

# ROTUNDA

Member Magazine  
Spring 2014 Vol. 39 No. 2

## Pterosaurs

*Flight in the Age  
of Dinosaurs*  
**NOW OPEN**



# From the President

Ellen V. Futter



After an unseasonably cold, snowy winter, the Museum is pleased to offer a number of springtime opportunities to awaken the inner naturalist in us all. This is the time of year when Museum scientists prepare for the summer field season as they continue to pursue new discoveries in their fields. It's also when Museum Members and visitors can learn about their own discoveries during the annual Identification Day in Theodore Roosevelt Memorial Hall.

Held this year on May 10, Identification Day invites visitors to bring their own backyard finds and curios for identification by Museum scientists. A green beetle bracelet from Brazil. A 72-million-year-old shark tooth. Three arrowheads. A walrus skull fossil. These are just a few of the many items identified by Museum scientists on ID Day over the years. Whether it's a rock, feather, bone, arrowhead, or cultural object, Museum scientists

will work to identify items from your collection, while also displaying intriguing specimens from the Museum's own world-renowned collections.

Of course, fieldwork and collecting have been hallmarks of the Museum's work since the institution's founding. What has changed, however, is technology. With a nod to the many ways that technology is amplifying how scientific investigations are done, this year, ID Day visitors can learn how scientists use digital fabrication to aid their research and have a chance to have their own objects scanned and printed on a state-of-the-art 3D printer.

Whether it's on one of our springtime bird walks or Members' excursions, or by participating in Identification Day, the Museum inspires visitors to think and act like scientists. And there's no better time than springtime to rekindle the naturalist in you.

## Table of Contents

News	3
Close-Up	4
Unearthing Pterosaurs	6
Suit Up!	12
Flying Colors	14
Next	16
Education	20
Seen	22



## ROTUNDA

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# More than 540,000 Marine Fossils Added to Paleontology Collection



Once one of the most common invertebrates in the oceans, ammonites went extinct more than 65 million years ago.

Thanks to a major donation from Ohio University at Athens, 15,000 pounds of marine fossils hundreds of millions years old recently have been added to the Museum's collection. The final share of the 540,000 fossil specimens—which include nautilus, ammonites, sponges, and fishes—was delivered from Ohio to New York late last year on 16 shipping pallets. The donation fills a chronological gap in the Museum's existing fossil collection, and after the formal accession this winter has pushed the total number of specimens and artifacts in the Museum's world-class collections over the 33-million mark.

"This collection is from the upper Paleozoic, roughly 240 to 350 million years ago, an era that is under-represented in our current holdings," says Neil Landman, curator-in-charge of the fossil invertebrate collection in the Museum's Division of Paleontology, who studies ammonites and other invertebrates to better understand the evolution of life on the planet. "These spectacular specimens will provide rich opportunities for scientific research far into the future as we investigate the record of marine biodiversity throughout Earth's history."

The fossil material mostly consists of invertebrates such as ammonites, trilobites, gastropods, and bivalves, but also includes vertebrate specimens such as exquisitely preserved fish skulls. The specimens were collected primarily from Arkansas, Oklahoma, Kansas, and Texas over a period of 45 years by Ohio University professors Roy and Gene Mapes and their students. In addition, a number of the specimens represent more distant locations, including Morocco, Russia, Japan, and Vietnam, the latter where Roy Mapes collected fossils while stationed there in 1970 as an officer in the United States Army.

Museum scientists have been studying Mapes specimens for years through collaborative work with Ohio University.

"The Mapes collection is an extremely valuable scientific collection, from which we've already described two new fish species, one in 1989 and one that is currently in press," says John Maisey, curator-in-charge of the fossil fish collection in the Museum's Division of Paleontology. "Many other specimens in this collection are destined to star in future papers about the anatomy and evolution of sharks and other early jawed vertebrates."

For more about ammonites, see story on page 5.

© AMNH/S. Thurston

## Collections at a Glance

Over nearly 150 years of acquisitions and fieldwork, the Museum has amassed preeminent collections that form an irreplaceable record of life on Earth. Today, 21st-century tools—sophisticated imaging techniques, genomic analyses, programs to analyze ever-growing sets of data—offer Museum scientists a comprehensive way to address critical questions about Earth and the larger universe.

**33 million**  
Artifacts and specimens, including new types of specialized collections such as frozen tissue and genomic and astrophysical data

**23.2 million**  
Specimens in the Invertebrate Zoology collections, which includes 13 specialized collections

**84,326**  
Frozen tissue specimens in the Ambrose Monell Cryo Collection, one of the newest of the Museum's six collection units

**5,433**  
Specimens in the meteorite collection of the Earth and Planetary Science Department

**More than 1,000**  
Scholarly visitors who access the Museum's collections on-site every year

Visit [amnh.org/our-research](http://amnh.org/our-research) for more about the Museum's research and collections.



The fossil ammonites shown here and above are from about 400 million years ago, during the Devonian period.

**MONSTER MATCH-UP**

Gila monsters measure up to 22 inches long and can weigh more than 2 pounds, making them the largest lizard native to the U.S. But they're quite small compared to the world's largest lizards, Komodo Dragons: male Komodo Dragons can weigh more than 150 pounds and measure up to 10 feet in length.

**VENOM VS. POISON**

When toxins occur in an animal's skin—as in golden poison frogs, also featured in the *Poison* exhibition—and pose danger to those who touch or eat it, such species are categorized as poisonous. But when the toxin is injected, for example by a snake, spider, scorpion, or lizard, the animals are considered venomous. The Gila monster falls in this latter category and is the only dangerously venomous lizard in the U.S.

**MONSTERS AT THE MUSEUM**

The Museum has more than 70 Gila monster specimens in its collection, including whole specimens, skeletons, and type specimens—the original specimens used to name and describe a species. Overall, the Department of Herpetology has one of the largest collections in the world, with some 360,000 specimens. The collection is significant for its long history, its many type specimens, and its strengths in certain regions and species groups, including dendrobatid frogs and venomous snakes.

**LIVE ANIMAL ON DISPLAY**

The Gila monster featured in *The Power of Poison* is a young male who, like his wild counterparts, sleeps most of the time. He has periods of activity, however, particularly after meals—he is served two dead mice a week—and after his weekly bath, when he soaks in a shallow tub. He likes to dig and occasionally climbs up the side of his enclosure using his muscular tail for balance.

**PIONEERING STUDIES**

In 1956, Museum Curator Charles M. Bogert, a lizard expert, published the landmark reference work *The Gila Monster and Its Allies* about Helodermatidae, a family of venomous lizards with rough, nail-like skin. In recognition of his work, a subspecies, the Guatemalan beaded lizard, was named *Heloderma horridum charlesbogerti* after him. Another herpetologist, Sherman Anthony Minton, produced groundbreaking research under Museum sponsorship in the 1960s on venom and anti-venom.

## Gila Monster

The dramatic pink, orange, black, and yellow markings on this lizard's bead-like skin may serve as warning to predators to stay away or risk a painful bite. But the venom of the Gila monster (*Heloderma suspectum*), which is featured as one of the live species in *The Power of Poison*, has medicinal capabilities as well: one of its components has been used to develop a diabetes drug.

