

A high-angle photograph of two young children, a girl and a boy, crouching on a stone floor. They are reaching out with their hands to touch a large, textured rock wall. The rock wall is covered in ancient, earthy-toned paintings, likely indigenous art. The girl is wearing a teal long-sleeved shirt and dark pants, while the boy is wearing a grey sweater and blue pants. The lighting is warm and focused on the children and the rock wall.

Connecting

People With Their Planet

2022 Annual Report

NATIONAL
MUSEUM *of*
**NATURAL
HISTORY**

 Smithsonian



Our Mission:

Understanding the natural world and our place in it.

Dear Friends,

We live on an amazing planet - one that is brimming with life, culture, and new natural wonders waiting to be discovered.

While the past few years have been challenging for all of us, it has been heartening to see that many people have used this time to reconnect with nature. To get outside and open their eyes to the beauty of the world around them.

Building this sense of connection to the natural world has been core to the mission of the [National Museum of Natural History](#) since we opened our doors in 1910 and it underpins everything we do today.

In 2022, we marked our first full year open to the public since the beginning of the pandemic. We welcomed nearly 4 million people back to the museum and engaged with at least four times that many online. Online or in-person, we aimed to prepare our visitors with the knowledge necessary to be a part of the solution to some of the planet's most pressing concerns.

Our scientists and collections staff were back in force discovering new species, generating a deeper understanding of our world, and caring for our collection of 148 million specimens. We invited the global scientific community back into the museum to access this irreplaceable archive of our planet in support of their research.

We began the process of rebuilding key aspects of our museum community including our fellowship, internship, and volunteer programs. Fostering the next generation of science and museum professionals is among the most important things we do. And our network of volunteers is critical to our success in so many ways, be it in the museum, behind the scenes, or as ambassadors to friends and family.

There is still more work to be done, more ground to be recovered, but the foundation—as it has been throughout the pandemic—remains strong.

Our success is, in no small measure, due to the ongoing support of our partners and individuals like you.

We hope you will enjoy taking a look back at some of our achievements from last year. And we look forward to working together with you to continue to connect people and our planet.

Sincerely,

John Foster,
Board Chair

Kirk Johnson,
Sant Director



John Foster,
Board Chair



Kirk Johnson,
Sant Director

Left: The historic 11-ton African elephant affectionately known as "Henry" has welcomed visitors to the museum since 1959.

A mysterious bonebed was once a marine reptile maternity ward

Long before whales swam onto the scene, the ocean's biggest behemoths were ichthyosaurs, a type of marine reptiles that resembled souped-up dolphins. One of the largest ichthyosaurs known is *Shonisaurus*, a humpback whale-sized predator that terrorized late Triassic seas more than 225 million years ago. Bones from at least 37 *Shonisaurus* individuals have been found at Berlin-Ichthyosaur State Park in the middle of the Nevada desert. For decades, paleontologists have attempted to figure out why so many ichthyosaurs perished here.

Some believed these marine reptiles were poisoned by toxic algal blooms, while others posit they met their end during a mass stranding event.

Museum paleontologist Nicholas Pyenson teamed up with several researchers, including former museum Peter Buck Fellow Neil Kelley to reinterpret the iconic site. They collected samples of the surrounding rock to recreate the area's ancient environment, sifted through museum collections for fossils from the site, and partnered with the Smithsonian Digitization Program Office to digitally recreate the jumble of *Shonisaurus* bones still in the ground with 3D imaging.

In a study published in the journal *Current Biology*, they concluded that the site was once an ichthyosaur birthing ground. Like modern whales, these marine reptiles returned to the same location over generations to give birth. Instead of one cataclysmic disaster, the site's bones accumulated over hundreds of thousands of years.



Artist's life reconstruction of adult and newly born Triassic ichthyosaurs *Shonisaurus*, 2022.

A new Jurassic reptile that scurried under dinosaurs

Wyoming's Morrison Formation is iconic for its fossils of titanic dinosaurs like *Stegosaurus*, *Camarasaurus* and *Allosaurus*. But these were far from the only inhabitants of this Jurassic ecosystem. Museum paleontologists Matthew Carrano and Dave DeMar identified the nearly complete skeleton of a 150-million-year-old reptile while examining fossils collected near an *Allosaurus* nest. In a [study in the *Journal of Systematic Paleontology*](#), the researchers named the six-inch long reptile *Opisthiamimus gregori*, after museum volunteer Joseph Gregor who painstakingly prepared the remarkable fossil.

Opisthiamimus resembled a stout lizard and likely munched on Mesozoic bugs. But the new critter is actually an ancient relative of New Zealand's tuatara, an enigmatic reptile that's the only living member of its entire taxonomic order, Rhynchocephalia. During the Mesozoic, these reptiles were rampant and *Opisthiamimus's* remarkably preserved skeleton may provide clues as to why this lost lineage was supplanted by lizards.

The newly discovered *Opisthiamimus gregori* preys on a now-extinct waterbug (*Morrisonnepa jurassica*), while in the background the predatory dinosaur *Allosaurus jimadseni* guards its nest.

Julius Costanzi

Our Places



Our Places: Exploring the Intersection of People and Nature

In July, the National Museum of Natural History unveiled the new exhibition, *Our Places: Connecting People and Nature*. The exhibit explores how peoples' experience with nature inspires them to go outside and make a difference, and includes participatory activities that range from identifying local birds and other animals in nature recordings to leaving notes to complement the displays themselves. Visitors will meet dedicated scientists and community members working to protect dynamic environments around the globe, from tropical rainforests and coastal mangroves to local neighborhood greenspaces spread across Washington, D.C.

Friends of Kenilworth Aquatic Gardens' Zerline Hughes Spruill (with colleague Megan Singleton), NMNH YEAH! teen program member Brandon, and Scott Budden of Orchard Point Oysters are among the many voices featured in *Our Places*.

Our Places highlights how developing a closer connection between people and nature can address many environmental issues. The exhibition's displays highlight efforts to incorporate accessible green spaces in urban communities, reinvigorate barren soil through Indigenous community-led restorative agricultural practices, and sustainably harvest seafood through minority-owned aquaculture programs in the Chesapeake Bay. Personal stories from scientists and local community leaders bring these projects to life and highlight why natural environments are worth protecting. Visitors not only learn about fieldwork in locales like India and Peru, but also get an in-depth look at vital places closer to the Washington area such as the city's Rock Creek Park and Maryland's Eastern Shore.



Many of these local spaces provide natural oases to communities often overlooked by conservation efforts. One example is Kenilworth Aquatic Gardens, the only national park in the country dedicated to aquatic plants like water lilies and lotuses. Nestled near the banks of the Anacostia River in northeast Washington's Kenilworth neighborhood, this mosaic of marshes had been utilized by the Nacotchtank tribe for millennia. In the 1880s, a Civil War veteran and his daughter cultivated the local wetlands into ponds bursting with aquatic plants that are home to animals like beavers, snapping turtles, and blue herons.

Today, the gardens and the nearby Anacostia Park are rare green spaces in a largely paved area of D.C. "In this historically Black area, people can find a place of solace in this backyard oasis," says Zerline Hughes Spruill, community engagement manager at Friends of Kenilworth Aquatic Gardens, who is one of the local community members featured in "Our Places." Hughes Spruill and her colleagues are dedicated to making this historic space as accessible to the local community as possible.

In *Our Places*, visitors will be able to learn more about why green spaces like Kenilworth Aquatic Gardens are so vital to local communities. "By emphasizing that we are all connected to the natural world, *Our Places* provides new opportunities for heightening understanding of our planet's biodiversity and a range of environmental issues," said Torben Rick, the museum's curator of North American archaeology who helped curate the new exhibition. "From differential access to nature and personal safety to biodiversity stewardship and sustainability, *Our Places* challenges museum visitors to see themselves as part of the natural world and share their experiences and connections with others."



SPECIMEN SPOTLIGHT:

Northern Giant Hornet Nest

The 'buzziest' specimen highlighted in *Our Places* is the historic northern giant hornet "nest zero." As the world's largest species of hornets, northern giant hornets are bound to make headlines when they show up outside of their native range of East Asia. In 2019, the discovery of a giant hornet nest in Washington state stoked fears that so-called "Murder Hornets" were on the loose. While the giant hornets are not threats to humans, these ruthlessly efficient predators, who have a penchant for biting off the heads of bees, are capable of devastating populations of important pollinators.

