Director’s Message

As I write this message during the fall of 2017, I confess to being more conflicted than in past years regarding the future of the natural world and the ability and inclination of human society to take steps needed to preserve and sustain it.

In the last 12 months, the United States has formally declared its intention to withdraw from the United Nations Paris Agreement on climate change; threats to nationally protected lands are being raised from within the federal government; and the ability of the U.S. Environmental Protection Agency to both monitor and protect the air we breathe and the water we drink is being severely curtailed, if not eliminated.

As an organization that is committed to exploring and understanding Earth’s biological diversity and sharing what we learn with professional colleagues, students and laypeople, these developments are of great concern.

It will be incumbent on future leaders to chart a different course and one that respects the natural environment, both to preserve the legacy of millions of years of biological evolution and to sustain a planet that is habitable for humans and other species.

Despite the worrisome picture painted above, the MCZ has extended its string of successful years in terms of outstanding scholarship, effective teaching and engaging public programs.

The most newsworthy development, and perhaps the one with the greatest long-term impact, follows a generous gift from Edward O. Wilson, MCZ faculty-curator emeritus, which will enable us to establish an endowed postdoctoral fellowship program.

The Wilson Biodiversity Fellows will be expected to focus their research on the discovery and formal description of animal species. This support will allow us to attract talented young researchers in an essential field and further their career development at a critical stage. The new program may be launched as early as next academic year, and it is expected to expand in subsequent years as the endowment grows.

Nobody loves parties more than we do, and we demonstrated this to great effect last spring with a ceremony to celebrate the 16 staff members who have achieved a long-term employment milestone: more than 25 years of service at Harvard University, with most of those years spent at the MCZ.

The museum is tremendously grateful for the ongoing contributions of its dedicated curatorial, research and administrative staff, who sustain the infrastructure that allows us to do great work.

Finally, as one of six Harvard museums associated with the public-facing Harvard Museums of Science & Culture, we were able to help HMSC, as well as the Harvard Art Museums, to further their missions to increase the utilization of museum collections across campus.

By reaching more educators, students and visitors, we are able to demonstrate the tremendous depth and breadth of Harvard’s museum resources.

I hope you enjoy reading the following pages and learning more about what we accomplished this year.
GRADUATE TRAINING

The MCZ has a robust doctoral program, which averages 42 students per year.

Under the umbrella of the Department of Organismic and Evolutionary Biology (OEB), approximately 40% of OEB graduate students are advised by one or more of MCZ’s 13 faculty-curators. MCZ students are also associated with other departments at Harvard, such as Molecular and Cellular Biology, as well as with the Howard Hughes Medical Institute. Funding sources include Harvard programs outside of OEB, the U.S. National Science Foundation and numerous research foundations worldwide. Graduates have gone on to assume prestigious postdoctoral fellowships and faculty positions, while others have become consultants and specialists in the private sector.

Brianna McHorse

“Turns out it’s surprisingly hard to find a place where you can combine biomechanics and paleontology for your PhD,” says Brianna McHorse. “This is a perfect place to do ambitious, interdisciplinary research.”

Brianna’s dissertation aims to answer how and why horses evolved from small, forest-dwelling creatures with three toes to the large, grazing, single-toed animals we know today. “I am planning to pursue a career in data science, which makes use of the problem solving, experimental design, statistics, coding and data analysis skills I’ve built up over the course of my dissertation,” says McHorse.

Mara Laslo

“I chose Harvard because the OEB department allows a lot of intellectual freedom,” says graduate student Mara Laslo. “I like the idea of being able to work out a question that was interesting to me and being able to pursue that question in a direction that I find most interesting.”

Laslo is interested in the evolution of life cycles and development. Direct-developing frogs bypass the tadpole stage completely and hatch as miniature adults. “I want to understand the role that thyroid hormones, which have diverse and long-lasting effects in all vertebrate taxa, potentially have in the repeated evolution of direct development in frogs.”

Bruno A. S. de Medeiros

Bruno A. S. de Medeiros received an undergraduate degree in biology and a master’s in zoology at the University of São Paulo, Brazil. At Harvard, he has focused on understanding the role of interactions between a group of weevils and their host plants—palm trees—on weevil diversification.

“I chose Harvard for many reasons,” says de Medeiros, “but OEB and MCZ are great places for anyone interested in studying biodiversity. Here I can interact with great people sharing similar interests and have plenty of resources for all steps in my research, from fieldwork to specimen imaging, molecular biology and bioinformatics.”
MCZ Faculty-Curators

Andrew A. Biewener
Charles P. Lyman Professor of Biology
Director, Concord Field Station

Prof. Biewener’s research focuses on understanding the biomechanics, neuromuscular control and energetics of animal movement on land and in the air.

His goal is to understand general principles that govern the biomechanical and physiological design of vertebrate animals related to their movement in natural environments.

Scott V. Edwards
Professor of Biology
Alexander Agassiz Professor of Zoology
Curator of Ornithology

Prof. Edwards’ research focuses on the evolutionary biology of birds and related species, combining field, museum and genomics approaches to understand the basis of avian diversity, evolution and behavior. Current projects utilize genomics technologies to study comparative genomics and the evolution of flightlessness in birds; phylogeography and speciation of Australian and North American birds; and the genomics of host–parasite coevolution between house finches and a recently acquired bacterial pathogen, *Mycoplasma*.

Brian D. Farrell
Professor of Biology
Curator of Entomology
Director, David Rockefeller Center for Latin American Studies

Prof. Farrell’s research is broadly concerned with the evolution of ecological interactions between host plants and animals and their parasites, such as insects and other tiny consumers. His current projects include applying next-generation sequencing to speciation and phylogenetic studies of associated species, documenting biodiversity in the Dominican Republic, and repatriating digital information from scientific specimens of insects and fossils in museums to their countries of origin.

Gonzalo Giribet
Alexander Agassiz Professor of Zoology
Professor of Organismic & Evolutionary Biology
Curator of Invertebrates
Harvard College Professor

Prof. Giribet’s primary research focuses on the evolution, systematics and biogeography of invertebrate animals, including the use of morphology and next-generation sequencing techniques. Current projects in the Giribet lab include the evolution of orb-weaving spiders and other arachnids, and systematics and biogeography of arthropods, mollusks and onychophorans, among other groups. He is also interested in philosophical aspects of molecular data analysis, emphasizing homology-related issues and the use of genomic-level data for inferring phylogenies.
of craniofacial patterning; the developmental basis of morphological novelty and life-history evolution; biodiversity informatics; and systematics and evolution of neotropical salamanders.

**James Hanken**
Professor of Biology
Alexander Agassiz Professor of Zoology
Curator of Herpetology
MCZ Director

Prof. Hanken utilizes laboratory-based analyses and field surveys to examine morphological evolution, developmental biology and systematics. Current areas of research include the evolution of craniofacial patterning; the developmental basis of morphological novelty and life-history evolution; biodiversity informatics; and systematics and evolution of neotropical salamanders.

**Hopi E. Hoekstra**
Professor of Organismic & Evolutionary Biology
Professor of Molecular & Cellular Biology
Alexander Agassiz Professor of Zoology
Curator of Mammalogy
Howard Hughes Medical Institute Investigator
Harvard College Professor

Prof. Hoekstra combines field and laboratory work to understand the evolution of mammalian diversity from morphology to behavior. Her research focuses on the genetic basis of adaptive variation—identifying both the ultimate causes and the proximate mechanisms responsible for traits that help organisms survive and reproduce in the wild. Research in the Hoekstra lab integrates ecological, behavioral, genetic and molecular approaches.

**George V. Lauder**
Professor of Biology
Henry Bryant Bigelow Professor of Ichthyology
Curator of Ichthyology

Prof. Lauder’s research focuses on the biomechanics of fishes and the development of robotic models for studying aquatic locomotion. His current studies focus on the function of shark skin and other surface structures, the role of flexibility in improving the efficiency of aquatic propulsion, and how fishes control body and fin position as they maneuver through obstacles. Additional broad interests include biological fluid mechanics and theoretical approaches to the analysis of form and function in organisms.