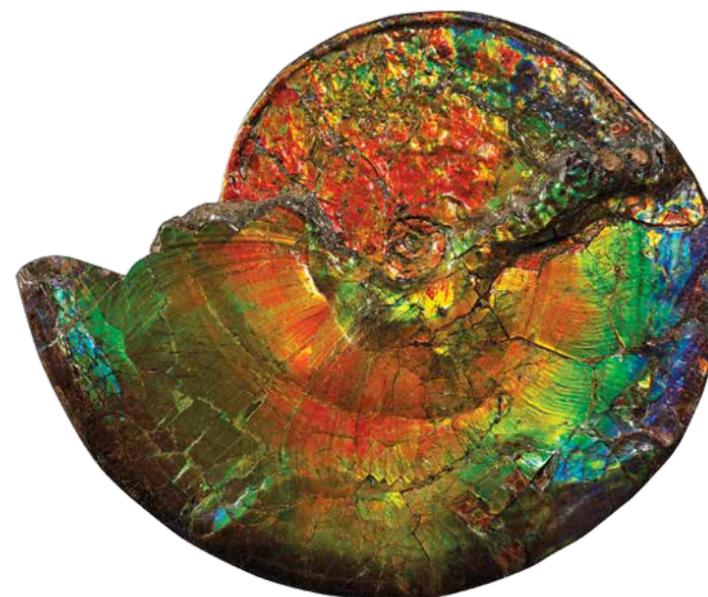
The key ingredient is exendin-4, a peptide that may slow the lizard's digestion and allow it to go for long periods without food. Gila (pronounced "HEE-lah") monsters, which are native to the southwestern U.S. and northern Mexico, are slow-moving and shy, spending most of their time concealed in underground retreats in deserts and other relatively dry habitats. These carnivorous lizards prey on nesting young rodents and rabbits, and the eggs of birds and reptiles. They can consume more than one-third of their body weight in a single feeding and endure many months between meals by storing fat in their thick tails and bodies.

As it turns out, exendin-4 is similar to a human peptide that stimulates insulin production and lowers blood sugar. A synthetic version of the hormone was developed for use in a drug to treat type 2 diabetes. In addition to regulating blood sugar, exendin-4 may also reduce appetite and help control obesity.

In the wild, venom may help Gila monsters immobilize prey or defend themselves when a predator or human disturbs them. If a quick slashing bite fails to deter a bothersome intruder, a Gila monster will grip the offender in its strong jaws and hold on for several minutes, forcing venom into the victim through grooves in the long teeth of its lower jaw. Although not fatal to humans, the venom nevertheless acts as a powerful deterrent: it causes extreme pain, swelling, reduced blood pressure, and internal bleeding.

See a live Gila monster in *The Power of Poison*, which is free for Members.

Gila monsters are the largest lizard species native to the U.S.



Catalog no. AMNH FI-56701

## Amazing Ammonites

The extinct mollusks known as ammonites inhabited the planet for more than 500 million years—almost twice as long as dinosaurs—before disappearing in the mass extinction event more than 65 million years ago. As many as 10,000 species may have existed, ranging from tiny organisms that measured only a fraction of an inch across to formidable animals more than 2 feet in diameter, such as the spectacular 75-million-year-old specimen shown above, which is on view in the Museum's Grand Gallery.

Like the modern-day pearly nautilus, ammonites had shells that contained a body chamber for the animal and a series of connected chambers to hold air, enabling them to remain buoyant in water. A thin tube ran through the chambers, allowing the removal of water and replacement by air. Diverse, widespread, and abundant in their marine environments, ammonites left behind an extraordinary number of fossils.

Curator Neil Landman, who is investigating whether ammonites were already in decline at the time of their extinction, has examined specimens from all 51 known genera from around the world that were alive at the very end of the Cretaceous period. He is also researching jaw and tooth structures of different species to determine their role in the marine food web. "The challenge in studying ammonites is that they all are found in rock," says Dr. Landman. "We are learning to get more information from CT [computed tomography] scans, which offer a non-destructive way to look at internal structures."

Ammonite fossils have intrigued humans for centuries. In medieval Europe, the coiled fossils were known as "snakestones" and were thought to have curative powers against snakebites and poisons. In North America, Crow, Sioux, and other Great Plains Indian tribes often found such fossils, relics of the sea that once covered the continent's western interior, and used these "stones" to heal injuries and to bring good fortune in marriage, hunting, travel, and warfare.

See ammonites on view in *The Power of Poison*, which is free for Members, and in the Grand Gallery.

**A RELIABLE INDEX**

Paleontologists look for "index fossils" in rock layers to help gauge geologic time. To serve as reliable indicators, fossil species must be abundant, widely distributed, distinctive, and have existed for a limited period—like ammonites. Since various ammonites lived and became extinct at different times, paleontologists can use ammonites to compare rock layers from separate locations to determine their approximate geologic age.

**FOSSILS NEAR AND FAR**

Given the broad distribution of ammonites, Dr. Landman's fieldwork can be far-flung. Recent research has taken him to sites in western Europe, New Zealand, and Antarctica, with a field trip to Morocco on the horizon. Closer to home, he often collects ammonite fossils in creek beds in suburban New Jersey, where, during the Cretaceous period, warm seas covered the land and ammonites were plentiful.

**PREDATOR AND PREY**

Ammonites were hunters, with beak-like jaws and teeth known as radula. The smallest species probably preyed on plankton, and the larger species likely ate crabs and similar marine animals. Ammonites were also a food source for other marine animals. Fossil evidence suggests that mosasaurs, giant extinct marine reptiles that were widespread in the Cretaceous period, were among their predators.

**SHAPELY SHELLS**

The most commonly found ammonite fossils are coiled like rams' horns. In fact, ammonites are named for the Egyptian god Ammon, who was sometimes represented as a ram. But many ammonites were elongated or tubular, others snail-like, with surfaces ranging from smooth to heavily ribbed, probably for protection from predation. Since soft body tissues rarely fossilize, shells, along with jaws, are the focus of most ammonite research.

**FOSSIL COLLECTIONS**

From its initial acquisition of 100,000 specimens in 1875, the Museum's paleontology collections have grown to include more than 5 million invertebrate specimens, one half of which are ammonite fossils. In 2013, the Museum received approximately 540,000 marine fossils, including about 150,000 ammonite specimens, from the Upper Paleozoic of North America, which were collected by Drs. Royal and Gene Mapes and their students at Ohio University over some 45 years.

© AMNH/C. Chesek

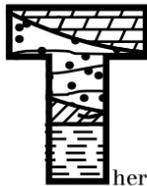
PREVIOUSLY UNEXPLORED  
LOCALES AND NEW METHODS  
ARE REVEALING MORE ABOUT  
THESE ANCIENT REPTILES

# UNEARTHING PTEROSAURS

**Flying predator** Based on its long, sharp teeth, *Scaphognathus crassirostris*, above, was likely a predator.



**Big Find** This humerus, or upper arm bone, supported the left wing of the tremendous pterosaur known as *Quetzalcoatlus northropi*.



There is a place called the Araripe Basin in a remote, sparsely populated region of northeastern Brazil. Arid but beautiful, it can be a difficult place for farmers to grow crops. But the earth provides another bounty: fossils. And among the bevy of bones are some rare finds—including 25 species of extinct flying reptiles called pterosaurs.

More than three decades ago, a local there found some large pterosaur bones. He delivered them to the Museu Nacional in Rio de Janeiro, where they were tucked away in a drawer. As it happens, many natural history museums have a trove of unexamined fossils awaiting study in their collections—there are just too many to go through. But a few years ago, paleontologist Alexander Kellner, a research associate at the American Museum of Natural History who as a doctoral student trained with Curators John Maisey and Malcolm McKenna, found the time to examine the 30-plus-year-old fossil finds

at the Rio museum, where he is now a curator.