To quell the impending invasion of these head-chopping hornets, researchers in Washington reached out to Matt Buffington, a Smithsonian-USDA research entomologist who works with the Systematic Entomology Laboratory. Buffington uses the museum's National Insect Collection as a reference to keep tabs on which insects belong in the United States and which are potentially destructive newcomers.

So when two-inch-long, orange and black hornet specimens came his way, he knew he was looking at something unlike any species native to North America. "The insect collection at the Smithsonian provided us with the knowledge to determine what the Asian giant hornet is and why it doesn't belong here," Buffington says. "Because if it did, we would have already encountered it in the collection."

After Buffington identified the insect interlopers, his colleagues at the Washington State Department of Agriculture suited up in heavy-duty mesh suits to protect themselves from the giant hornet's quarter-inch stingers and headed into the forest. By attaching a radio transmitter to a hornet, they were able to pinpoint and remove the potentially harmful hornet hive, which eventually ended up in the museum's collection.

The first northern giant hornet nest discovered in the United States is now on display in *Our Places* alongside one of the sci-fi inspired suits the team wore and a giant hornet specimen outfitted with a radio transmitter.



Our Changing Planet



Study finds more 'losers' than 'winners' among plants in the age of humans

A new analysis spanning more than 86,000 plant species from Smithsonian botanists John Kress and Gary Krupnick finds that on this human-dominated planet, many more species of plants are poised to “lose” rather than “win.” The [study was published in the journal *Plants, People, Planet*](#).

From changing Earth’s climate to destroying, degrading, and altering ecosystems on a massive scale, human choices now largely dictate the environmental conditions across much of the globe and, as a result, which species of plants and animals can survive and persist and which will go extinct. Species lucky enough to be directly or indirectly aided by human activities are likely to survive and can be thought of as “winners,” while those that are pushed to ecological irrelevance or extinction by those same activities are the ultimate “losers” in evolutionary terms.

Indigenous communities sustainably shucked oysters for thousands of years

In estuaries around the world, centuries of overharvesting have caused oyster populations to plummet. The decline of these filter-feeding reef-builders damages the entire ecosystem. But new research by museum anthropologist Torben Rick reveals that humans were able to sustainably harvest oysters for millennia prior to colonial times. The team studied accumulations of oyster shells called middens — a few of which towered up to 30 feet into the sky — left by Indigenous communities in North America and Australia. In a [study published in the journal *Current Biology*](#), Rick’s team concludes that these communities were able to consume billions of oysters without causing populations of these precious bivalves to crash. Tapping into some of their practices may improve current efforts to restore oysters in places like the Chesapeake Bay.

“A broader dialogue that includes the Indigenous peoples whose ancestors stewarded these ecosystems for millennia is critical when restoring an ecosystem or making conservation decisions. This broadening of perspectives can enhance biological conservation and help restore connections between Indigenous peoples and their ancestral homelands.”

— **TORBEN RICK**, Curator of North American Archaeology



Eroding Late Holocene Native American oyster midden at low tide in Fishing Bay, Maryland.



Q&A with Sant Director Kirk Johnson

As the person in charge of the world’s largest natural history museum, Sant Director Kirk Johnson is well-versed on subjects running the gamut of nature. Johnson is a paleontologist who specializes in understanding the ancient past. His research has given him a prehistoric perspective on global change that is often lacking in current climate discussions.

In November, Johnson brought that point of view as part of the Smithsonian Delegation to COP 27, the 27th United Nations Climate Change Conference, in Sharm El Sheikh, Egypt.

Why is it important for the Smithsonian to participate in these global events?

We attended COP 27 because the conference’s focus on climate change and biodiversity loss aligns with several important initiatives at the museum and the Smithsonian at large. Many of the meetings revolved around finding nature-based solutions to climate change.

We also thought we should be a voice there because of the perspective we can offer as a large museum. It became clear to me that not many people there were in the business of communicating climate change to the public. And not many organizations actually had scientific collections. Those are two unique assets that the museum brings to global conversations like COP 27.

What role do you envision museums playing to combat climate change in the future?

We’re in a time of immense change and museum collections are the record of what’s happening. Humans are very good at adjusting to incremental change. If you change things a little bit every day, people just adjust to it and miss the fact that the cumulative change is quite dramatic. Collections allow us to see the patterns of the past and they document the fact that we have been living in a world of shifting baselines for the last few hundred years.

And that’s why I’ve been trying to bring the world’s museums together. Working with a team of natural history museum directors, we have contacted the 110 largest museums in the world and created a method to measure their holdings as a first step to creating a global natural collection. In theory, the global collection is the physical manifestation of what humans know about the natural world and our place in it. This is important because we document species and ecosystems that are now extinct. If we didn’t have the specimens in museums, we wouldn’t be able to access our recent past.

The work of a museum is never done and we need to keep collecting and recording the changing world. If we are successful, people in 2100 will be able to look back to 2022 and see that natural history museums played a significant role in understanding and preserving the natural world in a time of great change.



A guide for conserving biodiversity at the microscopic scale

Many researchers agree that the Earth is currently in the midst of its sixth mass extinction as animals like coral, bees, bats, and amphibians disappear at alarming rates. To stem this biodiversity crisis, an international group of researchers including Smithsonian scientist Blake Ushijima recently teamed up to explore what methods can be adopted to protect ecosystems at their smallest scale — the microbiome. Microbiomes are communities of microbes like bacteria, fungi, algae, and viruses that are found everywhere from coral reefs to the human gut. These complex communities help keep larger ecosystems healthy, which is why it is paramount to maintain microbiome diversity. In a paper published in the journal *Nature Microbiology*, Ushijima and his co-authors outline a framework for conserving these tiny, yet essential, biological communities.

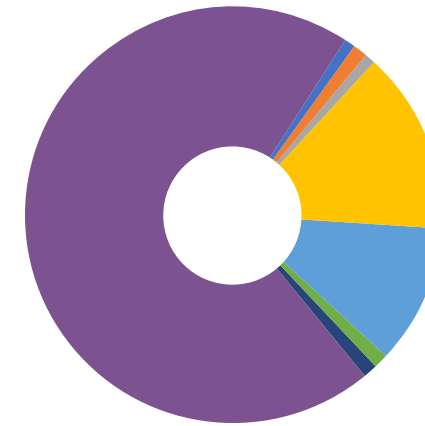
By the Numbers 2022

The pandemic changed us all and the museum was no exception. We were closed for 461 days between 2020 and 2021, yet the work of the museum carried on. We used our digital platforms to reach our audiences and build new connections. We continued the important work of caring for our collections and using them as the foundation of our research endeavors. Now, fully operational once again, we are working to rebuild and strengthen our core in support of our critical mission.

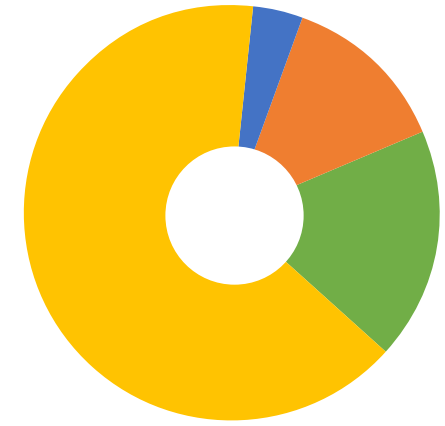


Financials

FY 22 Revenue
\$80.3 Million



FY 22 Expenses
\$78.9 Million



- Federal - 70%
- Trust Discretionary - 1%
- Advancement Allotment - 1%
- Butterfly Pavilion - 1%
- Endowments - 14%
- Gifts - 11%
- Government Grants - 1%
- Non-Government Grants - 1%
- Science - 65%
- Advancement & Communications - 4%
- Exhibits, Education & Outreach - 13%
- Operations - 18%



