



MUSEUM OF COMPARATIVE  
ZOOLOGY  
ANNUAL REPORT  
HARVARD UNIVERSITY



2012-2013



# DIRECTOR'S MESSAGE

Determination, persistence, stamina, confidence, inquisitiveness and patience are among the cornerstones of a successful career in science.

Humor, wit, stubbornness and charm don't hurt either. These characteristics and more made Farish A. Jenkins Jr. an esteemed mentor, teacher, colleague and friend to many—in fact, to just about everyone. On November 11, 2012, we said goodbye to this beloved member of the MCZ. Farish touched us deeply, and he is remembered fondly by all who knew him. He really was one of a kind.

In anticipation of Farish's retirement, which had been scheduled for this past summer, last year we launched a formal search to hire his successor as MCZ's Curator of Vertebrate Paleontology and faculty member in Organismic and Evolutionary Biology. This search concluded successfully, and I am extremely pleased to introduce Dr. Stephanie Pierce, BSc, MSc, PhD, and welcome her to the MCZ. Stephanie will join us beginning in fall 2014 after she completes a very successful lectureship appointment at the Royal Veterinary College and the University of Cambridge, UK. More of Stephanie's professional background and research accomplishments are described elsewhere in this report.

Detailed plans, developed over many years, to insure the long-term care and utilization of many of our specimen collections are finally being realized. The mammalogy collection has already moved into MCZ's new state-of-the-art research and teaching facility in the Northwest Building, essentially ending Phase I of the project. As I write this, the ornithology collection is making a similar migration as the centerpiece of Phase II. Additional collections are preparing for their move beginning this coming year, which will complete Phase III.

Many of the projects and collaborations that help sustain our reputation as a global

center for research and education in comparative biology are highlighted in this report. By participating in national initiatives such as *Advancing Integration of Museums into Undergraduate Programs*, *Network Integrated Biocollections Alliance* and *Advancing Digitization of Biological Collections*, we are developing and implementing new tools that foster access to and utilization of museum collections. And the Encyclopedia of Life Learning + Education Group, based here, continues to develop innovative ways to promote bioliteracy worldwide.

Beginning two years ago, the Faculty of Arts and Sciences initiated a major effort to strengthen, support and highlight the public activities of its six research and teaching museums, including the MCZ. The most tangible results are the launch, earlier this year, of the Harvard Museums of Science & Culture and the hiring of its executive director, Ms. Jane Pickering. Under Jane's leadership, the HMSC will manage exhibits, outreach events and other public programs while also encouraging more extensive integration of its component museums, and especially their world-class collections, within the academic life of the university. The MCZ stands to benefit greatly from this affiliation, and I look forward to sharing new developments and accomplishments in future reports.

I close by thanking and applauding the faculty-curators, staff, postdoctoral fellows and students for their role in making 2012–2013 a successful and productive year at the MCZ.

James Hanken  
*Director*



Catherine Weisel

Cover photo credits:  
Top, left to right: Naomi Pierce; Christopher Kenaley; JumpStart Youth Connection; Jonathan Losos; Catherine Weisel

Bottom, left to right: Andrew Williston; Marianne Espeland; Shane Campbell-Staton; Gonzalo Giribet; Jeremiah Trimble

Opposite page: Tiktaalik roseae by Stephanie Mitchell, Harvard University News Office



# INTRODUCING THE MCZ'S NEWEST FACULTY-CURATOR



Dr. Stephanie Pierce



3-D reconstruction of *Ichthyostega*



Dr. Pierce being filmed for a documentary

All photos courtesy of Stephanie Pierce

The MCZ welcomes Dr. Stephanie Pierce as the new Curator of Vertebrate Paleontology and a faculty member in Organismic and Evolutionary Biology.

She will be joining the MCZ in fall 2014 after completing her lectureship appointment at the Royal Veterinary College, UK. “Both MCZ and OEB are delighted that Stephanie has agreed to join us,” says MCZ Director James Hanken. “She will bring unique talents and expertise that nicely complement those of faculty across campus, and I anticipate many fruitful collaborations in both research and teaching. We’re also very much looking forward to having Stephanie oversee the MCZ’s vertebrate paleontology collections and associated laboratories in their new home in the Northwest Building.”

A fascination with vertebrate evolution led Dr. Pierce to study the interaction of muscles and bones during feeding and movement. Most recently, she has been examining the locomotion of the earliest limbed vertebrates to decipher how their muscular and skeletal systems evolved as they made the transition from water to land.

In an innovative project, Dr. Pierce led a team that created a 3-D computer model of the skeleton of *Ichthyostega*, one of the first four-legged creatures to transition from water to land during the Devonian period around 400 million years ago.

“Reconstructing the anatomy and biology of the earliest tetrapods is paramount to unraveling the evolution of terrestrialization and how that ultimately set up biodiversity for the rest of Earth’s history,” says Dr. Pierce. The team used an X-ray micro-CT scanner to build a complete skeleton from 12 different fossil specimens.

Using the 3-D model, Dr. Pierce assessed the range of motion of *Ichthyostega*’s shoulder, elbow, hip and knee joints and

compared it to modern animals that live both on land and in water.

The results were surprising. “Ever since its first discovery almost a century ago, *Ichthyostega* was presumed to walk around on land on four sturdy limbs—much like a salamander does today. Now the evidence suggests that this pivotal early tetrapod was moving more like a mudskipper than a modern tetrapod.”

Mudskippers are fish that travel on land by using their front fins like “crutches” to pull the rest of their body along, and *Ichthyostega*’s front limbs operated in much the same way. *Ichthyostega*’s hind limbs would have barely touched the ground, making them more useful in the water than on land. This research, and subsequent findings, were published in *Nature*.

Next, Dr. Pierce intends to use dynamic 3-D modeling techniques, such as X-ray Reconstruction of Moving Morphology (XROMM), to reconstruct the evolutionary sequence of locomotor behaviors across the water–land transition. This study will incorporate important fossil material housed in the MCZ’s vertebrate paleontology collections.

