MEET YOUR MICROBES

THE SECRET WORLD INSIDE YOU
OPENS NOVEMBER 7

EXPLORING CUBA
From the President
Ellen V. Futter

Fall means "back to school," and this year that phrase has new and deeper meaning at the Museum. Since 2011, we have been offering a Master of Arts in Teaching program in partnership with the Regents of the University of the State of New York. To date, 36 Kathryn W. Davis Teaching Fellows have graduated and are now teaching Earth and space science in high needs schools in New York State. This innovative Master's degree is the only such museum-based program in the country that is not affiliated with a university. Until recently, it has been operating in a pilot phase, and graduates have received their Master's degrees from the Regents. I am pleased to report that this summer, the Regents, by unanimous vote, authorize the Museum to formalize this program under the auspices of our Richard Gilder Graduate School. Beginning with the class that enters in 2016, the Gilder Graduate School will confer the Master's degree, along with the Ph.D. degree in comparative biology that the Museum has been authorized to grant since 2006.

This milestone not only validates our strategic vision to deepen and extend our longstanding work in teacher preparation but also signals the State's confidence in our ability to provide a non-traditional, innovative, and uniquely effective solution to improving science teaching.

And so, at the Gilder Graduate School's Commencement this fall--our third--we will celebrate the Museum's increasingly prominent formal role in higher education while saluting the achievement of another cohort of doctoral students earning Ph.D. degrees in comparative biology and Teaching Fellows receiving Master of Arts degrees in teaching. And we will very proudly send these bright young scientists and science teachers into a world that so sorely needs them.

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Renovated Space Theater Reopens Next Month

The Hayden Planetarium's Space Theater, which has been closed since mid-August while undergoing renovation, will reopen November 24 with a few improvements you won't want to miss. While the updates include new carpet and refurbished seats, the main attraction in the 425-seat theater will be a state-of-the-art screen that will ensure the Hayden Planetarium’s award-winning Space Shows—including Dark Universe, which returns to view—are displayed to their full advantage. The Space Theater’s last screen, which was installed in 2000, has been a limiting optical factor for the dome, says Director of Rose Center Engineering Benji Berhardt. That’s due to the small but noticeable seams that hold it together.

The new screen is built from sheets of aluminum and coated with powder to give it a startling white hue that makes it an ideal backdrop for planetarium projections. It’s held together by invisible “nanoseams” that make each of the pieces flush with one another, rather than overlapping. When a projection is shown on the dome, the seams disappear entirely, creating a fuller sense of reality and immersion for viewers.

And while doors have been closed for the addition of the new screen, other upgrades have been going on too, all supported by the Charles Hayden Foundation. A new LED lighting system will be installed to cut heat generation and energy costs for lighting the dome, and the projector will be getting updated as well.

Dark Universe Returns Nov. 24

When the Hayden Planetarium Space Theater reopens in November, it’s coming back with a bang—the Big Bang, in fact. The Museum’s latest Space Show, Dark Universe, returns to view this fall. In Dark Universe, astrophysicist and Frederick P. Rose Director of the Hayden Planetarium Neil deGrasse Tyson is your guide on a trip through space and time, from the Big Bang to a telescope in modern-day California. The destination: two recently discovered, and still mysterious, phenomena in astrophysics—dark matter and dark energy. Finding out more about dark energy and dark matter is key to understanding the nature of the world we live in.

In running scenes based on scientific data—including a NASA probe’s breathtaking plunge into Jupiter’s atmosphere and groundbreaking visualizations of unsolvable dark matter—Dark Universe explores this new era of cosmic discovery and reveals the mysteries that have been brought to light so far.

Please see page 4 for crediting information.
An Amazing Amphibian

The Museum hosts a wide variety of live animals in exhibitions, including several species of butterflies and spiders currently starring in special exhibitions. But this fall, Members can also get a close look at the astonishing salamander known as the axolotl (Ambystoma mexicanum).

Perhaps the most impressive quality possessed by axolotls is their incredible response to injury. These amazing amphibians have shown themselves capable of fantastic recovery, regenerating limbs and bouncing back from wounds without so much as a scar. Axolotls can even recover from trauma as grievous as a crushed spinal cord.

To perform these seemingly miraculous feats, the axolotl’s cells do an impressive bit of time travel. Near an injury like an amputated limb or tail, the cells undergo a process called de-differentiation: they lose their characteristics—the defining traits that make them skin cells or bone cells—and return to a state like that of stem cells, early cellular forms that can become any cell type.

Next, a structure called a blastema forms at the injury site, creating a kind of cap over the injured tissue. This blastema becomes the scaffolding for a new limb, where undifferentiated cells can congregate and get to the work of restoring the damaged—or even missing—tissue. Eventually, the blastema transforms into a functioning version of the lost limb. Since there’s no scarring, it’s difficult to tell anything had been missing.

