

 AMERICAN MUSEUM OF NATURAL HISTORY

ROTUNDA

Member Magazine
Spring 2018 Vol. 43 No. 2



Explore
Unseen
Oceans



SCOUTING MINERAL SPECIMENS

From the President

Ellen V. Futter



More than 70 percent of the Earth's surface is covered by oceans. Yet for so long, much of the oceans have been too dark, too forbidding, too remote for scientific exploration. Home to myriad unknown species, complex ecosystems, and hidden clues to the story of life on Earth, the oceans are considered Earth's greatest uncharted frontier by scientists.

Today, astonishing advances in technology and engineering such as submersibles, robotics, satellite monitoring, miniaturization, and high-definition imaging are enabling a new generation of scientists, including those at our Museum, to explore the oceans as never before. These powerful tools, combined with creative, cross-disciplinary approaches and a spirit of ingenuity and adventure, are enabling scientists in the field to explore the oceans from surface

to floor and to reveal the wondrous diversity of invertebrates, mammals, fishes, microbes, and much more that call them home.

The Museum's spring exhibition *Unseen Oceans* tells the stories of these pioneering ocean scientists, the amazing technologies and tools they are developing and using, and the important discoveries they are making, all at a time when their work is more important than ever. In fact, scientists are racing to explore and understand these mysterious ecosystems while the escalating effects of climate change and environmental destruction threaten ocean habitats that are essential to all life on Earth.

What secrets do the oceans hold about the advent of life on Earth? What can they tell us about our future? Come to *Unseen Oceans* and see for yourself!

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ROTUNDA

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Magazine
Editorial Director Eugenia Levenson
Editor Alanna Ruse
Contributors Joan Kelly Bernard, Jill Hamilton, Eliza McCarthy, Karen Miller, Elena Sansalone
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Leeches' Blood Meals Can Be Used to Track Regional Biodiversity



Researchers have identified DNA in *Haemadipsa* leeches from a variety of mammals, such as muntjacs, macaque monkeys, and rodents, among others.

When it comes to tracking mammals in a particular area, including for conservation work, it turns out that humans have a tiny, blood-sipping spy on their side. New research led by Museum scientists confirms that examining DNA found in leeches' blood meals can be used as a powerful tool to provide information about a forest's inhabitants.

The study, which was published in February in the journal *Systematics and Biodiversity*, analyzed close to 750 terrestrial leeches in the genus *Haemadipsa* collected from forests in Bangladesh, China, as well as in Cambodia during the 2015 Constantine S. Niarchos expedition, supported by the Stavros Niarchos Foundation.

In their samples, researchers identified DNA from a wide variety of mammals, including muntjacs, macaque monkeys, wildcats, porcupines, rats, and gaur, or Indian bison. They also found DNA from three types of ground-dwelling birds and one species of bat, marking the first time this method has been used to successfully identify these species.

"Our recent work has demonstrated that we can determine what mammals are in a protected area without hunting, without trapping, without the use of scat or hair samples, and especially without camera traps—all of which are problematic methods for one reason or another," said Mark Siddall, a curator in the Museum's Division of Invertebrate Zoology and an author on the study. "Instead, by sequencing the host DNA that remains inside of terrestrial jungle leeches for months after feeding, we can outperform all other methods of biodiversity monitoring in terms of accuracy, completeness, speed, and cost."

Siddall and lead author Michael Tessler, a postdoctoral fellow in the Museum's Sackler Institute for Comparative Genomics, compared sampling invertebrate-parasite-derived DNA, or iDNA, with camera trapping in another recently published study. They found that pairing camera trapping with the iDNA method allowed for quicker and more complete survey results.

"This work is turning out to be an extremely useful tool for conservation purposes," said Dr. Tessler. "A snapshot of the vertebrates in an area can be taken with just one day's worth of sampling. The current standard for surveys, camera traps, takes months or longer."

In their work, Siddall, Tessler, and colleagues also explored genetic diversity among *Haemadipsa* leeches, and suspect there are likely many new species to be described.

Leech: © AMNH/M. Siddall, Divers: © Neil van Niekerk

Members See *Unseen Oceans* Free

Haven't seen *Unseen Oceans* yet? Members receive free admission every day!

Encounter the giants of the sea in a 180-degree, immersive experience featuring life-sized animations of blue whales, giant squid, and manta rays. Marvel at the diversity of biofluorescent species in a large-scale floating display. And don't forget to pose for a picture in a submersible!

Lead funding for *Unseen Oceans* and its educational resources is provided by OceanX, an initiative of the Dalio Foundation.

The American Museum of Natural History gratefully acknowledges the Richard and Karen LeFrak Exhibition and Education Fund.

Unseen Oceans is generously supported by Chase Private Client.



Rotunda Returns This Fall

Rotunda is taking a short break this summer, returning in Fall 2018! In the meantime, visit amnh.org for updates about summer programs, and don't forget to follow the Museum on:

- Twitter @amnh
- Facebook @naturalhistory
- Instagram @amnh
- YouTube at youtube/amnh.org

*Lampropeltis polyzona***WHAT'S IN A NAME?**

An old folk tale inspired the once-popular belief that milksnakes would sneak into barns late at night to suck the milk from cows' udders. In reality, milksnakes were probably there to hunt mice. It would likely be impossible for them to milk a cow since they cannot make suction with their lips nor can they digest lactose.

MNEMONIC MIMICRY

You may have heard the rhyme, "Red touches yellow, kills a fellow. Red touches black, friend of Jack." The colorful patterns of some milksnakes are so close to those found in venomous coral snakes that this popular verse has long been used to help hikers tell the difference. But beware—the song isn't always correct. In the tropics, some coral snakes can be found with adjacent black and red bands.

MILKSNAKE NO MORE

Lampropeltis elapsoides (scarlet kingsnake) was once classified as a subspecies of milksnake but has recently been reclassified as a distinct species. These relatively small snakes, which grow at most to 2 feet long, are admired for their bright red, black, and yellow banding.

HIGH ALTITUDE COLORS

Not all milksnakes keep their bright hues for life. Those found in Costa Rica's high elevations are red, black, white, and yellow when young but turn black as adults. Their darker color is thought to allow better absorption of the Sun's warm rays.

