American Museum of Natural History

ROTUNDA

Member Magazine
Fall 2016 Vol. 41 No. 4

¡Cuba!

Opens November 18 for Members

Asteroid Mission

From the President

Ellen V. Futter

On July 9 in Havana, the American Museum of Natural History and the Cuban National Museum of Natural History signed a Memorandum of Understanding (MoU), pledging to collaborate on scientific research and training, education, and exhibition. This historic milestone builds on and deepens a longstanding relationship between our two institutions.

Museum scientists have worked in collaboration with Cuban colleagues for many decades, including more recently through our Center for Biodiversity and Conservation. The changing political climate offers us the extraordinary opportunity to formalize and extend this work. Already, scientists engaged in our Explore21 expedition initiative have been on the ground with Cuban colleagues in major, multi-disciplinary fieldwork studying the astonishing and unique biodiversity of this remarkable island nation.

Perhaps the most visible manifestation of this exciting partnership will be the collaborative presentation of a major exhibition entitled *¡Cuba!* Opening at the Museum this fall, it will present the cultural and biological diversity of Cuba and highlight the work of the Explore21 expedition. In addition, at the upcoming commencement of our Richard Gilder Graduate School, we will confer an honorary degree on our distinguished Cuban colleague Dr. Gilberto Silva Taboada, a world-renowned authority on Caribbean bats.

The MoU is a groundbreaking step for both signatory museums, certainly, but it is also a model for collaboration between U.S. and Cuban museums and research institutions more broadly. We know that science has the power to unite, build bridges, and transcend differences. This effort underscores the importance of that role for museums in the 21st century, and of the global imperative to work together to advance conservation and cultural understanding.

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The 40th Margaret Mead Film Festival Opens October 13

A Flickering Truth, *one of dozens of documentaries featured at the 2016 Margaret Mead Film Festival, explores the rich history of cinema in Afghanistan.*

This fall, the Margaret Mead Film Festival returns to celebrate the groundbreaking spirit of the legendary Museum anthropologist.

With the theme "Re:Frame," the 2016 Margaret Mead Film Festival invites viewers to probe their own perspectives and to celebrate stories and art forms that offer us opportunities to see the world anew. In this way, the festival honors the legacy of Dr. Mead, the Museum curator whose groundbreaking approach to anthropology revealed how our histories, values, and points of view frame our encounters with other cultures and communities. As always, the Mead will feature intimate conversations with filmmakers and film subjects, as well as the presentation of the annual Margaret Mead Filmmaker Award.

In addition to the exciting shorts and eye-opening feature-length documentaries, this year's Mead will offer a variety of special events, performances, and installations. Highlights will include a display of Balinese masks designed by contemporary artists and an installation by Samoan artist Dan Taulapapa McMullin, who explores the dynamics of cultural appropriation in Tiki kitsch.

A nod to the festival's legacy includes a screening of *Wife Among Wives,* a classic film from the Mead's archives. At the same time, the future of filmmaking will be on display in the Virtual Reality Lounge, where visitors can test-drive VR headsets and experience how this cutting-edge technology is poised to transform cinema.

On Saturday, October 15, festival consultant Dr. Faye Ginsburg, director of the New York University Center for Media, Culture and History, will host the Mead's Emerging Visual Anthropologists Showcase, featuring four short documentaries and a Q&A session with filmmakers.

For a full lineup of films and showtimes, and to purchase tickets, visit amnh.org/mead.

2016 Margaret Mead Filmmaker Award Contenders
A Revolution in Four Seasons (Opening Night)
A Different American Dream
A Flickering Truth
Belén
Casa Blanca
Drokpa
Reindeer in My Saami Heart
Shooting Ourselves
Under the Clouds (Das Nuvens Pra Baixo)
Urmila: My Memory is My Power
Zach's Ceremony

The Margaret Mead Film Festival is made possible by the New York State Council on the Arts with the support of Governor Andrew M. Cuomo and the New York State Legislature.

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© J. Bryant

Anolis equestris

Lookalike Lizards

There are 414 species of lizard classified as *Anolis*, making this genus among the most species-rich known to science. Dozens of these are found only in Cuba.

"The island of Cuba is so large, it acts as a miniature continent," says Chris Raxworthy, co-curator of *¡Cuba!* and curator-in-charge of the Department of Herpetology. "Evolution there has produced a lot of species that can't be found anywhere else in the world."

Many of these lizards, however, do have doppelgängers on neighboring islands like Jamaica and Puerto Rico. But despite appearances, these doubles are often not closely related to one another. Anoles have ecomorphs–groups of species that share physical features and behaviors because they have adapted, often independently, to similar ecological niches.

Behind these legions of lookalikes is an evolutionary process called adaptive radiation, which has played out each time anoles landed on a new island. When the first anoles arrived in a new place, they headed for the trees, which hosted smaller microhabitats at the ground, at the top, and in between, on trunks and twigs. The original species evolved over time into several, each adapting to their own distinct niche.

In Cuba, large knight anoles, like the one pictured above, live in the crowns of trees, where they dine on fruits as well as on animals like tarantulas, geckos, and even small mammals and birds. Smaller brown anoles (below), meanwhile, live where the tree trunk meets the ground, preying on small insects.

The different habitats anoles occupy also affect their behavior. When a knight anole feels threatened, it will skitter away; brown anoles, accustomed to blending in with their surroundings, are more likely to freeze.

See live Cuban anoles in *¡Cuba!*, which is free for Members. Member Preview Days begin Friday, November 18.

Tear-away Tails

Many anole species use a drastic defense mechanism when faced with a threat—they will shed their own tails. The lost tail continues to move, distracting the predator and giving the anole time to make an escape. In most cases, the anole will regrow the tail it sacrificed.

Little Lizards

If the idea of radiation and lizards fills you with Godzilla-sized anxiety, you can relax. Even Cuban knight anoles, the largest anole species known to science, don't get any larger than 2 feet in length, and most species—including the other anoles on display at the Museum as part of *¡Cuba!*—are significantly smaller.

Colorful Neckwear

All anoles have a dewlap —a fold of skin beneath their neck that they can extend and retract. Dewlaps are usually a different color than the rest of the lizard's body, and their display may be used to attract mates, scare off intruders barging into their territory, and possibly for other purposes.

Fine The Way They Are

A 2015 study that compared modern anoles to fossils trapped in amber from 20 million years ago found that these lizards have changed little over that span of time.

Sounds Like...

Is anole a two-syllable word that rhymes with "coal" or a three-syllable word that rhymes with "holy"? Curator Chris Raxworthy says two will do.

Anolis sagrei

Green Eggs

No, that's not the Museum's famed avocado specimen–below, you can see the large, thick-shelled, and emerald-hued egg of the Northern Cassowary. Visitors can see examples like this–among other amazing ova–in the special exhibition *Dinosaurs Among Us*.