**Jonathan B. Losos**
Monique & Philip Lehner Professor for the Study of Latin America
Professor of Organismic & Evolutionary Biology
Curator of Herpetology

Prof. Losos’ research focuses on the behavioral and evolutionary ecology of lizards, specifically how lizards interact with their environment and how lizard clades have diversified evolutionarily.

His laboratory integrates approaches from systematics, ecology, behavior, genetics and functional morphology, taking both observational and experimental approaches in the field and in the laboratory.
FACULTY-CURATORS

James J. McCarthy  
Professor of Biological Oceanography  
Alexander Agassiz Professor of Biological Oceanography  
Acting Curator of Malacology

Prof. McCarthy’s research focuses on factors that regulate the processes of primary production and nutrient supply in the ocean. Using field studies and modeling, Prof. McCarthy and his group examine the effects of seasonal or interannual climate change on marine life from plankton to whales.

Stephanie E. Pierce  
Assistant Professor of Organismic & Evolutionary Biology  
Curator of Vertebrate Paleontology

Her work tends toward 3-D modeling and experimentation of the musculoskeletal system, with particular attention to the link between form and function. Current projects include the fin-to-limb transition, the evolution of the mammalian backbone, and the origin of the avian neck.

Robert M. Woollacott  
Professor of Biology  
Curator of Marine Invertebrates

Prof. Woollacott’s research focuses on aspects of marine invertebrate life history, such as synchronization of reproductive events and ecology and physiology of larvae. Topics of particular interest include larval dispersal and population connectivity, as well as human impacts on life in the sea.

Naomi E. Pierce  
Sidney A. & John Hessel Professor of Biology  
Curator of Lepidoptera

Prof. Pierce’s research focuses on the behavioral ecology of species interactions, particularly insect/plant associations, and symbioses between ants and other organisms, including bacteria, fungi, plants and caterpillars of butterflies in the family Lycaenidae. Prof. Pierce is interested in how parasitic and mutualistic life histories can influence the evolutionary trajectories of each partner.

Mansi Srivastava  
Assistant Professor of Organismic & Evolutionary Biology  
Curator of Invertebrate Zoology

Dr. Srivastava’s research focuses on understanding the evolution of animal development and regeneration. Her group utilizes the three-banded panther worm, Hofstenia miamia, which Dr. Srivastava has developed as a new acoel model system. Acoels represent the sister-group to all animals with bilateral symmetry, which allows the study of genetic mechanisms that span 550 million years of animal evolution. Current projects in the lab range from identifying gene regulatory networks for regeneration to determining the embryonic origins of pluripotent stem cells to understanding the origins of bilateral nervous systems.
MCZ Emeriti

Richard C. Lewontin
Professor of Biology, Emeritus
Alexander Agassiz Professor of Zoology, Emeritus
An evolutionary geneticist, Prof. Lewontin pioneered the field of molecular population genetics by merging molecular biology and evolutionary theory, as well as the philosophical and social implications of genetics and evolutionary theory.

Among his many books are The Genetic Basis of Evolutionary Change; Biology as Ideology: the Doctrine of DNA; Human Diversity; and The Triple Helix: Gene Organism and Environment.

A. W. “Fuzz” Crompton
Faculty-Curator, Emeritus
Fisher Professor of Natural History, Emeritus
Prof. Crompton, former Curator of Mammalogy, was the Director of the MCZ from 1970 to 1982, having served as Director of both the Peabody Museum of Natural History at Yale University and the South African Museum in Capetown. His primary research interests include the origin and evolution of mammals, functional anatomy, and neural control and evolution of feeding in recent and fossil vertebrates. Prof. Crompton received two Guggenheim fellowships for his research on vertebrate paleontology and functional morphology, and in 2011 received the Romer-Simpson Medal from the Society of Vertebrate Paleontology.

Edward O. Wilson
Honorary Curator in Entomology
Pellegrino University Professor, Emeritus
Prof. Wilson is considered the founder of sociobiology and evolutionary psychology and has developed the basis of modern biodiversity conservation. He has received many of the world’s leading prizes in recognition of his research, creative literature and environmental activism.

Among those in literature, he was awarded two Pulitzer Prizes for his books The Ants (1990, with Bert Hölldobler) and On Human Nature (1978). Prof. Wilson received the TED Prize in 2007, where he articulated the concept of the Encyclopedia of Life, and the Hubbard Medal in 2013, the rarely given highest award of the National Geographic Society.
Courses in 2016–2017 Led by MCZ Faculty-Curators

Organismic and Evolutionary Biology

OEB 10: Foundations of Biological Diversity
Brian D. Farrell (and Andrew Richardson and Elena Kramer)
An integrated approach to the diversity of life, emphasizing how chemical, physical, genetic, ecological and geologic processes contribute to the origin and maintenance of biological diversity.

OEB 51: Biology and Evolution of Invertebrate Animals
Gonzalo Giribet (and Cassandra Extavour)
Introduction to invertebrate diversity, covering the development, adult anatomy, biology and evolutionary relationships of the main animal phyla, including sponges, mollusks, annelids and arthropods, among others.

OEB 57: Animal Behavior
Naomi E. Pierce (and Bence P. Olveczky)
A review of the behavior of animals under natural conditions, with emphasis on both mechanistic and evolutionary approaches.

OEB 115: The Developmental Basis for Evolutionary Change
Mansi Srivastava (and Matthew Harris and Clifford Tabin)
Introduction to evolutionary developmental biology, focusing on the molecular and cellular bases of how embryos generate adult body plans in order to understand how form, physiology and life history strategies are modulated over the course of evolution.

FRSEMR 50E: The Science of Cats
OEB 125: Molecular Ecology and Evolution
Scott V. Edwards
A survey of theory and applications of DNA technologies to the study of evolutionary, ecological and behavioral processes in natural populations.

OEB 126: Vertebrate Evolution
Stephanie Pierce
A comprehensive survey of the origin and evolution of vertebrates through an examination of the fossil record, focusing on major events in Earth’s evolutionary history, with an emphasis on anatomical and physiological transformations in fish, amphibians, reptiles, birds and mammals.

OEB 141: Biogeography
Gonzalo Giribet
Aims to explain distributions of organisms through historical and ecological factors, focusing on the history of biogeographic research, developments in the area of historical biogeography and ecological processes that affect distributions of whole clades.

OEB 155r: Biology of Insects
Naomi E. Pierce (and Michael R. Canfield)
Introduction to the major groups of insects—life history, morphology, physiology and ecology—through a combination of lecture, lab and field exercises.

OEB 190: Biology and Diversity of Birds
Scott V. Edwards
An introduction to the biology of birds. Covers the fossil record and theories for avian origins, physiology and anatomy, systematics, speciation processes, behavior, vocalizations, demography and conservation.

OEB 200: The Evolution of Stem Cells and Regeneration
Mansi Srivastava
An exploration of stem cell biology and the cellular, molecular and genetic principles of regeneration. Covers the main concepts and methods concerning the study of stem cells and familiarity with comparative approaches as applied to stem cell biology and regeneration.
OEB 258: Contingency Versus Determinism: Is Evolution Predictable?
Jonathan Losos

Discussion of Stephen Jay Gould’s ideas presented in his 1989 book Wonderful Life, how they have been developed and transformed over the last quarter century, and what the data say after 25 years of molecular phylogenetics and experimental field studies of evolution.

General Education
Science of Living Systems 22: Human Influence on Life in the Sea
Robert M. Woollacott and James J. McCarthy
Over-harvested fish stocks, pollution and anthropogenic climate change affect the stability and productivity of marine ecosystems. This course asks what we need to know about the causes and effects of anthropogenic change to best protect marine ecosystems and ensure sustainable harvests from the sea.