Now researchers are studying the axolotl’s regenerative abilities to learn about which genes and proteins are involved in the process. The hope is that these lessons could one day be put to work to improve human healing.

See live axolotls in Life at the Limits, which is free for Members at the $105 Membership level and above.

Clues for Conservation

For the last few months, Museum conservators have been working to treat and rehouse rare articles of clothing collected in Siberia more than a century ago during the Jesup North Pacific Expedition. Led by Franz Boas, who set out to study the cultures of indigenous peoples on both sides of the Bering Strait, the expedition team collected more than 5,000 items.

“This is one of our largest and oldest collections, regularly accessed by researchers from around the world,” says Judith Levinson, director of conservation in the Museum’s Division of Anthropology.

The collection includes two bridal coats made by the Sakha people, which Sakha scholar Zinaida Ivanova-Unarova suggests were made by a mother to guard her daughters as they were about to wed and begin families of their own. Each coat includes an eagle-shaped insignia on the back, possibly a family crest that symbolized this protective quality.

To better understand how these objects were made, conservators Jessica Pace and Amy Tjiong tapped into the expertise of colleagues from entirely different fields: mammalogy and genetics. They first turned to Neil Duncan, collections manager in the Department of Mammalogy, who provided hairs from hides of known origin in the Museum’s collection. Conservators used these to compare to hairs from the coats in order to identify the animals from which the coats were made. By looking at both samples under a microscope, Pace and Tjiong could examine the smallest details, like the hairs’ scaling. The conservators also worked with technicain Rebecca Hersch in the Museum’s Sackler Institute for Comparative Genomics to extract DNA from the hairs to confirm the identifications, which determine how the objects are treated.

As they work to preserve these artifacts, a project supported by the Stockman Foundation Trust and the Institute of Museum and Library Services, Pace and Tjiong will also update the original collection records for future researchers.

Learn more at bit.ly/SiberianCollections.

Comprehensive Collection

Even more impressive than the quantity of material collected by the Jesup North Pacific Expedition, which took place from 1897 to 1902, is its breadth. Collections range from photographs and models of dwellings to animal pelts and recordings—made on wax cylinders—of the languages of indigenous peoples.

Preserving Tradition

After being repressed under the Russian Empire and Soviet regime, Sakha culture has undergone a revival in recent decades. During this period, numerous craftsmen and scholars have traveled from Siberia to study the Museum’s collection and to consult with conservators.

Playing Favorites?

One of the two bridal coats is fashioned from horse hide, while the other is crafted from reindeer hide. The white reindeer coat may have been made for a favored daughter in the family, but that’s a conjecture not even DNA analysis can confirm.

Information Exchange

When researchers come from around the world to study the Siberian collection, they can also offer vital information. For example, visiting consultants helped conservators understand the provenance of these bridal coats.

Reindeer Games

Reindeer still play a central role in Sakha culture and life. The animals are celebrated at Sakha festivals and used for their hides, as well as for meat, milk, and transportation.
Your body hosts a vast array of microscopic life that researchers are only just beginning to understand.

Physical contact—like the bumping during a roller derby bout—can change the plethora of microorganisms living on an individual’s skin.
The Secret World Inside You

What’s Inside You?

Our bodies are home to approximately 100 trillion bacteria living inside us and on us—a vast community known as our microbiome. Fascinating new research is revealing how many of these microbes work with the body to manufacture vitamins, boost our immune system, and even affect how we feel.

Our secret world inside you

What’s Inside You?

Our bodies host trillions of microbial life forms, too small to see but vitally important to our lives and health. You can get a tour through the amazing ecosystems present in all of us in the Museum’s latest exhibition, The Secret World Inside You.

Making a Microbiome

Our microbiome begins forming before we’re born, and it grows and changes with us over the course of our lives. It reflects the places we go and the things we do, and, like fingerprints, irises, and DNA profiles, no two human microbiomes are the same.

We model our genes from both parents, early studies have suggested that our first microorganisms are gifts from our mothers. During pregnancy, women’s gut and reproductive microbiomes undergo a series of changes, some of which seem to help weight gain during pregnancy and others that appear to stabilize the microbial inheritance that the baby receives first in the womb, and then again when it passes through the birth canal.

Skin-to-skin contact introduces infants to additional microbiomes. And breast milk turns out to be a bacterial brew, with more than 700 microbial species delivered directly to the baby. In addition to bacteria, breast milk contains sugars that can’t be digested by humans—and so appear to be included specifically to feed and nurture the baby’s early microbial hangovers.

While we get our first microbes from mom, these populations are always changing. Touching a doorknob or riding public transit can introduce new microbes to your skin microbiome, for example. And, as it turns out, other people can literally rub off on you. A 2015 study of roller derby competitors found that after a match—which, as derby fans know, involves lots of physical contact—the skin microbiomes of the players had temporarily become more similar than before. All that bumping and jostling provided the perfect way for microbial populations to exchange with each other.