There, you'll get a look at how ancient dinosaurs never went extinct. Instead, they gave rise to the first birds, some of which abandoned flight for the terrestrial lifestyle pursued by species like cassowaries.

This egg's green tint is actually a clue to where–and how–the cassowaries nest, and as you may have guessed, it's not up a tree. Like their closest relatives, the emus, these ground-dwelling birds build nests among thick foliage, scratching shallow depressions in the dirt and lining them with leaves and grass.

These well-camouflaged nests usually hold between three and six eggs, which are watched over by the male. The proud papa incubates them for nearly two months while the female departs, sometimes to mate again. Once the eggs hatch, the father also cares for the young birds for nine months or longer, helping the chicks find food and protecting them from predators.

Thanks to a few extraordinary fossils, paleontologists now think that this nesting behavior looks very similar to that of some dinosaurs. A cast of one such specimen, *Citipati osmolskae*, is featured in *Dinosaurs Among Us*, along with fleshed-out models. Discovered in 1993, this oviraptorid dinosaur specimen is positioned over the center of a large nest, assuming a protective posture over its eggs that is similar to that adopted by modern birds like hawks.

Uncovered at Ukhaa Tolgod, Mongolia, by scientists from the Museum and the Mongolian Academy of Sciences, the original *Citipati* fossil shows that nesting was present more than 80 million years ago, far back in the dinosaur line. Paleontologists think that behaviors like parental care by males may have already developed by that time, too.

***Dinosaurs Among Us*, which is free for Members, is open through January 2, 2017.**

All in the Family

Cassowaries are part of a group of large, flightless birds known as ratites that includes ostriches, rheas, emus, and kiwis. The Southern Cassowary is the largest cassowary species. Measuring more than 5 feet tall and weighing up to 130 pounds, it is second only to the ostrich in weight.

Free-range Eggs

Female cassowaries leave egg-incubating and chick-rearing to their mates, but other birds take this hands-off approach even further. Australian brush-turkeys—large birds that belong to a family called megapodes—make a giant compost heap in which to lay their eggs, letting the heat from the rotting pile incubate them. Although the male builds the nest and tends it regularly to maintain optimum temperature, neither parent sticks around to help the newborn chicks, who are on their own once they hatch.

Camouflage Chic

All three species of cassowary sport colorful skin, with hues that include bright blues, reds, purples, and pinks. Cassowary chicks, however, are striped brown and tan to blend into their surroundings—a useful adaptation for avoiding predators.

Prominent Paleo

Citipati osmolskae is named for a famous Gobi dinosaur hunter: Polish paleontologist Halszka Osmólska. That's not the only species that honors her legacy. The dromaeosaurid *Velociraptor osmolskae*, the reptile *Osmolskina czatkowicensis*, and the ancient mammal *Prolagus osmolskae* bear her name as well.

AMNH Egg & Nest Collection 16971

ISLAND RULES

WHY CUBA BRIMS WITH BIODIVERSITY

Giant ground sloths and 3-foot-tall owls may sound like creatures of fantasy, but these animals roamed Cuba until just a few thousand years ago. Today, the island nation is still home to endemic species that demonstrate the amazing power of evolution: birds no bigger than insects, frogs that fit on a fingertip, and one of the world's rare venomous mammals.

"In many ways, islands function as natural experiments," says Ana Luz Porzecanski, director of the Museum's Center for Biodiversity and Conservation and co-curator of *¡Cuba!,* a special exhibition that opens this November and lets visitors explore the island's extraordinary biodiversity. "They are isolated from the mainland and from one another, they have set boundaries, and they vary in size and geography. Islands are an evolutionary biologist's dream!"

On islands, the effects–and pace–of evolution can be more dramatic, for a variety of reasons. When an animal arrives on an island, be it by crossing a temporary land bridge, washing up there on a raft of vegetation, or hitching a ride with another species, there may be nothing on the island that is looking to eat it.

With fewer predators, most evolutionary pressure comes from within. As members of the same species compete for resources, they will naturally find different niches to occupy, and new species can arise in the process. (For more about this process, known as adaptive radiation, turn to page 4 and read about Cuban anoles.)

Island species can often be endemic, which means they exist only on the particular island on which they evolved. In Cuba, for instance, 95 percent of the dozens of frog species are found nowhere else on the planet. These include *Eleutherodactylus iberia,* one of the world's smallest frog species; adults can fit on a human fingernail with room to spare.

"ISLANDS ARE AN EVOLUTIONARY BIOLOGIST'S DREAM!"

DR. ANA LUZ PORZECANSKI
DIRECTOR, CENTER FOR BIODIVERSITY AND CONSERVATION

American Museum & Natural History

Page 6 photo © Getty Images/S. Winter; Hummingbird photo © iStockPhoto/USO; Frog photo © AMNH/C. Raxworthy

Cuba is the largest island in the Caribbean region. Technically, it's an archipelago with more than 4,000 islands and cays.

(Left) Cuba's native bee hummingbird is the smallest bird in the world. (Above) Eleutherodactylus iberia: *Like about 30 percent of Cuba's vertebrate animals, this tiny frog is only found on the island.*

CREATURES GREAT AND SMALL

This minuscule amphibian is just one Cuban example that might fit the so-called "island rule," which proposes that over time, animals on islands tend to evolve smaller body sizes when food resources are constrained, or evolve to become bigger when there is less pressure from predators.

Until about 6,000 years ago, Cuba's forests were home to *Ornimegalonyx,* the largest owl ever known. Researchers estimate that this awesome bird weighed as much as 38 pounds in life–three times heavier than today's largest living owls. *Ornimegalonyx* likely evolved from a smaller ancestor and grew to its enormous proportions due to the absence of mammalian competitors for its specialized diet of large rodents and sloths. But when its prey started to die out, so did this big bird. "Specialization is a one-way ticket, no return," explains Cuban paleornithologist Dr. William Suarez, who was curator of birds from 1999 to 2012 at the Cuban National Museum of Natural History in Havana. "Without an adequate source of food, we think this owl was unable to adapt."

Cuba was also home to *Megalocnus rodens,* a giant ground sloth. While similar giant sloths went extinct about 11,000 years ago in North and South America, radiocarbon dating shows that *Megalocnus* survived in the forests of Cuba until just a few thousand years ago, long after its counterparts on the mainland were wiped out.

ISLAND THREATS

Islands face many of the same conservation challenges as the mainland, but the effects can be more pronounced given the sharp boundaries of island life.

On islands, endemic plants and animals can evolve in parallel and play a major role in one another's life cycles. A 2012 study found that Cuba's bee hummingbirds visited just 10 species of flowers looking for a nectar meal; nine of these plants are native or endemic to the island.

Island species are also particularly vulnerable to the threat of invasive species. These relatively isolated ecosystems are not used to new arrivals, and their introduction can spell disaster for native species.