Graduate Courses
Reading and Research
OEB 300: Museum Collections Management and Curation
James Hanken

OEB 310: Metazoan Systematics
Gonzalo Giribet

OEB 320: Biomechanics and Evolution of Vertebrates
George V. Lauder

OEB 321: Evolution of Regeneration and Development
Mansi Srivastava

OEB 323: Advanced Vertebrate Anatomy
Stephanie Pierce

OEB 325: Marine Biology
Robert M. Woollacott

OEB 334: Behavioral Ecology
Naomi E. Pierce

OEB 335/E-PSCI 337: Biological Oceanography
James J. McCarthy

OEB 341: Coevolution
Brian D. Farrell

OEB 355: Evolutionary Developmental Biology
James Hanken

OEB 362: Research in Molecular Evolution
Scott V. Edwards

OEB 367: Evolutionary and Ecological Diversity
Jonathan Losos

OEB 370: Mammalian Evolutionary Genetics
Hopi Hoekstra

OEB 51: Biology and Evolution of Invertebrate Animals
COURSES

Freshman Seminar
FRSEMR 22T: Why We Animals Sing
Brian D. Farrell
Investigates the sounds and structures of different kinds of acoustic animals—including birds, mammals, frogs and insects—and the different kinds of habitats in which they produce their songs and calls.

FRSEMR 50E: The Science of Cats
Jonathan Losos
Focuses on how scientists are using state-of-the-art methods from the fields of evolutionary biology, ecology, behavior and molecular biology to understand Felis catus, the house cat.

FRSEMR 50H: The Biology of Movement
Andrew A. Biewener
Explores why and how organisms move, providing an overview of the biological motors animals and microbes use to power movement, and mechanisms plants use for growth and geo-/photo-taxis.

Life Sciences
LIFESCI 1B: An Integrated Introduction to the Life Sciences: Genetics, Genomics and Evolution
Hopi Hoekstra (and Kevin Eggan and Pardis Sabeti)
An integrated approach showing how genetics and evolution are intimately related, together explaining the patterns of genetic variation we see in nature, and how genomics can be used to analyze variation.

LIFESCI 2: Evolutionary Human Physiology and Anatomy
Andrew Biewener and George V. Lauder (and Daniel E. Lieberman)
Explores human anatomy and physiology from an integrated framework, combining functional, comparative and evolutionary perspectives on how organisms work.

MCZ History
Since its founding, the Museum of Comparative Zoology has been overseen by a governing board, the MCZ Faculty. Among the original four members was Dr. Oliver Wendell Holmes Sr.

A physician, poet and prolific author, Holmes served at the Harvard Medical School for 36 years, including seven as dean. Holmes saved countless lives by championing the theory that puerperal fever, a disease that particularly afflicts mothers after childbirth, could be transmitted during delivery via unclean surgical instruments, bedclothes and linens.

He also penned “Old Ironsides,” an iconic ode to the naval frigate U.S.S. Constitution, and was arguably the most popular author in the English language for much of the 19th century.

Holmes Sr.’s fame and accomplishments are largely overlooked today, but the same can’t be said for his son. Following the Civil War, when he suffered a nearly fatal wound in the Battle of Antietam, Oliver Wendell Holmes Jr. was ultimately appointed by President Theodore Roosevelt a justice of the U.S. Supreme Court, where he issued groundbreaking opinions that still resonate today.

The Autocrat of the Breakfast Table, lithograph of Dr. Oliver Wendell Holmes from Vanity Fair, 1886, by English caricaturist Leslie Ward (1851–1922).
**A Robot with Heart**

Made of heart cells from a rat, applied to an elastic silicone body encasing a tiny gold skeleton, this minute biohybrid robot is part machine, part living tissue. Patterned on a stingray, the nickel-sized swimming raybot is propelled and guided by light. Researchers at Harvard’s Department of Bioengineering and Applied Sciences, George Lauder and others created the hybrid ray, described in a cover story in *Science*.

Bio-inspired design in robotics aims to apply the naturally occurring qualities of biological organisms in order to improve the performance of robots. In this case, learning to structure and control heart cells could lead to artificial hearts that function more like natural hearts, propelling blood more effectively through the body, as well as to small autonomous biorobots.

The ray was selected as a model because of the stability of its round, flat body and agile maneuvering in water. Heart cells are printed on a layer of silicone in a radial pattern and bioengineered to contract when exposed to light, making downward motion possible. A small gold skeleton stores the energy of the downward movement and springs upward when the contraction is released. The serpentine pattern of the muscle circuits allows them to be activated sequentially, moving the robot forward in an undulating swimming motion. And because each fin is tuned to a different light pattern, the robot can be turned with light and is able to complete an obstacle course that requires complex coordination and maneuvering.

Although slow by stingray standards, the raybot outperformed existing moving, biohybrid systems in terms of speed, distance traveled and durability, demonstrating the potential of self-propelled, light-activated tissue-engineered robots.


**Tiny, Threatened Thorius**

At less than two inches long, minute salamanders from the genus *Thorius* are the smallest four-legged tailed organisms on the planet. They have short legs and long bodies and tails, often have a red stripe on their back and are extremely difficult to find in the wild.

With animals this tiny, and external appearances so similar, species are hard to tell apart. Despite the challenges, James Hanken and an international team of researchers have identified three new species of *Thorius* from the remote, high-altitude mountain forests of Oaxaca, Mexico. The team used molecular techniques, including DNA sequencing; digital imaging, such as X-ray computed tomography; and anatomical analyses to differentiate the three new species.

Described in *PeerJ*, *Thorius pinicola* is named for its pine forest home, *T. longicaudus* for its long tail and *T. tlaxiatus* for a nearby city. Like other minute salamanders, they have well-articulated bodies despite their small size, breed on land, and their young hatch from eggs as diminutive adults, with no tadpole stage.

Once plentiful in southern Mexico, *Thorius* populations have declined precipitously in the last few decades due to habitat destruction, disease and other environmental factors. They may be the most endangered genus of amphibians in the world and could be extinct before the end of the century. The newly described species are already considered critically endangered, and they highlight the quest to discover and describe species before they disappear entirely.

Making Sense of Social Scents

With insects, as with humans, communication is key to successfully living in a group. For social insects, this communication typically occurs via chemical signals, including pheromones, and is perceived through hair-like sensilla in antennae and legs.

Highly advanced social insects like bees, ants and wasps have complex social systems, and thus have the most elaborate chemical communication systems. They use these signals to allocate tasks, care for offspring, provide reproductive status, defend the nest and acquire food.

Surprisingly little is known about how chemical communication systems differ between solitary species and their highly social relatives. For example, social behavior in ants, all of which are social, evolved long ago in the Cretaceous, making comparisons between modern-day social ants and their solitary ancestors difficult. To investigate this relationship, Naomi E. Pierce, Li E. K. Murphy, Sarah D. Kocher and others studied “sweat bees” in the family Halictidae.

The Halictidae comprises species that exhibit the full range of social behaviors, from solitary to highly advanced societies. Halictid bees evolved sociality relatively recently and on several occasions reverted to a solitary lifestyle. Thus a comparison of the physiological investment in chemical communication systems can be made more easily in this group between social and closely related non-social or “solitary” species.

Their research, published in *PNAS*, confirmed that as sociality is gained and lost, evolutionary changes occur in the sensory systems and chemical signals of both solitary and social halictid bees. As social species increasingly rely on chemical signals, rapid adaptations occur in their glands to produce more complex odor profiles and in their antennae to produce more sensilla. However, when social behavior is lost, sensilla density decreases since less complex chemical signals need to be received.

Wittwer B, Hefetz A, Simon T, Murphy LEK, Elgar MA, Pierce NE, Kocher SD (2017) Solitary bees reduce investment in communication compared with their social relatives. *Proc Natl Acad Sci USA* 114:6569-6574

A New Light on Stripes

A wide range of creatures have evolved striped coats, from zebras to tigers to chipmunks, and this patterning is thought to provide camouflage that assists in survival in the wild. However, little is known about how stripes evolved. To investigate the genetic mechanisms that develop this pigmentation pattern, Hopi E. Hoekstra and postdoctoral researcher Ricardo Mallarino chose the African striped mouse (*Rhabdomys pumilio*). This mouse, found throughout southwest Africa, is active during the day and sports two dark-light-dark stripes along its back very similar to those of the chipmunk.