New Exhibits



The Uncle Sam Diamond

Great American Diamonds

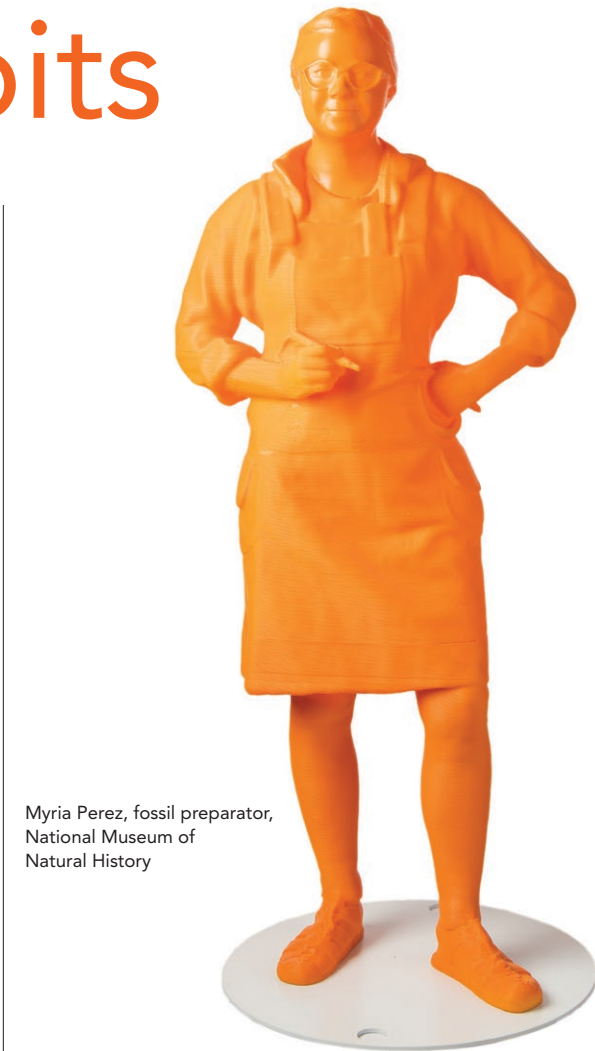
Did you know that diamonds can be found in the United States? In June, we unveiled *Great American Diamonds*, a new exhibit displaying four of the most stunning diamonds ever found in our country.

Some of these gems are record holders, including Colorado's Freedom Diamond, the largest faceted diamond ever to originate in the United States, and Arkansas' Uncle Sam Diamond, an emerald-cut stone fashioned from the largest uncut American diamond ever discovered.

These American diamonds join the Smithsonian's National Gem and Mineral Collection, the world's most visited collection of gems, thanks to gifts by Peter Buck (Uncle Sam Diamond) and Robert E. and Kathy G. Mau (Freedom Diamond).



Freedom Diamond



Myria Perez, fossil preparator, National Museum of Natural History



#IfThenSheCan – The Exhibit

Some of the brightest minds in science and technology visited the Smithsonian in March. But instead of a one-night lecture circuit, these scientists, who do everything from design rockets to create shark sanctuaries, were stationed at museums around the National Mall in the form of life-sized, 3D-printed sculptures.

Featuring 120 bright orange statues of contemporary female scientists, *#IfThenSheCan – The Exhibit* is the largest collection of statues of women ever assembled at a single location at one time and included our very own fossil preparator, Myria Perez.

The exhibit is part of Lyda Hill Philanthropies' IF/THEN initiative that aims to inspire middle school age girls to pursue STEM careers.

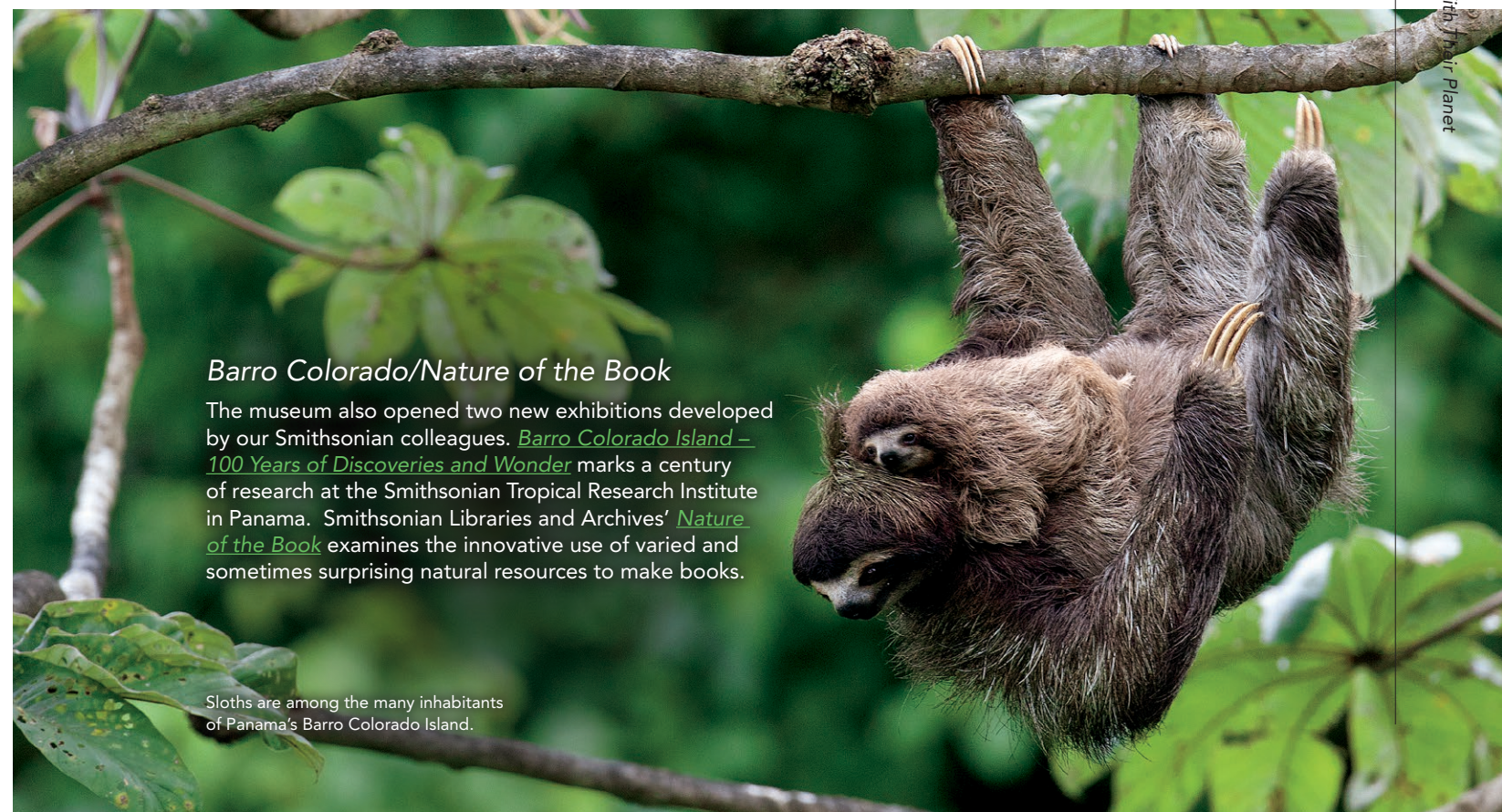


Outbreak: Epidemics in a Connected World

After a four-year run, we've closed *Outbreak: Epidemics in a Connected World*. Opened 18 months before the COVID-19 pandemic, the exhibit explored how pathogens can "jump" from wildlife to humans and cause disease outbreaks that spread internationally. Visitors were invited to be detectives, joining experts in tracking down and responding to these outbreaks. The museum's DIY version of the exhibit is now on view in an adjacent gallery.

Do-It-Yourself Exhibits

Our free [Do-It-Yourself \(DIY\) Exhibits](#) program continues to reach audiences around the world. Designed to be flexible and adaptable, our Do-It-Yourself (DIY) exhibits, can be easily installed in any type of location, from schools to hospitals and libraries to shopping centers. Last year, 175 organizations applied to host one of our three DIY exhibits: *Outbreak*, *Genome*, and *Dig It!*



Barro Colorado/Nature of the Book

The museum also opened two new exhibitions developed by our Smithsonian colleagues. *Barro Colorado Island – 100 Years of Discoveries and Wonder* marks a century of research at the Smithsonian Tropical Research Institute in Panama. Smithsonian Libraries and Archives' *Nature of the Book* examines the innovative use of varied and sometimes surprising natural resources to make books.

Sloths are among the many inhabitants of Panama's Barro Colorado Island.

Education, Outreach, & Visitor Experience

TechGirls take over Q?rius

In July, more than 130 teen girls from TechGirls gathered in Q?rius to have conversations with over 20 different museum experts about their work and careers. TechGirls is an international summer exchange program designed to empower and inspire young women ages 15 to 17 from around the world to pursue careers in science and technology. At the event, the girls moved through 11 "conversation stations" hosted by several of the museum's female scientists and education and exhibit staff. They were able to explore objects, give feedback about exhibits in development, ask questions, and share their goals and interests.