Dr. Gilberto Silva Taboada, curator emeritus at the Cuban National Museum of Natural History, says the giant catfish *Clarias gariepinus* is a particularly destructive example of invasive species, and not just in the Zapata wetlands where they were introduced.

"This large fish can survive outside water for days," Silva Taboada says. "It regularly climbs onto dry land, wandering and feeding on all kinds of endemic animals, even inside caves."

¡CUBA!

MEMBER PREVIEW DAYS
FRIDAY, NOVEMBER 18, SATURDAY, NOVEMBER 19, AND SUNDAY, NOVEMBER 20
10:30 AM TO 4:30 PM

See the Museum's new special exhibition *¡Cuba!* before it opens to the public. A weekend of exclusive Member Preview Days for Members at the $105 level and above begins Friday, November 18. Tickets available starting November 1 by calling 212-769-5200.

The new special exhibition *¡Cuba!* will explore the extraordinary biodiversity across the island's remote forests, deep caves, expansive wetlands, and dazzling reefs through immersive exhibits that have been developed with colleagues at the Cuban National Museum of Natural History. In addition, the exhibition will highlight Cuba's culture, its people, and its history.

Curated by Director of the Center for Biodiversity and Conservation Ana Porzecanski and Associate Curator Chris Raxworthy, *¡Cuba!* features a re-creation of Zapata wetlands, home to the endangered Cuban crocodile; a display of a cave environment where visitors can examine fossil remains of extinct species; and live lizards, boas, and frogs.

Major funding for ¡Cuba! *has been provided by the* **Lila Wallace-Reader's Digest Endowment Fund.**

Generous support for ¡Cuba! *has been provided by the Dalio Ocean Initiative.*

The Ford Foundation has also committed to supporting ¡Cuba!

Today, Cuba's giant animals include the hutia, a 15-pound rodent, as well as knight anoles, the largest example of their genus. The island is also home to the world's smallest bird species–the bee hummingbird. Some mainland species get close to its size, but this species takes tininess to a whole new level: an average male weighs in at less than 2 grams.

Their small size is matched only by their massive appetite, says Dr. Arturo Kirkconnell, curator of birds at the Cuban National Museum of Natural History. "Hummingbirds are highly evolved nectarivores whose diet is about 90 percent nectar," Kirkconnell says. The birds are fast eaters, too, able to consume their body weight in sugary nectar in just a few hours.

TIME CAPSULE

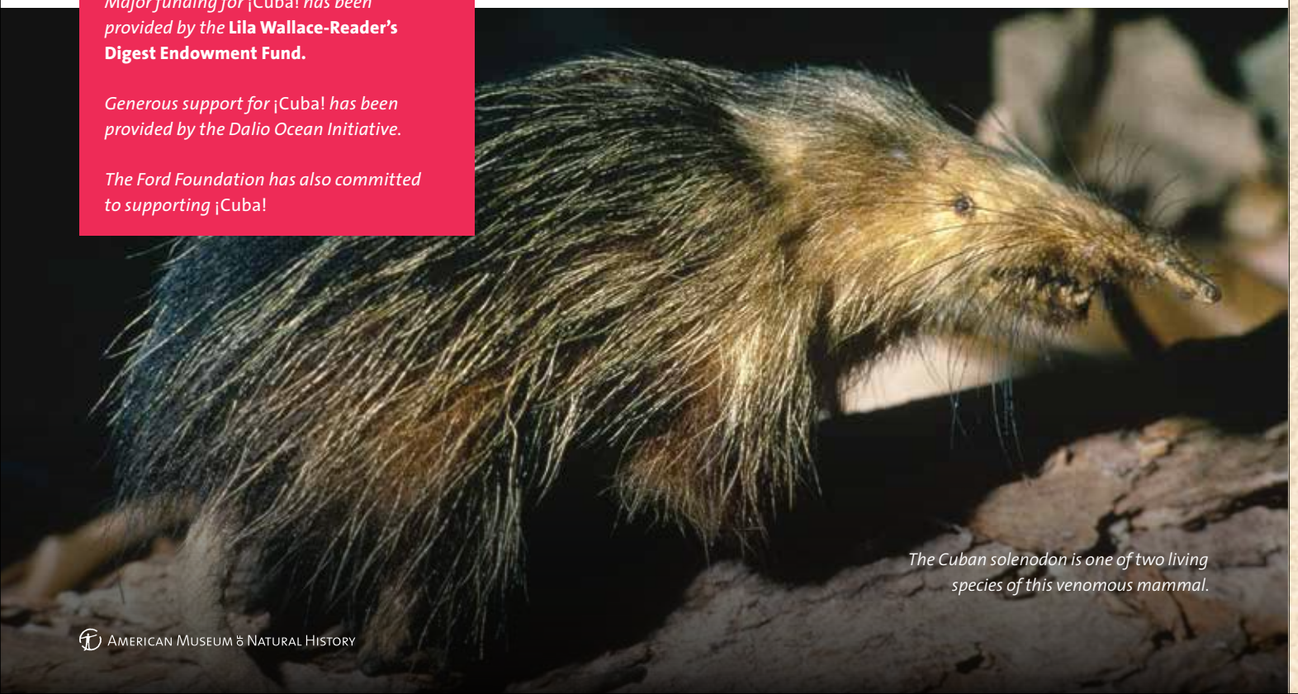
Animals that have gone extinct elsewhere can sometimes survive on islands due to the isolation they offer. That's the case with Cuban solenodons, insectivorous mammals with a venomous bite that are part of a mammalian line that has existed since the time of the dinosaurs. Today, only two species of solenodon survive–one in Cuba and another on the nearby island of Hispaniola.

That makes protecting their few remaining habitats all the more important, says Gerardo Begué-Quiala, deputy director of Alexander Humboldt National Park, one of the solenodon's few known stomping grounds.

"Their ecology and natural history is still not well understood, and these attributes make it a focal species for conservation in the park," Begué-Quiala said through an interpreter. "If there is a mammal in Cuba that needs to be studied, it is undoubtedly the solenodon."

And while solenodons are remarkable, they're just one endemic species on an island where about half of the plants and a third of vertebrate animals share that distinction. Despite its rich history, Cuba's biodiversity is still being explored–and the island that has been home to so many amazing species likely holds more discoveries in store.

***¡Cuba!* opens to the public on November 21, and Members see it for free. Member Preview Days begin Friday, November 18.**



The Cuban solenodon is one of two living species of this venomous mammal.

Solenodon photo © Getty Images/J. Hancock; Owl photos © AMNH/R. Mickens

BUILDING BIG BIRD

One of the highlights of *¡Cuba!* is a life-sized model of *Ornimegalonyx*, a giant owl that became extinct about 6,000 years ago.

Ornimegalonyx was first described by the father of Cuban vertebrate paleontology, the late Oscar Arredondo, from subfossils—bones on their way to becoming fossils—found in 1954. All of the specimens, though, were incomplete, and scientists are still debating whether there was more than one species.