Blending into the Background

So, you think that because you've seen one milksnake you've seen them all? Think again.

Recent research has identified up to seven distinct species within the genus *Lampropeltis*. Some milksnakes have tri-color patterns similar to those of venomous coral snakes. Researchers suspect it's a way to ward off predators by advertising toxic species' warning signals, a phenomenon known as Batesian mimicry.

But since milksnakes—which inhabit a large geographic region that includes northeast Canada, the United States, Central America, and even parts of Ecuador, Colombia, and Venezuela—have also been found in areas where coral snakes do not occur, researchers have a second hypothesis for their coloring: flicker-fusion.

Brightly banded in reds, blacks, and yellows, these snakes' distinctive patterns are hard to miss when the animal is motionless. But once it begins to swiftly slither, its bands blend together. The movement creates an optical illusion making the snake hard to spot against the background of its usual natural environment in tall grasses or the forest floor. And when it freezes, for just a moment, it seems to disappear almost completely.

"This theoretically confuses the predators as they lose sight of the position of the snake," says Frank Burbrink, associate curator in the Museum's Department of Herpetology. "This may play in tandem with the Batesian mimicry of the venomous snake when the jig is up."

It's an adaptation that might even be more efficient than mimicking a more dangerous animal. After all, predators can't eat you if they can't see you.

Tiny Dancers



Relying on sight, scent, and touch, honey bees navigate the world—and even dance to it.

Their antennae are highly sensitive to vibrations. They also have numerous receptors that respond to odors and other stimuli. Together, these keen senses may explain how worker bees are able to pick up and interpret the so-called "waggle dance," which they use to share the location of food with fellow worker bees of the colony.

While the process is not completely understood, it goes a little something like this: a successful forager uses an elaborate dance pattern to indicate both the direction of food in relation to the Sun and its distance from the hive. The dancer adjusts the direction over time to account for the movement of the Sun, as do the foragers in the field.

The worker bees don't actually see the waggle dance within the pitch-black hive, perhaps giving new meaning to the phrase "dancing in the dark." Instead, the bees sense air vibrations through their antennae, which are held close to the dancing, wagging bee. "What they sense is the motion that's created," says Jerome G. Rozen, Jr., curator in the Division of Invertebrate Zoology, who oversees one of the world's largest collections of bee eggs, larvae, and pupae at the Museum. "They feel it."

The dance is accompanied by an olfactory message, too: pollen brought back by the returning dancing bee or regurgitated nectar conveys the scent of the food at the forage site. Finally, the richness of the nectar source is indicated by the duration of the dance. The bees don't exactly measure the length of the dance, but the longer the bee dances, the more foragers are recruited—essentially matching the workforce to the harvest at hand.

Learn more about the senses of honey bees and other insects in the special exhibition *Our Senses: An Immersive Experience*, which is free for Members.

*Apis mellifera***A ROSE BY ANY OTHER COLOR**

While the human eye has photoreceptors to detect blue, green, and red, honey bees see in shades of ultraviolet, blue, and green. A red rose won't appear as such to a honey bee, but the insect's ability to see ultraviolet allows it to see patterns humans can't. These markings act like a bullseye, drawing bees toward life-sustaining nectar and pollen.

FAMILIAR FIGURE

Of the approximately 20,000 described bee species, perhaps the best known is the European honey bee (*Apis mellifera*), valued by amateur beekeepers and commercial honey producers alike. The honey bee is essential to agricultural pollination in the U.S., as is another nonnative species called *Megachile rotundata*, the alfalfa leafcutter bee.

BEE BREAKDOWN

Social bees, like honey bees and bumble bees, make up about 10 percent of species. Solitary bees comprise 80 percent. They only produce enough honey to feed their offspring but are prized as pollinators. The other 10 percent are cleptoparasitic bees that steal pollen and nectar from other species and lay eggs in solitary bee nests.

BEES AND THE CITY

Bee raising has been allowed in New York City since 2010, and honey bee hives have proliferated. Last summer, Madison Square Park installed five upright boxes to attract leafcutter and mason bees, solitary bees that build their nests in open crevices rather than social hives.

SUMMER SESSION

Every August, Curator Jerome Rozen offers an intensive nine-day course on bees at the Museum's Southwest Research Station in Portal, Arizona. The workshop is open to conservation biologists, graduate students, state and federal agency staff, and other professionals. Participants come from two dozen countries and as far away as Australia.



From **New Jersey** to **Uruguay**, specimens for the new Allison and Roberto Mignone Halls of Gems and Minerals are being sourced from near and far.

SPECIMEN

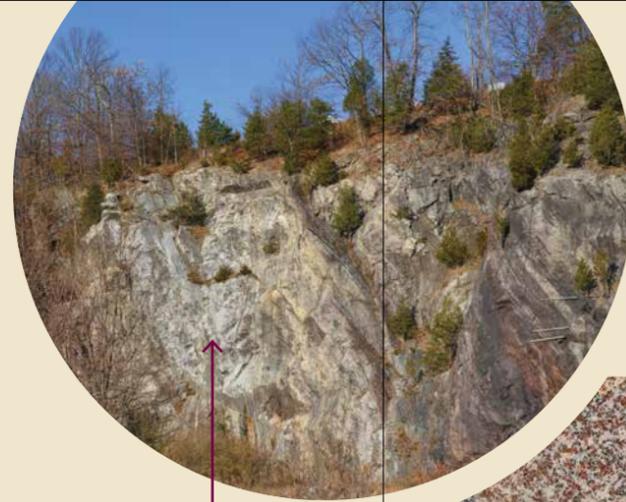
STORIES

After 40 years under gallery lights, thousands of gems and minerals from the Museum's collection are undergoing cleaning and processing after the closure of the historic halls last fall for a major renovation.

But that's just part of the behind-the-scenes work taking place in preparation for the new Allison and Roberto Mignone Halls of Gems and Minerals, which are set to open in 2019. The Museum is adding a set of spectacular large-scale specimens, as well as bringing back old favorites, to tell the story of why our planet is home to an astonishing diversity of minerals—some of which grew next door in New Jersey while others are coming from farther afield.

The Museum gratefully acknowledges Allison and Roberto Mignone for their leadership support of the redesigned Halls of Gems and Minerals.