Before studying the bones, Kellner had to dissolve the calcereous “nodules” of rock in which the bones were entombed by sinking the fossils into buckets of formic acid. Using a pneumatic hammer, specialists at the museum gradually freed a partial skeleton of the animal from its stony home.

It included part of the animal’s skull, complete with a bony crest at the tip of its nose, vertebrae, pelvis—and, perhaps most dramatically, arm and wing-bones. The wingspan of this pterosaur was, the research team concluded, nearly 27 feet—the largest pterosaur discovered so far in the Southern Hemisphere. A model of this recently described giant specimen, from the species *Tropeognathus mesembrinus*, flies overhead at the entrance to the special exhibition *Pterosaurs: Flight in the Age of Dinosaurs*, overseen by Curator Mark Norell with Kellner as co-curator.



**First discovery** *Pterodactylus antiquus* was the first pterosaur to be studied and described. A fossil of this unusual animal was acquired by a German ruler in the late 1700s.

Previous page, photo © AMNH/C. Chesek

## NOT A BIRD, NOT A DINOSAUR

What is a pterosaur? It sounds like such a simple question. But the answer was by no means obvious when the first pterosaur skeleton was discovered in the mid-1700s, in the Solnhofen limestone quarry in Germany. Perhaps, early observers theorized, that specimen’s long skinny arm-and-finger bones were for swimming? Or was it some kind of toothed, clawed, winged bird? Or even a mammal? Debates raged, even after 1801, when the great French anatomist Georges Cuvier analyzed drawings of the skeleton and determined the animal to be something new to science: a flying reptile that Cuvier later named *ptero-dactyle* (wing finger in Greek), whose wings were composed of a shortened upper arm bone, along with a dramatically elongated fourth finger that likely supported a wing membrane.

Since Cuvier’s time, the fossil record has revealed much more about these extinct reptiles, which lived from about 220 million years ago to the end of the late Cretaceous period 66 million years ago, disappearing at the same time as large dinosaurs in a mass extinction event.

Still, although pterosaurs may often be grouped with dinosaurs in children’s picture books, they are not dinosaurs.

“Dinosaurs are characterized by a set of anatomical features pterosaurs don’t have,” explains Norell, including a hole in the hip socket. Today’s scientific consensus is that pterosaurs are nonetheless more closely related to dinosaurs, whose living descendants are birds, than to any other group, including the next-closest, crocodiles.

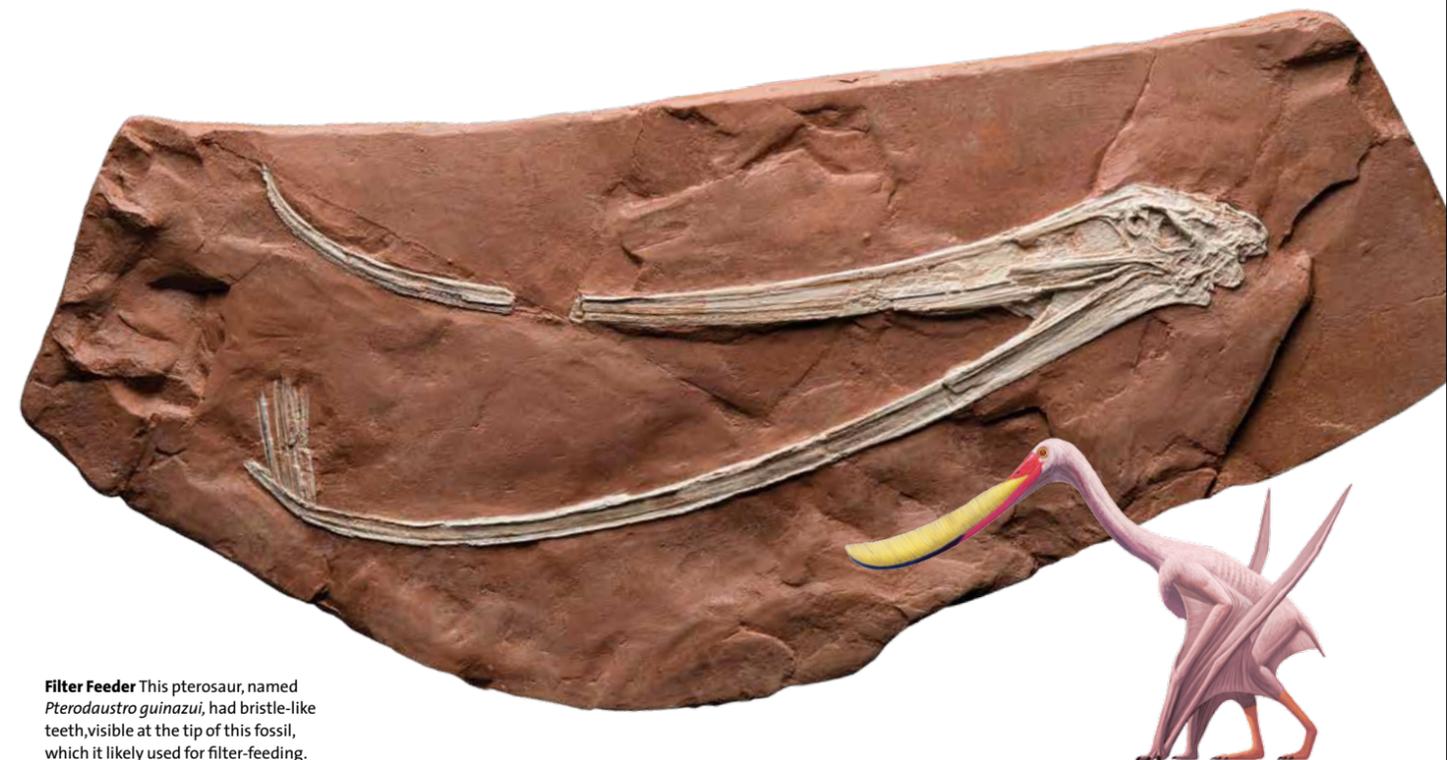
What is also clear is that pterosaurs were the first vertebrates to fly—an amazing feat. Tiny, invertebrate insects had long since taken to the air, but nothing as large as a four-legged vertebrate had attempted such a thing.

“They are the most fabulous creatures that ever existed! I am not exaggerating,” says Kellner. “They made the first attempts among vertebrates to conquer the air—they were the first to develop powered flight,” that is, the type of sustained flight that evolved, later and independently, in birds and bats.

Still, many mysteries remain. What type of material covered their skin? Was it hair, or feathers, or something in between? What did they eat, and how did they hunt? Many pterosaurs had flesh-and-bone crests atop their skulls—dramatic anatomical characteristics whose purpose is still debated by paleontologists. (See p. 14 for more about crests.)

## UNLIKE DINOSAURS, PTEROSAURS LEFT NO LIVING DESCENDANTS WHEN THEY DISAPPEARED FROM EARTH.

Unlike dinosaurs, whose living descendants are modern birds, pterosaurs left no heirs when they disappeared from Earth. That means paleontologists have no living analogs to draw from as they make inferences about pterosaur behavior. Nonetheless, in the past decade or two, there has been a resurgence of pterosaur research and synthesis, as new methods of examining fossils, such as computed tomography (CT) scanning and UV lighting to discern heretofore invisible details, have become commonplace; as researchers share data digitally; and as researchers begin to find new fossils in previously unexplored locales, including China and Brazil.



**Filter Feeder** This pterosaur, named *Pterodaustro guinazui*, had bristle-like teeth, visible at the tip of this fossil, which it likely used for filter-feeding.