Arredondo oversaw reconstructions of the bird's skeleton that were previously exhibited at Havana's Museo de Historia Natural Felipe Poey. The new model on display in *¡Cuba!* is a masterful likeness based on the latest scientific analysis. Extrapolating from fragments of bones, beak, talons, and other fossil evidence, Jason Brougham, senior principal preparator in the Exhibition department, worked closely with researchers to fashion a striking lifelike model from steel, polyurethane foam, and epoxy.

Arredondo once speculated that *"Ornimegalonyx* had to have been the scourge and terror of most of the larger mammals of the Pleistocene of Cuba, and the claws and mandibles of this bird would have constituted a terrible combination of superior destructive power." With its outspread wings, long legs, and captivating stare, the eye-catching 39-inch-tall model is true to the intimidating impression this gargantuan bird likely made in life.

See the model of *Ornimegalonyx* in *¡Cuba!*

(Top to bottom) *The head of the giant owl* Ornimegalonyx *takes shape in the Museum's workshop, where senior principal preparator Jason Brougham has been building a 39-inch-tall model with outstretched wings.*

American Museum of Natural History

Cuba's Reefs

Tourism and fishing in the Jardines de la Reina archipelago south of Cuba's main island have been tightly restricted for 30 years, ensuring that its coral reefs remain largely undisturbed.

The result, says Katherine Holmes, a marine biologist at the Wildlife Conservation Society, is that the reefs found here are among the healthiest and most diverse in the region, and likely help to support similar ecosystems throughout the region.

Dive into a reef like this one in ***¡Cuba!***, which opens November 18 and is free for Members.

¡Cuba! **Opens November 18**

Spotted Eagle Ray

These large rays, with wingspans of up to 10 feet, are thought to migrate between Cuba and the coasts of Florida and Mexico.

Brain Coral

Like all corals, brain coral is made up of tiny, genetically identical organisms known as polyps. New generations build their homes on top of past ones, in time forming the reefs for which corals are famous.

Queen Conch

In the wild, these huge snails can live for up to 40 years, but many are taken for their edible meat and beautiful shells before they make it to old age.

Elkhorn Coral

Broken branches of elkhorn coral can reattach to reefs and grow again, but the identical genetic makeup of the polyps mean they are particularly vulnerable to the sort of diseases that have struck reefs around the world.

Make Your Own Brain Coral

Step One

Take a grapefruit-size piece of green clay and make it into a dome shape.

Step Two

Stick on pieces of "radiatore" pasta to mimic the coral's surface.

Step Three

Paint the pasta pieces olive green, like the algae that live with real brain coral.

To learn how to make other kinds of coral and explore more hands-on projects, visit **amnh.org/explore/ology**.

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 cancelled 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 September 1. Please check amnh.org/calendar for updates.

October

Celebrate Pacific Northwest Cultures

First Saturdays, October 2016–May 2017
Noon–4 pm
Free

Experience the Hall of Northwest Coast Indians through a series of activities guided by Museum educators. Explore the interactive digital totem, a touch-screen portal to the people, places, and sounds of the Pacific Northwest, and tour the hall with Haida Gwaii Museum Curator **Sean Young** through a telepresence robot.

The Science of Stem Cells

Weekends, October 1–2 and October 8–9
12–5 pm
Sackler Educational Laboratory
Free with Museum admission and for Members

What are stem cells, and what promise do they hold for medicine? Research in the field is advancing rapidly, filled with immense challenges and potential. Stop by the Sackler Educational Lab to discover the basic biology of stem cells, their function in development, and how they can be used in the treatment of diseases.

Hall Tour: The World of Crocodilians

Sunday, October 2
10:30–noon; 1:30–3 pm
Free
Registration required; call 212-769-5200

Join a Museum tour guide to learn more about the evolution, biology, diversity, and behavior of crocodilians. Visit displays in halls including Reptiles and Amphibians, the Akeley Hall of African Mammals, and the Hall of Biodiversity to gain new insight into this ancient and diverse group of reptiles.

This tour is appropriate for Members ages 10 and up.

Mapping the Heavens

Monday, October 3
7:30 pm
$12

The cosmos are now known to be expanding at an accelerating pace, propelled by dark energy and structured by dark matter. Join astrophysicist **Priyamvada Natarajan** as she explains the science behind these essential ideas and provides an understanding of how radical scientific theories gain acceptance.

A book signing will follow.

Fall Lunchtime Bird Walks in Central Park

Four Tuesdays, October 4–October 25
Noon–1:30 pm
$50

Join ornithologist **Paul Sweet** on walks through Central Park during fall migration. Learn how to identify the varied bird species that pass through New York City using field marks, behavior, and song.

SciCafe: Secrets of the Crocodile Mummies

Wednesday, October 5
7 pm
Free for 21+ with ID

Evon Hekkala, a professor at Fordham University and research associate in the Museum's Department of Herpetology, discusses how tissue samples from centuries-old Museum specimens shed light on the mysterious origins of the Nile crocodile. This DNA detective work may even explain the presence of crocodiles in medieval medicine cabinets.

Exhibitions

Admission is by timed entry only.

¡Cuba!

Free for Members

This exhibition explores the extraordinary biodiversity across the island's remote forests, deep caves, expansive wetlands, and dazzling reefs, as well as highlighting its culture, its people, and its history.

Dinosaurs Among Us

Free for Members

From flight to feathers, nests to wishbones, and brains to lungs, this exhibition highlights the continuities between living dinosaurs—birds—and their extinct ancestors.

What a Fish Knows: The Inner Lives of Our Underwater Cousins

Thursday, October 6
Linder Theater
6:30 pm
Free for Members with RSVP; call 212-769-5200.

Myth-busting animal behavior expert **Jonathan Balcombe** explores the minds of fishes to reveal the surprising capabilities of these animals.

The 40th Annual Margaret Mead Film Festival: Re:Frame

Thursday, October 13–Sunday, October 16
Screenings: **$10**
Opening Night: **$13**
For more information, showtimes, and tickets, visit **amnh.org/mead.**

With the theme "Re:Frame," the 2016 Margaret Mead Film Festival invites viewers to probe their own perspectives and to celebrate stories and art forms that offer us opportunities to see the world anew.

Family Astronomy

Saturday, October 22
6:30 pm
$10

The Hayden Planetarium invites our youngest astronomers to an evening of star-hopping as we look at the fall and winter constellations using the Zeiss Mark IX Star Projector. Learn how to navigate the night sky and see whether you can find celestial objects hiding in plain sight.

Recommended for children ages 4–11.

Sci-Fi Universe

Tuesday, October 25
7 pm
$12

Where is that galaxy "far, far away?" Could someone really survive on Mars? See the universe through the lens of science fiction with **Brian Levine** and **Irene Pease** as you examine locations and situations from film, television, and novels, and uncover how much has (and hasn't!) been explored.