K-12 school programs: A response to changing classroom needs

Few sectors in the U.S. have been as impacted by the Covid-19 pandemic as education. In 2022, we were recognized with a Smithsonian Innovation and Access Award for our [Transmedia Content Bundles](#) developed in response to the pandemic. Starting in 2020, our educators created and have refined a new model for digital engagement at NMNH consisting of transmedia content collections or "bundles" of digital resources from webinars to podcasts to best serve teachers, students, and parents in school districts nationwide. This content strategy created more entry points for access; offered more variety in content and delivery mechanisms; inspired interest and positive associations with science content; and provided pre-made content packages for over-burdened teachers.

Teens return for on-site internships

We welcomed back high-school interns for the Youth Engagement through Science (YES!) Summer Internship Program. The program's home base in Q?rius, the Coralyn W. Whitney Science Education Center was once again filled with energy, enthusiasm, and camaraderie.

YES! is a paid internship for high-school students in the Washington, D.C. area from populations traditionally underrepresented in the sciences, including African Americans, Hispanics, and girls. This program provides young people with immersive, hands-on research and science communication experiences. The interns work directly with museum researchers. They also experience a wide variety of professional development and enrichment opportunities, such as tours, field trips, career panels, skills workshops, and college visits.

YES! culminates in a Community Day, a traditional part of the internship also held in Q?rius. There interns share what they've learned through their science research projects with their friends, families, the museum community, and the general public.

Little ones and their families: learning science together

In 2022, we resumed [in-person programming](#) with unique co-learning opportunities for children, their families, and caregivers that featured a wide variety of topics, such as coral reefs, insects, prehistoric sea creatures, meteorites, and more.

Program collaborators included Latin Grammy Award-winning musical artist MISTER G, NASA, and the Hirshhorn Museum and Sculpture Garden to provide a truly diverse set of learning experiences for multi-generational visitors. After a two-year hiatus due to the pandemic, the museum welcomed more than 1,500 young visitors and their families back for these imaginative and fun learning experiences.

Children participate in the museum's Fossil Day activities



Biodiversity and conservation training for teachers

A special workshop for educators was offered in October in celebration of Half-Earth Day and co-hosted by the E.O. Wilson Biodiversity Foundation and National Museum of Natural History. The Half-Earth Project is devoted to engaging diverse audiences in efforts to reverse the extinction crisis and to leave no species behind, including humans. Education is a keystone of the project. The workshop supported educators as ambassadors belonging to a community dedicated to finding ways to infuse biodiversity and conservation topics into curricula at the middle school, high school, and college levels, and to support the development of the next generation of biodiversity stewards. Forty educators from the D.C. metropolitan area attended the workshop.

The museum once again welcomed local teachers and guests for a variety of onsite programs for adult audiences.



Evening programming Returns!

We were excited to welcome back our adult "After-Hours" guests for two exciting, sold-out events: "Bats and Tequila" in October and "Ancient Sea Monsters and Spirits" in November. As part of a Bat Week celebration, participants could taste three types of bat-friendly tequila and learn about how bats and tequila are connected, engage in bat-related arts and crafts, watch clips from the National Geographic film, *The Bat Man of Mexico*, and talk to our on-hand bat experts.

The second program was inspired by the museum's *Sea Monsters Unearthed Exhibit*. Attendees could make a plesiosaur hat, "dig" for fossils, add their contributions to a collaborative mural of the ancient seas, and sample a signature cocktail and Twisted Cedar Wines. They could also speak with our experts and with a librarian from DC's Martin Luther King, Jr. Memorial Library about the on-theme book, *Remarkable Creatures* by Tracy Chevalier.



Community outreach

Black Birders Week, May 28, 2022

The Black AF In STEM Collective presented the third annual Black Birders Week, a series of events nationwide from May 29 to June 4 aimed at highlighting Black nature enthusiasts and increasing the visibility of Black birders, who often face unique challenges and dangers when engaging in outdoor activities. We joined the Collective, the National Museum of African American History and Culture, and the National Zoo in partnering to pilot programming for Black Birders Week.

Black Birders Week Family STEM Day at the museum provided seven different educational experiences for families that were facilitated and led by our educators. These ranged from observing specimens with microscopes to creating their own observing tools and exploring birds through play.

World AIDS Day, December 4, 2022

For this year's World AIDS Day lecture, three guest speakers took stock of the U.S. HIV/AIDS epidemic to celebrate those working to end the epidemic and assess the work yet to be done. Since 1988, the world pauses in December to observe World AIDS Day to honor those affected by HIV and resolve to end the epidemic. The conversation was moderated by Eugene Scott, National Political Reporter at *The Washington Post*. The panelists were Linda Villarosa, contributing writer at the *New York Times Magazine* and author of *Under the Skin*; Rebecca Kahn, Director of Nutrition Services at Food & Friends; and Naseema Shafi, Chief Executive Officer, Whitman-Walker Health. HIV/AIDS is a focus of the museum's exhibit *Outbreak: Epidemics in a Connected World*.

Collections Spotlight:

In 2022, museum staff were hard at work acquiring, labeling, preserving, and studying specimens that range from pressed plants and pinned butterflies to Martian meteorites and massive whale bones.

Most of this work took place in the labyrinth of cabinets and labs at both the museum and its collections facility in Suitland, Maryland and was essential to maintaining—and growing—the largest natural history collection on Earth.

The museum's Botany Department completed a [seven-year effort to digitize the entire United States National Herbarium](#)—one of the world's largest collections of plant material that contains everything from microscopic algae to mammoth palm fronds. Most of the herbarium's specimens are dried plants pressed onto large sheets of paper. To bring this sprawling botanical library online, museum collection staff teamed up with the Smithsonian Digitization Program Office and Picturae, a Dutch digitization company. A conveyor belt was installed to rapidly process the herbarium sheets. As the belt whirred, the sheets passed below a high-speed camera, which snapped pictures of the specimen and its various labels every six seconds.

In total, 3.8 million herbarium sheets made their way across the conveyor belt. By the time the last sheet was photographed in May, the United States Herbarium became the first fully digitized botanical collection in the country. The accomplishment makes this prodigious collection of pressed plants available to outside researchers. It also allowed museum scientists to add 80,000 new taxa into the department's database, rounding out the full breadth of the



collection for the first time. “What I really enjoy is not the specimens we already knew about, but the ones we find by accident,” said Sylvia Orli, the Botany Department's digitization manager who spearheaded the effort.

The museum's Department of Paleobiology [also capped a monumental move](#). In 2018, the United States Geological Survey (USGS) agreed to send nearly 1,000 cases packed with fossils to the museum. Over the next three years, 23 fully-loaded freight trucks donated by FedEx would make the 1,600 mile journey from a USGS warehouse in Denver, where the fossils had been housed for decades, to the museum's collection facility in Maryland.

In total, the museum's paleobiology team moved some 342,532 pounds of fossils, adding more than 1.5 million new specimens to the museum's collection. Several of these specimens, including the skeleton of a predatory marine reptile called a mosasaur and the tightly-coiled shells of squid-like ammonites, hail from an ancient seaway that

covered a large swath of western North America during the age of the dinosaurs. “Without this reference collection, we wouldn't have that knowledge of what was living when or what was happening to the seaway,” said Kathy Hollis, the museum's Paleobiology collection manager. “The richness of this collection allows us to continue asking and answering questions.”

Now that the fossiliferous freight has arrived, collection staff are sifting through the trove and integrating it into the National Fossil Collection. The team is also using the influx of fossils as an opportunity to reorganize the museum's entire fossil collection. The goal of the additional effort, dubbed the Defragmentation Project, is to make the sprawling collection more cohesive and to relocate hundreds of cases of fossil mollusks, sediment cores, and oversized bones from the museum's flood-prone basement. Hollis said of the effort: “We don't just want to preserve the collection as it is. We want to remove any current confusion to make the collection a better resource for scientists.”



“As the museum's chief scientist, I'm a champion of the incredibly valuable role that museum collections play in understanding our world and helping to conserve it. Collections help us both understand the past and inform the future.”