“I am incredibly excited to join the MCZ team and integrate their world class vertebrate paleontology collections into my research and teaching,” says Dr. Pierce. “The unprecedented combination of specimen access, technology and know-how will no doubt lead to new insights into the water–land transition and beyond.”

In addition to her work on early tetrapods, Dr. Pierce is also interested in the functional morphology of modern animals and other extinct vertebrate groups, such as marine reptiles and ancient crocodiles.



# 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 relatives, combining field, museum and genomics approaches to understand the basis of avian diversity, evolution and behavior. Current projects utilize technologies to examine genome evolution across the reptile-bird transition; phylogeography and speciation of Australian and North American birds; and the genomics of host-parasite co-evolution between house finches and a recently acquired bacterial pathogen, *Mycoplasma*.

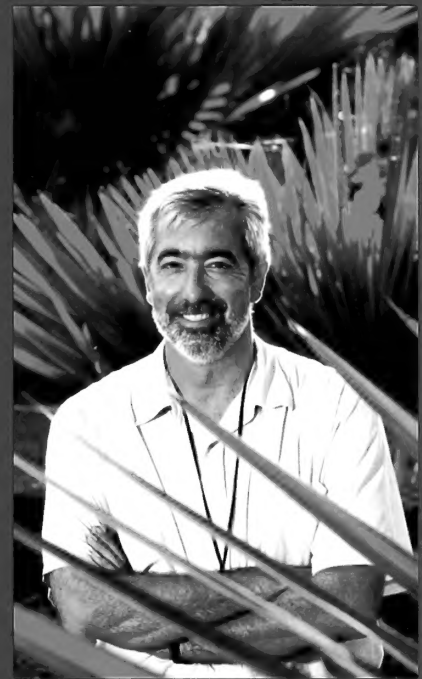
## **Brian D. Farrell**

*Professor of Biology  
Curator of Entomology*

Prof. Farrell's work focuses on whether the diversity of species on Earth is a cause or a consequence of the diversity of roles that species play in ecosystems.

To understand the interplay of adaptation, speciation and evolution over geological time, the Farrell lab focuses on the relationships between insects and plants. Beetles are of particular interest because of their unparalleled species diversity and their ecological impact as herbivores, predators, fungal feeders, decomposers, parasites and pollinators. The lab has just completed the NSF-supported Beetle Tree of Life project, a collaborative and comprehensive evolutionary study aimed at understanding these insects' many shifts among trophic levels. A new, complementary NSF-supported initiative to document the MCZ insect fossils has just begun.

Because direct experience serves education, Farrell also leads long-term initiatives that provide educational and research opportunities and materials for undergraduates by documenting species diversity in the Boston Harbor Islands and in the Dominican Republic. In July 2012, Farrell completed a yearlong Fulbright Scholarship to the Universidad Autónoma de Santo Domingo in the Dominican Republic, where he and his Dominican colleagues established a U.S.-style museum specimen study laboratory with undergraduate researchers.



Rose Lincoln

Stu Rosner



## In Memoriam

It was with profound sadness that MCZ bid farewell to longtime colleague and friend Farish A. Jenkins Jr., Professor of Biology, Alexander Agassiz Professor of Zoology and Curator of Vertebrate Paleontology, who passed away on November 11, 2012.

One of the world's leading biologists, Jenkins considered himself a "hybrid" of anatomist, zoologist and vertebrate paleontologist. Combining a polymath's curiosity with a scientist's tenacity, he worked both in the lab with live animals and out in the field with fossils, trekking across the globe from East Africa to Greenland, the American West to the Arctic tundra.

His quest to solve one of the great mysteries of evolutionary biology—how swimming and crawling creatures eventually evolved to walk, run, jump and fly—was his lifelong passion. In 2004, Jenkins was part of a team that traveled to Ellesmere Island in Nunavut Territory, Canada, where they made the groundbreaking discovery of *Tiktaalik roseae*, the 375-million-year-old fossil that represents a critical transitional stage between fish and four-legged animals.



Prof. Jenkins was one of Harvard's most beloved professors, a man of rigorously high standards who took the time to know every student by name and craft lectures that were part science, part art, part adventure and completely unforgettable. A stylish dresser in his pressed white shirts, dapper suits and polished shoes, Jenkins was nonetheless not above donning a body stocking painted with a human skeleton for an anatomy lecture or putting on a peg leg to act out sections of *Moby Dick* to demonstrate theories of human gait. His intricate anatomical illustrations, made on the blackboard with pieces of chalk whose ends he honed to sharp tips, revealed yet another talent: world-class artist.

"Farish A. Jenkins was the epitome of a Harvard professor. He was a true gentleman with impeccable manners and he had a deep love of learned institutions. He cared deeply for his students, and he was for many of them the best teacher they would ever know. He was a superb scientist and model university citizen. Every pursuit received 100% of his effort, and he expected the same of his students and his faculty colleagues," recalls Professor James McCarthy.

Among his many accolades, Jenkins served as president of the Society of Vertebrate Paleontology in 1981–1982, was the recipient of its Romer-Simpson Medal for lifetime achievement in 2009, received a Harvard College Professorship in 2011 and was honored with a June 2012 MCZ symposium celebrating his decades-long career. He will long be remembered for his profound impact on countless students, colleagues and collaborators worldwide.

A memorial fund has been established at the MCZ to support student fieldwork in evolutionary biology. Contributions may be made to: Farish A. Jenkins Jr. Fund, c/o The Museum of Comparative Zoology, 26 Oxford Street, Harvard University, Cambridge, MA 02138.