Generous support has been provided by the Arthur Ross Foundation.



FLUORESCENT ZINC-ORE

NEW JERSEY
Franklin Marble

Paraná Basalts: Flickr/G. Rocha
© AMNH/R. Mickens/© AMNH/D. Finnin

URUGUAY
Paraná Basalts



AMETHYST GEODE

Sprung from the Seafloor

Miners began extracting zinc from the Franklin-Ogdensburg area of New Jersey in 1739, but it wasn't until the development of electric power 190 years later that the ore's brilliant "hidden" stripes of calcite and willemite, which fluoresce reddish-orange and greenish-yellow, were discovered. The surprising bursts of color will be highlighted in the Mignone Halls of Gems and Minerals, where the Museum plans to install a massive panel of ore from Sterling Hill Mine in Ogdensburg.

Ogdensburg's zinc deposits are a "virtually unique deposit on the planet," says George Harlow, curator in the Museum's Division of Physical Sciences, who is overseeing the new halls. They're part of a 1.3 billion-year-old geological feature called the Franklin Marble, which stretches just beyond the New Jersey border.

This ore first formed when metalliferous brines erupted on the bottom of what was then a shallow sea basin, crystallizing and accumulating as thick layers of calcite and metal-infused mud on the seafloor. A collision of two tectonic plates buried, heated, and metamorphosed the deposits, forming the vast array of minerals found today.

Born in Basalt

"I've never seen anything like it," says Dr. Harlow of the Museum's new 12-foot-tall, 9,000-pound amethyst geode, which went on temporary display in the Grand Gallery last fall. "It's the largest and most beautiful I have ever seen."

The gigantic specimen comes all the way from Uruguay's Bolsa Mine, which sits within the Paraná Basin, an area roughly 1.2 million square kilometers in size. The Paraná Basin is a large sedimentary depression in South America—among the world's largest—which was partially filled with basalt lava when the African and South American continents separated 135 millions years ago.

It's also known for some of the largest preserved gas bubbles in the world. The so-named amygdules were produced when molten magma rich in dissolved H₂O flowed between layers of magma, cooled, and released giant steam bubbles. Over a period of many millions of years, the quartz crystals transformed into deep purple amethyst. As water seeped through the "frozen" bubbles, it created minerals—specifically, crystallized chalcedony and quartz crystals. 📌



Charting the Great Unknown



There's a whole world beneath the oceans' surface. Scientists are exploring more of it than ever before.

Did you know the ocean off New York City hides a gorge that rivals the Grand Canyon? Or that a partially submerged volcano in Hawai'i is a mile higher than Mount Everest, the world's highest peak? Or how about the fact that two dozen Empire State Buildings, stacked one on top of the other, can fit inside the Pacific Ocean's Mariana Trench?

Space has been called the final frontier. And yet, here on Earth there is a vast unknown realm that's ripe for discovery: the bottom of the oceans. To this day, very little of the seafloor—only about 15 percent—has been mapped with reasonable accuracy by direct measurement.

"We have more detailed maps of the surface of Mars than we do the ocean floor," says John Sparks, curator in the Department of Ichthyology and curator of the special exhibition *Unseen Oceans*.

New technology and recent exploration, however, are helping today's researchers find answers to big questions, such as how life can flourish in the most extreme environments or what terrain under the water can help us learn about the rest of our planet—and even about distant worlds.

Shining a Light in the Dark



140 MILLION SQUARE MILES OF SEAFLOOR

FEET BETWEEN BEST MULTI-BEAM SCANS TO DATE **30**

Bathymetry, the measure of the depth and shapes of underwater terrain, has come a long way since the days of sailors dropping weighted ropes from the side of ships. Radar pulses from orbiting satellites, laser beams sent by piloted planes, unmanned drones, and sonar or sound waves emitted from ships and submersibles are allowing researchers to see the seafloor clearer than ever before. Still, despite the advances in technology, levels of resolution are, well, all over the map. For the moment, the most effective tool is sonar, since sound waves travel faster and farther under water than on land. Even so, the most efficient use of sonar—called multi-beaming or "mowing the lawn"—is very slow and painstaking.

The most ambitious international effort to date—to map all 140 million square miles of seafloor by 2030—was announced in 2017, but until now mapping has largely been the result of a patchwork of efforts: commercial searches for oil and other natural resources, scientific studies, and even search and recovery, such as the 2014 investigation of missing Malaysian Airlines Flight 370.

That said, there has been steady progress. For example, in August 2015, an international expedition to the Galápagos Islands refined the resolution of deep-sea depth readings by 100 times. By simultaneously using multi-beam sonar from a ship and side-scan sonar in an autonomous underwater vehicle (AUV), researchers were able to reduce the distance between scans from over 3,000 feet to 30 feet.

EPIPELAGIC ZONE
0 to 656 feet (0 to 200 meters): Sunlit coral reefs support an abundance of biodiversity.

MESOPELAGIC ZONE
656 to 3,300 feet (200 to 1,000 meters): Glowing lanternfishes and dragonfishes abound.

BATHYPELAGIC ZONE
3,300 to 13,000 feet (1,000 to 4,000 meters): Numerous species of bioluminescent anglerfishes are found here.

BENTHOPELAGIC ZONE
Below 13,000 feet (4,000 meters): Xenophyophores are among the deepest of deep-sea organisms known to science.

Dynamic Landscapes

2014

NEW ISLAND EMERGES



Below-surface versions of above-water geological formations—mountain ranges, valleys, volcanoes—are often much bigger and more impressive in scale. They also provide clues to geofeatures on Earth and possibly even other planets. For instance, the Mid-Atlantic Ridge, where the Eurasian and North Atlantic plates meet at the bottom of the Atlantic Ocean, is the largest mountain range on Earth. The underwater volcano Tamu Massif, located in the Pacific Ocean, has recently been identified as the planet's largest volcano. And with only a fraction of its towering peak seen above the water, Hawai'i's now-inactive submerged volcano Mauna Kea is 33,474 feet tall—nearly a mile higher than Mount Everest.