Even changing your diet can alter your microbiome, providing food that is better for some microbial communities and helping them thrive, and worse for others, which may be hampered or defeated completely. These changes to microbial populations can happen especially quickly in the human gut, which hosts the vast majority of the body’s microbes.

Just four days on a new diet—one that’s exclusively vegetarian, or entirely based on animal products—may be enough to radically reshape the bacterial population of your gut.

Microbes with merit

The makeup of your bacterial team isn’t totally understood yet, but studies (done mostly in model animals, like mice) suggest that the microbiome plays a major role in human health, from immune system response to inclination towards obesity. (For more, see the story on p. 10.) Studies have even found that microbiomes can have an effect on the moods of mice, suggesting that the bacteria in our gut could similarly play a role in conditions like depression.

Getting a better understanding of just how these bacteria work in our bodies, and what the balance of different bacterial communities needs to be, is turning out to be one of the more pressing issues in human health. The early results, though, have researchers questioning the wisdom of overusing products like antibacterial hand sanitizers, which can wipe out all bacteria on the patch of skin being “cleaned,” good and bad alike. When you carpet-bomb bacteria that way, you could be taking out innocuous microbes and giving detrimental ones the opportunity to dominate your ecosystem.

The same principle is fueling new questions about antibiotic use—and overuse. Researchers like Martin Blaser at New York University have conducted studies suggesting that rapidly increasing antibiotic use in the United States may be connected to high obesity rates and other unforeseen effects. Some doctors are also beginning to prescribe probiotics—substances that can feed and strengthen the microbes in your gut—alongside antibiotics, a practice that studies have suggested can alleviate the stomach problems sometimes associated with antibiotic use.

There are other concerns as well. While microbiomes can change over time, the microbiota population of humans in industrialized nations seems to be getting less diverse. Earlier this year, researchers took samples of the microbiomes of members of the Yanomami tribe, a people living in the Amazon rain forest who have had minimal contact with the modern world. The 54 members of the Yanomami who were tested provided researchers with an incredibly varied swatch of microbial life.

That diversity, which may be attributable to the Yanomami’s lack of exposure to antibiotics and to their hunter-gatherer lifestyle, could provide a window into the pre-industrial past, letting us see what our microbiomes may have looked like before penicillin, processed foods, and, yes, Purell.

The special exhibition The Secret World Inside You opens November 7 and is free for Members at the $105 level and above.
SUPPORTING PLAYERS

ARE YOUR BODY’S BACTERIA FRIEND OR FOE, PATHogen OR PROTECTOR? IT’S COMPLICATED.

Perhaps not surprisingly, skin, our interface with the world, supports the body’s most diverse population of bacteria. There are at least 1,000 different species found on skin, along with dozens of fungi and other microbes. Most of these bacteria aren’t harmful, and many serve a protective function. They live among the dead skin cells that make up the outer layer of our skin while defending their own turf against other microbes. One strain of the bacterium *Bacillus subtilis*, which is sometimes found on the skin, produces bacitracin—a common ingredient in many over-the-counter antibiotic ointments. *B. subtilis* also releases toxic chemicals to kill fungus, possibly including *Trichophyton interdigitale* and other species that cause athlete’s foot.

**GUT FEELING**

In the mid-1980s, internist Barry J. Marshall tested, and proved, his theory that ulcers could be cured with antibiotics by infecting himself with the corkscrew-shaped bacterium *Helicobacter pylori*. This not only earned him the nickname “guinea-pig doctor” but also the Nobel Prize, which he shared in 2005 with pathologist J. Robin Warren for their discovery of *H. pylori*. Their work led to the near-eradication of stomach ulcers in developed countries through treatment with antibiotics, as well as to a drop in stomach cancers, for which gastritis is a risk factor. But as welcome as these cures are, researchers now think *H. pylori* isn’t just a pathogen. Studies strongly suggest that it is essential to the prevention of asthma, allergies, gastroesophageal reflux disease, and esophageal cancer.

**SKIN DEEP**

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Who isn’t familiar with the dreaded strep throat? An extremely painful form of pharyngitis, or inflammation of the back of the throat, it’s caused by the bacterium *Streptococcus pyogenes*—hence its name—which is also the culprit in rheumatic heart disease. But there are more than 50 recognized species of *Streptococcus*, many of them regular denizens of the human mouth, respiratory tract, and elsewhere. Some, like *S. pyogenes*, are proven pathogens, the cause of everything from cavities (*S. mutans*) to pneumonia (*S. pneumoniae*). But others seem to do no harm and may even help by working against troublesome strains of fellow streptococci. *Streptococcus salivarius*, for example, which is found in the human mouth and respiratory tract, can be dangerous, even lethal, in people with weakened immune systems in the rare event it escapes outside the oral cavity. But in the mouth, it appears to help prevent both gum disease and tooth decay. When cultured side by side in the lab, *S. salivarius* inhibited the formation of decay-causing plaque by *S. mutans*.