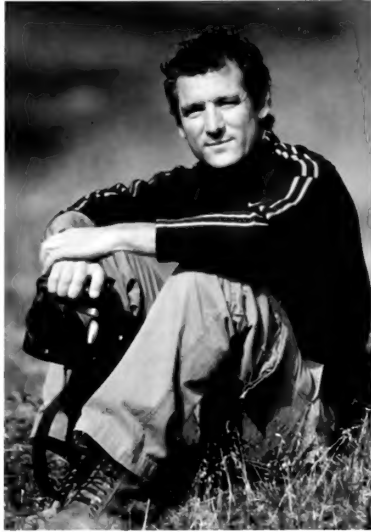


**Gonzalo Giribet**

*Professor of Biology  
Alexander Agassiz  
Professor of Zoology  
Curator of Invertebrate  
Zoology*

Prof. Giribet's primary research focuses on the evolution, systematics and biogeography of invertebrate animals. Current projects in the Giribet lab include multidisciplinary studies for Assembling the Bivalve Tree of

Life, the diversity of Neotropical arachnids, and systematics and biogeography of arthropods, mollusks, sponges, sipunculans, platyhelminthes and onychophorans. He is also interested in philosophical aspects of DNA sequence data analysis, emphasizing homology-related issues.



© Casey Dunn

**James Hanken**

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

Prof. Hanken combines laboratory-based analyses with fieldwork to examine morphological evolution, developmental biology and systematics. Current areas of research include the evolution of cranial patterning, the developmental basis of morphological novelty, biodiversity informatics, and the taxonomy and systematics of neotropical salamanders. Prof. Hanken serves on the Executive Committee of the Encyclopedia of Life (**eol.org**) and on several other boards.



Catherine Weisell



Gretchen Ertl

**Hopi E. Hoekstra**

*Professor of Organismic and Evolutionary Biology  
Professor of Molecular and Cellular Biology  
Alexander Agassiz Professor of Zoology  
Curator of Mammalogy*

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.



Stephanie Mitchell

**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, on the role of flexibility in improving the efficiency of aquatic propulsion and on 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.



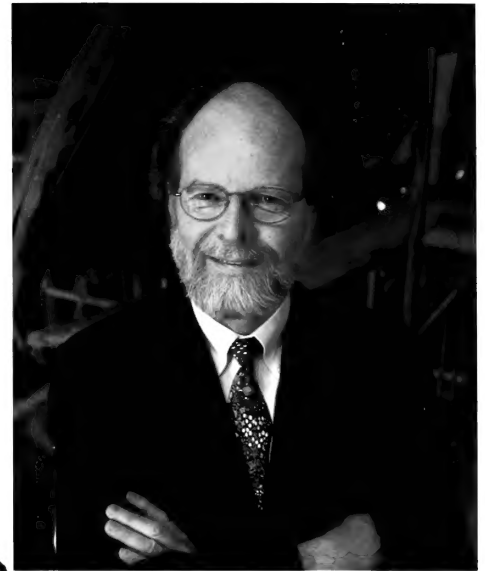


Rose Lincoln

**Jonathan B. Losos**  
*Monique and Philip Lehner Professor for  
 the Study of Latin America  
 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.



Jon Chase

**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. Through controlled laboratory studies and field investigations, Prof. McCarthy and his group examine the effects of strong seasonal or interannual climate change on marine life and biogeochemical systems.

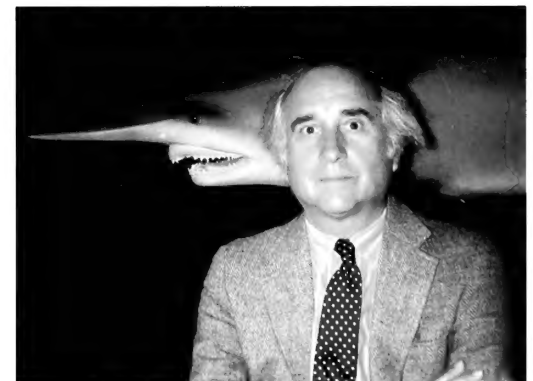
**Naomi E. Pierce**  
*Sidney A. and John Hessel  
 Professor of Biology  
 Curator of Entomology*

Prof. Pierce's primary research focuses on the behavioral ecology of species interactions, particularly cooperative interactions between plants and their pollinators, and symbioses between ants and many different organisms including bacteria, fungi, plants and caterpillars of butterflies in the family Lycaenidae. Prof. Pierce is interested in how species associations such as parasitism and mutualism influence the evolutionary trajectories of each partner.



Some of this research is functional, searching for genes and/or pathways involved in the evolution of insect herbivory on the one hand, or plant resistance to pathogen/insect attack on the other. Other projects are comparative, seeking to understand the adaptive advantages of traits such as specialized diets in the Lepidoptera. Current grant-funded research is also investigating environmental and genetic influences in the evolution of social behavior in stingless bees.

Prof. Pierce has also been engaged in reconstructing the evolutionary Tree of Life for ants, bees and butterflies, using the resulting molecular phylogenies to analyze life history evolution, geographic distributions and rates of diversification. In the MCZ entomology collections, Prof. Pierce has been involved in a project to digitize and photograph the butterflies. Recent grants have supported collection of ants of the Navajo Nation, as well as the development of a database of locality records and identification tools for ants from the American Southwest.



Kris Stralbe

Jean-Francois Bertrand

**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 the distribution of marine organisms.





## MCZ EMERITI



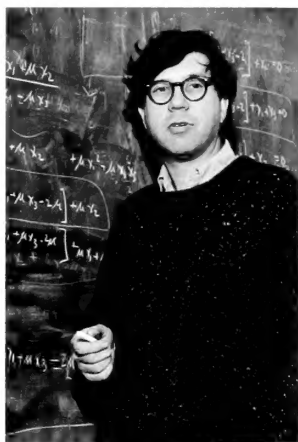
**Kenneth J. Boss**  
*Faculty-Curator, Emeritus*  
*Professor of Biology, Emeritus*

Prof. Boss, former Curator of Malacology, has been with Harvard for 40 years. His research focus is the classification, systematics

and evolution of mollusks, using data from shell morphology, anatomy and zoogeography to analyze the phylogenetic relationships within various groups of gastropods and bivalves. He has also published on the history of malacology. Prof. Boss has contributed extensively to the *Occasional Papers on Mollusks* and formerly served as editor for *Breviora* and the *Bulletin of the Museum of Comparative Zoology*.