Mammals rely on skin cells called melanocytes, which migrate around the embryo as it develops, to produce pigment. The white bib on a cat or the blaze on the nose of a horse occur because melanocytes didn’t reach those areas, leaving the hair without color. However, the researchers discovered the African striped mouse has melanocytes in the skin under its white stripes, but something stopped these cells from maturing. They found that a gene called ALX3, linked to craniofacial development but not known to affect patterning, was highly expressed in the skin underneath the white stripes.

Mallarino and Hoekstra then turned to the eastern chipmunk (*Tamias striatus*) and found that the same genetic mechanism caused its light stripes. The ALX3 gene is also responsible for the white bellies of many rodents, and the researchers think this gene was co-opted and reused during evolution to make white stripes in both species. But because their last common ancestor was about 70 million years ago, it is likely they evolved their stripes independently.

Decoding the Genetic Basis of Parental Care

The oldfield mouse is an exception among mammals—it is monogamous, and both parents are solicitous in the care of their pups. However, closely related deer mice are promiscuous and less attentive parents. To investigate these differences, Hopi E. Hoekstra, lead author Andres Benesky and other Harvard colleagues designed an elegant study to trace the genetic basis of these behaviors, and for the first time have linked DNA to variation in parenting habits among mammals.

First, they documented parental behaviors of both species in the lab—including nest building, licking, huddling for warmth and retrieving pups removed from the nest—in both sexes. Oldfield mice (Peromyscus polionotus) build elaborate nests and fathers are generally as active as mothers in caring for their young, while deer mice (Peromyscus maniculatus) create more basic nests, if any at all, and fathers are much less involved in parenting. They then ruled out parenting as a learned behavior, pointing to a genetic source of parenting behaviors.

Along Romer’s Route

In the 1950s, Harvard paleontologist and former MCZ Director Alfred S. Romer explored Nova Scotia, collecting fossils from the Carboniferous period. He was the first to recognize that this period holds the key to the evolution of fish to early four-legged animals—tetrapods—between 360 million and 345 million years ago. This gap in the fossil record is known as “Romer’s gap,” a period from which relatively few fossils have been discovered.

In the summer of 2017, Stephanie Pierce, a native of Alberta, set out to follow her predecessor on a prospecting trip to Nova Scotia—one of the only places in the world to find fossils from this important period in animal evolution—hoping to fill some of that gap. Guided by Romer’s detailed field notes, Pierce, Katrina Jones, Blake Dickson and Chris Capobianco replicated the route of Romer’s 1956 expedition, hunting fossils in Parrsboro, Blue Beach and Sydney.

To identify the molecular mechanisms, the researchers crossbred oldfield and deer mice to create 769 second-generation hybrids and then measured their parental behavior with their own pups. The results ran the gamut, allowing genetic analysis to isolate 12 stretches of DNA, called loci, associated with parenting. They found some loci affect very specific behaviors, like nest building, while others affect parenting more broadly. In addition, many of the loci were influential in only one sex, suggesting that parental care can evolve independently in males and females. Finally, they homed in on one locus associated with a difference in nest-building behavior. Further investigation into the 498 genes in this locus identified the gene that controlled production of the hormone vasopressin in the brain, and revealed that increased levels of vasopressin decreased nest building.


Hopi Hoekstra

Stephanie Pierce

As with any expedition, the search was both exhilarating and frustrating. When they located fossils, the tide drove them to work speedily, unearthing large rocks containing their finds and lugging them across rocky beaches. Their treasure is a large tetrapod’s jaw, and Pierce feels they have found something new in tetrapod evolution from Nova Scotia’s Carboniferous period.
Highlights from the Collections

During the past year, MCZ personnel assisted in the installation of exhibitions and other displays around the university, providing expertise and specimens for public education and enjoyment.

All the World Is Here

The Peabody Museum of Archaeology & Ethnology celebrated its 150th anniversary by opening All the World Is Here: Harvard’s Peabody Museum and the Invention of American Anthropology on April 22, 2017. The exhibition features an astonishing array of over 600 objects from Asia, Oceania and the Americas, many on display for the first time, woven into a narrative tracing the early history of the museum’s collections and the birth of American anthropology.

Visitors enter the world of a late 19th-century museum and are transported into the midst of the 1893 World’s Columbian Exposition, where the museum’s second director, Frederic W. Putnam, and the Peabody presented their anthropological vision and collections to a wider world. All the World Is Here displays remarkable and historically significant items, including exotic materials traded and collected by 18th-century Boston ship captains.

“The exhibition’s curators were interested in something that would exemplify the practice of collecting natural history specimens as part of otherwise unscientific commerce,” says Curatorial Assistant Jonathan Woodward. “They wanted a model of an animal that could have been found along a Pacific Ocean trade route.” The Blaschka glass animal in All the World Is Here depicts a Pacific Ocean sea cucumber. “In the time period covered by the exhibition, preservation methods weren’t sufficient to preserve a sea cucumber for scientific study. That’s why the glass models were so useful.”

The Malacology specimen in this exhibit is the black-lip pearl oyster (Pinctada margaritifera). “The curators wanted a ‘mother-of-pearl’ oyster from somewhere in the Indo Pacific,” says Curatorial Associate Adam Baldinger. He selected specimens that matched the requirements in terms of species, locality, preservation type, size and condition, and from these options the exhibit developers made their selection. “The inner layers of the shell are composed of nacre, often referred to as ‘mother-of-pearl,’ which can give rise to very beautiful pearls,” says Baldinger. The exhibition will remain on view through at least 2022.
**Scale: A Matter of Perspective**

At the Collection of Historical Scientific Instruments, *Scale: A Matter of Perspective* examines the concept of scale and its power to transform perceptions of the world and our place in it. It explores the concept of scale from multiple perspectives, including models that scale things up—such as glass flowers and embryological models—and those that scale things down, like ethnographic dioramas of village life.

To demonstrate the power of scaling things down, a miniature diorama of a desert field site features Harvard paleontologist and former MCZ Director Alfred S. Romer unearthing a fossil specimen. Interestingly, the decades-old diorama was found in 2013 by HMNH exhibit staff while they were cleaning out a storage area. It was then accessioned by the Vertebrate Paleontology department, but recalled during planning for the exhibition.

According to Curatorial Associate Jessica Cundiff, the exhibition team wanted a skull of the giant 300-million-year-old amphibian, *Eryops megacephalus*, like the one Romer was placing in a plaster jacket in the diorama. “We looked through Romer’s *Eryops* material,” says Cundiff, “and found a skull that was still partially in a plaster jacket. It matched well with the miniature plaster jacket and gave a good sense of the difference in scale.” Cundiff and Curatorial Assistant Victoria Wilke assisted with the diorama and specimen.

To show how specimens were once scaled up to make features or activities more plainly understood, Curatorial Assistant Jonathan Woodward provided Reiber Glacite models—enlarged 3D depictions of microscopic organisms. Working at the Rochester Museum in the first half of the 20th century, Edwin H. Reiber developed an early translucent plastic that he called “glacite,” and he created and sold these models to educators.

MCZ Special Collections has nine of these historical glacite models made from this unique proto-plastic material. “If they had been produced earlier, glass or even wood would likely have been the medium, whereas now they would likely be 3D printed,” says Woodward. “So they function as a snapshot in time of three-dimensional illustrative enlargement practices.”