And the formation of new land is happening all the time, both above and below water. New islands created by volcanic eruption—for example Surtsey, which emerged off Iceland in 1963—offer researchers unique opportunities to learn not only more about the evolution of volcanoes but how pristine areas become populated. Consider the Hawaiian Islands, empty of terrestrial life as a newly formed volcanic chain millions of years ago with the nearest continent 2,500 miles away. Today, Hawai'i is one of the most biodiverse places on Earth, with many species that are endemic—that is, found nowhere else.

The 2014 emergence of a volcanic island in the South Pacific has even opened a window into the geological history of other planets. A comparison of features on this new island in the Kingdom of Tonga showed similar structures to those found on Mars, which appear to indicate that billions of years ago the Red Planet had water, as well as an abundance of volcanic activity.

MOUNT EVEREST
29,029 feet (8,848 meters)
tall: Mount Everest is Earth's highest mountain above ground.

MAUNA KEA
33,474 feet (10,203 meters)
tall: From its underwater base to its sunlit peak, the dormant Hawaiian Island volcano Mauna Kea is nearly a mile higher than Mount Everest.

HUDSON CANYON
About 4,000 feet (1,200 meters): The canyon is a biodiversity hotspot.

MARIANA TRENCH
Approx. 6.9 miles (11 kilometers): Depth of the Mariana Trench, the deepest known spot on Earth.

Diversity of the Deep



21 PERCENT ENDEMIC CORAL REEF FISHES IN HAWAII

MILES DEEPEST DEEP-SEA CRITTERS FOUND 6.6

Just as above-ground landscapes from the tropical rain forests to the alpine tundra support a variety of life forms, landforms beneath the sea provide an array of rich marine ecosystems. And scientists are only just beginning to uncover the diversity of life in the deep ocean.

"Once we started looking at the genetics of deep-sea fishes, we found that they're far more diverse than people once thought," says Dr. Sparks. "We also discovered that bioluminescence has evolved many more times than we ever imagined in marine fishes."

In July 2011, an expedition by the Scripps Institution of Oceanography in La Jolla, California, dropped untethered digital video cameras developed by the National Geographic Society into the Mariana Trench in the Pacific Ocean, the deepest-known spot on Earth. (If Mount Everest were located in the trench, there would still be around 6,864 feet of water between its peak and the surface!)

Near the bottom, at about 6.6 miles, the cameras captured images of 4-inch ameboid animals called xenophyophores—among the largest-known single-celled organisms—as well as deep-sea jellyfish. And during the 2015 Galápagos expedition that refined deep-sea depth reading, a new species of catshark was discovered. Meanwhile, the Hudson Canyon in the Atlantic Ocean, carved by the ancient Hudson River tens of thousands of years ago is a biodiversity hotspot that supports numerous fishes, including bottom-dwelling tilefish, deep-sea corals and sponges, and microbes that aggressively oxidize methane seeping up from the seafloor.

If some of these so-called extremophiles can survive in places previously thought uninhabitable, perhaps there are lifeforms waiting to be discovered somewhere even more remote and seemingly inhospitable, like in Europa's frozen oceans. 

Dig trenches and create islands on an interactive sand table in the special exhibition *Unseen Oceans*, which is free for Members.

31,500 ft
9,601 m

18,000 ft
5,486 m

0 ft
0 m

22,500 ft
6,858 m

31,500 ft
9,601 m

MARIANA TRENCH

MOUNT EVEREST

MAUNA KEA

DESCEND TO THE DEEP

SCIENTISTS CAN OBSERVE DEEP-SEA SPECIES ON DIVES IN A SUBMERSIBLE

When you study fishes, you want to be where they are. In the past five years, John Sparks, curator in the Museum's Department of Ichthyology, has descended on numerous submersible dives to study bioluminescence and biofluorescence in marine fishes and invertebrates. Sparks, who oversaw the special exhibition *Unseen Oceans*, recently shared what it takes to go deep.

DRESS TO DIVE • In the tropics, it's shorts and a T-shirt. "At the surface, it's hot because you're inside an acrylic ball in the Sun. It's like being under a magnifying glass," says Sparks.

POP, POP • Much like take-off and landing in an airplane, your ears pop when the hatch is sealed and the sub is pressurized.

MID-SEA CRITTERS • On the way down, sights include schools of anchovies, jellyfish, ctenophores, and squid, which "welcome" the sub by covering the windows with ink: "It's amazing how much ink they produce."

LIGHTS OUT • As the submersible descends, light appears as a small circle—an optical phenomenon known as "Snell's window." At 300 to 450 meters below the surface in clear ocean water, there is very little remaining light, if any, from the surface.

NIGHT VISION • "When you get down several hundred meters, the current diminishes, and it's frequently crystal clear," explains Sparks. "You can see a variety of bizarre deep-sea fishes close up and sit on the bottom with lights out and observe."

TIGHT FIT • Legroom in the rounded sub cabin is tighter than on your typical airline flight, so a 6- to 8-hour dive can feel cramped.

NO LEAKS • Feel a drop of water? Don't panic. That's just condensation from passengers' breath, which collects on the dome ceiling.

FANTASTIC VOYAGE

Experience a vertical adventure through marine environments at different depths in a special presentation in *Unseen Oceans*, featuring BBC footage captured during filming of the popular nature series BBC AMERICA's *Planet Earth: Blue Planet II* and the giant-screen film *Oceans: Our Blue Planet*, co-produced by BBC Earth and OceanX Media.

A partial replica of a Triton submersible is also on view, so don't forget to pose for a picture!

NAVIGATION AND COMMUNICATION SYSTEM

The surface crew stays in touch with the sub and tracks its position with sonar.

HATCH

There's one way to get into this sub: by lowering yourself into a narrow opening at the top of the acrylic sphere and dropping down.

UNSEEN OCEANS NOW OPEN
MEMBERS SEE IT FREE!

ACRYLIC SPHERE

Researchers get a 360-degree view from the transparent "windshield," allowing them to observe passing species from all angles.

LIGHTS AND CAMERAS

To capture fluorescence, Sparks and colleagues use specialized lights and cameras. Blue lights mimic the ocean's blue environment, while cameras outfitted with color filters capture the lower-energy wavelengths emitted by biofluorescent animals.

THRUSTERS

These help the pilot maneuver. During descent, the sub can drift by several miles if the currents are strong. Thrusters also help push past "ceilings" and "floors" of salinity gradients, layers of varying salt concentrations in the water column.