**LOOK, MA, NO CAVITIES!**

The gut, as you might say, has your back. Here are thousands of species of bacteria inhabiting our bodies, but researchers are only beginning to understand the complex relationships among them—and between them and us. Some are known to act as disease-causing pathogens. Others not only appear to work against less beneficial bacterial brethren, but also to work for us in a variety of ways, from aiding digestion to protecting our teeth.

It’s a complicated dynamic, but it seems that some microbes can be good or bad, depending on the size of their population and on conditions in their ecosystem; the balance is key. **Balance.** Maintaining a healthy equilibrium in their ecosystem, the human body. The key? They live among the dead skin cells that make up the outer layer of our skin while defending their own turf against other microbes. One strain of the bacterium *Bacillus subtilis*, which is sometimes found on the skin, produces bacitracin—a common ingredient in many over-the-counter antibiotic ointments. *B. subtilis* also releases toxic chemicals to kill fungus, possibly including *Trichophyton interdigitale* and other species that cause athlete’s foot.

**COLON COLONY**

By far the largest population of bacteria in the human body is found in the colon. The majority are anaerobic, which means they don’t require oxygen and, of these, species of the genus *Bacteroides* are among the most common. Outside the gut, strains of *Bacteroides* can cause abscesses in the abdomen, brain, liver, pelvis, and lungs, as well as bacteremia or infection of the bloodstream. But in the colon, they serve important functions, breaking down carbohydrates, producing enzymes specifically designed to deal with different foods, and extracting energy from those foods. One species, *B. fragilis*, appears to stimulate immune cells called regulatory T-cells, which restrain aggressive inflammatory T-cells that can trigger colitis and other disorders. Researchers are also beginning to tease out the possible relationship between the overall makeup of a person’s gut microbeome and a propensity toward obesity. In any case, the usefulness and ubiquity of bacteria in the colon probably can’t be overstated. Three-quarters of human feces is water and, of the remaining quarter, one-third is composed of bacteria—or as Giulia Enders, author of *Gut: The Inside Story of Our Body’s Most Underrated Organ*, describes them, “gut flora that ended their careers in the digestive business and are ready to retire from the workplace.”

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**Make Your Own Microbial Medley**

**A Famous Investigation You Can Do at Home**

The poet William Blake prodded us to "see a world in a grain of sand," and this simple project does just that—only with a cupful of mud! Just add a few other easy-to-find ingredients to create an entire ecosystem for bacteria called a Winogradsky column, named for a Russian microbiologist. Over several weeks, different species will separate into visible layers depending on how they use—or don’t use—oxygen, light, and nutrients such as carbon or sulfur. It’s a living lesson in how the bacteria that inhabit our bodies break down foods to give us energy. Or, as Rob DeSalle, co-curator of the special exhibition The Secret World Inside You, likes to say: "The human digestive tract is one huge Winogradsky column."

**The Secret World Inside You**

The human digestive co-curator of the special exhibition way the bacteria that inhabit our bodies break down foods to give us energy. Or as Rob DeSalle, microbes play an essential role in the life cycle as they reuse and recycle nutrients, not unlike the use—or don’t use—oxygen, light, and nutrients such as carbon or sulfur. It's a living lesson in how microbes play an essential role in the life cycle as they reuse and recycle nutrients, not unlike the way the bacteria that inhabit our bodies break down foods to give us energy. Or as Rob DeSalle, co-curator of the special exhibition The Secret World Inside You, likes to say: "The human digestive tract is one huge Winogradsky column."

**How to Construct the Column**

**1. Dig mud from top layer of pond, puddle, or riverbed. Remove rocks, twigs, and other solids.**

**2. Cut off the top of the bottle and save as a funnel for the mud.**

**3. Spoon egg-paper-mud mixture through funnel; tapping bottle on table occasionally to remove air pockets as mud settles. In same way, top with reserved mud.**

**4. Add an inch or so of water, leaving air at the top.**

**5. Cover with plastic wrap and secure with a rubber band.**

**6. Place your column near a brightly lit window but not in direct sunlight.**

**7. Over the next six to eight weeks, watch for various color bands to form. At least once a week, on the same day, take photos for comparison, being careful to note the day and time the photo was taken.**

**Keep a Log**

Over the next six to eight weeks, watch for various color bands to form. At least once a week, on the same day and at the same time, write down any changes you see, including colors, the movement or thickening of sediment, and any differences between the side facing the light and the one facing away. Take photos for comparison, being careful to note the day and time the photo was taken.

**What is Going On?**

Some bacteria in the mud get their nutrients by breaking down the newspaper and the egg yolk, releasing carbon dioxide and hydrogen sulfide, respectively. A chain of consumption and conversion is set off and down the column, as bacteria break down compounds and recycle carbon, hydrogen, sulfur, and oxygen according to need. Bacteria that require oxygen (aerobic bacteria) will thrive toward the top of the column, while those that only tolerate it or cannot abide it at all (anaerobic bacteria) will proliferate in the lower sections. This idealized version illustrates the various layers that might form.