“This collection of glacite models of protists is fascinating,” says Linda S. Ford, Director of Collections Operations. “We are pleased to see that these objects are becoming recognized for their historical uniqueness.” *Scale: A Matter of Perspective* is on view from March 10 to December 9, 2017.
The Philosophy Chamber

Between 1766 and 1820, Harvard College assembled an extraordinary collection of paintings, portraits and prints; mineral, plant and animal specimens; scientific instruments; Native American artifacts and relics from the ancient world. These objects were displayed in three rooms in Harvard Hall adjacent to the college library. The largest of these spaces, the Philosophy Chamber, was an ornately decorated room named for the discipline of natural philosophy, a cornerstone of the Enlightenment-era curriculum that wove together astronomy, mathematics, physics and other sciences.

After nearly 200 years, The Philosophy Chamber: Art and Science in Harvard’s Teaching Cabinet, 1766–1820, reunites many of these original objects at the Harvard Art Museums. It features more than 100 works and specimens, including a loose reconstruction of the Philosophy Chamber itself. To represent the original biological natural history exhibits, MCZ contributed specimens from Ornithology, Ichthyology, Herpetology and Vertebrate Paleontology collections. These include a long-eared owl (Asio otus) prepared by Charles Willson Peale (1786–1827), a dried skin of an eastern diamondback rattlesnake, fish from New England collected in the late 18th century, and fossil fish that were in the collection during the time of the Philosophy Chamber.

The fish specimens were collected by William Dandridge Peck, Harvard's first Massachusetts Professor of Natural History, in the late 1790s. According to Karsten Hartel, Curatorial Associate in Ichthyology, "Peck split the fish in half, removed the soft tissue and then stitched them to paper to dry. This was consistent with the preservation methods of the day." Hartel, who co-wrote Inland Fishes of Massachusetts some 200 years after Peck explored the area, provided specimen information for the exhibition.

“Exhibition curators originally requested fossil specimens that were displayed and/or used for teaching at Harvard College between 1766 and 1820,” says Curatorial Associate Jessica Cundiff, “including a fossil fish.” A database search for specimens in the collection during that time period produced a list that indeed included a fossil fish, so that specimen was selected as the focus of the fossil material in the exhibition.

The Philosophy Chamber runs from May 19 to December 31, 2017, and then travels to The Hunterian at the University of Glasgow.
**Next of Kin**

An experiential art exhibition, *Next of Kin: Seeing Extinction through the Artist’s Lens*, was on display at the Harvard Museum of Natural History from December 17, 2016, to June 4, 2017, supported by a generous gift from 1968 Harvard Business School graduate Clark Bernard and Susana Bernard. This exhibition presented a provocative and powerful new perspective on the biodiversity extinction crisis by encouraging the viewer to make an emotional connection with animals long gone, and those that may soon be lost.

*Next of Kin* showcased two sets of mirrored portraits of endangered species by visual artist Christina Seely, accompanied by sculptural installations of extinct and threatened animals made in collaboration with Susannah Sayler and Edward Morris of The Canary Project, which produces art and media on ecological issues. Specimens of extinct, endangered and threatened animals from the MCZ collections helped contribute to the immersive experience and evoke a profound sense of empathy with our “next of kin.”

The Ornithology department contributed boxes of bones of the great auk, extinct since 1844, demonstrating the bird’s onetime abundance across the North Atlantic. There are skeletons, feathers and eggs of several other extinct birds, notably the flightless moa from New Zealand. Curatorial Associate Jeremiah Trimble assisted with the selection of these specimens. Nine specimens of extinct, endangered or threatened animals were provided by the Mammalogy department, including the California grizzly bear, white-tailed deer, blesbok, black-faced impala, giant sable antelope, and two whales, a narwhal and sei whale. Curatorial Assistant Mark Omura helped with these specimens.

**The Cabinet of Curiosity**

“The cabinets have been in that hallway for as long as I can remember,” says Adam Baldinger, referring to the first-floor entrance to the Invertebrate Zoology department. “They once contained MCZ’s Vertebrate Paleontology specimens, but were emptied around the time that the department moved to the Northwest Building.”

Faculty-curator Gonzalo Giribet came up with the idea to use the cabinets to display specimens from Invertebrate Zoology and Malacology collections. Once the request was approved, the cabinets were refurbished and exhibit-quality lights added under the direction of Jay McNeil, and curatorial staff in both departments selected specimens for display. “Our goal was to highlight the diversity of the phyla represented in the Invertebrate Zoology and Malacology departments, in many ways unifying them,” says Baldinger. The Cabinet of Curiosity debuted in April 2017.

Additional Invertebrate Zoology and Malacology faculty-curators and staff who worked on the project include Mansi Srivastava, Penny Benson, Laura Leibensperger, Jennifer Lenihan, Murat Recevik, Alana Rivera, Jennifer Goldstein, Ally Jarvis, Kate Sheridan and Sarah Kariko.
Projects & Initiatives

Encyclopedia of Life Learning + Education Group

The Encyclopedia of Life (eol.org) is a global effort to bring together species information in a free, trusted online resource. Content on EOL is provided by hundreds of partners, including the MCZ. EOL’s Learning + Education Group, which is based at the MCZ, encourages the development of innovative and effective uses of EOL content, data and tools in educational settings.

New Website

L+E has a new website, education.eol.org. The goal is to help make the wealth of biodiversity information on EOL accessible through free tools, resources and activities for students, educators, citizen scientists and nature enthusiasts. The site contains lesson plans (education.eol.org/lesson_plans), species cards (education.eol.org/species_cards) and podcasts (eol.org/info/podcasts) that can be used in the classrooms or in the field. All EOL lesson plans are aligned to Next Generation Science Standards and are designed for students 7 to 18 years old.

Collaboration on What’s in a Name?

What’s in a Name? incorporates four interactive kiosks into existing exhibits at the Harvard Museum of Natural History. The project explores the world of species identification and naming through interactive exhibits and online resources. The project is a partnership among the Harvard Museums of Science & Culture, EOL and the Biodiversity Heritage Library, as represented by the MCZ’s Ernst Mayr Library, and was made possible through support from the Institute of Museum and Library Services. The EOL Learning + Education Group created and manages the website for the interactive exhibition, whatsinaname.hmnh.harvard.edu.

City Nature Challenge

EOL provided educational resources for the 2017 City Nature Challenge (CNC), a friendly competition among urban areas to determine which location can log the highest number of nature sightings over a four- or five-day period in April. L+E and several partners helped organize the Boston CNC (inaturalist.org/projects/city-nature-challenge-2017-boston-area). In addition, all research-grade images from the CNC flow to EOL from the iNaturalist biodiversity observation platform (inaturalist.org) another open science project. The next CNC will be an international event that takes place from April 27 to 30, 2018.
New MCZ Fund Will Support Postdoctoral Research

A generous gift from Edward O. Wilson, MCZ Faculty-Curator Emeritus, University Research Professor Emeritus, has established the E. O. Wilson Postdoctoral Support Fund. Income from this fund will be awarded to support MCZ postdoctoral researchers in the discovery and formal taxonomic descriptions of the Earth’s animal species.

In addition to a career filled with national and international accolades, Prof. Wilson is uniquely beloved at Harvard. He is known for the humor and charm he infuses into his work, and for his memorable ability to weave stories out of his life and research. His accomplishments are the perfect embodiment of the MCZ’s research and educational mission; he not only understands and contributes himself to the rigorous study of comparative and evolutionary biology, but he translates these facts into illuminating stories that captivate listeners. The MCZ is deeply grateful for Prof. Wilson’s support.

Ernst Mayr Library / Biodiversity Heritage Library

William Brewster’s Field Notes

For several years, the Ernst Mayr Library has been digitizing William Brewster’s journals, diaries, correspondence and photographs thanks to an Institute of Museum and Library Services (IMLS) grant and one from the Council for Library and Information Resources led by the Smithsonian Institution. Brewster was curator of mammals and birds at MCZ from 1885 until his death in 1919. So far 21,179 of 33,824 pages have been digitized and deposited in Harvard’s Digital Repository Service and the Biodiversity Heritage Library (BHL). Approximately 5,000 pages have been transcribed.