Welcome to the Universe

Wednesday, October 26
7 pm
$20

Welcome to the Universe is a personal guided tour of the cosmos by three of today's leading astrophysicists, inspired by the popular introductory astronomy course that **Neil deGrasse Tyson, Michael A. Strauss,** and **J. Richard Gott** taught together at Princeton.

A book signing will follow.

Live Bat Encounter

Saturday, October 29
11 am (recommended for young children)
1 pm, 2:30 pm
$15

Get an up-close and personal introduction to live bats from around the world! Conservation biologist and bat expert **Rob Mies** will host this unforgettable presentation with many species of live bats, including a Rodrigues fruit bat, a straw-coloured fruit bat, a big brown bat, and a Malayan flying fox.

November

SciCafe: The Science of Predicting an Election

Wednesday, November 2
7 pm
Free for 21+ with ID

How much do political polls mean, and what should we really be looking for? Data scientists **Sam Wang** and **Josh Katz** discuss how data can be mined creatively for insights into what's really happening in this campaign season and beyond.

Meet the Scientist in the Lab

Saturday, November 5
3–5 pm
Free

Join us in the Sackler Educational Laboratory to hear primate researcher **Shahrina Chowdhury** discuss the complexity of social structures and behavior in wild baboons. Bring your curiosity as exciting new findings in the field of primatology are presented in an informal lab setting.

Countdown to Zero

Free for Members

This exhibition, developed in collaboration with The Carter Center, focuses on the scientific innovations that are ridding the world of ancient afflictions—including the 30-year campaign that may soon eradicate Guinea worm disease.

Crocs: Ancient Predators in a Modern World

Explore the complex lives of crocodilians in this exhibition, which features live species from around the world, including a rare African dwarf crocodile.

Hall Tour: *Tyrannosaurus rex*
Saturday, November 5
10:30 am–noon
Free
Registration required;
call 212-769-5200
Join a Museum tour guide to explore the iconic Hall of Saurischian Dinosaurs. Learn more about the history of the *Tyrannosaurus rex*, its discovery by scientists from the Museum, and its place in the popular imagination.

Sackler Brain Course
Brain 101: The Inside Story
Five Mondays,
November 7–December 4
6–8 pm
$240
Join us for a five-part introductory course exploring the inner workings of the brain, with experts who will discuss the latest neuroscience research. Discover how the brain processes sensory stimuli, delve into its anatomy, and explore the evolutionary history of this magnificent and mysterious organ.

The Remarkable Nature of Edward Lear
Monday, November 7
6:30 pm
Free for Members with
RSVP; call 212-769-5200.
Edward Lear (1812–1888) is best known for "The Owl and the Pussycat," but he was also a fine painter of animals and landscapes around the world. Author **Robert Peck** discusses the remarkable life and natural history paintings of this beloved children's writer.

Yes, Humans Are Causing Earthquakes
Thursday, November 10
6:30 pm
Free for Members with
RSVP; call 212-769-5200.
Since 2009, the central United States has experienced a significant increase in earthquake activity, specifically in areas employing new and emerging oil and gas production technologies. Join **Dr. Justin Rubinstein,** deputy chief of the Induced Seismicity Project at the United States Geological Survey, as he discusses the many ways that humans can cause earthquakes.

Double Discount Days
November 14–20
and December 4–10
Members can get out in front of holiday shopping with twice their regular discount! For a week each in November and December, Members save 20 percent on purchases in the Museum's retail shops and online store. Just have your membership card handy at checkout.

Member Preview Days: *¡Cuba!*
Friday, November 18
Saturday, November 19
Sunday, November 20
10:30 am–4:30 pm
Free for Members at the
$105 level and above.
Admission by timed
entry only. Tickets available
starting November 1;
call 212-769-5200.
Be among the first to explore remote forests, deep caves, expansive wetlands, and dazzling reefs at the new special exhibition *¡Cuba!* before it opens to the public.

Seismodome: Sights and Sounds of Earthquakes and Global Seismology
Saturday, November 19
7 pm
Free
Registration required;
call 212-769-5200
Earthquakes happen frequently–but what causes them? Why are they unpredictable? What do they tell us about Earth's deep interior? Explore these questions through immersive displays of earthquakes and seismic waves with Earth scientists, astrophysicists, and sound artists.

Hackathon: Hack the Stacks
Sunday, November 20
2 pm
Free
Wallach Orientation Center
Data is everywhere, from the smartphone in your pocket to scans of rare books in the Museum collections. As part of the third annual Hackathon, programmers are developing new ways to visualize and understand Museum archives. Join us to find out what coders can create in 24 hours.

The Butterfly Conservatory
Opens December 10, 2016
Housed in a vivarium that approximates their natural habitat with live flowering plants, butterfly species in this ever-popular exhibition include iridescent blue morpho butterflies, striking scarlet swallowtails, and large owl butterflies.

Wonders of the Arctic
Through compelling stories told by scientists and Inuit leaders, this giant-screen film reveals the impact of ice on the inhabitants, both human and animal, of one of the most beautiful and frigid places on Earth.

Spaceman: An Evening with Mike Massimino
Monday, November 21
7:30 pm
$12
Astronaut **Mike Massimino's** journey to becoming an astronaut is as unlikely as it is compelling. His new book, *Spaceman*, is an ode to following your dreams and finding your place in this world–or out of it.

A book signing will follow.

Next-Generation Astronomy
Tuesday, November 29
7 pm
$12
Jackie Faherty and **Jana Grcevich** highlight the science propelled by missions like the Hubble Space Telescope and explain what you can expect to see in the near future from missions like Gaia and the James Webb Space Telescope.

December

Painting the Natural World
Eight Tuesdays,
December 6, 2016–January 24, 2017
7–9 pm
$240
In this after-hours painting workshop, artists **Greg Follender** and **Eric Hamilton** provide hands-on instruction in acrylic paint. Get a glimpse into the history and craftsmanship behind world-class dioramas and take home a painting of your own.

Basic painting experience is recommended for this course.

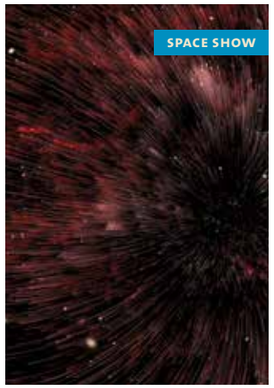
SciCafe: When Black Holes Collide
Wednesday, December 7
7 pm
Free for 21+ with ID
When black holes collide, they offer clues about their nature in the form of gravitational waves. Earth-based detectors aim to record the "songs" of these waves, turning up the volume on the soundtrack of the universe. Barnard College professor and astronomer **Janna Levin** shares her research on the first recordings of a gravitational wave from the collision of two black holes 1.3 billion years ago.

Origami Fest
Sunday, December 11
30-minute sessions
from **10:30 am to 2:30 pm**
$5 per person; registration
required
Fold, crease, and create an assortment of origami models with a team of volunteers from OrigamiUSA. Enjoy a display of some of the organization's most complex creations, snack on milk and cookies, and take home a collection of your own models for the holidays.