— REBECCA JOHNSON,
Associate Director for Science and Chief Scientist
at the National Museum of Natural History



Other highlights from the collections:

Insider Close-up

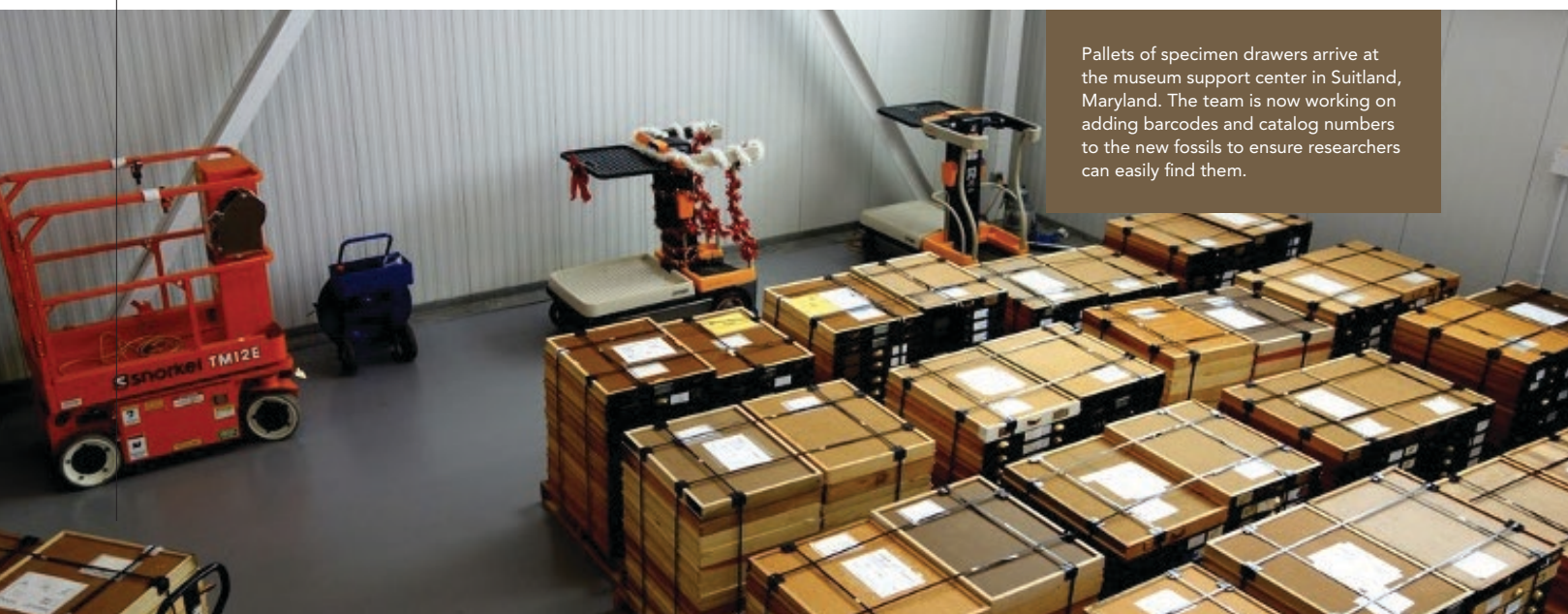
As part of their popular series, *Colossal Collections*, Business Insider took viewers behind the scenes of the museum's [sprawling collections](#). Over the course of three videos, viewers met curators and researchers from across the museum. They learned [how scientists use the feathers and tissue \(or “snarge”\) of birds struck by airplanes to prevent future collisions](#) and saw how collection staff (with the help of flesh-eating beetles) prepare and store entire whale [skeletons](#). In total, the videos have been watched more than 17.2 million times.

Butterfly Bounty

In the fall of 2022, Floyd Shockley, the collection manager of the museum's immense insect collection, [hit the road to pick up butterfly and moth specimens](#) compiled by collectors around the country. Over the course of twelve days, Shockley drove more than 4,100 miles and passed through 16 states. The bulk of the haul was a cache of Lepidoptera specimens painstakingly collected and curated by a physician in Fresno, California, who donated hundreds of drawers brimming with butterflies and moths to the museum.

Viral Clues

In a [study published in August](#), several Smithsonian researchers including Melissa Hawkins, the museum's curator of mammals, fine-tuned a new approach to collect fragile genetic molecules called RNA from bat specimens deposited in the museum's collection decades ago. Pinpointing RNA is particularly helpful for tracking the spread of viruses, including coronavirus, because many store the bulk of their genetic signatures. According to Hawkins, refining this process “unlocks the Smithsonian's 600,000 mammal specimens for researchers to understand mammalian diversity and pathogen evolution.”



Pallets of specimen drawers arrive at the museum support center in Suitland, Maryland. The team is now working on adding barcodes and catalog numbers to the new fossils to ensure researchers can easily find them.

Science+Research

An ancient human's meat-based diet gets a closer look

The appearance of *Homo erectus* two million years ago appears to be a turning point in human evolution. Unlike older early humans, *Homo erectus* sported a large brain and walked upright. It also appears to have had a taste for meat — eastern Africa is littered with fossil sites brimming with butchered animal bones from the time that *Homo erectus* was walking around.

Scientists have long believed this fondness for flesh influenced *Homo erectus*'s brain size and proportions. But paleoanthropologist Briana Pobiner, of our Human Origins Program, took a closer look at several of these fossil sites and concluded that their influence is partially due to sampling bias. Paleoanthropologists have paid more attention to sites in this region, missing out on potentially older evidence of human carnivory in other areas. In a paper published in the journal *Proceedings of the National Academy of Sciences*, Pobiner and her team conclude that the human-like traits of *Homo erectus* are likely due to other factors beyond their protein-packed diets.

A new species of jellyfish relative from the Clarion-Clipperton Zone that attaches itself to the tops of sponge stalks growing out of nodules.



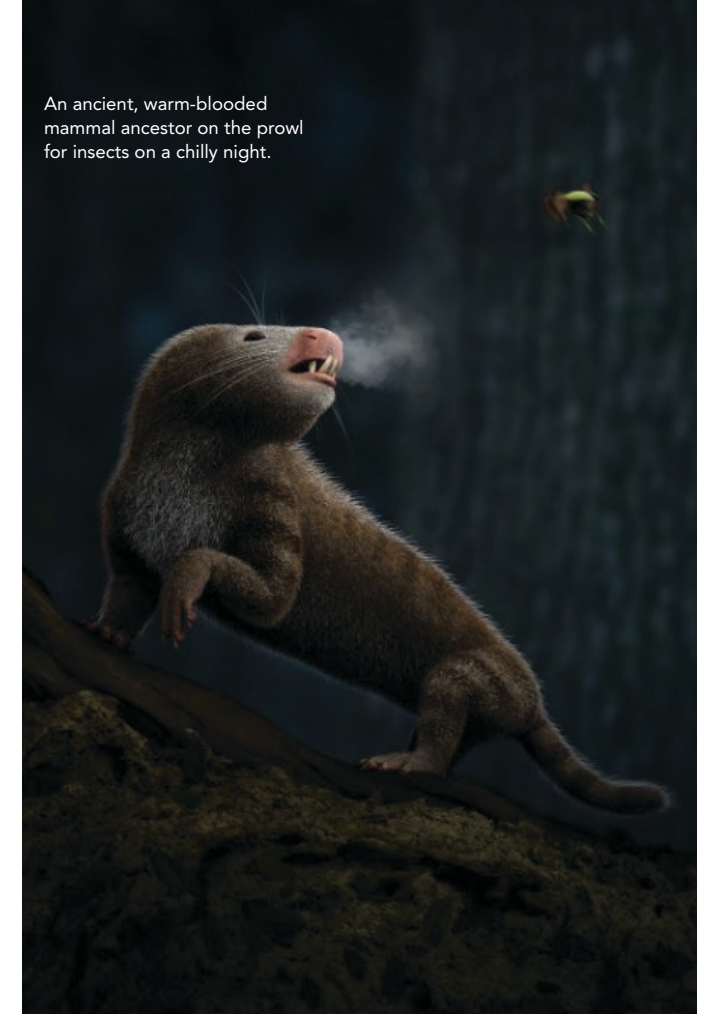
Artist John Gurche's bronze statue of *Homo erectus* on display in the David H. Koch Hall of Human Origins.

The secret to how mammal ancestors became warm-blooded is in their ear

One of the traits that make mammals so widespread is their warm-bloodedness. Unlike reptiles, who rely on the external temperature to keep them warm, mammals are able to maintain a near-constant body temperature, allowing them to conquer chilly climates.

