste oil into a storm drain, and by various routes they will travel to a body of water. Agricultural lands drain pesticides, antibiotics, and fertilizers into streams and rivers, while stormwater from urban areas carries everything from waste oil to metals worn off brake pads. As a result of pollution from nonpoint sources, upwards of 40 percent of the rivers and streams in the U.S. are considered to be impaired, and many more are threatened.

The City of Philadelphia is undertaking a multi-million dollar stormwater management project. This program includes "green" solutions, such as rain gardens, permeable pavement, and artificial wetlands, all designed to manage watershed flows.

To fully protect our watersheds, we must learn to "think like a watershed," becoming stewards of the waters upon which we depend. Learn more about preserving our life-sustaining waters during the Academy's Bicentennial Town Square Series, "New Questions for an Old Planet." Visit ansp.org for more information. 

PATRICIA TYSON STROUD: A SCHOLAR WITH A MISSION



John Hubbard

Academy Senior Fellow Robert Peck and historical biographer Patricia Tyson Stroud

INDEPENDENT SCHOLAR PATRICIA TYSON STROUD FINDS HER STUDIO IN EAST BLUE HILL, MAINE, THE PERFECT PLACE TO WRITE. That's where she composed some of her text for *A Glorious Enterprise: The Academy of Natural Sciences of Philadelphia and the Making of American Science* (University of Pennsylvania Press, 2012), the Academy's bicentennial book written with Senior Fellow Robert Peck. When Stroud isn't in Maine, she writes at her home in Wayne, Pennsylvania, a train ride away from the Academy's Library and Archives.

As an award-winning historical biographer, Stroud sees a treasure trove in the Library and Archives' extensive holdings. She consulted these resources while writing *A Glorious Enterprise*; a biography of an Academy founder, *Thomas Say: New World Naturalist* (1992); and a biography published in 2000 of Say's protégé and Napoleon's nephew, naturalist Charles-Lucien Bonaparte. While using the Archives, she uncovered minutes,

letters, and journals that enlivened her depictions of these Academy personalities.

Stroud learned her way around the institution before she discovered the ins and outs of the Archives. She served on the Academy's Women's Committee for many years and was chair from 1980 to 1982. One of the committee's fundraisers was Philadelphia's first Wildfowl Exposition of works by leading U.S. contemporary wildfowl carvers, artists, and photographers. With Peck, Stroud wrote and published five expo catalogs (1979–1984) highlighting the exhibitors. Together Stroud and Peck also edited three early 1980s issues of the Academy's magazine, *Frontiers*, which contained articles by natural science scholars.

These contributions and Stroud's service as chair of Friends of the Library and on the Board's Library Committee made her a dependable Academy colleague—one trusted to take on the momentous task of writing an institutional history. Limnologist Ruth

Patrick even approached Stroud and Peck separately in the 1990s with the idea of writing the Academy's life history.

Nearly two decades later, as Stroud and Peck considered the upcoming Bicentennial, they decided the Academy needed a documented history.

"We figured if we did it together, it wouldn't be such an enormous job," Stroud says. "Bob has worked for the Academy every day for 35 years. Without him, writing this history would have taken 10 years."

Stroud and Peck decided to tell the Academy's story "warts and all," to share the stories that reveal the institution's "human" side. Stroud uncovered fascinating facts about the Academy's controversial decisions to sell some of its most valuable minerals at a time of financial hardship and to end its focus on anthropological studies.

This history needed to be told, she believes, for the very individuals who negotiated these challenges as well as those instrumental to the institution's countless successes.

"The Academy is comprised of the people who cared about it for over 200 years," she says. "They would be lost without a history. This book is a memorial to them."

The individuals who color the Academy's history built an institution for which Stroud has developed a profound respect. To honor the Academy's central place in her own life, she recently decided to join the institution's 1812 Society by establishing a charitable gift annuity with the Academy. By making this commitment to supporting the Academy's future, Stroud is demonstrating her long-term dedication to science at the Academy and her appreciation of the "wonderful resources" that have bolstered her work.

"I love natural science, and I feel very attached to the Academy," Stroud says. "It has been the most important volunteer involvement in my life since the mid-1970s." 🌊

DONATING YOUR RETIREMENT ASSETS

DID YOU KNOW THAT YOUR RETIREMENT PLAN assets are facing double taxation? If you leave the assets to your family members, you'll generate "income in respect of a decedent." Not only is this amount diminished by estate taxes, but the recipient must also pay taxes on it.

Your decision regarding who receives the remainder depends on your family members' circumstances—their needs come first. If you can make other provisions for them, there is a better option for your retirement plan assets—a charitable gift to the Academy of Natural Sciences of Drexel University.

TAX ADVANTAGES

Individual account plans, such as IRAs, Keoghs, or 401(k) accounts, resemble tax-sheltered savings accounts. If a participant dies before the entire account has been distributed, the remaining balance can be transferred to a relative or charitable organization like the Academy.

The principal advantage of donating retirement plan assets to the Academy is that you avoid all income and estate taxes. Giving the assets to individual family members may trigger a total effective marginal tax rate that is incredibly steep—even exceeding 65 percent in some cases.

MANY WAYS TO GIVE

If you've already provided for your relatives in your estate plan, simply name the Academy as the primary beneficiary of your retirement assets. If you want to make sure you don't shortchange your family members, here are a couple of other possibilities:

- ▶ Designate a specific amount to be paid to the Academy, before the division of the remainder among beneficiaries.
- ▶ Name the Academy as the beneficiary of part, or even all, of the balance remaining after your spouse's or another beneficiary's lifetime.