The Twisted Universe
Monday, December 12
7:30 pm
$12
Professor **Brian Keating** leads this exploration of mysteries in cosmology from the nature of space to concepts such as the "Arrow of Time."

Dinos After Dark
Friday, December 16
$35 (two drinks included)
21+ with ID
Go back in time for a prehistoric party in the Museum's celebrated dinosaur halls. Have a chance to toast The Titanosaur during an exciting evening of expert talks, demonstrations, and after-hours access to *Dinosaurs Among Us*. Wander freely, with cocktail in hand, and come face-to-face with dinos after dark.

Winter Solstice Telescope Party
Wednesday, December 21
7 pm
$12
Join **Steve Beyer, Brian Levine,** and **Ted Williams** for a sneak peek at the celestial objects that appear in our winter sky. Begin the evening by learning the techniques of observation from inside the Hayden Planetarium Space Theater. Then, weather permitting, head out to the Arthur Ross Terrace to look through telescopes.



Dark Universe
Narrated by Neil DeGrasse Tyson, the 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 more.

Credits

Major funding for ¡Cuba! *has been provided by the* **Lila Wallace-Reader's Digest Endowment Fund.**

Generous support for ¡Cuba! *has been provided by the* Dalio Ocean Initiative.

The Ford Foundation has also committed to supporting ¡Cuba!

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

Dinosaurs Among Us *is proudly supported by* **Chase Private Client.**

Additional support is generously provided by Dana and Virginia Randt.

Credits continue on p. 18

The Grand Tour
Tuesday, December 27
7 pm
$12
Do we hold a special place in the universe? Join **Brian Abbott** and **Ted Williams** to experience the entire observable universe and come to a cosmic understanding of where we are and how we came to be.

KWANZAA 2016: Songs for the Soul
Friday, December 30
Noon and 3 pm
Film Screening at **4:30 pm**
Free for Members or with Museum Admission
Milstein Hall of Ocean Life and Kaufmann Theater
American Idol champion **Ruben Studdard** sings all the right notes to usher in a year of renewed faith, love, and unity in his Museum debut. Hosted by **Linda Humes,** Museum festivities kick off with a performance by students from the **Celia Cruz Bronx High School of Music** and an international marketplace. A screening of *Let Freedom Sing: How Music Inspired the Civil Rights Movement* concludes the celebration.

Credits:

The Science of Stem Cells is supported by the Empire State Stem Cell Fund through New York State Department of Health Contract # DOH01-C30157GG-3450000.

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

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.

Student classes in the Sackler Educational Laboratory, offered through the Museum's Gottesman Center for Science Teaching & Learning, are made possible by a generous grant from The Mortimer D. Sackler Foundation, Inc. and The Spitzer Hall of Human Origins' lead benefactors Anne and Bernard Spitzer.

The Annual IRIS/SSA Lecture Series is presented in collaboration with the Incorporated Research Institutions for Seismology and the Seismological Society of America.

The Hackathon is part of BridgeUp: STEM, an initiative educating youth and the public about cutting-edge computing in scientific research and science communication.

BridgeUp: STEM is generously supported by a grant from the Helen Gurley Brown Trust.

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

The Margaret Mead Film Festival is made possible by the New York State Council on the Arts with the support of Governor Andrew M. Cuomo and the New York State Legislature.

Support for Celebrate Culture, the Margaret Mead Film Festival, and Kwanzaa 2016: Songs for the Soul is provided, in part, by the May and Samuel Rudin Family Foundation, Inc.; the Sidney, Milton and Leoma Simon Foundation; the family of Frederick H. Leonhardt; and The Max and Victoria Dreyfus Foundation.

Kwanzaa 2016 is co-presented by Community Works and New Heritage Theatre Group.

The Kwanzaa marketplace is organized by the Harlem Arts Alliance.

With special thanks to Whole Foods Market.

Credits continued from p. 17

Crocs: Ancient Predators in a Modern World *was created by* Peeling Productions *at Clyde Peeling's REPTILAND.*

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

Countdown to Zero *is presented by the American Museum of Natural History in collaboration with The Carter Center.*

Countdown to Zero *is proudly supported by Conrad N. Hilton Foundation, Lions Clubs International Foundation, Mectizan Donation Program, and Vestergaard.*

This exhibition is made possible by the generosity of the Arthur Ross Foundation.

Wonders of the Arctic *is a co-production of Science North and Giant Screen Films; major funding for the film was provided by Raglan Mine (a Glencore Company) and the Northern Ontario Heritage Fund Corporation.*

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.**

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.*

AMNH/D. Finnin, R. Mickens, A. Porzecanski, C. Raxworthy, with the exception of *Countdown to Zero* (The Carter Center/E. Staub), *Dinosaurs Among Us* (Z. Chuang/ Peking Natural Science Organization), *Crocs* (J. McDonald) *Salero* (M. Plunkett), Next-Generation Astronomy (NASA), and *Wonders of the Arctic* (D. Lickley)

October

1
SATURDAY
Celebrate Pacific Northwest Cultures
Family Program
First Saturdays through May 2017

The Science of Stem Cells
Family Program

2
SUNDAY
Hall Tour: The World of Crocodilians
Member Tour

3
MONDAY
Mapping the Heavens
Hayden Planetarium Program

4
TUESDAY
Fall Lunchtime Bird Walks in Central Park
Nature Walk

5
WEDNESDAY
SciCafe: Secrets of the Crocodile Mummies
After-hours Program

6
THURSDAY
What a Fish Knows: The Inner Lives of Our Underwater Cousins
Museum Lecture

8
SATURDAY
The Science of Stem Cells
Family Program

11
TUESDAY
Fall Lunchtime Bird Walks in Central Park
Nature Walk

13
THURSDAY
The 2016 Margaret Mead Film Festival
Through October 16

18
TUESDAY
Fall Lunchtime Bird Walks in Central Park
Nature Walk

22
SATURDAY
Family Astronomy
Hayden Planetarium Program

25
TUESDAY
Fall Lunchtime Bird Walks in Central Park
Nature Walk

Sci-Fi Universe
Hayden Planetarium Program

26
WEDNESDAY
Welcome to the Universe
Hayden Planetarium Program

29
SATURDAY
Live Bat Encounter
Member Program

November

2
WEDNESDAY
SciCafe: The Science of Predicting an Election
After-hours Program

5
SATURDAY
Meet the Scientist in the Lab
Family Program

Hall Tour: *Tyrannosaurus rex*
Member Program

7
MONDAY
Brain 101: The Inside Story
Mondays through December 4

The Remarkable Nature of Edward Lear
Museum Lecture

10
THURSDAY
Yes, Humans Are Causing Earthquakes
Museum Lecture

18
FRIDAY
Member Preview Begins: *¡Cuba!*
Member Program

19
SATURDAY
Seismodome: Sights and Sounds of Earthquakes and Global Seismology
Hayden Planetarium Program

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SUNDAY
Hackathon: Hack the Stacks
Family Program