**Cyanobacteria**

About two billion years ago, bacteria like these appeared and produced the oxygen-rich atmosphere that paved the way for green plants and other life on Earth. They use sunlight, carbon, and hydrogen to produce energy while giving off oxygen.

**Purple Non-Sulfur Bacteria**

Purple non-sulfur bacteria, anaerobic bacteria that come in a range of colors, derive their energy from sunlight and carbon.

**Purple and Green Sulfur Bacteria**

Purple and green sulfur bacteria, also anaerobes, use light, carbon, and hydrogen.

**Sulfate-Reducing Bacteria**

Anaerobic sulfate-reducing bacteria consume the egg yolk, releasing hydrogen sulfide, which, not surprisingly, smells like rotten eggs and is definitely not for human consumption! These bacteria are the ones that thrived for the first two to four billion years of life on the planet, before the appearance of cyanobacteria.

**Want More Winogradsky?**

The Museum’s science website for kids, Ology, is launching a new section this month. Visit amnh.org/ology/microbiology for more Winogradsky column projects and to learn more about the human microbiome.
Programs and Events

October

Behind the Scenes: Sackler Institute for Comparative Genomics
Thursday, October 15
1:30–3:30 pm
$10

Director George Amato and Collections Manager Julie Feinstein lead a rare tour of the Sackler Institute for Comparative Genomics, a state-of-the-art facility devoted to genomic research. Explore the Museum’s frozen-tissue collections, view equipment used in labs, and learn about current research being conducted by Museum scientists.

SciCafe: Seeing Inside Bats
Wednesday, October 17
7 pm
Free for 21+ with ID

Join Curator Nancy Simmons and postdoctoral fellow Abigail Curtis from the Museum’s Department of Mammalogy for an exciting journey inside the world (and bodies!) of bats. Using CT-scanning technology, Simmons and Curtis are taking a new look at bat skeletons from their wrists to their sinuses.

Birding in Green-Wood Cemetery with Paul Sweet
Saturday, October 17
10 am–11 pm
$35

Observe the fall migration at Green-Wood Cemetery with Ornithology Collections Manager Paul Sweet. Green-Wood Cemetery hosts a colony of Monk parakeets and is also an ideal place to observe migrating birds, particularly raptors. With fall foliage in full color, many birds find sanctuary among the trees, shrubs, and graves of the cemetery.

Frontiers Lecture: From Mars to the Stars
Monday, October 19
7:30 pm
$12

Mars may be the only destination beyond the Moon to ever see human footprints. Join aerospace engineer Louis Friedman as he shares a provocative vision for the future of space travel. In his latest book, Friedman suggests that space travel will continue well into the future, human travel beyond Mars will become an obsolete idea, supplanted by evolving nanos and bio-technologies and by an ever-expanding information age.

The 2015 Margaret Mead Film Festival: Thresholds
October 22–25
Visit amnh.org/med for tickets and showtimes.

The annual Margaret Mead Film Festival is the preeminent showcase for contemporary cultural media and conversation in the unique setting of the Museum. In an era defined by mobility and transformation, the artists and filmmakers of this year’s festival explore boundaries of all kinds—geographic, cultural, personal, and metaphysical—that define contemporary life across Earth.

Questions for a Resilient Future: What Connects Culture and Conscience
Monday, October 26
6–8 pm
Free; reservations required

The Center for Humans and Nature’s Senior Scholars, anthropologist Melvin Konner and social psychologist Jonathan Haidt, will offer brief talks in response to the question: what are the connections between culture and conscience? They will further unravel their ideas in conversation with Krista Tippett, host of NPR’s On Being.

Thunder & Lightning: Weather Past, Present, Future
Thursday, October 29
6:30 pm
Free; reservations required

Lauren Redniss, author of Radioactive: Marie & Pierre Curie debuts her new title. Developed while she was an artist in residence at the Museum, Thunder & Lightning: Weather Past, Present, Future brings her unique style to a journey from the driest desert on Earth to an island in the Arctic and beyond.

Exhibitions

Admission is by timed entry only.

The Secret World Inside You
Free for Members at the $105 level and above
Explore the new world that’s being discovered in human bodies. New research shows that, rather than make us sick, many bacteria living in and on our bodies are often key to our health.

Life at the Limits: Stories of Amazing Species
Free for Members at the $105 level and above
Discover the diverse and jawdropping strategies animals and plants employ to find food, fend off predators, reproduce, and thrive in habitats we would find inhospitable, even lethal.