Illustrations on pages 8 and 9 © AMNH 2014; photos © AMNH/C. Chesek



**Showy Crest** One of the smaller Brazilian crested species, *Tapejara wellnhoferi* sported a rounded crest.



### RARE FOSSILS

Pterosaur bones have been found on every continent including Antarctica. Although all pterosaurs share the wing anatomy in which the upper-arm bone (humerus) and elongated fourth digit form the truss of the wing membrane, the wing shapes are quite diverse: from long, thin soaring wings like those of an albatross to short, stubby wings that might have allowed for more frequent flapping flight, like that of a cardinal. Some early pterosaurs had peg-like teeth seen in living reptiles, while many others were toothless. Early pterosaurs often had long tails that they might have used as airborne rudders, while later species have a short tail or no tail at all.

## PTEROSAUR BONES ARE THIN-WALLED AND HOLLOW, SO VERY DELICATE.

Despite this diversity, however, the number of recovered pterosaur fossils remains low, notes Norell. So far, only several thousand pterosaur bones have been discovered, perhaps one-tenth the number of bones of dinosaurs that have been unearthed. As Kellner points out, too, the majority of those fossils come from just a handful of sites around the world—so-called *Lagerstätten* sites “where bones are well-preserved, basically, and there’s a lot of material,” and where the fossils aren’t flattened like “Mesozoic roadkill” but instead are preserved more or less three-dimensionally. These include sites in Solnhofen, in Germany; the Brazilian Araripe Basin, also known as the Santana Formation (see page 11), and sites in England, Canada, the northeastern U.S., and China. One reason pterosaur bones are relatively rare is that they were thin-walled and hollow, so lighter for flying but also very delicate—like those of birds and bats, whose fossil forms are also rare.

### GIANT DISCOVERY

Over the more than 150 million years pterosaurs existed, they evolved a range of sizes, from that of a sparrow to that of a small plane. The exhibition includes a cast of the 10-inch-wingspan pterosaur *Nemicolopterus crypticus*, as well as a model of the gigantic *Quetzalcoatlus northropi*. Discovered in the early 1970s in Big Bend National Park in Texas, *Quetzalcoatlus*, named for an Aztec god who was represented as a feathered snake, likely had a wingspan of 35 feet. Since its discovery, it’s been considered the largest pterosaur of all.

But over the last few years, a team of Romanian and American researchers including Dr. Norell has discovered fossils of a pterosaur that may rival *Quetzalcoatlus* in size.

Working in the Carpathian Mountains in Romania, the team knew there was a cliff where pterosaur and dinosaur bones had previously been located. Using binoculars to survey cliffsides for potential sites, the scientists rappelled down the face of the cliff to collect the fossils. So far, they’ve collected several bones of this new, still unnamed specimen, including a single vertebra the size of a bowling ball. “It’s quite a spectacular thing,” says Norell of the animal represented by the bones they found... “a lot heavier than *Quetzalcoatlus*—with a shorter neck and bigger head.” He adds, with a bit of understatement: “It’s a pretty neat thing to think that this animal could really get up and fly?”

With some of these specimens on view in the new *Pterosaurs* exhibition, visitors will have the rare opportunity to see a new species known only to a few of the world’s top pterosaur specialists—and to join in the excitement of a new discovery. 📍

*Pterosaurs: Flight in the Age of Dinosaurs* opened April 5 and is free for Members.

Illustration © AMNH 2014; fossil image © AMNH/C. Chesek

# WHAT A WORLD! 🌐

## ARARIPE BASIN, BRAZIL

If you want to spoil budding paleontologists, says Alexander Kellner, co-curator of the *Pterosaurs* exhibition, send them on their first dig to the Romualdo Formation in the Araripe (Santana) Basin in northeastern Brazil.

In the Romualdo (like all of the Araripe Basin), says Kellner, “You always find fossils! It’s amazing.”

Many are beautifully preserved, immediately recognizable as the animals they once were. The fossils are also of particular geological interest because they date from a time—110 million years ago—when the continents weren’t in the same positions as they are today. South America was only starting to split off from Africa, and a north-south seaway may have run down through today’s Brazil, including through the Romualdo. So the fossils form a snapshot of a vanished assemblage of animals in an ever-changing world.

A diorama in the *Pterosaurs* exhibition will bring to life the Romualdo Formation from that time—a time when pterosaurs also ruled the skies. Large, crested pterosaurs, *Thalassodromeus sethi*, swoop over a lagoon, hunting schools of the unsuspecting fishes in the water below. Underwater, schools of *Rhacolepsis* fish are being chased by a predatory 3-foot-long *Cladocycclus*. In the background, spinosaurid dinosaurs walk amid trees called *Brachyphyllum*, which paleontologists know were part of the ecosystem at the time.

This early Cretaceous scene is “definitely a plausible scenario,” says John Maisey, curator in the Division of Paleontology, who studied the fossil fishes of the Araripe for decades.

“These fossils are world-famous,” he says, because they are often so well-preserved, sometimes including soft tissue, muscles, and blood vessels. Why? For one thing, says Maisey, the animals may have fossilized very quickly. Instead of being scavenged, perhaps they sank quickly to the bottom of the water, getting stuck in what Maisey calls, evocatively, a low-oxygen “algal goo.” There, bacteria may have eaten through the tissue, afterward excreting phosphates that, in effect, created a 3D model of what was there before—hence the beautiful preservation. “It’s like a 3D printer, using bacteria,” says Maisey.



See more fish fossils from the Santana Formation (also known as the Araripe Basin) on display in the Museum’s Hall of Vertebrate Origins.



These *Rhacolepsis* fishes date from about 110 million years ago.

Illustration © Ivy Rutzky; top fossil image © AMNH/J.M. Shanley; bottom fossil image © AMNH/D. Finnin

# SUIT UP—GOING DOWN!

Missed the Exosuit during a rare public display at the Museum last month? This newest generation atmospheric diving system (ADS) offers a way for scientists to observe and interact with fishes and invertebrates in their habitats in the ocean's depths.

By keeping the pilot protected from the effects of pressure, the Exosuit allows divers to perform delicate work at depths of up to 1,000 feet (305 meters) for hours. Researchers from the Museum, City University of New York, and the John B. Pierce Laboratory-Yale University are partnering with J.F. White Contracting Company to develop scientific applications for the Exosuit, which will be paired together with a remotely operated vehicle (ROV) that the team has designed to allow researchers to observe, photograph, and collect marine life in areas that are otherwise difficult to explore.

The Exosuit's first scientific test will come this July on the Stephen J. Barlow Bluewater Expedition to study deep-water habitats off New England.

**OXYGEN SYSTEMS** allow for multi-hour dives, with up to 50 hours of life support

Powerful **LED LIGHTS**

**FIBER-OPTIC TETHER** provides two-way communication, sends a live video feed to the surface and allows for topside monitoring of pressure and oxygen

**TEARDROP-SHAPED VIEW PORT** allows the pilot to see clearly down to chest level

Four 1.6 horsepower water-jet **THRUSTERS** provide propulsion

**MANIPULATORS** act as gripping devices. Custom tools in development will enable the pilot to collect and photograph marine life

The aluminum alloy **SUIT** weighs 530 pounds (240 kg)

Pressure-sensitive **FOOT PADS** enable the pilot to control the thrusters and move forward, backward, left, right, up and down

The Exosuit opens at the **TORSO**, allowing the pilot to enter and exit

18 patented **ROTARY JOINTS** provide flexibility so the pilot can examine and collect specimens

Nuytco Research Ltd.