**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. Prof. Lewontin's current research involves computer simulation and evaluation of statistical tests for selection. 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*. He served as President of the Society for the Study of Evolution, the American Society of Naturalists and the Society for Molecular Biology and Evolution.



**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 and the former Director of the Peabody Museum of Natural History, Yale University, and the South African Museum, Capetown. His primary research interests are the origin and evolution of mammals, functional anatomy, neural control and evolution of feeding in recent and fossil vertebrates. Prof. Crompton is a fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science. He 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.



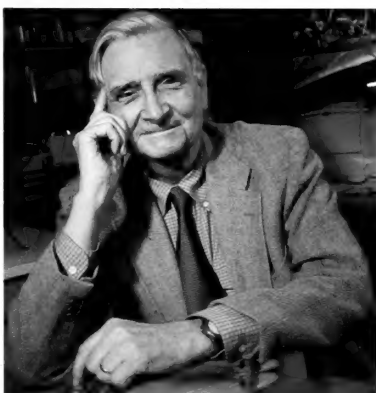
Justin Ide

**Herbert W. Levi**  
*Faculty-Curator, Emeritus*  
*Alexander Agassiz Professor of Zoology, Emeritus*

A former Curator of Arachnology, Prof. Levi's research focuses on the taxonomy of New World orb weaving araneid spider genera. The author of *Spiders and Their Kin*, as well as numerous articles on various spider genera, his research has made possible identification of 1,500 species in 66 genera in the Americas. Prof. Levi served as president of the International Society of Arachnology and, in 2007, won the ISA's Eugene Simon Award for lifetime achievement for his immense influence on spider research.



Courtesy of the Ernst Mayr Library



**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 and environmental activism. He was awarded two Pulitzer Prizes for his books *The Ants* (1990, with Bert Hölldobler) and *On Human Nature* (1978). In 2007, Prof. Wilson received the Technology, Entertainment, Design (TED) Prize, where he articulated the concept of the Encyclopedia of Life—a contemporary, dynamic Web page for every named species.

Jim Harrison



# COURSES IN 2012–2013 LED BY MCZ FACULTY-CURATORS



Naomi Pierce

OEB 155r: *Biology of Insects*  
(offered fall 2013)

## Organismic and Evolutionary Biology

### OEB 10: Foundations of Biological Diversity (undergraduate)

*Brian D. Farrell (and N. Michele Holbrook)*

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 (undergraduate)

*Gonzalo Giribet*

Introduction to invertebrate diversity, with special emphasis on the broad diversity of animal forms, their adaptations to different ecosystems and how these phenomena shape animal evolution.

### OEB 57: Animal Behavior (undergraduate)

*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 121a: Research in Comparative Biomechanics Seminar (undergraduate and graduate)

*Andrew A. Biewener, George V. Lauder  
(and Stacey A. Combes, Anna G. Warrener)*

Introduction to experimental techniques used to investigate the structure and physiology of vertebrates, where each instructor offers research projects that are undertaken in their laboratory.

### OEB 130: Biology of Fishes (undergraduate and graduate)

*George V. Lauder*

Explores the unparalleled diversity of fish across different aquatic environments including deep seas, intertidal zones, coral reefs, polar waters, the vast Amazonian basin and great East African lakes.

### OEB 234: Topics in Marine Biology (graduate)

*Robert M. Woollacott*

Examines human impacts on marine life and ecosystems of the sea.

### OEB 255: Nature and Regulation of Marine Ecosystems (graduate)

*James J. McCarthy*

A presentation of topics that are of current interest in marine ecosystems, emphasizing identification and quantification of biological and environmental factors important in the regulation of community structure.

### OEB 275r: Phylogenomics, Comparative Genomics and Adaptation (graduate)

*Scott V. Edwards*

Explores the ways in which comparative genomics can inform phylogeny and genomic adaptation, surveying recent methods for harnessing thousands of loci for phylogenetic reconstruction.

### OEB 275br: Evolutionary Genomics and the Museum: Enhancing Insight into Evolutionary Processes Using Museum Collections (graduate)

*Scott V. Edwards, James Hanken*

Explores the diverse ways to enhance evolutionary studies via online databases for genomics and museum collection through discussions, presentations and video conferencing across multiple institutions.

OEB 130: *Biology of Fishes*



Catherine Wenzel



## Graduate Courses of Reading and Research

### OEB 307: Biomechanics, Physiology and Musculoskeletal Biology

*Andrew A. Biewener*

### OEB 310: Metazoan Systematics

*Gonzalo Giribet*

### OEB 320: Biomechanics and Evolution of Vertebrates

*George V. Lauder*

### OEB 325: Marine Biology

*Robert M. Woollacott*

### OEB 334: Behavioral Ecology

*Naomi E. Pierce*

### OEB 341: Coevolution

*Brian D. Farrell*

### OEB 345/E-PSCI 337: Biological Oceanography

*James J. McCarthy*

### OEB 355: Evolutionary Developmental Biology

*James Hanken*

### OEB 362: Research in Molecular Evolution

*Scott V. Edwards*

### OEB 367: Evolutionary and Ecological Diversity

*Jonathan B. Losos*

### OEB 370: Mammalian Evolutionary Genetics

*Hopi E. Hoekstra*



*Andrew Williston*

*OEB 130: Biology of Fishes*



*Jonathan Losos*

## Freshman Seminars

### FRSEMR 21k: Monsters and Movers in the Deep

*Robert M. Woollacott*

Explores fantastic beasts of the sea, both imaginary and real, using historical dimensions but emphasizing contemporary sciences.