BALLAST CHAMBERS

Cylindrical tubes underneath the sub control ascent and descent as air is vented out and water is pumped in.

ROBOTIC ARM AND "SQUISHY FINGERS"

Researchers at the Harvard Microrobotics Laboratory, along with CUNY scientists, have developed a special attachment for the robotic arm, allowing scientists to collect fragile organisms such as sea cucumbers, nudibranches, and soft corals.



Programs and Exhibits

For more programs and to purchase tickets, visit 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. 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. 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 canceled by the Museum.

Please check amnh.org for Member ticket prices for live animal exhibits and giant-screen 2D and 3D films.

Information about programs is current as of March 8, 2018. Please check amnh.org/calendar for updates.

APRIL

Lunchtime Bird Walks in Central Park
Four Tuesdays, April 3–24
Noon–1:30 pm
\$50

Join ornithologist **Paul Sweet** for walks through Central Park to observe birds migrating north this spring. Learn how to identify bird species using field marks, behavior, and song.



Morning Bird Walks in Central Park
Tuesday–Friday, April 3–May 25
7 am (T, Th) and 9 am (W, F)
\$85

Ornithologists **Paul Sweet** (T, F) and **Joseph DiCostanzo** (W, Th) lead this walking tour to observe the spring migration of birds in Central Park. Identify birds such as warblers, thrushes, tanagers, and orioles as they pass through New York City en route to their summer homes.

SciCafe: Seeing Is Believing
Wednesday, April 4
7 pm
Free with cash bar
21+ with ID

How does our brain allow us to focus on specific objects or locations while blocking out others? Neuroscientist **Marisa Carrasco** explores how our minds process sensory inputs to make sense of the world around us and shape what we see.

Discovery Squad
Saturday, April 7
9 am
Free

Registration required; call 212-769-5200
Families affected by autism spectrum disorders are invited to take a 40-minute tour led by specially trained tour guides, then spend some time exploring the Discovery Room before the Museum opens to the public.

Hall Tour: Planet of the Apes
Saturday, April 7
10:30 am
Free

Registration required; call 212-769-5200
Visit the Spitzer Hall of Human Origins and the Hall of Primates to examine our closest evolutionary relatives. Trace primates' 65-million-year evolution to learn more about the traits that make these mammals unique.

Frontiers Lecture: Visualizing Planets with Radio Telescopes
Monday, April 9
7:30 pm
\$12

Astrophysicist **Meredith Hughes** introduces the weird and wonderful young systems that we can see with extremely powerful radio telescopes and provides a window into our own place in the universe.

A book signing follows.

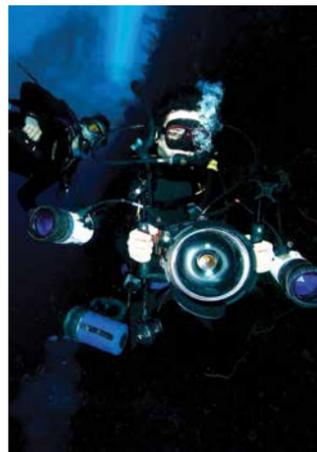


Exhibitions

Admission is by timed entry only.

Unseen Oceans
Free

Meet the elusive giants of the sea, including whales, sharks, and giant squid; sink beneath the waves in a virtual submersible theater; and marvel at the vivid fluorescence displayed by marine creatures but invisible to us ... until now.



Our Senses: An Immersive Experience

Free

Explore 11 funhouse-like spaces that dare you to trust your senses—and show you how or why what we perceive is not always as it seems. See a garden through the eyes of a bee or butterfly, test your skills at tracking sounds, try to unpack a scent, and much more.



Animal Encounter: Wild Babies
Saturday, April 14
11 am (recommended for families with younger children), 1 pm, 3 pm
\$15

Spring is the season for new discovery, and the beginning of new life for creatures around the world. Meet some of nature's cutest youngsters, and learn how they adapt to their unique habitats. **Grant Kemmerer**, wildlife expert and animal caretaker from the Wild World of Animals, will introduce you to a diverse group of babies, large and small, from across the Animal Kingdom.

Scales of the Universe
Saturday, April 21
10:30 am
12:30 pm

Free
Registration required; email accessibility@amnh.org
This tour for the blind or partially sighted and subsequent American Sign Language-interpreted tour invite visitors to explore the scales of the cosmos and investigate what lies beyond in the Rose Center for Earth and Space.



EarthFest
Sunday, April 22
All Day
Free

From 7 am yoga to a performance of John Luther Adams' *Become Ocean* by **Chelsea Symphony Orchestra**, visitors will be immersed in art, science, and culture at this festival honoring Earth Day.

Astronomy Live: Exoplanets
Tuesday, April 24
7 pm
\$12

Jackie Faherty will take you on a virtual tour of our local galactic neighborhood and explore the diversity of potential living conditions on newly discovered extrasolar planets.



Evening Access: Unseen Oceans
Thursday, April 26
6–8 pm
Free

Registration required; call 212-769-5606
Our new exhibition *Unseen Oceans* explores a marvelous, alien world hidden beneath the sunlit surface. Travel to new depths in a virtual submersible, see elusive giants of the deep, and learn how scientists are using technology to make new discoveries.

MAY

Lunchtime Bird Walks in Central Park
Four Tuesdays, May 1–22
Noon–1:30 pm
\$50

Join ornithologist **Paul Sweet** for walks through Central Park to observe birds migrating north this spring. Learn how to identify bird species using field marks, behavior, and song.

The Butterfly Conservatory
Free for Members at the \$115 level and above

This popular live-animal exhibition features up to 500 free-flying tropical butterflies from the Americas, Africa, and Asia. Housed in a vivarium with flowering plants, iridescent blue morphos, striking scarlet swallowtails, and more flutter about.



CLOSES MAY 28

Opulent Oceans
Free

Inspired by the book *Opulent Oceans: Extraordinary Rare Book Selections from the American Museum of Natural History*, this exhibition includes 46 exquisite reproductions from 33 rare and beautifully illustrated scientific works.



CLOSES JUNE 30

SciCafe: Ocean Locomotion: Bioinspiration from the Sea
Wednesday, May 2

7 pm
Free with cash bar
21+ with ID
How can studying sea life help us to create more efficient technologies? Marine biologist **Frank Fish** researches the unique ways marine animals move underwater and uses this knowledge to inspire new engineering approaches.