# flying colors

**PTEROSAURS' DRAMATIC CRESTS STILL PUZZLE PALEONTOLOGISTS.**

**NYCTOSAURUS GRACILIS**

**84 mya**

Late Cretaceous

**2-3 m**

wingspan

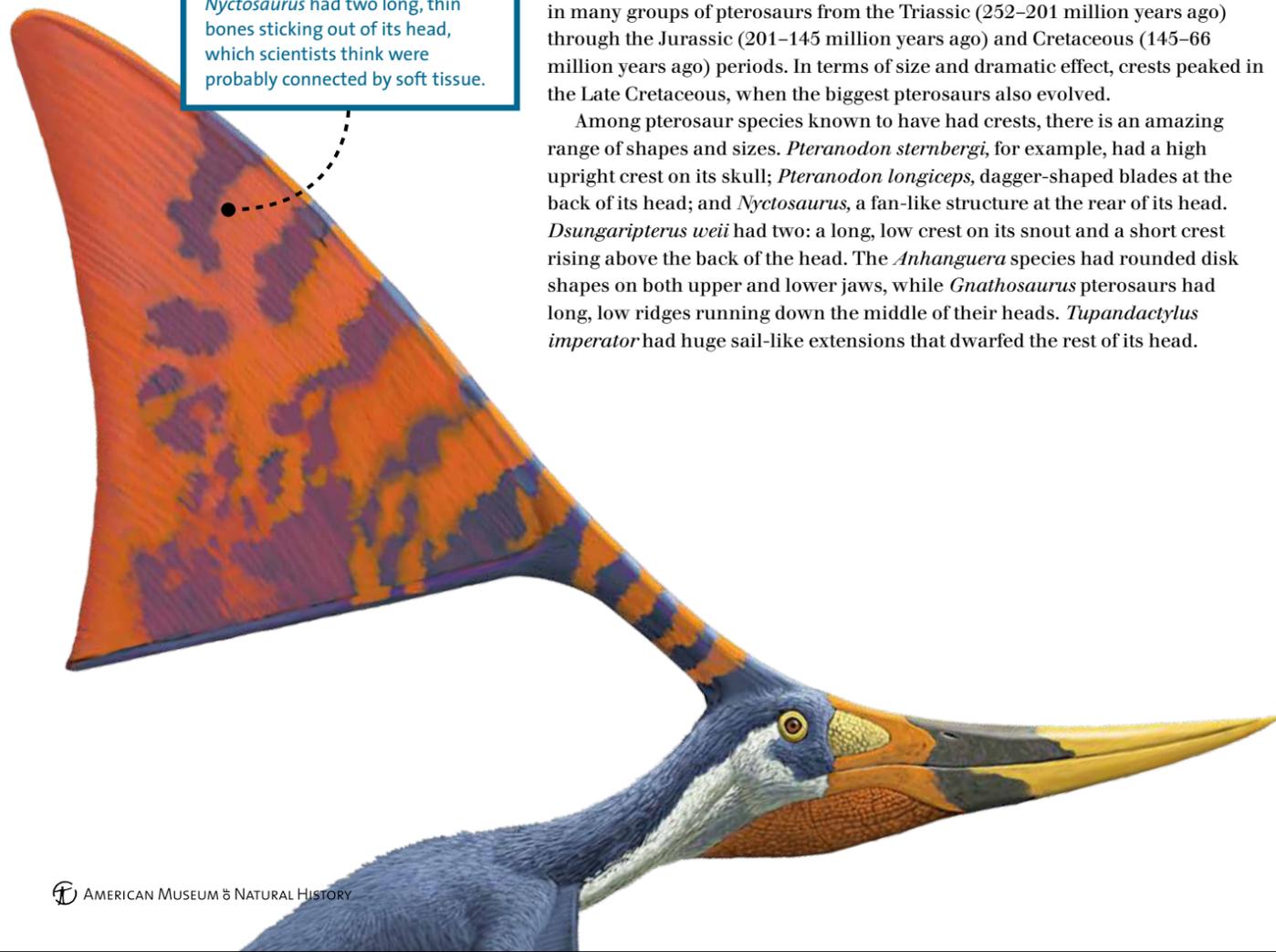
*Nyctosaurus* had two long, thin bones sticking out of its head, which scientists think were probably connected by soft tissue.

The incredible diversity of pterosaurs is perhaps best expressed in one of the prehistoric flying reptile's most intriguing and mysterious features: the head crest.

Akin to a rooster's comb, peacock's crown, or the frill on some lizards' necks, pterosaur crests were prominent anatomical features found across many species. But rather than flesh or feathers, these reptiles' crests were made at least in part of bone—a boon to paleontologists, as hard bone tends to be preserved as a fossil. Recent research also indicates that other horn-like material comprised part or even most of some pterosaur crests, with the thin, underlying bony structure supporting sometimes expansive membranes.

Pterosaurs crests are thought to have been fairly ubiquitous, appearing in many groups of pterosaurs from the Triassic (252–201 million years ago) through the Jurassic (201–145 million years ago) and Cretaceous (145–66 million years ago) periods. In terms of size and dramatic effect, crests peaked in the Late Cretaceous, when the biggest pterosaurs also evolved.

Among pterosaur species known to have had crests, there is an amazing range of shapes and sizes. *Pteranodon sternbergi*, for example, had a high upright crest on its skull; *Pteranodon longiceps*, dagger-shaped blades at the back of its head; and *Nyctosaurus*, a fan-like structure at the rear of its head. *Dsungaripterus weii* had two: a long, low crest on its snout and a short crest rising above the back of the head. The *Anhanguera* species had rounded disk shapes on both upper and lower jaws, while *Gnathosaurus* pterosaurs had long, low ridges running down the middle of their heads. *Tupandactylus imperator* had huge sail-like extensions that dwarfed the rest of its head.



Illustrations © AMNH 2014



**TUPANDACTYLUS IMPERATOR**

**115 mya**

Early Cretaceous

**3 m**

wingspan

No other pterosaur had a bigger crest relative to its body size than *Tupandactylus*.

Could something so flashy be all form and no function? The heavier crests cost the reptiles a lot in energy to grow and carry around. Reason suggests if they weren't useful, they would have disappeared over millions of years of evolution. But just what that use was is a question that puzzles pterosaurologists to this day.

There are competing theories, chief among them that crests serve as a form of species identification. Other possibilities include a role in sexual selection, heat regulation, as a rudder in flight, or as a keel in the water, stabilizing the reptile as it dove or skimmed for food. The discovery in Brazil of wildly different crests among closely related species lends credibility to the theory of species identification: like a Mesozoic mohawk, a distinct crest would allow ready recognition of one's own kind and, equally important, rule out others.

Were the crests as brightly colored as shown in artists' renderings? While scientists cannot know for certain, light and dark bands of color on the rare preserved tissue of a *Pterorhynchus wellnhoferi* crest found in China led to speculation that crests might indeed have been highly colored, especially if they served to communicate identity or attract mates.

Still, without living descendants for comparison and the relative paucity of fossils, definitive proof has been elusive—so far. 🦖

*Pterosaurs: Flight in the Age of Dinosaurs* is free for Members.

## Programs and Events

For more programs and to purchase tickets, visit [amnh.org/calendar](http://amnh.org/calendar).

For updates and reminders, sign up for monthly Calendar Highlights for Members by sending your membership number and request to subscribe to [members@amnh.org](mailto:members@amnh.org). The Museum does not trade, rent, or sell this information.

## Tickets

Tickets are available by phone at 212-769-5200, Monday–Friday, 9 am–5 pm, or by visiting [amnh.org](http://amnh.org). Please have your membership number ready.

Availability may be limited. Please purchase tickets in advance.