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

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**November**

**Sackler Brain Bench Brain: The Inside Story**

**Mondays, November 2–November 30**

6 pm–8 pm

$25

The brain is your window to the world around you. Join us for a five-part introductory course exploring the inner workings of this magnificent and mysterious organ with experts who will discuss the latest neuroscience research. Laura how the brain senses, feels, thinks, and ages.

**Live Bat Encounter**

Saturday, November 14

11 am (recommended for young children) 1 pm, 2:30 pm

$12

Get an up-close and personal introduction to live bats from around the world! Conservation biologist and bat expert Bob Mies will give an unforgettable presentation with live bats, including a Malayan flying fox, the world’s largest bat species.

**Frontiers Lecture: Spooky Action at a Distance**

Monday, November 9

7:30 pm

$12

“Spooky action,” the ability of one particle to affect another instantly across the vastness of space, appears to be almost magical. George Musser, author of Spooky Action at a Distance: Why Space and Time are Doomed and What It Means for Black Holes, the Big Bang, and Theories of Everything, sets out to explore the phenomenon.

**SciCafe: How the Brain Shows Its Feminine Side**

Wednesday, December 1

4:30–6:30 pm

Free

Join us and a Museum curator for a private viewing of our latest exhibition, The Secret World Inside You, at this exclusive event for Jesup Society members only. The Jesup Society honors those who have made bequests or life income donations. The Jesup Society is recommended for this course.

**IRIS Lecture: The Global Surge of Great Earthquakes**

Thursday, November 12

6:30 pm

Free; reservations required

Eighteen earthquakes of seismic magnitudes greater than 8.0 have struck around the world in just the past decade. Join Dr. Thorne Lay as he discusses how analysis of these earthquakes forced researchers to revise long-standing ideas about the behavior of huge built ruptures.

**Skilled in Spiders**

Saturday, December 12

10 am–noon

Free; reservations required

How do we know what the planet was like four billion years ago? What causes earthquakes and volcanoes? Join a Museum guide as you explore the planet’s surface. The exhibition include iridescent species in this ever-popular area, discussing the behavior of huge built ruptures.

**Hoyden Planetarium Space Show: Dark Universe**

November 24

Narrated by Neil de Grasse Tyson, the Space Show Dark Universe celebrates pivotal discoveries and the cosmic mysteries that remain. Gala up at the Milky Way from Mt. Wilson Observatory in California, plunge into Jupiter’s atmosphere with a NASA probe, and more.

**La Mer:**

Friday, November 6

9:30 am–10:30 am

Free; reservations required

Come discover the world of spiders. Get an up-close and personal introduction to live bats from around the world! Conservation biologist and bat expert Bob Mies will give an unforgettable presentation with live bats, including a Malayan flying fox, the world’s largest bat species.

**Jean-Michel Cousteau’s Secret Ocean**

Jean-Michel Cousteau’s Secret Ocean introduces audiences to more than 30 marine species and behaviors captured for the first time thanks to groundbreaking advances in underwater filming. Narrated by renowned oceanographer Sylvia Earle, this 40-minute giant screen film is shown in 2D and 3D.

**Family Bird Walks**

Saturday, December 5

9 am–11:30 am

Free

Explore the birds of Central Park with Museum naturalist Noah Burg. Young explorers will begin their adventure by learning the tools and skills of observation using Museum specimens. Then, head out to Central Park to identify the many bird species and habitats in our own backyard. Binoculars and bird guides are included. This program is recommended for families with children ages 4–10.

**Frontiers Lecture: Dark Matter and the Dinosaurs**

Monday, December 7

7–9 pm

Free for 21+ with ID

Join Museum Curator Emeritus Jack Horvath on a journey through the world of wine. Enjoy tastings and a grand tour of the secret world of wine.

**SciCafe: Mapping our Microbial Ecosystem**

Wednesday, December 2

7 pm

Free for 21+ with ID

It is estimated that Americans spend approximately 92 percent of their time indoors, yet we know little about the diversity of microbes that exist in this built environment. Geneticist and the Dinosaurs

**Spiders Alive!**

Saturday, November 7

10:30–noon

Free; reservations required

How did the Earth form? How did life begin? How did the world in just the past 10,000 years? Join Museum Curator Emeritus Jack Horvath on a journey through the world of wine. Enjoy tastings and a grand tour of the secret world of wine.

**Doomed and What It Means for Black Holes, the Big Bang, and Theories of Everything,**

Sets out to explore the phenomenon.

**The Scientists:**

Saturday, November 28

7 pm

Free

Two scientists are invited to see the new exhibition, The Secret World Inside You, at a special pre-opening private wine reception in the Akeley Hall of African Mammals. See page 8 for more information about the exhibition.

**Member Preview:**

The Secret World Inside You
Friday, November 6

4–8 pm

Free for Members at the $105 level and above; reservations required at 212-769-5606

Members are invited to see the new exhibition, The Secret World Inside You, at a special pre-opening private wine reception in the Akeley Hall of African Mammals.