Biodiversity Heritage Library

The Ernst Mayr Library has contributed 9,715 volumes (3,247,544 pages), containing 12,280,228 species-name instances, to the Biodiversity Heritage Library. Since 2008, items from our library have been downloaded 8,675,343 times. The most-used title, Memoires couronnes et memoires des savants etrangers, publies par l’Academie royale des sciences, des lettres et des beaux-arts, t.29 (1856–1858), has been downloaded 11,869 times!

Laura Bush 21st Century Librarian Award

The grant-funded project Foundations to Actions: Extending Innovations in Digital Libraries in Partnership with National Digital Stewardship Learners is 50% complete. Image searching and identification tools are being reviewed, collections and gap identification are in process, and better connections with the Global Biodiversity Information Facility and the Encyclopedia of Life (EOL) are being sought.

Expanding Access to Biodiversity Literature (EABL)

Awarded in 2015 to the New York Botanical Garden with partners Ernst Mayr Library and Missouri Botanical Garden, this grant aims to increase the availability of biodiversity literature by seeking out content providers who may need assistance in digitization and negotiating with copyright holders for more recent publications. Among other accomplishments, permissions to add 187 in-copyright titles have been successfully negotiated. The EABL Collection in BHL currently holds 6,013 volumes from 725 titles and contains 656,309 pages.

Research

Mary Sears, Head of Public Services, co-authored The Blagg Collection of California Bryozoa at the Museum of Comparative Zoology, Harvard University, which was published in the journal Breviora. Sears and Museum Librarian Connie Rinaldo collaborated with staff from the Harvard Museums of Science & Culture, MCZ and EOL on the IMLS grant, What’s in a Name. library.mcz.harvard.edu/node/964921
Awards & Recognition

Faculty

Gonzalo Giribet was awarded a five-year Harvard College Professorship, which recognizes exceptional undergraduate teaching.

Hopi Hoekstra was elected a Fellow of the American Academy of Arts and Sciences, President of the Society for the Study of Evolution, and a member of the Board of Directors of the Genetics Society of America.

Naomi Pierce was one of five recipients of the Verrill Medal from the Yale Peabody Museum of Natural History.

Mansi Srivastava was awarded the Smith Family Award for Excellence in Biomedical Research and a U.S. National Science Foundation CAREER award.

Staff

Sixteen MCZ staff members met long-term service milestones as Harvard employees:

- 25+ years: Ronnie Broadfoot, Judy Chupasko, Andra Hollis, Catherine Musinsky, Kenneth Wilcox and Robert Young
- 30+ years: Stefan Cover, Dana Fisher, Laura Leibensperger, Pedro Ramirez and Mary Sears
- 40+ years: Paul Dwyer, Karsten Hartel, John Nevins and José Rosado
- 51 years: Kathleen Horton

OEB staff members also celebrated service milestones:

- Wendy Heywood, 20 years;
- Megan McHugh, 10 years; and
- Kristin Pennarun, 5 years.

Wendy Heywood, OEB Communication and Events Coordinator, and Jonathan Woodward, Curatorial Assistant, received a Dean’s Distinction award from the Harvard Faculty of Arts and Sciences.

Damari Rosado, OEB Associate Director of Administration, received a Harvard Heroes award.

Emeritus

Richard Lewontin was awarded the Thomas Hunt Morgan Medal by the Genetics Society of America for lifetime achievement in the field of genetics.

Edward O. Wilson received the 2016 Humane Society of New York’s Humane Medal. He also won the 2017 Reed Environmental Writing Award for his book, *Half-Earth: Our Planet’s Fight for Life.*
Postdoctoral Researchers

Katrina Jones received an American Association of Anatomists postdoctoral fellowship.

Mary C. Stoddard won the 2016 Theodosius Dobzhansky Award from the Society for the Study of Evolution.

Graduate Students

Felix Baier was selected as a three-year Howard Hughes Medical Institute International Research Fellow.

Nicole Bedford was awarded a Young Investigator Travel Award from the Society of Molecular Biology and Evolution.

John Boyle, Glenna Clifton, Tauana Cunha, Philip Grayson, Ambika Kamath, Kelsey Lucas, Brianna McHorse, Zachary Morris, Pavitra Muralidhar, Allison Shultz, Kira Treibergs and Dylan Wainwright each received a Derek Bok Certificate of Distinction in Teaching.

Tauana Cunha, Phil Lai, Mara Laslo, Caitlin Lewarch, Brianna McHorse and Zachary Morris each received a Doctoral Dissertation Improvement Grant from the U.S. National Science Foundation.

Emily Hager received an American Society of Mammalogists Grant-in-Aid of Research.

Sang Il Kim was awarded a Graduate Student Research Award from the Society of Systematic Biologists.

Mara Laslo received one of two Best Student Oral Presentation Awards at the International Conference on Comparative Endocrinology.

Undergraduates

Emmanuel D’Agostino was awarded a Beacon Travel Award to attend and present his research at the annual meeting of the Society for the Study of Evolution.

Rebecca Greenberg and Annika Gompers were awarded Harvard Herchel Smith Undergraduate Fellowships.
**MCZ Grant Recipients**  
**Academic Year 2016–2017**

**Grants in Aid of Undergraduate Research (GUR)**

These grants support research by Harvard College undergraduates under faculty supervision. Priority is given to projects that utilize MCZ, Harvard University Herbaria (HUH) and Arnold Arboretum (AA) research collections, laboratories and facilities. Support for these grants comes from the MCZ’s Myvanwy M. and George M. Dick Scholarship for Students, HUH and AA.

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Faculty Sponsor/ Academic Dept.</th>
<th>Project Title</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Julie A. Baldassano</td>
<td>Hopi Hoekstra/ Organismic and Evolutionary Biology</td>
<td>Expression patterns of nesting-related candidate genes in <em>Peromyscus</em> brains</td>
<td>$2,500</td>
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<tr>
<td>Lorena M. Benitez</td>
<td>Stephanie Pierce/ Organismic and Evolutionary Biology</td>
<td>Vertebral anatomy and locomotor evolution in mammals: A geometric morphometrics approach</td>
<td>$500</td>
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<tr>
<td>Adrienne M. Bielawski</td>
<td>Hopi Hoekstra/ Organismic and Evolutionary Biology</td>
<td>Structure versus function: Relating nest score to insulation index in <em>Peromyscus polionotus</em> mice</td>
<td>$452</td>
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<tr>
<td>Julius G. Bright Ross</td>
<td>Paul Moorcroft/ Organismic and Evolutionary Biology</td>
<td>Hunting feeding station impact on roe deer habitat selection</td>
<td>$500</td>
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<tr>
<td>Eamon C. Corbett</td>
<td>Scott Edwards/ Organismic and Evolutionary Biology</td>
<td>Phylogeography of a widespread South American dry forest furnariid, the rufous-fronted thornbird</td>
<td>$2,500</td>
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<tr>
<td>Katherine A. Culbertson</td>
<td>Jonathan Losos/ Organismic and Evolutionary Biology</td>
<td>An investigation of inter-specific interactions of <em>Anolis carolinensis</em> and <em>A. sagrei</em></td>
<td>$2,500</td>
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<tr>
<td>Emmanuel R. D’Agostino</td>
<td>Hopi Hoekstra/ Organismic and Evolutionary Biology</td>
<td>Developing Amazon Mechanical Turk as a method for specimen analysis using <em>Peromyscus</em></td>
<td>$650</td>
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<tr>
<td>Emmanuel R. D’Agostino</td>
<td>Hopi Hoekstra/ Organismic and Evolutionary Biology</td>
<td>Analyzing and furthering Amazon Mechanical Turk-based specimen analysis</td>
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<tr>
<td>Sarah E. Gonzalez</td>
<td>Stephanie Pierce/ Organismic and Evolutionary Biology</td>
<td>Regional variation in the mechanical properties of the vertebral column in <em>Felis catus</em></td>
<td>$2,500</td>
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<tr>
<td>Cara R. Jacobson</td>
<td>Richard Wrangham/ Human Evolutionary Biology</td>
<td>Senior thesis on the effects of male dominance on consortship costs in Kibale olive baboons</td>
<td>$950</td>
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</table>
### Robert G. Goelet Research Awards

Goelet Awards support MCZ graduate student research projects. These grants are made possible through a gift from Mr. Robert G. Goelet.