Please be aware that ticket sales are final for all Member programs. All programs go ahead rain or shine. There are no refunds unless the program is cancelled by the Museum.

## APRIL

**Baby Animal Encounter**  
Saturday, April 5  
11 am; 1 pm; 2:30 pm  
\$10

Meet some of nature's wildest and cutest youngsters with zoologist **Jarod Miller**.

**Discovery Room: Meet the Scientist**  
Saturday, April 5  
2:15 pm; 3 pm; 3:45 pm  
Free (Tickets available on a first-come, first-served basis)

Visitors ages 7 and up can learn more about the work of Museum scientists in these informal, child-friendly presentations.

**A Night at the Museum Sleepover**  
Friday, April 11  
Friday, May 2  
Saturday, May 17  
Friday, June 13  
Saturday, June 21  
\$135 per person

Break out your sleeping bags on this after-hours adventure for children ages 6 through 15 and their caregivers.

**Frontiers Lecture: Unraveling the Mystery of the Continental Crust**  
Monday, April 7  
7:30 pm  
\$12

**Oliver Jagoutz** and **Max Schmidt** have discovered a long sought-after missing piece explaining the formation of Earth's continental crust. Their explorations in the 100-150-million-year-old Kohistan Arc, which is the best-exposed arc section in the world, led to their discovery of a hidden flux in Earth's mantle. The talk will explore the implications of this discovery for understanding Earth's evolution.

**Behind-the-Scenes Tour in Paleontology**  
Saturday, April 12  
10:30 am, 11 am, or 11:30 am  
\$35

Tour the collections of the Division of Paleontology to see pterosaur fossils and the "Big Bone" collection. Must be 10 or older to participate.

**Milstein Science Series: Poseidon's Poisons and Marine Medicines**  
Sunday, April 13  
11 am–4 pm  
Free

Join Curator **Mark Siddall** for a dynamic program that expands on the Museum's exhibition *The Power of Poison* and offers family-friendly activities, including a live animal encounter with zoologist **Jarod Miller**.

**Taste the Museum: Beers from Around the World**  
Wednesday, April 16  
6:30 pm or 7:30 pm  
\$40 for 21+

This walking tour and tasting highlights the history and manufacturing processes of beers around the world.

**Our Genes, Ourselves: What Can Our DNA Tell Us?**  
Wednesday, April 23  
7 pm  
\$12

A panel with neuroscientist **Robert Darnell** and other experts focuses on the potential of genome-mapping.

## Exhibitions

*Admission is by timed entry only.*

**Pterosaurs: Flight in the Age of Dinosaurs**  
Opens Saturday, April 5  
Free for Members

The fossils of ancient winged reptiles known as pterosaurs puzzled paleontologists for hundreds of years. Find out about how incredible new discoveries are revealing more about this extraordinary group of animals.

**The Power of Poison**  
Free for Members

Explore poison's paradoxical roles in nature, myth, and human health and history while helping solve poisoning mysteries. Live presenters in the Detecting Poisons theater share real-world cases and highlight dramatic advances in toxicology and forensic science.

**Natural Histories**  
Free for Members

View reproductions of beautifully illustrated scientific works from the Museum Library's Rare Book collection in a new exhibition inspired by the 2012 book *Natural Histories*. Highlights include large-scale reproductions of works by Albrecht Dürer, Joseph Wolf, and John Woodhouse Audubon.

Please check [amnh.org](http://amnh.org) for Member ticket prices for live-animal exhibits, 3D or IMAX films, and Space Show.

**Walking Tour: Fossils of Fifth Avenue**  
Thursday, April 24  
6–8 pm  
\$25

Join **Sidney Horenstein** along Fifth Avenue to investigate its ancient fossils and geological formations.

**Slide Slam**  
Monday, April 28  
6:30 pm  
Free

Celebrate the launch of a new database of digital images from the Library with Director **Tom Baione** and New York-based artists **Alexis Rockman** and **Mark Dion**.

**Sackler Brain Bench: Adult Learning Salons**  
Four Mondays, starting April 28  
6–8 pm  
\$35 per session (\$105 for the series)

Learn how the brain influences our personalities, emotions, and behavior. Sessions include **Brain Power: The Other 90 Percent** (April 28); **Beyond Left Brain, Right Brain** (May 5); **Coming to Terms with Fear** (May 12); and **Sex Differences in the Brain** (May 19).

**Astronomy Live: Celestial Fireworks in Spring Skies**  
Tuesday, April 29  
6:30 pm  
\$12

Take a tour of constellations and exoplanet locales in the Hayden Planetarium with **Joe Rao** and **Steve Beyer**.

**Environmental Lecture and Luncheon**  
Wednesday, April 30  
Celebrate the 20th anniversary of the Center for Biodiversity and Conservation. Call 212-769-5166 for details.

## MAY

**Our Earth's Future: A New Course for Adults**  
Five Thursdays, May 1–May 29  
6–8:30 pm  
\$25 for the series

Become fluent in the science of climate change in this unique course led by Museum scientists and other experts. Organized around case studies, the course offers a unique opportunity to gain solid understanding of key scientific principles and to learn how to communicate about global climate phenomena.

**Milstein Science Series Presentation: Capturing the Ocean's Glow**  
Thursday, May 1–Saturday, May 31  
Free

See spectacular footage of bioluminescent and biofluorescent ocean species in a dome presentation in the Milstein Hall of Ocean Life.

**The Adventurers' Virgin Voyage**  
Sunday, May 4  
3 pm  
Free

Library Director **Tom Baione** discusses explorer Roy Chapman Andrews's time aboard *The Adventurers* in 1915.

**SciCafe: Collective Behavior in Ant Colonies and Beyond**  
Wednesday, May 7  
7 pm  
Free for 21+

Stanford University biologist **Deborah Gordon** discusses research about collective behavior in ant colonies.

**Identification Day**  
Saturday, May 10  
Noon–4 pm  
Free

Bring your shells, rocks, insects, feathers, bones, or artifacts, and a Museum expert will help identify your find. For the first time, visitors will also have a chance to have their objects scanned and printed on a 3D printer.

**Frontiers Lecture: The Cosmic Cocktail**  
Monday, May 12  
7:30 pm  
\$12

Astrophysicist **Katherine Freese** ponders dark matter and the universe's composition.

**Spring Birding Excursion**  
Saturday, May 17  
8 am–5 pm  
\$90

Ornithologist **Paul Sweet** leads bird watching at Minnewaska State Park Preserve followed by a visit to a local vineyard for a tasting. Cost includes transportation by private coach.

*Credits*  
Pterosaurs: Flight in the Age of Dinosaurs was organized by the American Museum of Natural History, New York ([amnh.org](http://amnh.org)).

*The Museum gratefully acknowledges the Richard and Karen LeFrak Exhibition and Education Fund.*

*Major funding for The Power of Poison has been provided by the Lila Wallace—Reader's Digest Endowment Fund.*

*The presentation of Natural Histories at the American Museum of Natural History is made possible through the generosity of the Arthur Ross Foundation.*

*Credits continue on page 18*

**Astronomy Live: The Sci-Fi Universe**  
**Tuesday, May 27**  
**6:30 pm**  
**\$12**  
 Explore the universe through a science-fiction lens with educators **Brian Levine** and **Christina Pease**.

**Frontiers Lecture: The Universe and Beyond**  
**Monday, June 9**  
**7:30 pm**  
**\$12**  
**Alexander Vilenkin** discusses developments suggesting that the Big Bang was not a unique event in cosmic history.