**Highlights Tour:**

Hall of Planet Earth
Saturday, November 7

10:30–noon

Free; reservations required

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

**Origami Fest**

Sunday, December 13

10:30 am–2:30 pm

$5 reservations required

Fold, crease, and create an assortment of origami models with a team of volunteers from Origami SA. Enjoy a display of some of Origami SA’s most complex creations, suck on cookies and milk as you fold, and then take home a collection of your own making for the holidays.

**Hackathon**

Sunday, November 22

Free

The Museum’s Hackathon returns for a weekend of presentations, activities, and demonstrations highlighting the role computer science plays in studying, visualizing, and understanding science.

**Painting the Natural World**

Friday, December 11

7–9 pm

$260

In an after-hours painting workshop in the Akeley Hall of African Mammals, artists Eric Hamilton and Greg Follender 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 ability is recommended for this course.

**SciCafe: How the Brain Shows Its Feminine Side**

Wednesday, December 1

4:30–6:30 pm

RSVP required; call 212-769-5190 or email plannedgiving@amnh.org

Join us and a Museum curator for a private viewing of our latest exhibition, The Secret World Inside You, at this exclusive event for Jesup Society members only. The Jesup Society honors those who have made bequests or life income donations. The Jesup Society is recommended for this course.

**IRIS Lecture: The Global Surge of Great Earthquakes**

Thursday, November 12

6:30 pm

Free; reservations required

Eighteen earthquakes of seismic magnitudes greater than 8.0 have struck around the world in just the past decade. Join Dr. Thorne Lay as he discusses how analysis of these earthquakes forced researchers to revise long-standing ideas about the behavior of huge built ruptures.

**A Natural History of Wine**

Tuesday, November 17

6:30 pm

Free

Join Museum Curator Emeritus Ian Tattersall and Curator Rob DeSalle as they weave together their respective fields—palaeoanthropology and molecular biology—in an exciting journey through the world of wine. Enjoy tastings and a grand tour of the secret world of wine.

**SciCafe: Mapping our Microbial Ecosystem**

Wednesday, December 2

7 pm

Free for 21+ with ID

It is estimated that Americans spend approximately 92 percent of their time indoors, yet we know little about the diversity of microbes that exist in this built environment. Geneticist Jack Gilbert will discuss some of the most recent discoveries in this area, discussing the complexities of this research and providing a guide for understanding the microbiome and the role diet and lifestyle play in shaping this health resource.

**Frontiers Lecture: Dark Matter and the Dinosaurs**

Monday, December 7

7–9 pm

Free

Join physicist Lisa Randall as she discusses her book, Dark Matter and the Dinosaurs, which weaves together the histories of Earth and the larger cosmos.

**Hoyden Planetarium Space Show: Dark Universe**

November 24

Narrated by Neil de Grasse Tyson, the Space Show Dark Universe celebrates pivotal discoveries and the cosmic mysteries that remain. Gala up at the Milky Way from Mt. Wilson Observatory in California, plunge into Jupiter’s atmosphere with a NASA probe, and more.

**Exhibition Credits:**

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

Generous support for Life at the Limits has been provided by the Eileen P. Bernhard Exhibition Fund.

Life at the Limits is proudly supported by Chase Private Client.

The Secret World Inside You is supported by the Science Education Partnership Award (SEPA) program of the National Institutes of Health (NIH).

The presentation of Opulent Oceans: Extraordinary Scientific Illustrations from the Museum’s Library is made possible by the generosity of the Arthur Ross Foundation.

**Members-Only Highlights Tour**

Saturday, December 19

2–3 pm

Free; reservations required

Families are invited to take part in this tour for adults and children alike. Experts will guide you through the Museum’s halls to explore some family favorites.

Exhibition Credits:

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

Generous support for Life at the Limits has been provided by the Eileen P. Bernhard Exhibition Fund.

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The presentation of Opulent Oceans: Extraordinary Scientific Illustrations from the Museum’s Library is made possible by the generosity of the Arthur Ross Foundation.
Celebrate Culture! Kwanzaa 2015: Energize, Recognize! Sunday, December 27 Noon and 3 pm Free

Harlem native and “human beatbox” Doug E. Fresh rings in the new year at the Museum’s 57th annual Kwanzaa spectacular! Storyteller Linda Hurmes guides us through a celebration of the roots of the African-American community, drawing on seven universal principles. An international marketplace and a special film screening complete the Museum’s Kwanzaa festivities.

Support for Celebrate Culture Programs including the Margaret Mead Film Festival and Kwanzaa 2015 is provided, in part, by the May and Samuel Ruddin Family Foundation, Inc.; the Sidney, Milton and Leoma Simon Foundation, the family of Frederich H. Leonhardt; and The Max and Victoria Dreyfus Foundation.

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

The Hanukkah is part of Bridge3: STEM, an educational initiative focused on the interaction of cutting edge computing, scientific research, and science communication.