Hall Tour: Foods of the World
Saturday, May 5

1:30 pm
Free
Registration required; call 212-769-5200
Explore the Hall of Mexico and Central America, the Hall of African Peoples, and the Stout Hall of Asian Peoples with a tour guide to learn more about the origins and evolution of some of your favorite foods, including chocolate, potatoes, and corn.

Frontiers Lecture: Planetary Origin Stories with Alycia Weinberger
Monday, May 14

7:30 pm
\$12
It would take 100 million years to see a planet fully form, but luckily there are plenty of planetary systems in development for us to observe. **Alycia Weinberger** uses "snapshots" of nearby stars to take us on a journey back in time to the origins of planets.



Field Trip to the Moon
Thursday, May 17

6–6:30 pm, 6:45–7:15 pm
\$8 for children; \$12.50 for adults
Join us for a virtual trip to the Moon in the immersive Hayden Planetarium. Feel the ground shake beneath you as you experience a thrilling NASA rocket launch. Take a guided tour of the cosmos and orbit the Earth to get an astronaut's view of a sunrise in space!

Discovery Squad
Saturday, May 19

9 am
Free
Registration required; call 212-769-5200
Families affected by autism spectrum disorders are invited to attend a 40-minute tour led by specially trained tour guides, then spend some time exploring the Discovery Room before the Museum opens to the public.

A World of Fossils
Saturday, May 19

10:30 am
Free
Registration required; email accessibility@amnh.org
Visitors who are blind or partially sighted are invited to trace the branches of the tree of life in the Museum's amazing fossil collections and explore the exhibits through verbal descriptions and touchable objects.

Nature in Native American Myths and Legends
Wednesday, May 23

2:30 pm
Free
Registration required; email accessibility@amnh.org
Visitors who are blind or partially sighted are invited to learn about the myths and legends of Native American cultures in the Bernard Family Hall of North American Mammals, Northwest Coast Hall, and Hall of North American Forests through verbal descriptions and touchable objects.



Amazon Adventure

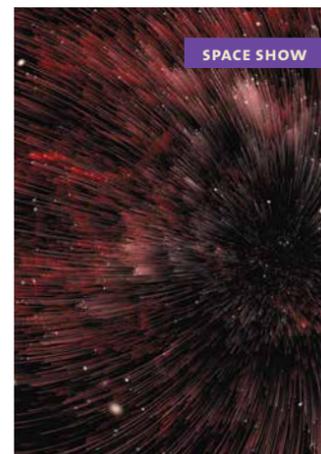
Members enjoy special benefits. This giant-screen film explores the extraordinary journey of 19th-century naturalist and explorer Henry Walter Bates. Audiences enter a wild world of breathtaking beauty and captivating animals, including an array of nature's masters of mimicry.



Captioning devices are available.

Dark Universe

Narrated by **Neil deGrasse Tyson**, Frederick P. Rose Director of the Hayden Planetarium, this Space Show celebrates pivotal discoveries and the cosmic mysteries that remain. Gaze up at the Milky Way from Mt. Wilson Observatory in California, plunge into Jupiter's atmosphere with a NASA probe, and find out what scientists are learning about dark matter and dark energy.



Captioning devices are available.



Reconstructing Human Evolution: From Fossils to Faces
Six Wednesdays, May 23–June 27

7–9:30 pm
\$195
18+
Discover how scientists and artists use fossil evidence to reconstruct our human relatives by building your own life-sized hominin head. Examine skull variations, learn how to create facial musculature, and take home your very own sculpted reconstruction from the past!

Astronomy Live: Multiwavelength Universe
Tuesday, May 29

7 pm
\$12
Astronomers use telescopes to identify the many wavelengths space objects emit. Join **Brian Levine, Emily Rice, and Jana Grcevich** to explore the universe through a different lens.

World Science Festival: Oceans Trivia Night
Thursday, May 31

7 pm
\$45
Mingle under the blue whale with a drink in hand, and show off your smarts in a pub-style quiz hosted by comedian and journalist **Faith Salie**.

JUNE

Hall Tour: The Art of Natural History
Saturday, June 2

10:30 am, 1:30 pm
Free
Registration required; call 212-769-5200
Join a tour guide to examine the Museum's spectacular art. Gain a better understanding of how imagery can be used as a vehicle for disseminating scientific knowledge.

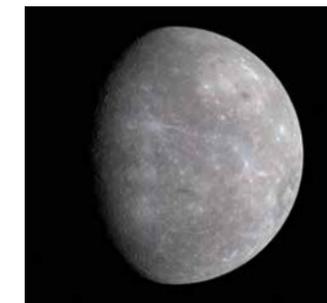
SciCafe
Wednesday, June 6

7 pm
Free with cash bar
21+ with ID
Please check amnh.org for details about the last SciCafe of the season.



Frontiers Lecture: Mercury Rising
Monday, June 11

7:30 pm
\$12
Our solar system's innermost planet has enough activity in its interior to generate a small magnetic field. Join guides **Denton Ebel and Carter Emmart** for an up-close examination of Mercury, thanks to NASA's completed MESSENGER probe mission.



Identification Day
Saturday, June 16

Noon–4 pm
Free
The Museum celebrates natural history collections by inviting visitors to bring in their own specimens for our annual Identification Day. Get an up-close look at specimens from the Museum's rarely seen collections while scientists attempt to identify your discoveries.

Science Throw Down: Sea vs. Land
Tuesday, June 19

7 pm
\$20
On the ground or into the deep—which is more compelling, intriguing, and inspiring? Join comedian and journalist **Faith Salie** for a lively discussion about the pros and cons of sea or land across a range of categories.

Exhibition Credits

Lead funding for *Unseen Oceans* and its educational resources is provided by **OceanX**, an initiative of the **Dalio Foundation**.

The American Museum of Natural History gratefully acknowledges the **Richard and Karen LeFrak Exhibition and Education Fund**.

Unseen Oceans is generously supported by **Chase Private Client**.

Our Senses is generously supported by **Dana and Virginia Randt**

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

The presentation of *Opulent Oceans: Extraordinary Rare Book Selections* from the American Museum of Natural History is made possible through the generosity of the **Arthur Ross Foundation**.