To implement your wishes, advise the plan administrator of your decision and sign any required forms. For an IRA or Keogh plan you administer personally, notify the custodian in writing and keep a copy with your valuable papers.

If you have questions about donating your retirement plan assets or you would like to receive a free copy of our guide to gift planning, *Leaving a Legacy*, you may contact our Office of Institutional Advancement at 215-299-1122 or plannedgiving@ansp.org. By donating your retirement assets, you will be eligible for membership in the Academy's new 1812 Society, honoring those who have remembered the Academy in their estate plans. Thank you for your support! 🐾

A GIFT THAT GIVES BACK

Like Patricia Tyson Stroud, you can join our 1812 Society by establishing a charitable gift annuity with the Academy. Through a charitable gift annuity, you can make a charitable contribution to the Academy and receive fixed payments for life for yourself or another person.

To learn more about life income gifts, please contact the Academy's Office of Institutional Advancement at 215-299-1122 or plannedgiving@ansp.org. Thank you for your support of the Academy!

continued from page 11



Stephanie Leach/ANSP

Patrick Center scientists found this Northern Spring Salamander at Straight Run in Tioga County, Pennsylvania. Comparing the diversity and abundance of salamanders in streams with different amounts of drilling may help our scientists assess the potential impacts of drilling.

macroinvertebrates, and salamanders; gathering information on algae; and assessing the shape and composition of stream channels. They sample in areas untouched by drilling as well as in areas with varying concentrations of well pads. Data gathered from these "undisturbed areas," which are likely to host well pads in the future, serve as reference points against which scientists can compare new stream data once drilling begins.

With adequate funding, this work could become a multiyear project, Velinsky says, especially as new drilling begins and the number of wells increases.

"These results could potentially help us make recommendations for management strategies that could enable the protection of Pennsylvania's forests and public lands," Velinsky says. "Science should drive the outcome of this work." 🐾

Academy Support

ON BEHALF OF THE ACADEMY'S BOARD OF TRUSTEES, we wish to recognize and thank those supporters who have contributed to the Academy between March 1 and May 31, 2012. Your generosity helps to fund the Academy's many programs of research and education, and we are tremendously grateful for your support.

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Member Margy Meyerson signs the Bicentennial Birthday Book.

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Drexel University President John A. Fry (left) and Academy President and CEO George W. Gephart, Jr., welcome attendees on Bicentennial Day.

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Bicentennial Weekend featured natural science activities, re-enactors, appearances by the Academy's new mascot, birthday cake, a barbershop quartet, and more.

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Lisa Litz-Neavear
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A student examines collection items in our special bicentennial exhibit, The Academy at 200: The Nature of Discovery.

Judy Devlin

Snapshots



Marvin Altamira

IN THE FIELD

Academy Malacologist Gary Rosenberg extracts shipworms from a piece of mangrove wood in Infanta, Quezon Province, Philippines, during a March 2012 field trip. Using a chisel and mallet, Rosenberg worked carefully for three hours to extract a single, large live shipworm. The shipworm, a type of mollusk, bores into wood that is immersed in seawater. It uses the valves of its shell to drill into the wood and lines the resulting burrow with a shelly tube that protects its body.

Shipworms ingest particles of wood as they burrow and digest these particles with the aid of bacteria in their gills. Rosenberg and his collaborators in the Philippine Mollusk Symbiont International Cooperative Biodiversity Group are interested in finding out if the enzymes the bacteria employ for digesting wood could be utilized in the production of biofuels from cellulosic waste products. ~M.C. 



Betsy Payne/ANSP

BEHIND THE SCENES

DebbieLynn Mayo is a junior at Walter Biddle Saul High School of Agricultural Sciences and a third-year student in the Academy's Women In Natural Sciences program. An intern with Ned Gilmore in the Herpetology Department, Mayo works in specimen collection and preservation.

In this photograph, Mayo files a snake specimen after having created a label and assigned the specimen a catalog number. Of all the projects she works on at the Academy, she says she loves the hands-on laboratory work the most. She works with new specimens, diluting the alcohol solution to be used in the specimens' preservation, and then she leaves the specimens in the solution for three months prior to cataloging and storing. Mayo, who would like to continue studying science after graduation, enjoys dispelling myths about the animals her classmates find during their agricultural fieldwork. "Everyone thinks frogs give you warts," she laughs. "I like being able to teach them something new." ~M.C. 



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!

PHOTO CHALLENGE

Can you spot four differences between these two photos of the specimen wall in the Academy's bicentennial exhibit, *The Academy at 200: The Nature of Discovery*? Circle your guesses, find the answers below, and visit us to find out which is the real version!



DID YOU KNOW...?

About one-half of all the known living species on Earth are insects.

– Michele Bassler,
Outreach Supervisor
and Teacher Naturalist



COLOR A HABITAT

A habitat is a home. In a habitat, you must have food, water, shelter, and space. The rainforest is a very colorful habitat. In this picture, can you find the bird, mammal, and reptile that call this habitat home?



Jennifer Anne

PHOTO CHALLENGE ANSWER
KEY: In the second photograph: In box 2, two of the Wilson's Birds of Paradise are missing; in box 5, the Almandine garnets have been replaced with birds; in box 8, the center mineral has been removed; and in box 11, the skull of an extinct pig-like animal is facing to the right.

Doug Wechsler/ANSP

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