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After-hours Program
Eight Tuesdays through January 24, 2017

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TUESDAY
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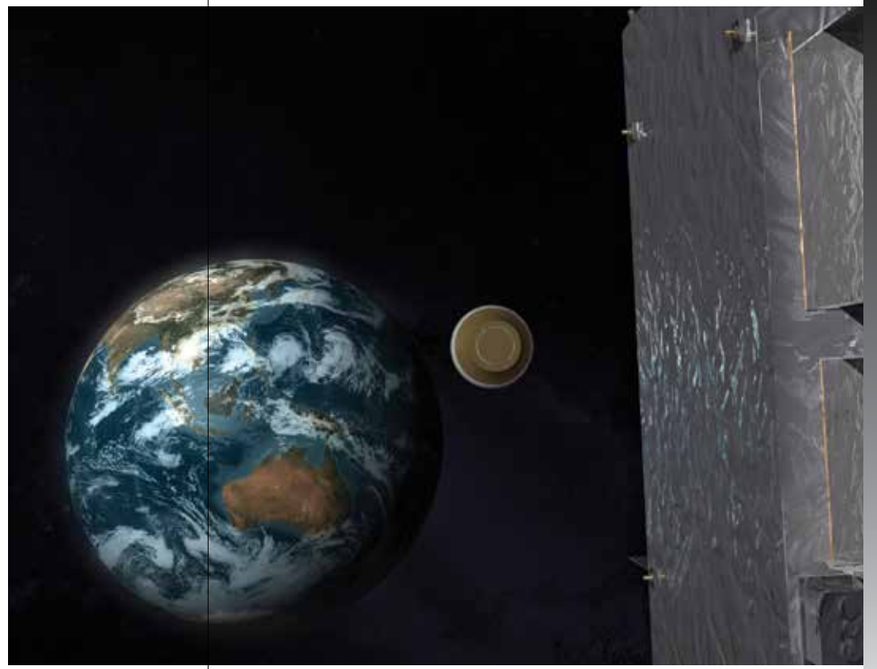
Hayden Planetarium Program

30
FRIDAY
KWANZAA 2016: Songs for the Soul
Family Program

The Long Haul



(left) Rendering of OSIRIS-REx deploying its sampling arm near the asteroid Bennu. (right) A return capsule will journey back to Earth with samples.

Mission Timeline

From planning to execution to return, the OSIRIS-REx mission will take more than 12 years. Here are highlights of how events unfold. →

2011

May 25, 2011: OSIRIS-REx mission announced.

2012

2013

April 9, 2014: OSIRIS-REx passes critical design review.

March 30, 2015: Spacecraft building begins.

2014

2015

May 27, 2016: Final launch prep begins at Kennedy Space Center, Florida.

September 8, 2016: OSIRIS-REx mission launches.

2016

2017

August 17, 2018: Arrival at Bennu.

2018

November 19, 2018: Survey of Bennu begins.

2019

August 15, 2019: OSIRIS-REx begins phase to choose a sample site.

July 4, 2020: Touch-and-go maneuver collects sample.

2020

2021

March 4, 2021: Window for departing Bennu opens.

2022

2023

September 24, 2023: Sample return capsule lands by parachute in the Utah desert.

Asteroid reconnaissance is not for the impatient–something geologist Harold C. Connolly, Jr., knows well.

It's been five and a half years since Connolly, a research associate in the Museum's Department of Earth and Planetary Sciences, was appointed to oversee the analysis of samples for OSIRIS-REx–the first U.S. mission to gather material from an asteroid. If the mission, which launched this September, goes according to plan, the NASA spacecraft will arrive at the asteroid Bennu in 2018 to spend a year and a half photographing and mapping this massive space rock. In 2020, a robotic arm will touch down on the surface to gather soil samples in the course of just a few seconds. Only in September 2023 will the work of studying the samples back on Earth begin.

Dr. Connolly isn't daunted by the wait. "It's what the process of exploring is about," he says.

Bennu is of particular interest to scientists because it has a high probability of crashing into Earth in the late 22nd century, and better understanding its nature is critical to possibly deflecting it. It is also a rare type-B asteroid, carbon-rich and composed of materials relatively unchanged since it formed more than 4.5 billion years ago. Researchers hope that surface samples will contain prebiotic organic compounds that can offer clues not just to the formation of our solar system but to the origin of Earth's oceans and earliest life.

Since the technology used to study the samples–CT scanning, electron beam imaging, mass spectrometry–is developing at a fast clip, the duration of the mission means scientists will have even better tools by the time Bennu specimens arrive on Earth.

"Already, the ability to look at really small things is astonishing," says Curator Denton Ebel, who analyzes the makeup of meteorites, pieces of asteroids that have landed on Earth. "We can look at pre-solar grains, truly stardust, found in meteorites."

Unlike studies of meteorites, the capture of samples in space offers scientists the rare opportunity to work with "pristine" specimens that haven't been altered by the heat and shock of traveling through Earth's atmosphere. The first asteroid-retrieval mission, led by the Japanese Aerospace Exploration Agency, brought samples from the asteroid Itokawa to Earth in July 2010. Connolly currently serves as one of several American co-investigators on the second mission, to asteroid Ryugu, which launched in 2014. Several Japanese co-investigators are also working on OSIRIS-REx.

One of the main tasks for Connolly and the OSIRIS-REx team following this fall's launch will be to determine the safest, most promising sampling site–a job complicated by the fact that Bennu is not a monolithic rock but more of "a rubble pile": a conglomeration of smaller rocks continuously pulling apart and moving back together again as Bennu revolves at the relatively fast speed of one rotation per four Earth hours. The yearlong mapping is essential to selecting the site, after which the spacecraft will have up to three tries to retrieve at least 2.1 ounces (60 grams) or up to 4.4 pounds (2 kilograms) of samples that may hold invaluable insights into our solar system and the emergence of life on Earth.

Says Connolly, who is also founding chair of geology at Rowan University, "Rocks are books. The pages are minerals. They tell us a story–how they were formed, where they were formed, what's happened to them since."

Meet the (Asteroid) Scientist

Harold Connolly was obsessed with rocks as a child. When he was five, his grandfather noticed this interest and told him that there are people who study rocks for a living—and that they're called geologists. Connolly was also inspired by his 9th-grade Earth science teacher, and by the time he graduated high school, his yearbook caption read: *Will study geology, become a geologist, and teach geology.* In college, Connolly did study geology, but also paleontology and, at the suggestion of an advisor, wrote not one but two senior theses—one in invertebrate paleontology on Devonian invertebrates and the other on chondrule formation in meteorites. His fate was sealed. "I discovered that what I was in love with was [deep] time," says Connolly. "And the ultimate fossil is a meteorite."