Bridge3: STEM is generously supported by a grant from the Helen Gurley Brown Trust.

Credits:
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 Schaeffer Family and the Helen W. Goldsmith Endowment Fund.

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.

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

Jean-Michel Cousteau’s Secret Ocean is directed by Jean-Michel Cousteau and produced by Ocean Futures Society and 3D Entertainment Films.

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

Made possible through the generous sponsorship of Accenture.

And proudly supported by Con Edison.

The Museum also gratefully acknowledges major funding from the Charles Hayden Foundation. Presented with special thanks to NASA and the National Science Foundation.

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

Exhibition Credits continue from page 17

Countdown to Zero is proudly supported by Conrail N. Hilton Foundation, Lions Club International Foundation, Metcalf Donation Program, and Vestergaard.

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

November

2 MONDAY Brain: The Inside Story Adult Course Mondays Through November 30

4 WEDNESDAY SciCafe: How the Brain Shows Its Feminine Side SciCafe

7 SATURDAY Special Event: Seeing Inside Bats SciCafe

December

1 TUESDAY Jesup Society Reception Special Event

Painting the Natural World Adult Course Tuesdays Through January 19

2 WEDNESDAY SciCafe: Mapping our Microbial Ecosystem SciCafe

October

7 WEDNESDAY SciCafe: Seeing Inside Bats SciCafe

15 THURSDAY Behind the Scenes: Sackler Institute for Comparative Genomics Member Program

17 SATURDAY Stem Cells in Neuroscience: Promises, Challenges, and New Frontiers Hayden Planetarium Program

19 MONDAY Frontiers Lecture: From Mars to the Stars Hayden Planetarium Program

22 THURSDAY The 2015 Margaret Mead Film Festival Through October 25

26 MONDAY Questions for a Resilient Future: What Connects Culture and All of Science Museum Lecture

29 THURSDAY Thunder & Lightning: Weather Past, Present, Future Museum Lecture

Rotunda / Fall 2015 / AMNH.org
More than a century after the first Museum expedition to Cuba, a new era of scientific exploration begins. Scientists from the Museum first traveled to this extraordinary Caribbean island 120 years ago to study its unique native birds, reptiles, mammals, and fishes. Research expeditions—and collaborations with Cuban colleagues at the Universidad de La Habana, the Academia de Ciencias de Cuba, and the Museo Nacional de Historia Natural—continued until the Cuban revolution in 1959 led to a 25-year pause. Expeditions resumed in the mid-1980s as researchers headed back to Cuba to confirm sightings of the elusive ivory-billed Woodpecker. Research trips over the past 30 years have included studies of Cuba’s birds, fossils, geology, spiders, and more, and in 1997 the Museum’s Center for Biodiversity and Conservation offered a course at the Museo Nacional. The Museum continues this legacy with the upcoming Explore21 Expedition to Cuba, an exciting new effort to learn more about this intriguing island.

SEE FOR YOURSELF!
TRAVEL TO CUBA WITH THE MUSEUM IN 2016.
FOR MORE INFORMATION, VISIT AMNH.ORG/CUBA

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FOR MORE INFORMATION, VISIT AMNH.ORG/CUBA
Here’s a look at some of the moments that made last year so memorable at the Museum.

**President Jimmy Carter Visits**
To mark the opening of Countdown to Zero, developed with The Carter Center, President Jimmy Carter visited the Museum in January to discuss efforts to eradicate Guinea worm.

**Startalk TV Show Premieres**
Neil deGrasse Tyson’s lauded podcast StarTalk came to TV screens on the National Geographic Channel, with episodes filming at the Museum.

**Science and Nature Program Graduation**
The Museum’s Science and Nature program celebrated the latest class of young naturalists.

**Google Field Trip**
More than 3,000 students from 47 schools attended Google Field Trip Day at the Museum, touring the halls and participating in hands-on educational activities.

**Urban Advantage Science Expo**
Carmen Fariña, Chancellor of the New York City Department of Education, visited with students presenting science projects conducted as part of the Urban Advantage middle-school science initiative.

**New Horizons Pluto Flyby**
Museum visitors of all ages watched up-to-second science visualizations and heard live commentary from mission scientists as the New Horizons probe made its historic flyby of Pluto in July.
Central Park West at 79th Street
New York, New York 10024-5192
amnh.org

General Information

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

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

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

**MUSEUM SHOPS**
The Museum Shop, Dino Store, Shop for Earth and Space, Cosmic Shop, Life at the Limits Shop, The Secret World Inside You Shop, and Online Shop (amnhshop.com) offer Members a 10-percent discount.

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

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

Cabrillo College lab technician Tasha Sturm grew this sample of the microbes found on her 8-year-old son’s hand after he was outside playing. Learn more about your own microscopic neighbors in the special exhibition *The Secret World Inside You*, which opens November 7 and is free for Members at the $105 level and above.