How and when this game-changing trait evolved in the earliest reptile-like mammal ancestors has remained enigmatic. But a team including Peter Buck Deep Time Postdoctoral Fellow Jacqueline Lungmus found a clue to this adaptation's timeline hidden in the fossilized ear canals of early mammals and their kin. These canals contain a fluid called endolymph that aids balance and the viscosity, or runniness, of the fluid is impacted by an animal's internal temperature. Because mammals maintain a high internal temperature, their ear canals have become narrower over time to help them stay balanced. In a study published in the journal *Nature*, the researchers concluded that warm-bloodedness evolved 233 million years ago during the Triassic alongside other mammalian features like whiskers and furs.

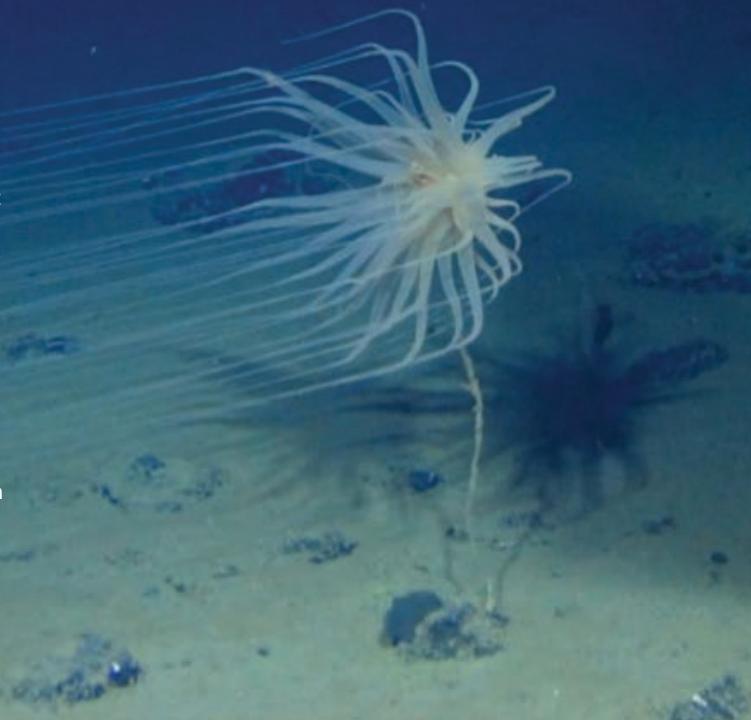
An ancient, warm-blooded mammal ancestor on the prowl for insects on a chilly night.



A bounty of new species inhabit a mineral-rich stretch of seafloor

A 3,100 mile swath of the central Pacific Ocean called the Clarion-Clipperton Zone (CCZ) is home to one of the richest assortments of potato-sized lumps of precious minerals called nodules. These nodules contain rare metals like nickel, copper, and cobalt that are essential to modern technology like cellphones. As a result, this area has become a proposed focus for deep-sea mining.

But the CCZ's submerged mountains, plains, and troughs are also home to a variety of sea creatures, many of which remain undescribed. To discover what resides down here, museum zoologist Stephen Cairns and an international team of researchers deployed a remotely operated vehicle to depths as deep as nearly 17,000 feet to scour the seafloor for life. In a study published in the journal *ZooKeys*, they described 48 different species, including sea cucumbers, basket stars, anemones, and sponges. Thirty-nine of these animals are potentially new to science.



Two newly discovered Amazonian fish are already swimming towards extinction

The Amazon River is brimming with aquatic life, including dolphins, caiman and more than 3,000 species of fish. In a study published in the *Zoological Journal of the Linnean Society*, Sara E. and Bruce B. Collette Postdoctoral Fellow Murilo Pastana and his team identified two new fish species as yet undiscovered in Amazon's aquarium. Both species are roughly an inch-long and belong to a group of fish known as South American darters. One of the species, *Poecilocharax callipterus*, which sports striking red and orange fins, is only found in a single stream. Unfortunately, both species live in a region of the Brazilian frontier experiencing habitat loss due to logging. The researchers fear these two new fish are already at risk of extinction.

The recently described fish, *Poecilocharax callipterus*, inhabits a single stream in Brazil.

Moving a step closer to predicting volcanic eruptions

Despite the profound hazards posed to human life and property by volcanic eruptions, humanity still cannot reliably and accurately predict them, and even when forecasts are accurately made by experts, they may not afford ample time for people to evacuate and make emergency preparations.

Accurate and reliable predictions have remained an elusive target largely because volcanologists do not fully understand the natural dynamics and processes of the magma underneath a volcano before it finds its way to the surface. Now, the results of a [Science study led by Peter Buck Fellow Dan Rasmussen](#), may bring experts one step closer to accurately forecasting volcanic eruptions.

The study finds that, for the world's most common type of volcano, magma with higher water content tends to be stored deeper in the Earth's crust. Connecting the depth at which magma is stored to water is significant because water largely initiates and fuels eruptions. Better understanding the physics and conditions of magma storage beneath volcanoes is an essential ingredient for the models necessary to more accurately forecast volcanic eruptions.

Ted Schultz, curator of Hymenoptera, National Museum of Natural History



Q&A with plant biologist Jun Wen

Plant biologist Jun Wen has spent her career studying the diversity and evolutionary history of the grape family, and many other plant groups besides. She tells us about her inspiration for becoming a scientist and why understanding plant diversity is crucial for humans and the planet.

Jun Wen, curator of Vitaceae and Asian Plants, National Museum of Natural History

You've studied a range of different plant groups throughout your career. What drew you to plants and their biology as a research subject?

I became interested in plants when I was a very young kid, maybe five or six years old. I grew up in Hubei Province in central China, and that province is very well-known for medicinal plants. My grandfather was an herbal doctor for my village, so he had a lot of knowledge about plant diversity and how it can benefit humankind as medicine. He went to the mountains to pick plants, and I helped him. So I've always had that appreciation for green diversity.

But because I was the daughter of his daughter, I was not allowed to inherit his medicinal knowledge—he's supposed to pass that knowledge on to his son or to his grandson. But I was guided and fascinated by the plant diversity that I saw every day in the forests. In college, I was studying forestry, and a professor would take us on field trips on the weekends. And in the mountains near my college, there must be 300 species of trees. So I asked him, 'How come? How can these plants come together in this place so harmoniously?' And he looked at me and he said, 'That's a very good question. You could dedicate your career to studying that question.' That was the moment. I clearly remember, after 40 years, that minute—that second. I knew I wanted to be a plant biologist.

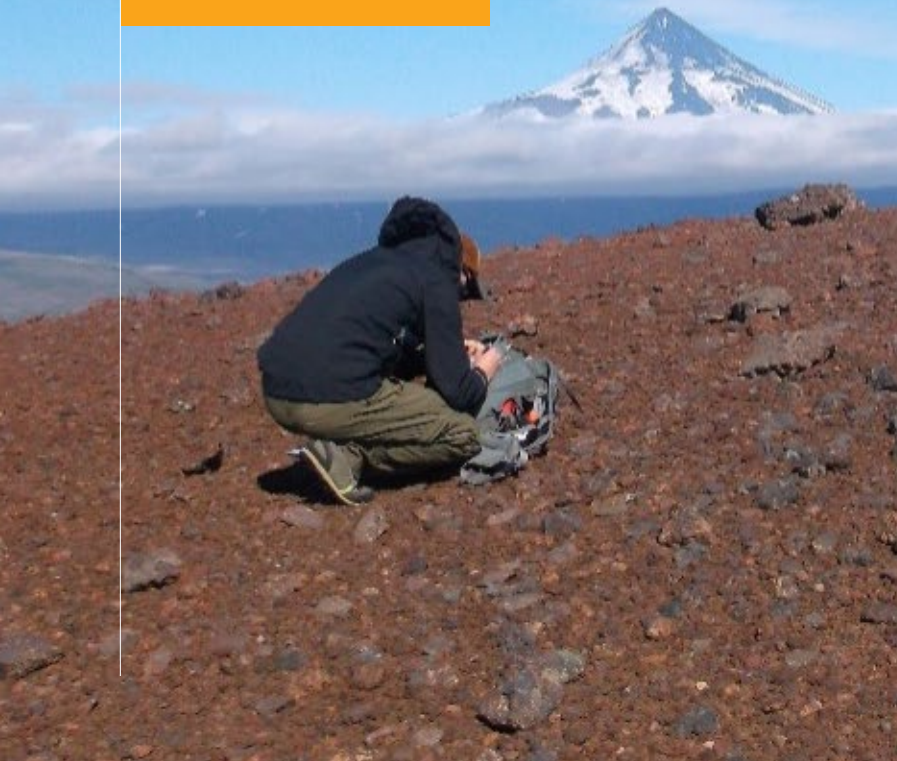
Why is it important to understand and document past and present plant diversity?