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**.

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) in collaboration with the **California Academy of Sciences**, **San Francisco**, and **GOTO INC**, **Tokyo, Japan**.

Astronomy Live: Summer Skies
Tuesday, June 26
 7 pm
 \$12

Joe Rao and Ted Williams highlight the spectacular sights of the summer sky, including Mars' close approach in July and the Perseids Meteor Shower on August 12.

Discovery Squad
Saturday, June 30
 9 am
 Free

Registration required; call 212-769-5200
 Families affected by autism spectrum disorders are invited to attend a 40-minute tour led by specially trained tour guides, then spend some time exploring the Discovery Room before the Museum opens to the public.



Meteorites
Saturday, June 30
 10:30 am
 Free

Registration required; email accessibility@amnh.org

Visitors who are blind or partially sighted are invited to discover the origin of the universe and our solar system in the Ross Hall of Meteorites through verbal descriptions and touchable objects.

Museum Highlights
Saturday, June 30
 12:30 pm
 Free

Registration required; email accessibility@amnh.org

From dinosaurs to meteors, this American Sign Language-interpreted tour will explore various popular exhibits in the Museum.

SUMMER PROGRAMS

Please check amnh.org for dates, times, and details.

Fun with Fossils
 \$95 per person

This June and July, pack your collecting bag, old sneakers, and lunch, and travel back in time with fossil experts **Carl Mehling** or **Paul Nascimbene** for an expedition to Big Brook in Monmouth County, New Jersey. This program includes about 45 minutes of walking.

Feel free to bring your own equipment; transportation provided. Children must be accompanied by an adult.

Summer Star Sail
 \$95 per person

Set sail on the Hudson River with a Museum scientist and watch the Sun set while learning the science and star lore that surround the summer sky.

Appropriate for children ages 10 and above. Children must be accompanied by an adult.

Program Credits:

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

SciCafe: Ocean Locomotion: Bioinspiration from the Sea and related activities are generously supported by the Science Education Partnership Award (SEPA) program of the National Institutes of Health (NIH).

Unseen Oceans programs are made possible by OceanX, an initiative of the Dalio Foundation, as part of its generous support of the special exhibition Unseen Oceans and its related educational activities and public programs.

The Museum gratefully 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, offering ongoing programs and resources for adults, teachers, and students to illuminate the extraordinary workings of the human brain.

Support for Hayden Planetarium Programs is provided by the Horace W. Goldsmith Endowment Fund.

Support for accessibility initiatives at the American Museum of Natural History has been provided by the Filomen M. D'Agostino Foundation.

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APRIL

3 TUESDAY
 Lunchtime Bird Walks in Central Park
 Nature Walks begin

Morning Bird Walks in Central Park
 Nature Walks begin

4 WEDNESDAY
 Seeing is Believing
 SciCafe

7 SATURDAY
 Discovery Squad
 Accessible Tour

Hall Tour: Planet of the Apes
 Member Program

9 MONDAY
 Visualizing Planets with Radio Telescopes
 Frontiers Lecture

14 SATURDAY
 Animal Encounter: Wild Babies
 Member Program

21 SATURDAY
 Scales of the Universe
 Accessible Tours

22 SUNDAY
 EarthFest
 Special Program

24 TUESDAY
 Exoplanets
 Astronomy Live

26 THURSDAY
 Evening Access: Unseen Oceans
 Member Program

MAY

1 TUESDAY
 Lunchtime Bird Walks in Central Park
 Nature Walks begin

2 WEDNESDAY
 Ocean Locomotion: Bioinspiration from the Sea
 SciCafe

5 SATURDAY
 Hall Tour: Foods of the World
 Member Program

14 MONDAY
 Planetary Origin Stories with Alycia Weinberger
 Frontiers Lecture

17 THURSDAY
 Field Trip to the Moon
 Member Program

19 SATURDAY
 Discovery Squad
 Accessible Tour

A World of Fossils
 Accessible Tour

23 WEDNESDAY
 Nature in Native American Myths and Legends
 Accessible Tour

Reconstructing Human Evolution: From Fossils to Faces
 Adult Course begins

29 TUESDAY
 Multiwavelength Universe
 Astronomy Live

31 THURSDAY
 World Science Festival: Oceans Trivia Night
 Special Program

JUNE

2 SATURDAY
 Hall Tour: The Art of Natural History
 Member Program

6 WEDNESDAY
 SciCafe

11 MONDAY
 Mercury Rising
 Frontiers Lecture

16 SATURDAY
 Identification Day
 Special Program

19 TUESDAY
 Science Throw Down: Sea vs. Land
 Special Program

26 TUESDAY
 Summer Skies
 Astronomy Live

30 SATURDAY
 Discovery Squad
 Accessible Tour

Meteorites
 Accessible Tour

Museum Highlights
 Accessible Tour

BYO Specimen

See rare items from our collections and have a Museum scientist identify yours.

It's almost that time again! On June 16, the Museum opens its doors for Identification Day, when Museum researchers and collections managers are on hand to identify your finds. Popular since the first program made *The New Yorker* magazine's Talk of the Town in 1979, the annual event brings in between 2,500 and 3,500 visitors each year, carrying items found on beaches and in backyards.

As you start thinking about what you'll bring this year, here are a few basic rules for specimens at Identification Day:

- No animals, please. Bring in a photo of your specimen instead.
- With plants, be sure you have permission to collect your sample.
- Fresh is best with fruits, flowers, or both. Also, put plants in zip-lock bags to keep them moist and—just as important—to foil pests.
- Remember, you don't have to bring in anything at all to enjoy Identification Day. Museum scientists and collections managers will be showing some of their favorite items to show you from behind the scenes.

So, come join the chorus of previous participants who have called the event "awesome," "really cool," and a "wonderful experience" as you discover and celebrate the lifeblood of the Museum's research—its world-class collections—and share your own.



DIVISION OF ANTHROPOLOGY

Favorite Find: "Two years ago, a woman brought in an Acheulean handaxe that her husband found while oil prospecting in Libya in the 1950s," says Adam Watson, a researcher in the Division of Anthropology. "This is a tool type manufactured solely by our hominin ancestors, *Homo erectus*, 500,000 to a million years ago."