### FRSEMR 22t: Why We Animals Sing (The Ways We Do)

*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 25j: Evolutionary Biology: The Lizard Perspective

*Jonathan B. Losos*

Examines the workings of evolution and adaptation through one of the most diverse types of vertebrate animals.

### FRSEMR 41u: Museums

*James Hanken*

Traces the history of museums from their beginnings to the modern institutions of today, considering issues in conservation, finances, exhibit design, legal and ethical issues, and their role in contemporary society.

*Freshman Seminar 25j: Evolutionary Biology: The Lizard Perspective*





Jacquith Trumble

*OEB 275br: Evolutionary Genomics and the Museum: Enhancing Insight into Evolutionary Processes Using Museum Collections*

## Life Sciences

### **LIFESCI 1b: An Integrated Introduction to the Life Sciences: Genetics, Genomics and Evolution (undergraduate)**

*Hopi E. Hoekstra (and Maryellen Ruvolo, Kevin C. Eggan, Pardis Sabeti)*

This course uses an integrated approach to show 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 (undergraduate)**

*Andrew A. Biewener, George V. Lauder (and Katherine J. Hinde)*

Explores human anatomy and physiology from an integrated framework, combining functional, comparative and evolutionary perspectives on how organisms work.

## General Education

### **Science of Living Systems 22: Human Influence on Life in the Sea (undergraduate)**

*Robert M. Woollacott, 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.

## Harvard Extension School and Harvard Summer School

### **BIOS E-225: Human Impacts on Marine Organisms and Ecosystems**

*Robert M. Woollacott*

Examines how anthropogenic-driven events are impacting the structure and function of marine communities.

*OEB 51: Biology and Evolution of Invertebrate Animals*



**BIOS S-74: Marine Life and Ecosystems of the Sea**

*Robert M. Woollacott*

A review of the life history and adaptations of marine life and the ecosystems of the sea, with emphasis on understanding the fragility and resilience of marine systems in the face of anthropogenically driven perturbations.

**BIOS S-158: Study Abroad: Biodiversity of the Dominican Republic**

*Brian D. Farrell*

Explores the interplay of ecological niches and evolutionary diversification in the organisms and habitats of a tropical island as a microcosm of the evolution of biodiversity on Earth.



*Freshman Seminar 25: Evolutionary Biology: The Lizard Perspective*



*Jonathan Lewis*

**MCZ History**

Two of the foremost evolutionary biologists of the 20th century were successive directors of the MCZ. Alfred Sherwood Romer (1946–1961) assumed his post at the close of World War II. He inherited an institution in “desperate” financial straits due to limited income and rampant (wartime) inflation. Most salaries, he decried, “were desperately small.” Yet, thanks to his skillful management and the generosity of key supporters, especially George and Mabel Agassiz, by the end of Romer’s tenure “the wolf is, for the moment at least, no longer scratching at the door.”

The improved situation enabled Ernst Mayr (1961–1970) to prevail over—indeed, to promote—an important expansion of MCZ, both physically and programmatically. He initiated construction of a new wing, the MCZ Laboratories, equipped for studies of behavior, environmental physiology, population biology and biochemical evolution, which would “enrich the intellectual atmosphere of the Museum.” He also helped establish the Concord Field Station and secure the Estabrook Woods for field studies.

The changing of the guard between these two champions of natural history museums in contemporary biology is captured in a photograph from that year’s annual report.



*Professor Romer (left) welcoming Professor Mayr to his new office as Director of the Museum*



## HIGHLIGHTS FROM THE COLLECTIONS



Nadine Rowland-Nielsen

GeoCenter Møns Klint

## Specimens Relocate to Denmark

During six weeks in fall 2012, fossil specimens of Greenland's ancient fish, amphibians, reptiles and mammals were carefully swaddled in foam and toilet paper for a 20-day sea voyage to Denmark.

The specimens were collected in expeditions led by **Farish A. Jenkins Jr.** during seven field seasons from 1988 to 2001. These expeditions to the Triassic Fleming Fjord Formation yielded significant finds, notably a nearly complete *Plateosaurus* dinosaur and its footprints that contributed to Prof. Jenkins' research on the dinosaur and its gait. The researchers also discovered a small mammal, *Haramiyavia clemmensei*, whose specialized teeth suggest that mammals may have diversified earlier than was previously thought, possibly in the Middle Triassic.

Prof. Jenkins was joined on the expeditions by colleagues from Denmark and the

United States. Under the collecting agreement with the Kingdom of Denmark, the specimens would be housed in the MCZ collections for research during Prof. Jenkins' tenure. Over the years the specimens have been used for research projects—both by Jenkins and his students—and for teaching purposes.

In anticipation of Prof. Jenkins' retirement, arrangements were made to return the specimens to Denmark. **Jessica Cundiff**, Acting Curatorial Associate and Collections Manager for Vertebrate Paleontology; **Mark Renczkowski**; **Bridget Power**; **Richard Knecht**; **Tsuyoshi Takahashi**; and **Victoria Wilke** painstakingly prepared and packed 90 specimens ranging in size from tiny mammal teeth that fit in a small box to the *Plateosaurus* dinosaur, which required five crates.

Sixteen heat-treated wooden crates were specifically constructed to safeguard the



Mark Renczkowski



Victoria Wilke



fossils during their long sea voyage. Small fragile specimens were placed in plastic boxes with foam sheets cut around their form. Larger specimens, such as the *Plateosaurus*, were sunk into beds of two-inch-thick foam blocks for added protection. Other less fragile specimens were wrapped in toilet paper and layered in the crates.

Prof. Jenkins felt that toilet paper was one of the best materials for wrapping fossils in the field as well as for cushioning them during shipment. “In a memorable moment during the packing process, Farish proclaimed how important it is to have toilet paper in the field—not only for its intended use, but also for wrapping fossils,” says Cundiff. “He proceeded to show us his fossil-wrapping technique, and then critiqued our skills and the aesthetics of our toilet paper bundles.”