<table>
<thead>
<tr>
<th>Recipient</th>
<th>MCZ Department</th>
<th>Project Title</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Mara Laslo</td>
<td>Herpetology</td>
<td>An unbiased view of thyroid hormone regulated development in a direct-developing frog</td>
<td>$600</td>
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<tr>
<td>Mara Laslo</td>
<td>Herpetology</td>
<td>Evaluating the role of thyroid hormone in limb development in a direct-developing frog, <em>Eleutherodactylus coqui</em></td>
<td>$2,456</td>
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<td><strong>Total Awards</strong></td>
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**GRANTS**

Nicole Bedford
Gwen S. Antell
Nina L. Morales
Robert G. Goelet

Research Awards support MCZ graduate student research projects. These grants are made possible through a gift from Mr. Robert G. Goelet.

<table>
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<tr>
<th>Recipient</th>
<th>Faculty Sponsor / Academic Dept.</th>
<th>Project Title</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Juliet Kim</td>
<td>Mansi Srivastava/ Organismic and Evolutionary Biology</td>
<td>Characterization of the neoblast niche in the regenerating acel <em>Hofstenia miamia</em></td>
<td>$2,500</td>
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<tr>
<td>Nina L. Morales</td>
<td>Jonathan Losos/ Organismic and Evolutionary Biology</td>
<td>Do behavioral changes of <em>Anolis sagrei</em> in the presence of <em>Leiocephalus carinatus</em> impact <em>A. sagrei</em> diet and greater trophic cascades?</td>
<td>$2,275</td>
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<tr>
<td>Christian Perez</td>
<td>Brian Farrell/ Organismic and Evolutionary Biology</td>
<td>International workshop on Neotropical praying mantises</td>
<td>$500</td>
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<tr>
<td>Elianna M. Shwayder</td>
<td>Richard Wrangham/ Human Evolutionary Biology</td>
<td>Senior thesis on the motivations for male-female friendships among olive baboons</td>
<td>$2,500</td>
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<tr>
<td>Shunn Theingi</td>
<td>Hopi Hoekstra/ Organismic and Evolutionary Biology</td>
<td>Pigmentation variation in <em>Peromyscus maniculatus</em> across an environmental gradient</td>
<td>$2,500</td>
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<td><strong>Total Awards</strong></td>
<td><strong>$23,327</strong></td>
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Frank E. Etzler
Gonzalo Giribet
Julia Cosgrove and Ligia Benavides Silva

---

Nicole Bedford

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Gwen S. Antell
Ernst Mayr Travel Grants in Animal Systematics

Ernst Mayr Grants support travel for research in animal systematics and are open to the scientific community worldwide. The principal objective of these grants is to stimulate taxonomic work on neglected taxa and/or poorly described species. Ernst Mayr Grants typically facilitate visits to institutional collections, with preference given to research that uses MCZ’s collections. These grants are made possible by a gift from Professor and former MCZ Director Ernst Mayr.

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Institutional Affiliation</th>
<th>Project Title</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Gwen S. Antell</td>
<td>Florissant Fossil Beds National Monument</td>
<td>Revision of orthopteroid insects from Florissant fossil beds</td>
<td>$1,150</td>
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<tr>
<td>Doug B. Booher</td>
<td>University of California, Los Angeles</td>
<td>Species-group revision of the Australasian ants of the genus Strumigenys</td>
<td>$1,500</td>
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<tr>
<td>Brendon E. Boudinot</td>
<td>University of California, Davis</td>
<td>The male ants of the New World: Keys to and diagnoses of the subfamilies and genera</td>
<td>$1,500</td>
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<tr>
<td>Aldo Caccavo de Araujo</td>
<td>Federal University of Rio de Janeiro</td>
<td>Taxonomic revision of the genus Neacanmys Thomas, 1900 (Rodentia: Cricetidae: Sigmodontinae)</td>
<td>$1,500</td>
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<tr>
<td>Gabriela Procópio Camacho</td>
<td>Smithsonian Institution</td>
<td>Taxonomy and systematics of Gnamptogenys Roger (Hymenoptera, Formicidae, Ectatomminae) in the world</td>
<td>$830</td>
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<tr>
<td>Anthony I. Cognato</td>
<td>Michigan State University</td>
<td>Scolytine type imaging</td>
<td>$1,500</td>
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<tr>
<td>Paulo Vilela Cruz</td>
<td>Universidade Federal de Rondônia, Brazil</td>
<td>Delimitation of the mayfly genera Paracloeodes Day, Rivudiva Lugo-Ortiz &amp; McCafferty, and Varipes Lugo-Ortiz &amp; McCafferty (Ephemeroptera: Baetidae): Analysis of the type specimens</td>
<td>$1,500</td>
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<tr>
<td>Jesús Alberto Cruz-López</td>
<td>National Autonomous University of Mexico</td>
<td>Taxonomy and phylogeny of the Metopilio-group (Opiliones: Eupnoi: Phalangioidea)</td>
<td>$1,500</td>
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<tr>
<td>Frank E. Etzler</td>
<td>Montana State University</td>
<td>Revision of the Hemicrepidius (Coleoptera: Elateridae) of the New World</td>
<td>$1,000</td>
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<tr>
<td>Aaron B. Evans</td>
<td>Auckland University of Technology</td>
<td>Systematics of the squid family Cranchiidae in the Pacific Ocean</td>
<td>$1,500</td>
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<tr>
<td>Andrey Frolov</td>
<td>Russian Academy of Sciences</td>
<td>Anochetus Mayr, 1861 (Hymenoptera: Formicidae: Ponerinae) of the MCZ</td>
<td>$1,500</td>
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<tr>
<td>Gerardo L. Gutiérrez de la Cruz</td>
<td>National University of San Marcos</td>
<td>An integrative taxonomic revision of genus Dicroden</td>
<td>$1,000</td>
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<tr>
<td>Manuel Ituriaga Monsisbay</td>
<td>Institute of Ecology and Systematics, Cuba</td>
<td>Taxonomic review of the blindsnakes of species group Typhlops lumbricalis (Scolecophilida, Typhlopidae) in Cuba</td>
<td>$1,500</td>
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<tr>
<td>Oliver Keller</td>
<td>University of Florida</td>
<td>Systematic revision of the firefly genus Robopus Motschulsky 1853 (Coleoptera: Lampyridae)</td>
<td>$1,500</td>
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<tr>
<td>Claire Lewis</td>
<td>University of Hawai’i at Manoa</td>
<td>Investigating historical collections to understand corals of the future</td>
<td>$1,407</td>
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<tr>
<td>Recipient</td>
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<td>Project Title</td>
<td>Amount</td>
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<tr>
<td>Ivan L. Fiorini Magalhaes</td>
<td>Museo Argentino de Ciencias Naturales</td>
<td>Systematics and taxonomy of the Nearctic <em>Kukulcania</em> spiders (Araneae: Filistatidae)</td>
<td>$1,460</td>
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<tr>
<td>Steven J. Messer</td>
<td>Arizona State University</td>
<td>The evolution and taxonomy of inquiline social parasites and their hosts in the crazy ant genus <em>Nyländeria</em></td>
<td>$1,500</td>
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<tr>
<td>Ana Paula Motta Vieira</td>
<td>São Paulo State University</td>
<td>Taxonomic review of the Neotropical genus <em>Phrynopus</em> Peters, 1873 (Anura: Craugastoridae)</td>
<td>$1,500</td>
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<tr>
<td>Sameer Mukund Padhye</td>
<td>Abasaheb Garware College</td>
<td>An in depth taxonomical re-assessment of the &quot;large branchiopods&quot; (Crustacea: Branchiopoda: Anostraca, Notostraca, Laevicaudata, Spinicaudata) collection from the Yale North India expedition deposited in the Yale Peabody Museum of Natural History</td>
<td>$1,500</td>
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<tr>
<td>Manju Siliwal</td>
<td>Wildlife Information Liaison Development Society, Coimbatore, India</td>
<td>Taxonomic studies on mygalomorph spiders from the Old World</td>
<td>$1,500</td>
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<tr>
<td>Scott L. Travers</td>
<td>University of Kansas</td>
<td>Evolutionary community assembly of Melanesian Island frogs: Phylogeny, species boundaries, and taxonomic revision of the genus <em>Cornufer</em> (Anura: Ceratobatrachidae)</td>
<td>$1,000</td>
</tr>
<tr>
<td>Candice Bobby Untiedt</td>
<td>University of Tasmania</td>
<td>Revision of <em>Chrysogorgia</em> (Coelenterata: Octocorallia: Alcyonacea: Chrysogorgiidae): Morphological and molecular diversity</td>
<td>$1,440</td>
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<tr>
<td>Matthew Van Dam</td>
<td>California Academy of Sciences</td>
<td>Revision of the genus <em>Trigonoscuta</em> Motschulsky 1853 (Coleoptera: Curculionidae)</td>
<td>$1,000</td>
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<tr>
<td>Diego F. B. Vaz</td>
<td>Virginia Institute of Marine Science, College of William &amp; Mary</td>
<td>Taxonomy and systematics of the genus <em>Porichthys</em> Girard, 1854 (Batrachoididae: Batrachoidiformes)</td>
<td>$1,500</td>
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<tr>
<td>Carolina Yamaguchi</td>
<td>University of São Paulo</td>
<td>Cladistic analysis of Phthiriinae Becker, 1913 (Diptera, Bombyliidae)</td>
<td>$1,500</td>
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</table>