Top Tip: "The more information—geographic context, documentation, family lore—the better," says Watson.



DIVISION OF PALEONTOLOGY— VERTEBRATES AND PLANTS

Most Popular Collection Item: Coprolite, or fossil feces, always gets a big reaction. "Kids squeal and cringe when I tell them what it is and remind them that they touched it," says Carl Mehling, senior Museum specialist in the Department of Paleontology. "Afterwards, when they think no one is looking, a few will sniff it."

Favorite Finds: "The most amazing thing was from 2001, a partial Pleistocene walrus skull from a beach in Virginia," says Mehling. "And in 2016, a Member named Sean Tobin, brought in a Late Cretaceous plesiosaur vertebra he found in a brook in New Jersey!"



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DIVISION OF PALEONTOLOGY— INVERTEBRATES

Favorite Find: "A keychain vial of foraminifera (unicellular amoeba-like organisms with hard shells) from Okinawa, Japan, that I have read about but never seen in person," says Mariah Slovacek, a Museum specialist in the Department of Paleontology.

Top Tip: "If the specimen isn't delicate, brushing off loose dirt and sand or washing the specimen gently with water helps make it more visible for examination," says Slovacek.



DEPARTMENT OF ORNITHOLOGY

Favorite Find: "A staff member brought in a bird skeleton her landlord had in a shoebox in his garage," says Paul Sweet, collections manager in the Department of Ornithology. "It was a Fairy Penguin (*Eudyptula minor*) native to Australia, and the mount was of a type that hasn't been manufactured for about 100 years."

Top Tips: Be gentle handling specimens that will be out for the day. Even big bones can break if grabbed too roughly. And prepare to be surprised. Sweet likes to set out a large and a small bone and ask children which is heavier. "They instinctively pick the large bone of the Andean Condor over the smaller bone of an Emperor Penguin," says Sweet. But when they hold the bones, "They say, 'That's weird!'" He explains how the condor has light hollow bones for flying, while penguin bones are dense and heavy for swimming.



DEPARTMENT OF HERPETOLOGY

What You'll See: "Cool specimens with extreme senses," says Senior Museum Specialist Lauren Vonnahme from the Department of Herpetology about what she will be showing at her table this year, with a nod to the current special exhibition *Our Senses: An Immersive Experience*. "Tuataras have a third eye, chameleons have a tongue twice the length of their body, crocodile skin is more sensitive than our fingertips, and boas can 'see' heat. I'll bring our live boa."

Top Tip: "Please bring us stuff to identify—we really like to do it!" says Vonnahme. "And complete specimens are better than incomplete ones. It's hard to tell what species it is from a 0.25-inch splinter of bone."

Beyond Today

Make a Commitment to Discovery



It all started more than a century ago. Maria DeWitt Jesup, devoted naturalist and wife of former Museum President Morris Jesup, knew that the Museum she loved would continue to shape future generations. So she arranged a generous gift in her will, inspiring other friends to step forward with their own gifts. This group became the Museum's Jesup Legacy Circle.

Looking to the Future

For nearly 150 years, the Museum has expanded our scientific horizons. The Jesup Legacy Circle's goal is to make certain that will continue for 150 more.

There is no minimum dollar requirement to join the Jesup Legacy Circle. Members receive special invitations to events and the knowledge that they will have a lasting effect on everyone who enters the Museum's doors—that their gift will help spark curiosity and inspire wonder for generations to come.

"Science is important to us... to our lives and existence. This bequest is an investment in our country's future."

—LINDA AND CHESTER WIDOMSKI
JESUP MEMBERS SINCE 2014

Members of the Jesup Legacy Circle are focused on the future of science and education. Their support will help the Museum to keep up with changing technologies, building new experiences for visitors both on-site and online. It will help to prepare teachers and scientists to solve tomorrow's biggest challenges. And, of course, their lasting legacy will extend learning opportunities for generations of children and families regardless of background—as the Museum has done since its founding.

Your Planned Gift for Tomorrow Can Also Provide Support Today

In celebration of the Museum's upcoming 150th Anniversary, an anonymous donor has set a challenge for our loyal friends. For any legacy gift that you arrange in your will or estate plan, the Museum receives \$1,000—for a total of up to \$150,000.

Planning a gift for the future of the Museum has always been a great way to extend your legacy beyond today and support the next generation of scientists. Now, as part of this challenge, you can help us to secure immediate funding as well—supporting vital current work in science and education.

Your planned gift will make you the newest member of the Museum's Jesup Legacy Circle. We'll invite you to special events and send this exclusive collapsible tote bag to thank you for your commitment.

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Ways to Join

There are many ways to join the Jesup Legacy Circle. A gift in a will—known as a bequest—is the most popular. This can be a dollar amount, specific assets, or a portion of what remains after providing for others. Gifts from IRA or 401K accounts only require completing a beneficiary form and help keep assets outside of probate. If properly planned, gifts for the Museum's future can be arranged using life insurance, real estate, business interests, or even an existing donor-advised fund or trust.

Life-income gifts, such as charitable gift annuities, are also very popular. A gift annuity provides fixed-rate payments for life, paid to the donor and/or another person they chose. Because the remainder will go to the Museum after their lifetime, there are also significant income tax benefits for the donors. Charitable remainder trusts can provide similar income and tax benefits. Other trusts, called charitable lead trusts, can pass assets on to children or grandchildren in tax-advantaged ways.



If you think you might be interested in the benefits of a planned gift, or want to find out more about the Jesup Legacy Circle, contact our Planned Giving Office by emailing plannedgiving@amnh.org or by calling 212-769-5119.



Central Park West at 79th Street
New York, New York 10024-5192
amnh.org



Submersibles have opened up an era of pioneering deep-sea exploration. Find out what it's like to dive deep on p.12.

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,
and Café on 4 offer Members
a 15-percent discount. Hours are
subject to change.

MUSEUM SHOPS

The Museum Shop, Dino Store,
Planetarium Shop, Cosmic Shop,
Senses Shop, Unseen Oceans Shop,
and Online Shop (shop.amnh.org)
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.

ACCESSIBILITY



For information on accessibility,
email accessibility@amnh.org
or call 212-313-7565.