The specimens arrived in December 2012 at the GeoCenter Møns Klint, a geological museum on the island of Møn in southeastern Denmark. Curators at the GeoCenter were particularly excited to receive the *Plateosaurus*, which was mounted and is currently featured in *The First Dinosaur*. The exhibition is based on the findings of the 2012 Danish expedition to Jameson Land in Greenland and the seven Harvard expeditions led by Farish Jenkins. Once the exhibition closes, the specimens will reside in the collections of the Natural History Museum of Denmark.

### The Ant Room, Transformed

The MCZ’s ant collection is the largest and most important in the world, so sprucing up the Ant Room was no small undertaking. In order to make the approximately one million specimens more searchable and accessible for research, the entire collection was reorganized alphabetically by taxonomic group.

**Stefan Cover** and **Jignasha Rana**, Curatorial Assistants in the ant collection, were joined in the massive undertaking by various users of the collection. Dr. Steve Shattuck and Robyn Meier of the Australian National Insect

Collection provided valuable assistance during the process.

The specimen reorganization will facilitate collection initiatives such as cataloging and databasing ant specimens in the collection, and organizing and transferring specimen material to the MCZ cryogenic facility. According to Rana, “The specimens in this new arrangement are certainly more accessible, which increases their scientific utility and value.”

The Ant Room underwent physical renovations, as well. With the help of Collections Operations staff, the Ant Room received specialized, lab-quality benches,



From left: Stefan Cover, Jignasha Rana and Steve Shattuck

updated light fixtures and new equipment for curatorial staff. **Edward O. Wilson**, Honorary Curator, provided the funding for work chairs that completed the room’s physical transformation, and also for a high-resolution imaging system to enable advanced specimen digitization. The new equipment and renovated workspace now provide welcoming open areas and increased capability for curatorial and research purposes.

The most critical components of the project have been accomplished. However, curating a world-class ant collection will always be a work in progress as new species are discovered and accessioned into the collection.



## A New, Powerful Three-Dimensional Research Tool

Over the past few decades, micro-CT scanners have become increasingly valuable for gathering detailed specimen data in a non-invasive manner. By combining this data with 3-D modeling techniques, researchers are able to visualize the skeletal structure and understand the functioning of creatures both modern and ancient.

In September 2012, the MCZ's new micro-CT scanner was installed in the Digital Imaging Facility in the MCZ Labs Building. Micro-CT is the standard technology for imaging and characterizing internal structures in three dimensions, giving researchers a powerful tool for answering a wide variety of questions in ways they might not have imagined previously.

The micro-CT scanner produces a large number of X-ray images as the sample rotates 180°. These images are processed by proprietary software to create a digital 3-D reconstruction of the sample, which can then be analyzed and characterized in a variety of useful ways.

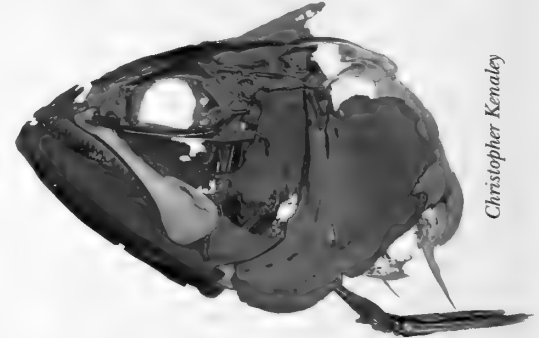
Researchers will be able to analyze and characterize skeletal and other aspects of internal morphology easily, consistently and non-destructively. For MCZ specimens, the data can be represented in MCZbase, the Museum-wide database, so that users can view and manipulate it in their Web browsers. The full data sets will also be available to share with outside researchers and collaborators.

**Christopher Kenaley**, postdoctoral fellow in the Lauder lab, explains the use of the technology in his research.

"I've been working on both biorobotics and biomechanics projects that use data from the micro-CT," says Kenaley. "The biorobotics work uses 3-D models of real fish to construct robotic fish heads that represent the complexity of the skeletal structure.

"The biomechanics work employs 3-D models to establish how feeding and fin morphology vary between species and how this variation has affected diversification."

Bass fish have been scanned for the robotics work, dragonfishes for the feeding work and remoras for the fin work. Most of the scanned specimens are from the MCZ ichthyology collection.



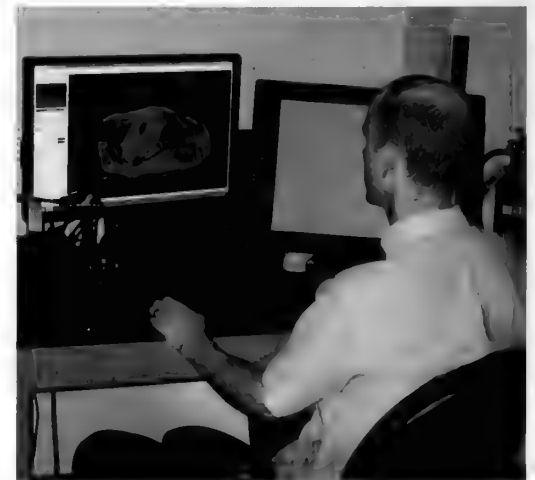
3-D model of a bass fish

Christopher Kenaley



Emma Sherratt

A mummified bird scanned by Emma Sherratt, postdoctoral fellow in the Losos lab, and Adam Aja, Assistant Curator of Collections at the Semitic Museum



Catherine Weisel

The technology can also be used to produce complex mathematical models of how skeletal properties affect the way bones perform.





# MCZ RESEARCH MAKING HEADLINES

## Unearthing the Genetic Homes of Burrowing Behavior

Relative to physical traits, very little is known about how genetics influence development of complex behaviors in nature. When animals build structures, whether beehives, birds nests or burrows, they seem to be guided by behaviors that are more innate than learned.