**Total Awards** $34,287
Putnam Expedition Grants

Putnam Expedition Grants are intended to support MCZ faculty-curators, postdoctoral fellows and graduate students in collecting specimens and data relating to the study of comparative zoology. Priority is given to projects that collect living specimens in regions where habitats are threatened or fossil specimens in regions most likely to hold important clues for unraveling evolutionary strategies. These grants are made possible by a gift from Mr. George Putnam, Jr., AB 1949 and MBA 1951, and Mrs. Nancy Putnam.

<table>
<thead>
<tr>
<th>Recipient</th>
<th>MCZ Department</th>
<th>Project Title</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicole Bedford</td>
<td>Mammalogy</td>
<td>Understanding the social and ecological contexts of burrowing behavior in wild beach mice</td>
<td>$9,280</td>
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<tr>
<td>Claire Marie-Soleil Dufour</td>
<td>Herpetology</td>
<td>Coexistence mechanisms between the native species Anolis oculatus and a new intruder Anolis cristatellus in Dominica: The second step</td>
<td>$4,735</td>
</tr>
<tr>
<td>Gonzalo Giribet</td>
<td>Invertebrate Zoology</td>
<td>Collecting in the open backyard of the forbidden land: An arachnological trip to Trinidad and Tobago</td>
<td>$9,305</td>
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<tr>
<td>Katrina E. Jones</td>
<td>Vertebrate Paleontology</td>
<td>Hunting for evidence of the earliest synapsids in Nova Scotia</td>
<td>$2,450</td>
</tr>
<tr>
<td>Melissa E. Kemp</td>
<td>Herpetology</td>
<td>Using fossils to predict how global change will impact future lizard communities</td>
<td>$9,810</td>
</tr>
<tr>
<td>Vanessa L. Knutson</td>
<td>Invertebrate Zoology</td>
<td>The evolution of shell loss in heterobranch gastropods</td>
<td>$5,285</td>
</tr>
<tr>
<td>Vanessa L. Knutson</td>
<td>Invertebrate Zoology</td>
<td>Characterization of taxonomy and shell variability in Phyllaplysia taylori, a potential model for heterobranch shell loss.</td>
<td>$4,872</td>
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<tr>
<td>Oriol Lapiedra</td>
<td>Herpetology</td>
<td>Evolution of animal personalities under new selective regimes: A field experiment in Anolis lizards</td>
<td>$3,925</td>
</tr>
<tr>
<td>Melissa R. Whitaker</td>
<td>Entomology</td>
<td>Cycad moths of southern Africa</td>
<td>$2,420</td>
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<tr>
<td><strong>Total Awards</strong></td>
<td></td>
<td></td>
<td><strong>$40,832</strong></td>
</tr>
</tbody>
</table>
- Elgar MA, Nash DR, Pierce NE (2016) Eavesdropping on cooperative communication within an ant-butterfly mutualism. Sci Nat 103:84
- For the cover story, George Lauder and colleagues contributed research on tiger shark morphology.
- “Carboniferous Onychophora from Montceau-les-Mines, France, and onychophoran terrestrialization” by Gonzalo Giribet and co-authors was the cover story.
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- Harvey MS, Huey JA, Hillyer MJ, McIntyre E, Giribet G (2016) The first troglobitic species of Gymnobiidae (Pseudoscopiones: Neobioidae), from Table Mountain (Western Cape Province, South Africa) and its phylogenetic position. Invertebr Syst 30:75-85
- Kamath A (2016) Ornament morphology varies with display behaviour and sexual size dimorphism, but not habitat, in the fan-throated lizard (Sitana, Agamidae). J Herpetol 50:394-403


These charts describe the income and expenses of the Museum of Comparative Zoology in fiscal year 2017.

Endowment income funds much of the Museum’s activities, including acquisition and maintenance of collections, faculty and staff salaries, capital projects, facilities renovation and maintenance. Included in Endowment Income is the annual distribution (payout) and endowed funds decapitalized per donor request. Transfers include financial support for the Ernst Mayr Library and other Harvard-funded projects. Other Income comprises miscellaneous income from publication subscriptions, royalties, sales and fees, and cost recovery from other MCZ-sponsored activities. Overhead is funding paid from MCZ-based sponsored projects to cover facilities and administrative costs for those projects. It is shown as both income (Overhead Earned) and expenses (Overhead Charged). Reserves indicates balances utilized to fund operations.

Capital Projects includes deployment of collections to the newly constructed space in the Northwest Building and renovation of the MCZ’s ground floor prep lab. Building expenses such as maintenance, facility improvements and utilities are captured in the Space & Occupancy category. Operating Expenses consist of equipment purchases, supplies, and consultant and conference fees, as well as annual subventions to the Department of Organismic and Evolutionary Biology (OEB) for administrative services and MCZ support for faculty-curator research. Support for MCZ-affiliated graduate students in OEB is included in Scholarships, Awards & Travel. Institutional Expenses are support for other University activities outside the MCZ, including FAS and University initiatives and general operating support to the Harvard Museums of Science and Culture.

*These two expense categories were calculated differently in prior years.*
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Charles P. Lyman Professor of Biology; Director, Concord Field Station

Scott V. Edwards
Professor of Organismic & Evolutionary Biology; Alexander Agassiz Professor of Zoology; Curator of Ornithology

Brian D. Farrell
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Gonzalo Giribet
Professor of Organismic & Evolutionary Biology; Alexander Agassiz Professor of Zoology; Curator of Invertebrate Zoology

James Hanken
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Hop E. Hoekstra
Professor of Organismic & Evolutionary Biology; Professor of Molecular & Cellular Biology; Alexander Agassiz Professor of Zoology; Curator of Mammalogy; Howard Hughes Medical Institute Investigator; Harvard College Professor

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Jonathan B. Losos
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Mansi Srivastava
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Professor of Biology, Emeritus; Alexander Agassiz Professor of Zoology, Emeritus

Edward O. Wilson
Honorary Curator in Entomology; University Research Professor, Emeritus

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The MCZ deeply appreciates the additional support and contributions of numerous interns and undergraduate students during the 2016–2017 academic year.