**Summer Star Sail**  
**Tuesday, June 17**  
**8–10 pm**  
**\$95**  
 Join astrophysicist **Charles Liu** to watch the Sun set on one of the longest days of the year while learning about the summer solstice.

**Credits:**  
*The SciCafe series is proudly sponsored by Judy and Josh Weston.*

*Support for Hayden Planetarium Programs is provided by the Schaffner Family.*

*The Milstein Science Series is proudly sponsored by the Irma and Paul Milstein Family.*

**Nature Walk in Central Park**  
**Saturday, May 31**  
**10 am–noon**  
**\$25**  
 Urban naturalist **Julie Feinstein** takes you on an exploration of wildlife in Central Park.

**Our Earth's Future: A New Course for Adults**  
**Five Tuesdays, June 10–July 8**  
**6–8:30 pm**  
**\$25 for the series**  
 Become fluent in the science of climate change in this course led by Museum scientists and other experts. Organized around case studies, the course offers a unique opportunity to gain solid understanding of key scientific principles and to learn how to communicate about global climate phenomena.

**Milstein Science Series: Sharks**  
**Sunday, June 22**  
**11 am–4 pm**  
**Free**  
 Learn more about these fascinating fishes in a family-friendly afternoon in the Milstein Hall of Ocean Life.

*The Museum greatly acknowledges The Mortimer D. Sackler Foundation, Inc. for its support to establish The Sackler Brain Bench, part of the Museum's Sackler Educational Laboratory for Comparative Genomics and Human Origins, in The Spitzer Hall of Human Origins.*

**JUNE**

**Behind-the-Scenes Tour: Ichthyology**  
**Tuesday, June 3**  
**6:30 pm** (family-friendly),  
**7 pm, or 7:30 pm**  
**\$35**  
 From modern fishes to fossil sharks, the Department of Ichthyology's collection includes more than 2 million specimens. Scientific staff will offer a rare look at the collection and discuss techniques for preserving and studying specimens on this tour for ages 10 and up.

**Family Astronomy in the Dome**  
**Saturday, June 14**  
**6:30 pm**  
**\$10**  
 Enjoy an evening of star-hopping, mythology, and stories of the sky.

**Hall Tour: Underground Secrets**  
**Sunday, June 22**  
**3 pm**  
**Free**  
 Tour Museum halls to see what's hidden underneath Los Angeles, the Great Plains, and Yellowstone.

*Our Earth's Future was made possible in part by the Institute for Museum and Library Services under grant number MA-10-13-0200-13.*

**Summer Skies Telescope Party**  
**Tuesday, June 24**  
**8:30 pm**  
**\$12**  
 Scan the skies with Hayden Planetarium experts. Please note start time.

*Credits continued from page 17*

*Lord & Taylor is the proud sponsor of The Butterfly Conservatory.*

*Generous support for The Butterfly Conservatory has been provided by the Eileen P. Bernard Exhibition Fund.*

*Dark Universe was created by the American Museum of Natural History, the Frederick Phineas and Sandra Priest Rose Center for Earth and Space, and the Hayden Planetarium.*

*Made possible through the generous sponsorship of **Accenture**.*

*And proudly supported by **Con Edison**.*

*The Museum also gratefully acknowledges major funding from the Charles Hayden Foundation.*

*Presented with special thanks to NASA and the National Science Foundation.*

*Dark Universe was developed by the American Museum of Natural History, New York ([www.amnh.org](http://www.amnh.org)), in collaboration with the California Academy of Sciences, San Francisco, and GOTO INC, Tokyo, Japan.*

**APRIL**

**1 Tuesday**  
 Early Morning Bird Walks begin

Lunchtime Spring Bird Walks Begin

**2 Wednesday**  
 SciCafe: The Evolution of Irrationality

Early Morning Bird Walks begin

**3 Thursday**  
 Early Morning Bird Walks begin

**4 Friday**  
 Early Morning Bird Walks begin

**5 Saturday**  
*Pterosaurs: Flight in the Age of Dinosaurs* opens

Baby Animal Encounter

Discovery Room: Meet the Scientist

**7 Monday**  
 Frontiers Lecture: Unraveling the Mystery of the Continental Crust

**11 Friday**  
 A Night at the Museum Sleepover (Girl Scouts)

**12 Saturday**  
 Behind-the-Scenes Tour in Paleontology

**13 Sunday**  
 Milstein Science Series: Poseidon's Poisons and Marine Medicines

**16 Wednesday**  
 Taste the Museum: Beers from Around the World

**23 Wednesday**  
 Our Genes, Ourselves: What Can Our DNA Tell Us?

**24 Thursday**  
 Walking Tour: Fossils of Fifth Avenue

**28 Monday**  
 Sackler Brain Bench: Adult Learning Salons begin

Slide Slam

**29 Tuesday**  
 Lunchtime Spring Bird Walks begin

Astronomy Live: Celestial Fireworks in Spring Skies

**30 Wednesday**  
 Environmental Lecture and Luncheon Celebrating the 20th Anniversary of the CBC

**MAY**

**1 Thursday**  
 Milstein Science Series Presentation *Capturing the Ocean's Glow* begins

Our Earth's Future adult course May session begins

**2 Friday**  
 Night at the Museum Sleepover

**4 Sunday**  
 Lecture: *The Adventurers' Virgin Voyage*

**7 Wednesday**  
 SciCafe: Collective Behavior in Ant Colonies and Beyond

**10 Saturday**  
 Identification Day

**12 Monday**  
 Frontiers Lecture: The Cosmic Cocktail

**17 Saturday**  
 Spring Birding Excursion

Night at the Museum Sleepover

**27 Tuesday**  
 Astronomy Live: The Sci-Fi Universe

**31 Saturday**  
 Nature Walk in Central Park

Milstein Science Series Presentation *Capturing the Ocean's Glow* ends

**JUNE**

**3 Tuesday**  
 Behind-the-Scenes Tour in Ichthyology

**9 Monday**  
 Frontiers Lecture: The Universe and Beyond

**10 Tuesday**  
 Our Earth's Future adult course June session begins

**13 Friday**  
 Night at the Museum Sleepover

**14 Saturday**  
 Family Astronomy in the Dome

**17 Tuesday**  
 Summer Star Sail

**21 Saturday**  
 Night at the Museum Sleepover

**22 Sunday**  
 Milstein Science Series: Sharks

Hall Tour: Underground Secrets

*The Butterfly Conservatory* closes

**24 Tuesday**  
 Summer Skies Telescope Party

## Urban Advantage: 10 Years of Connecting Students to Science

As the Urban Advantage Middle School Science Initiative celebrates a 10-year milestone this year, stories abound about how the program has helped New York City public middle-school students delve more deeply into science.

There was the Bronx boy who was galvanized to get up at dawn to track the salinity of the Hudson River. The autistic Manhattan 8th-grader who went on to receive one of the highest scores on his New York State Intermediate-Level Science Test. The shy Brooklyn girl who surprised everyone with her poise while presenting her project at the annual Urban Advantage Science Expo, held at the Museum at the end of every school year since the program was launched. Through Urban Advantage, these students—and thousands of others, as well as their families and teachers—have tapped into extraordinary resources at the Museum and at the city's zoos, gardens, and science centers.

"Science is more than reading a book," says Kevyn Jackman, a science teacher at the Academy for Personal Leadership and Experience in the Bronx and an Urban Advantage teacher for seven years who names the Museum as his go-to destination for several science topics. "If we're studying astronomy, we go to the Hayden Planetarium. Evolution? The (Spitzer) Hall of Human Origins. Fossils, the fourth-floor dinosaur halls."