A team of researchers led by **Hopi E. Hoekstra** studied two species of mice and identified four regions in their genome that appear to influence the style of burrows they build. Their findings were published in *Nature*.

The subjects of the study were oldfield mice (*Peromyscus polionotus*) and the closely related deer mice (*Peromyscus maniculatus*). Each species creates their homes in a distinctive style: oldfield mice burrows are complex, with a long entrance tunnel leading to the nest and a separate escape tunnel that ends slightly below the surface; deer mice burrows are smaller, with simple, single-tunnel structures. Both species will consistently dig shelters of the same design and tunnel length, regardless of soil composition, whether in the wild or in the lab.

When the species were crossbred, the next generation opted for the more elaborate burrow of the oldfield mice. But when these hybrid offspring were bred with deer mice, the subsequent generation's burrows were a combination of the two styles. By matching genetic variations among the mice with their tunnel styles, the researchers found three regions of the genome that determine tunnel length and one that is related to the inclusion of an escape tunnel. The next steps will be to identify the specific genes involved and how changes in those genes affect burrowing behavior.

The paper, featured in *The New York Times*, was authored by Prof. Hoekstra; **Jesse Weber**, former graduate student in the Hoekstra lab; and **Brant Peterson**, postdoctoral fellow in the Hoekstra lab.

Weber JN, Peterson BK, Hoekstra HE (2013) Discrete genetic modules are responsible for complex burrow evolution in *Peromyscus* mice. *Nature* 493:402-406.



Measuring burrows

Liz Pennisi



JB Miller

## Looking for Lizards in Colombia

After focusing on the anole species of the Caribbean islands for most of his career, **Jonathan B. Losos** is on a quest to study the mainland anoles of Central and South America.

There are more anole species on the mainland (250 species) than in the islands (150 species), but less is known about them. As part of an effort to rectify this imbalance, the field team—Prof. Losos; **Rosario Castañeda**, a postdoctoral fellow in the Losos lab; and Anthony Herrel, an MCZ Associate based at the Muséum National d'Histoire Naturelle Paris—spent three weeks in Colombia and Venezuela in the spring of 2013. Biology students from the Universidad de Los Andes and elsewhere joined the team to assist in data collection and receive training in field methods.

The expedition is part of ongoing research that so far has compiled behavioral,

ecological and morphological data on anole species in Costa Rica, Ecuador, Honduras, Mexico and Panama. In three very different locations and climates, the team used field observations, videotaping and lab work to document the lizards' habitat, diet, behavior, locomotion and biomechanical capabilities such as speed and bite strength.

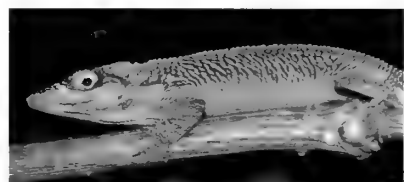
The researchers are investigating whether the mainland anoles have, in fact, followed the same developmental path as the island anoles, or whether they have evolved in a different manner, and if so, why.

An MCZ Putnam Expedition Grant supported the fieldwork, and Prof. Losos blogged about their experiences and findings for *The New York Times* Scientist at Work series.



Jonathan B. Losos

Jonathan Losos



Jonathan Losos





Andrew Berry

Fred Ausubel and Naomi Pierce

## Vegetarian Flies Fond of Mustards

Half of the world's insect species feed on plants. Considering their agricultural importance, we still know relatively little about the genetic mechanisms underlying plant-insect interactions.

In a long-term collaboration, **Naomi Pierce** and Frederick Ausubel (Department of Genetics, Harvard Medical School) have used experimental infections of the plant genetic model *Arabidopsis thaliana* with the genetically characterized pathogen *Pseudomonas syringae* to dissect defense-signaling pathways and virulence factors involved in plant-pathogen interactions. By adding to this system a generalist herbivore, the cabbage looper *Trichoplusia ni*, they discovered complex three-way interactions involving pathogen virulence, host resistance and susceptibility to attack by pathogens and herbivores.

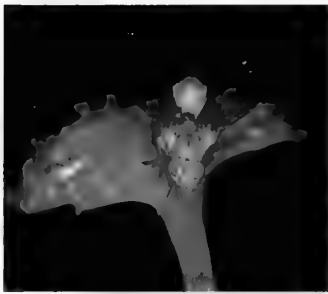
In their most recent paper, published as a cover story in *Genome Biology Evolution* with postdoctoral fellow Noah Whiteman (now at the University of Arizona) as first author, they extend this research by genetically characterizing *Scaptomyza flava*, a drosophilid fly whose leaf-mining larvae specialize on plants in the Brassicaceae—the mustard family—which includes vegetables such as broccoli, cabbage

and cauliflower, as well as *Arabidopsis*. They show that this genetically tractable system can be used to investigate pathways underlying plant-insect interactions.

When fed upon, *Arabidopsis* generates increased amounts of defense compounds called glucosinolates. However, these toxins do not deter *S. flava*. Although the glucosinolates of *Arabidopsis* still adversely affect larval development—indicating that the flies are not entirely immune to the plants' defenses—these specialists are able to detoxify them and thrive on the plants. The expression of a number of stress-related genes in the flies suggest that these genes may play a role in the detoxification process.

Insects cause major damage to crop plants around the world, and in addition to learning about the evolution of herbivory, a better understanding of mechanisms underlying plant-insect interactions will facilitate development of novel insecticides and plant breeding strategies.

Whiteman NK, Gloss AD, Sackton T, Groen S, Humphrey PT, Lapoint R, Sønderby I, Halkier BA, Kocks C, Ausubel FM, Pierce NE (2012) Genes involved in the evolution of herbivory by a leaf-mining drosophilid fly. *Genome Biol Evol* 4:788-804.