As humans, sometimes we forget—we really rely on plants a lot. Imagine if we didn't have plants, what life would be like. So doing this science is not just of interest to me as a scientist. We're trying to understand how humans can benefit from this vast plant diversity. It's pretty amazing; we think we understand everything about these economically important plant groups, like grapes, but we're only scratching the surface. With the cutting-edge genomic tools we have, there are a lot of new questions to address: how the species actually interact with each other, how they hybridize and establish in new areas. We're trying to understand this vast diversity and its potential uses for humankind.

Our science can also teach us to conserve that plant diversity, so it can benefit not only us, but future generations. Humans are causing so much irresponsible change, and many species are in danger. For example, some ginseng species are endemic to such small areas, and I was collecting them 30 years ago, but now I can no longer find them in the wild. Before we even understood them, they went extinct. So extinction is not a fantasy, it's the reality.

Our whole motivation is that history is a window that allows us to predict the future, and we learn lessons from the past. I think right now our mission is to help people understand how vulnerable this diversity is, and how easily species can go extinct. And we as scientists dedicate our careers to understanding that diversity, to learn how humans can conserve it and make sure our future is sustainable.

Dan Rasmussen, Peter Buck Fellow, collects volcanic ash samples from Neptune Ridge, a volcanic feature on Fisher Caldera.



The agricultural connection between humans and insects

Farmers and bugs are often locked in a pesticide-fueled arms race. But human farmers have much in common with many insects. After all, insects were the original farmers. In the aftermath of the asteroid impact that doomed most dinosaurs 66 million years ago, ants began tending fungi gardens. Entomologist Ted Schultz, who heads the museum's AntLab, specializes in studying how these leafcutter ants farm fungi.

According to Schultz, ants and humans are far from nature's only farmers. "If it has anything to do with growing your own food, there's lots of animals that do it," he says. Other insects like termites and beetles have also been producing crops for millions of years. And vertebrate species like tuber-cultivating pocket gophers and algae-growing damselfish have also joined the ranks of agricultural animals.

In 2022, Schultz [explored several of these cultivating critters](#) when he coedited the new book, *The Convergent Evolution of Agriculture in Humans and Insects*. The tome explores just how similar human farmers are to their nonhuman counterparts like ambrosia beetles, termites and ants.



Awards+Honors

Kay Behrensmeyer was formally inducted as a member of the Academy of Sciences.

Ted Schultz was named a Fellow of the American Association for the Advancement of Science.



Cari Corrigan was elected as a Fellow of the Meteoritical Society.

Courtney Wagner received the Bradley Award from the Geological Society of Washington.

The museum's Global Volcanism Program was honored with the 2021 USGS Shoemaker Award for Communications Product Excellence for the [20th Anniversary of the USGS/Smithsonian Weekly Volcanic Activity Report \(WVAR\)](#) website.

Conrad Labandeira received the 2022 Paleontological Society Medal, the most prestigious honor bestowed by the Society.

Torben Rick was named a Fellow of the California Academy of Sciences.

Yale University named **Kirk Johnson** one of the recipients of 2022's Wilbur Cross Medal.

Rick Potts received the John Tanner Lectureship Award from Brigham Young University.

The Department of Botany's project to digitize the United States National Herbarium was shortlisted for the Apollo Awards 'Digital Innovation of the Year.'

Alice Tangerini was presented with the Jill Smythies Award in Botanical Illustration by the Linnean Society of London.



Kay Behrensmeyer, curator of Vertebrate Paleontology, National Museum of Natural History

Q&A With Curator Kay Behrensmeyer

who was formally inducted as a member of the National Academy of Sciences in April 2022.



Jeff Post was honored with a special session at the 2022 Geological Society of America Annual Meeting in Denver.

Dawn Biddison received the Alaska Museum Prize for producing the 'Material Traditions' Webinar Series.

Joanna Scherer was awarded a Lifetime Achievement Award by the Society for Visual Anthropology.

Our Education, Outreach and Visitor Experience team was honored with the Smithsonian's 2022 Innovation & Access Education Award for their preK-12 digital-learning strategy and programs designed and implemented throughout the pandemic.

Bruce B. Collette was presented with the Robert K. Johnson Award for excellence in service by the American Society of Ichthyologists and Herpetologists.



Can you tell us more about what your induction into the National Academy of Sciences means to you?

It's the highest honor for a scientist in this country, and I never dreamed that I would be elected. Unbeknownst to me, my colleagues in different fields recognized what I was doing. Apparently they joined forces to support my election, and that's how it happened.

In a way, I have to reassess my future. As a woman scientist at the National Museum of Natural History, I may be a more effective spokesperson for a lot of different causes now, including the science of paleontology and STEM education for more young women.

What is the importance of having women in STEM?

I think women, and people of all ethnic groups and diverse backgrounds bring a lot of different ways of thinking to science. And they ask different questions.

The more different kinds of people you bring together around common problems, the better off you're going to be and the more you're going to discover. One viewpoint just doesn't do it. I like convergence of different ways of thinking and seeing what comes out of that.

Ethical Returns and Shared Stewardship

Ethical Returns and Shared Stewardship

Museums around the world are reckoning with the methods and means by which they have acquired their collections and the effects this has had on impacted communities of origin worldwide.

Our museum has been playing an important role in this space for years, particularly as it relates to meeting our obligations under the National Museum of the American Indian Act to repatriate human remains and funerary objects – many of which had been part of our collections for more than a century.

In April 2022, the Smithsonian directed each museum to develop individualized policies around [Ethical Returns and Shared Stewardship](#) which include enabling the return of collections, in appropriate circumstances, based on ethical considerations. Our museum spent last year developing and finalizing such a policy for formal implementation in 2023.

The conversation around ethical returns and collections is ongoing and we will continue to demonstrate leadership in this space.

A Journey Home for Indigenous Australians

In 2015, when the museum established its international repatriation policy, NMNH formally offered 37 Australian Aboriginal individuals and 6 Torres Strait individuals for repatriation to Australia. This repatriation was originally scheduled for March 2020 but had to be postponed due to the pandemic.

On July 21, the museum hosted a handover ceremony that enabled the first group of these ancestors to begin their rightful journey back home. The ceremony marked the return of 25 individuals: 19 Indigenous Australian individuals and 6 Torres Strait Islanders. Representatives from two Indigenous Australian communities — the Narungga and the Kurna, both from South Australia — were on hand to receive the remains and escort them to Australia.

A third community was unable to attend this ceremony and has asked that NMNH delay the return of their ancestors until a later time. The museum will hold a second repatriation in a timeframe that works for the community.

The ceremony was hosted by NMNH Chief Scientist Rebecca Johnson and featured remarks from Australian Ambassador Arthur Sinodinos, Smithsonian Under Secretary for Museums and Culture Kevin Gover, NMNH Sant Director Kirk Johnson, and Australian Deputy Secretary of Infrastructure, Transport, Regional Development and Communications Dr. Stephen Arnott, as well as Douglas Milera and Cyril Kartinyeri (Narungga Nation Aboriginal Corporation) and Allan Sumner and Major Sumner AM (Kurna Yerta Aboriginal Corporation). It was preceded by a smoking ceremony held outside on the lawn of the museum.

The ceremony was an important milestone in the ongoing journey to redress our museum's historic practices and build relationships with the Indigenous communities of our nation and the world.



A Look Ahead to 2023

Lights Out: Recovering Our Night Sky

In March, we unveiled [Lights Out: Recovering Our Night Sky](#), a new 4,340-square-foot exhibition about how the night sky—and its disappearance due to light pollution—affects all life on Earth, from natural ecosystems to human cultures. Through extraordinary photographs, objects from the museum's collections, and interactive displays, *Lights Out* offers ways to discover and regain our storied connection with the night sky. In addition to the exhibition's visual components, it also offers opportunities for visitors who prioritize experiential and multi-sensory learning.

This photo of the Milky Way from Alabama Hills, California is featured in "Lights Out: Recovering Our Night Sky"

Our Unique Planet

Despite centuries of research, there are fundamental questions about the origin of the Earth and its ocean, continents, and life that we have yet to answer.