With annual funding from the Council of the City of New York and the New York City Department of Education, Urban Advantage is a partnership between the New York City Department of Education and the American Museum of Natural History, Brooklyn Botanic Garden, New York Hall of Science, Queens Botanical Garden, Staten Island Zoo, The New York Botanical Garden, Bronx Zoo, and New York Aquarium that supports science education in middle schools by providing materials for scientific investigations in the classroom, field trips to science-rich institutions, teacher access to such partner resources as collections and scientists, and professional development for educators across the five boroughs aimed at bringing the best of science teaching to the classroom.

In addition to offering teachers up to 40 hours of workshops on a range of topics, the Urban Advantage program has created a strong network of middle-school science teachers that educators value for its collegiality, collaboration, and the opportunity to share curricular resources.

"As a former teacher and principal, I know how critical professional development is to empower, cultivate, and retain great teachers," says New York City Schools Chancellor Carmen Fariña. "That's why it's great to see Urban Advantage, a truly wonderful program, using the cultural institutions of our City to help teachers innovate new strategies to inspire their students. This program provides tremendous service to school communities, and as science education becomes even more critical for our students over the next decade, I look forward to its continued success?"

Teachers also stress that bringing their classes on visits to partner institutions, such as the Museum, helps energize students and expose them to new disciplines. Julie Wood, a science teacher at The Young Women's Leadership School of Brooklyn, recalls visits to the Museum in which her students were excited to meet with educator Jay Holmes to learn about Earth science. On a different visit, her 8th graders learned about and performed a molecular biology technique used to isolate DNA—gel electrophoresis—at the Sackler Institute for Comparative Genomics, a methodology Wood says students ordinarily find out about only in high school.

In addition to visiting with teachers, Urban Advantage students also receive vouchers so that they can bring their families to New York's museums and science centers outside of school hours for a fun day that also makes parents active participants in their child's science education.

"We find a way to involve every member of the family," says Joanna Cuevas, parent coordinator at the Urban Assembly Academy for Civic Engagement in the Bronx, who arranges family field trips to the Urban Advantage institutions. "The parents get to see their kids working so hard, to see the passion they have for what they are working on. It's amazing how proud and supportive they are of their kids?"

Their pride isn't misplaced. Independent studies conducted by New York University's Institute for Education and Social Policy showed that, on average, students attending Urban Advantage-participating schools outperform peers on the eighth-grade exam—yet another measure of the program's success.

The Urban Advantage Science Expo will be held at the Museum on Saturday, June 7.

### BY THE NUMBERS

# 52,616

Students served across 6th-, 7th-, and 8th grades in 2013–2014

# 525

NYC teachers active in Urban Advantage in 2013–2014

# 173

Schools participating across all five boroughs, or approximately 30 percent of NYC middle schools in the 2013–2014 academic year

# 10

Years since Urban Advantage launched with the support of the Council of the City of New York and the New York City Department of Education

# 8

**Partner institutions:** American Museum of Natural History, Brooklyn Botanic Garden, New York Hall of Science, Queens Botanical Garden, Staten Island Zoo, The New York Botanical Garden, Bronx Zoo, and New York Aquarium



Clockwise from top left: Students from IS 75 in Woodrow, Staten Island, examine a hedgehog from the Staten Island Zoo during a 2004 event launching the Urban Advantage program at the Museum, while teacher Nicole Shiu Horowitz and her student Davon Carter from MS 184 in the Bronx tuned in next door. The annual Urban Advantage Science Expo takes place at the Museum in June, with hundreds of students presenting their projects.

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1. Preparator Celeste Carballo works on the foot of *Tropeognathus mesembrinus* for a model in *Pterosaurs: Flight in the Age of Dinosaurs*.

2. Hannah Rawe works on a life-size model of *Quetzalcoatlus*, the head of which measures about 8 feet.  
3. Beck Meah builds the wings of *Tropeognathus*, one of the largest pterosaurs, with a wingspan of more than 25 feet.

4. Preparator Andrea Raphael paints a cast of a *Pterodactylus* fossil.  
5. Tory Ferraro works on the *Quetzalcoatlus* model, which will float over visitors in the exhibition section devoted to pterosaur flight.

© AMNH/R. Mickens



1. As part of the January behind-the-scenes tour for Members in the Department of Herpetology, participants were able to examine several remarkable specimens.  
2. Curator Mark Norell and Research Associate Amy Balanoff led the January SciCafe about dinosaur brains.

3. SciCafe takes place every first Wednesday of the month.  
4. Curatorial Associate David Kizirian showed off specimens from the Department of Herpetology Collection on the January behind-the-scenes tour.

© AMNH/D. Finnin and R. Mickens

## Save the Date! Upcoming Events at the Museum

**MAY**  
5/6 Members at the Adventurer level and above are invited to the annual Open House, with opportunities to meet scientists, enjoy educational activities, and watch the 3D movie *Mysteries of the Unseen World* after hours. Please call 212-769-5606 for more information.



5/10 Bring your shells, rocks, insects, feathers, bones, and artifacts to the annual Identification Day. Museum scientists will attempt to identify your discoveries while showing you some specimens from the Museum's collections.



5/15 Dance the night away at the annual Museum Dance, the social event of the spring season. Please call 212-769-5166 for more information.

**JUNE**  
6/7 The annual Urban Advantage Science Expo is held in the Milstein Hall of Ocean Life.

6/14 Members at the Adventurer level and above are invited to begin their day at the Museum with a light breakfast and before-hours showing of the Space Show *Dark Universe*. Please call 212-769-5606 for more information.

6/26 Join the Junior Council for an evening of music and cocktails at the annual Jazz on the Terrace. Please call 212-769-5986 for more information.



**JULY**  
Explore the amazing world of arachnids when the exhibition *Spiders: Alive!* returns this summer.

Central Park West at 79th Street  
New York, New York 10024-5192  
[amnh.org](http://amnh.org)



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Millions of years ago, the skies were ruled by pterosaurs, the first animals with backbones to fly under their own power. Now these ancient flying reptiles have arrived at the Museum in the new exhibition *Pterosaurs: Flight in the Age of Dinosaurs*. Featuring life-size models, casts, and rarely displayed fossils, the exhibition reveals the latest findings about how these extraordinary vertebrates moved on land and in the air, how they hunted, and what they ate, as well as what scientists are discovering about them today.

## General Information

### HOURS

Museum: Open daily, 10 am–5:45 pm;  
closed on Thanksgiving and Christmas.

### ENTRANCES

During Museum hours, Members may enter at Central Park West at 79th Street (second floor), the Rose Center/81st Street, and through the subway (lower level).

### RESTAURANTS

Museum Food Court, Café on One, Starlight Café, and Café on 4 offer Members a 15 percent discount. Hours are subject to change.

### MUSEUM SHOPS

The Museum Shop, Dino Store, Shop for Earth and Space, Cosmic Shop, Pterosaurs Shop, The Power of Poison Shop, and Online Shop ([amnhshop.com](http://amnhshop.com)) offer Members a 10 percent discount.

### PHONE NUMBERS

Central Reservations 212-769-5200  
Membership Office 212-769-5606  
Museum Information 212-769-5100  
Development 212-769-5151

### TRANSPORTATION AND PARKING

Subway: **B** (weekdays) or **C** to 81st Street; **1** to 79th Street, walk east to Museum  
Bus: M7, M10, M11, or M104 to 79th Street; M79 to Central Park West  
Parking Garage: Open daily, 8 am–11 pm; enter from West 81st Street. Members can park for a flat fee of \$10 if entering after 4 pm. To receive this rate, show your membership card or event ticket when exiting the garage.