Sharing Space

As OSIRIS-REx wends its way to the asteroid Bennu, the Museum will be able to share accurate-to-the-second visualizations of its journey through a unique collaboration with NASA: OpenSpace.

This open source software program draws on constantly updated data generated by NASA space explorations and builds on the Museum's experience of translating scientific data into stunning imagery—think Hayden Planetarium Space Shows—to create engaging public presentations.

Numerous scientific institutions, including universities, other museums, and various NASA entities are involved in the development and dissemination of OpenSpace with a view to increasing scientific literacy through public programs and, eventually, shared access for high school teachers and others online.

Over the course of the OSIRIS-REx mission, the Museum's visualization team will be updating the visualization with images of Bennu's surface taken by the spacecraft.

More OpenSpace-powered events are in the works, too. The team is currently working on a presentation to visualize global change, tentatively scheduled for April 21 as a celebration of Earth Day. Stay tuned!

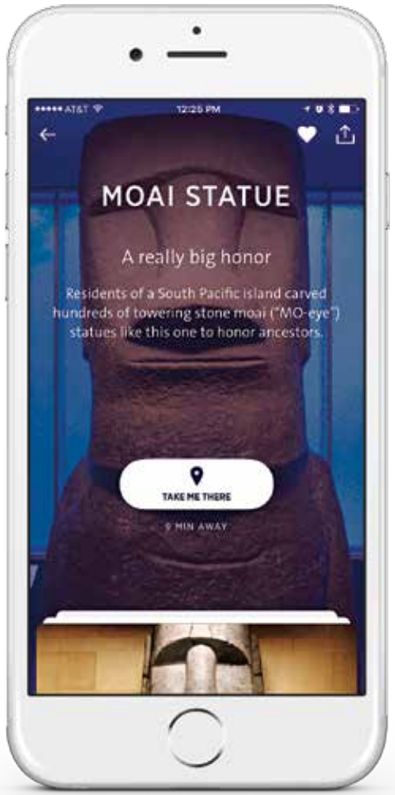
OpenSpace is based upon work supported by NASA under award No NNX16AB93A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.

2016 By the Numbers

From microscopic life to massive dinosaurs, from pressing public health concerns to the exploration of outer space, the Museum's exhibitions, research, and education initiatives ranged far and wide in 2016. None of this would happen without the support of our Members.

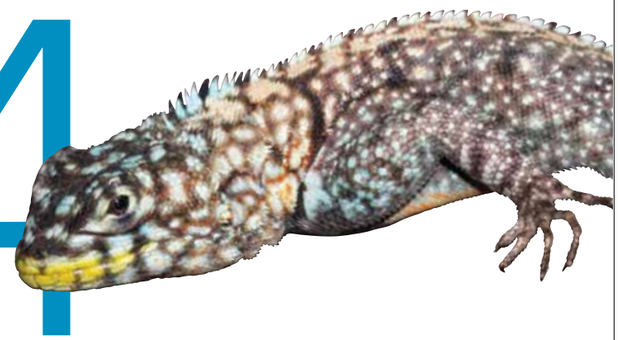
What this institution means to visitors, educators, and scientists can seem abstract at times. But whether it's behind-the-scenes science, innovative learning experiences, or groundbreaking new exhibitions, your support makes everything we do possible.

The full impact of the work you support is immeasurable, but there are some things we can quantify—things that every Member can point to and say "I helped make that!" Here are just a couple, presented with our thanks.



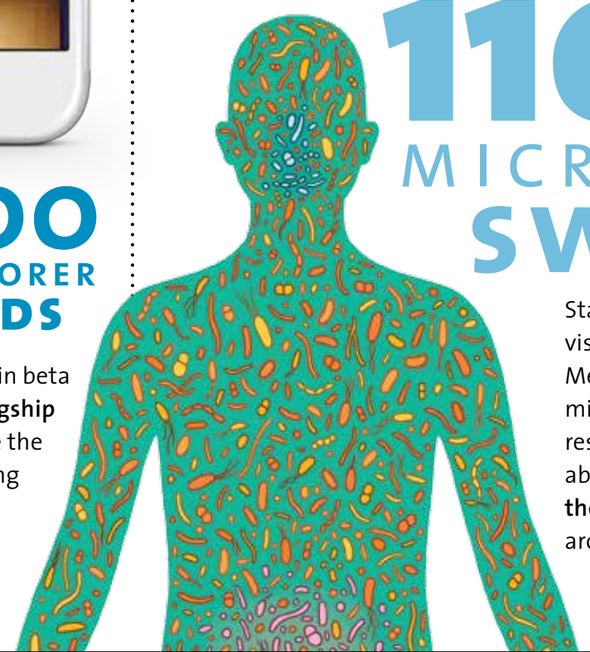
110,000 EXPLORER DOWNLOADS

Revamped and relaunched in beta in March, the Museum's **flagship app** offers a new way to see the halls, whether you're walking through them or checking in from across the world.



4 NEW LIZARD SPECIES

Richard Gilder Graduate School Ph.D.-degree student **André Carvalho** described four new lizard species—including ***Tropidurus lagunablanca,*** pictured—encountered during his fieldwork in South America.



1100+ MICROBIAL SWABS

Starting in May, Museum visitors—including many Members—donated their microbial samples to help researchers learn more about the makeup of **the human microbiome** around the world.

122 FEET OF TITANOSAUR

The newest addition to the fourth-floor fossil halls became an **instant icon.**

65 MAT ALUMS IN CLASSROOMS

13 students began the **Museum's Masters of Arts in Teaching** program as it entered its sixth year this summer, joining the 65 alums already teaching in schools all over New York.

40 YEARS OF MEAD

This October, the 2016 Margaret Mead Film Festival marks a milestone as a preeminent showcase for **international documentary films.**

Clockwise from top left: © AMNH, A. Carvalho, AMNH/D. Finnin, McDonald Wildlife Photography, Felix & Paul Studios, AMNH/G. D'Alessandro

4 CROCODILE SPECIES

Crocs: Ancient Predators in a Modern World brought live crocodilians to the Museum, including adorable American alligator babies and a rare dwarf crocodile.

2017: ANOTHER GREAT YEAR

Reaffirm your vital role as an advocate for science and education by making a tax-deductible gift today to the **Museum's Annual Fund** at amnh.org/annualfund.

American Museum of Natural History
Membership

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

Cover © iStockPhoto/sdbower

The special exhibition *¡Cuba!* opens for Member Preview Days on November 18. Come explore the extraordinary biodiversity of the island's remote forests, deep caves, expansive wetlands, and dazzling reefs, as well as Cuba's culture and history. Live animals on display include the brown anole, featured on the cover of this issue.

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, Planetarium Shop, Cosmic Shop, ¡Cuba! Shop, Dinosaurs Among Us 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 at the Museum, email accessibility@amnh.org or call 212-313-7565.