**What was the source of the Earth's oceans?
How did silica-rich continental crust first form?
What was the role of minerals in the origin of life?**

Our Unique Planet is a new keystone research and outreach initiative that will tackle these questions and, in the process, change our understanding of our planet and the universe. Anchored by the analyses of a sample from the asteroid Benu slated to arrive on Earth in September 2023 as part of NASA's OSIRIS-REx mission, we will combine our expertise and our collections with a cadre of early-career scientists to begin to unlock these mysteries. The research team based in our Mineral Sciences department will synthesize data from Benu with additional insights from meteorites, oceanic and continental crust, volcanoes, biominerals, and the oldest minerals on Earth.

Ocean Science Center

We will formally establish our [Ocean Science Center](#) with the anticipated hire of its leader, the new Sant Chair of Marine Science. The Ocean Science Center will consolidate our marine research expertise and vast collections into a collaborative center to expand our understanding of the ocean, the life and cultures that depend upon it, and the tools and pathways to conserve it. The Ocean Science Center has already launched two pan-museum projects that leverage our systematic, genetic, and ecological expertise, educational and outreach assets, and our world-class marine collections. It will also be closely aligned with the Smithsonian's new Ocean strategy which will build on the ocean assets of the entire institution.

Cellphone: Unseen Connections

[Cellphone: Unseen Connections](#), a new exhibition exploring the technological, environmental and cultural impact of these devices opens on June 23. Through an impressive array of objects, personal profiles, and interactive displays, *Cellphone* will offer visitors a chance to explore the many ways that cellular phones bring us closer to one another, often in ways we never realized. The multi-faceted, first-of-its-kind exhibition is made possible through generous gifts from lead sponsor Qualcomm and major sponsor T-Mobile.



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The Smithsonian National Museum of Natural History gratefully acknowledges our steadfast and generous supporters.

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Donor Profiles

Heather Sturt Haaga and Paul G. Haaga, Jr.

Heather Sturt Haaga and Paul G. Haaga, Jr. have been steadfast supporters of the museum since 2018. They have generously pledged \$2,500,000 toward our new Ocean Science Center's innovative Ocean DNA project.

The [Ocean Science Center](#) consolidates our marine research expertise and vast collections into a collaborative effort to expand our understanding of the ocean, the life and cultures that depend upon it, and the tools and pathways to conserve it.

Ocean DNA will develop a genomic toolkit to rapidly assess marine biodiversity and ocean health. It supports this effort by curating a DNA reference library to enable rapid, large-scale surveys of marine life, especially of undiscovered "dark taxa" that may play a critical role in ecosystems. The toolkit will be applied to discover new species, detect invasive species, monitor change, assess the effectiveness of marine reserves and management practices, and inform priorities for conservation.

"Heather and I are thrilled to be able to support the Ocean DNA project. Oceans cover 70% of our planet and are being subjected to unprecedented human-mediated impacts from habitat destruction, pollution, overfishing, acidification and climate change," said Paul Haaga. "Ocean DNA presents us with a new tool to rapidly identify all organisms living in a marine ecosystem through environmental DNA, creating an ocean genomic reference library that will inform conservation priorities far into the future."

Mr. Haaga is former chairman and director of Capital Research and Management Company, is a member of the museum's advisory board, currently serving as Campaign Co-Chair. Mrs. Haaga is a plein air painter in California and has more than 25 years of experience in nonprofit board leadership.



Paul G. Haaga, Jr. and Heather Sturt Haaga

"Ocean DNA presents us with a new tool to rapidly identify all organisms living in a marine ecosystem through environmental DNA, creating an ocean genomic reference library that will inform conservation priorities far into the future."

– PAUL HAAGA

Qualcomm

The National Museum of Natural History received the second largest corporate contribution in our history thanks to the generosity of Qualcomm Incorporated.

In 2021, Qualcomm pledged \$3,000,000 as lead sponsor of the exhibition *Cellphone: Unseen Connections*, which opens on June 23, 2023. Qualcomm's gift also supports educational programming for youth, classrooms, and adults as well as a free, do-it-yourself pop-up version called *Cellphone DiY*.

Through an impressive array of objects, personal profiles, and interactive displays, *Cellphone* explores the unseen yet powerful social, cultural, and environmental significance of cellphones as the most transformative communication tool in human history. *Cellphone* will enable visitors to explore the many ways that cellular phones and technology connect us to the Earth and to each other, often in ways we never realized.

Qualcomm team

"At Qualcomm, we believe that cell phones have positively changed the way we communicate with each other and the world around us," said Susie Armstrong, SVP, Engineering, Qualcomm. "We are proud to be the company that pioneered so much of that wireless semiconductor technology and so excited that it's being leveraged for a broader impact on humanity. We are honored to support the Smithsonian's efforts to tell the story of how mobile technology has transformed the world."



In Memoriam



In Memory of Dr. Peter Buck

The National Museum of Natural History remembers Dr. Peter Buck who passed away at the end of 2021.

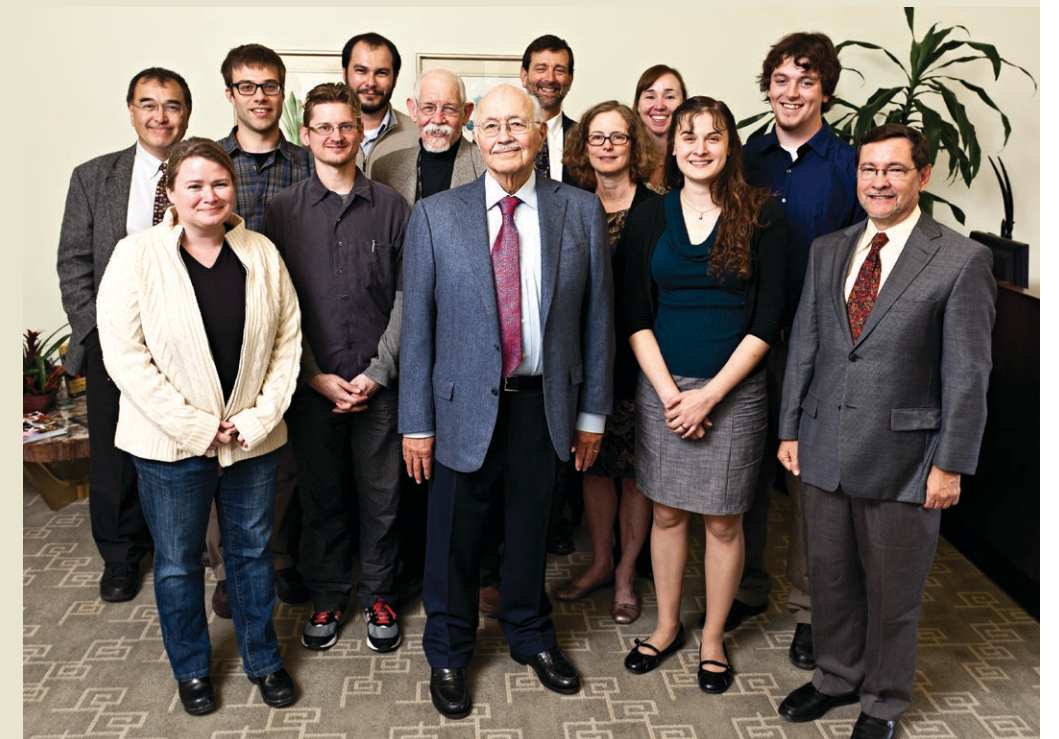
Dr. Buck's relationship with the museum began in 2004 when he gifted a 23.10 carat ruby from Burma, named after his late wife, Carmen Lucia Buck. He soon joined the museum's board, serving for nearly a decade and was named an emeritus board member in 2014.

It is impossible to overstate the impact of Dr. Buck's generosity on the scientific community at museum and, as a result, his role in furthering our understanding of the evolution of our planet and everything that has lived upon it.

The establishment of the Peter Buck Fellowship Program Endowment has thus far allowed the museum to attract over 160 of the best and brightest early career scientists in the world. And his support for our Human Origins Program has enabled transformative research that has furthered the scientific and public understanding of humanity and the origin of our species. These scientific investigations are enhanced by making the findings available to people everywhere.

Dr. Buck's final gift to the museum was the "Uncle Sam Diamond," the largest diamond ever unearthed in the United States. It is now a centerpiece of our Great American Diamonds exhibition.

We are forever grateful for Dr. Buck's unwavering support of the National Museum of Natural History.



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