Noah Whiteman

## What a Complex Web They Weave

When visualizing a spider web, it is most likely the wheel-like shape of the orb weavers. With more than 12,000 known species, orb weavers make up about 30% of spider diversity.

Understanding the timing and mode of orb web evolution has been hampered by the relatively small size of the samples in previous genetic studies. To address this significant research hurdle, **Gonzalo Giribet** and colleagues compiled a massive dataset that surpasses the size of all prior molecular studies of spider phylogeny.

The resulting research genetically confirmed the hypothesis that orb weavers descended from a single ancestor, but found that ancestor emerged around 207 to 231 million years ago, earlier than suggested by the fossil record.

The results also showed that the history of web diversification is probably much

more complex than previously thought. Rather than the web architecture evolving in response to the diversification of prey, the researchers propose that variety in web design was most likely a response to abundant prey and increasingly complex habitat, allowing the spiders to build webs in different types of spaces and therefore decrease competition among spider species. The findings were published in *Proceedings of the Royal Society B*.

Dimitrov D, Lopardo L, Giribet G, Arnedo MA, Álvarez-Padilla F & Hormiga G (2012) Tangled in a sparse spider web: single origin of orb weavers and their spinning work unravelled by denser taxonomic sampling. *P Roy Soc B* 279:1341-1350.



Gonzalo Giribet



Gonzalo Giribet



# PROJECTS & INITIATIVES

## Encyclopedia of Life Learning + Education Group

The Encyclopedia of Life is a global effort to bring together species information in a free, trusted online resource available at [eol.org](http://eol.org). Content on EOL is provided by hundreds of partners, including MCZbase.

The EOL Learning + Education Group encourages the development of innovative and effective uses of EOL content in educational settings. One way of achieving this goal is to partner with model projects that inform and inspire, thereby providing concrete examples that can be modified to suit various educational needs.

### Contributing to Lifelong Learning

EOL is used in formal and informal education settings, both as a trusted resource and for its tools to organize information around particular areas of interest and allow for directed and open-ended learning activities.

- EOL has developed resources like the *One Species at a Time* podcast series, *Biodiversity on the Move* Google Earth Tours and an EOL page on iTunesU. The *One Species at a Time* podcasts at [education.eol.org/podcast](http://education.eol.org/podcast) are organized by scientific topic and skill.
- The Center for Essential Science at the University of Michigan and others are testing the *Changethinking* curriculum about the impact of climate change on North American species. The EOL Ecosystem Explorer Tool, which provides an easy way to create engaging graphs of species interactions within an ecosystem, is integrated into this study.
- EOL Learning + Education Group, in conjunction with the Professor Garfield Foundation and New York State Teacher Centers, invites students from grades 6 to 8 to participate in a science-based comic contest about invasive species through investigation of [eol.org](http://eol.org).
- *Families by the Seaside: Building Community-Based Outdoor Ocean Science Learning Experiences* uses EOL field guides, observation capabilities and games to improve ocean literacy. The program,

run by five New England marine science centers on a NOAA grant, engages underserved families in marine exploration and learning through hands-on and technology-assisted activities.



### In Support of Citizen Science

One of EOL's goals is to transform how people participate in biodiversity science, increasing public involvement, maximizing



JumpStart Youth Connection

effectiveness and accelerating innovation. In June 2012, EOL and iNaturalist debuted an app for Android and iOS operating systems that enables EOL community members to more easily contribute to the growing record of life around us. Citizen scientists can now key their observations directly into their phones, and those observations are then displayed on a map within EOL Collections.

### Serving America's National Parks

EOL has partnered with the U.S. National Park Service in 24-hour species inventories called BioBlitzes, conducted to learn more about the biodiversity, distribution and abundance of species in a specific area. Participating in a BioBlitz lets anyone get involved with nature, increasing awareness and understanding of the environment. People can even conduct their own BioBlitz using the tools and tips on the EOL Learning + Education website, [eol.org/discover](http://eol.org/discover).

bioblitz	
BISCAYNE NATIONAL PARK	
A 24-HOUR SPECIES INVENTORY	
Amphibians	3
Birds	65
Corals	80
Fish	192
Fungi	7
Insects	71
Mammals	6
Nonvascular Plants	68
Other Invertebrates	102
Reptiles	7
Vascular Plants	209
<b>TOTAL</b>	<b>810</b>

Encyclopedia of Life



## New Alliance Promotes Digitization of Nation's Biocollections

Some of the most valuable resources available to science are contained within our nation's 1,600-plus biological collections. Representing an estimated one billion specimens, these collections are vitally important to the various research, educational and technological pursuits of biologists and non-biologists alike.

As species discovery, documentation and analysis continues to grow, it has become increasingly imperative to improve access to both existing and future collections while also reducing their risk of loss. At a February 2010 workshop held at the National Evolutionary Synthesis Center in Durham, North Carolina, various members of the biocollections community created a strategic plan to do just that. They established the *Network Integrated Biocollections Alliance*, a coordinated, large-scale, sustained effort to digitize the biocollections held within our nation's natural history museums, university science departments and other repositories, and integrate them into an online database. In September 2012, the American Institute

of Biological Sciences, with support from the National Science Foundation, held a workshop to put this strategy into action.

The resulting plan of implementation, authored in part by MCZ Director **James Hanken** and Director of Collections Operations **Linda S. Ford**, outlines the key steps, milestones and stakeholders required to build NIBA over the next ten years. Once it is operational, NIBA's biocollections database will be extremely helpful in coping with consequences of climate change, invasive species, pollution and other major environmental problems.

Once its organizational and governance structure has been achieved, NIBA will provide national leadership to implement a digitized biocollections network and sustainable knowledge database. In addition, the alliance will identify key stakeholders as potential members, lead efforts to train existing and future collections staff, and encourage specimen-based learning and exploration in both formal and informal education.



Adam Baldinger

## MCZ Opens Collections to Undergraduates in AIM-UP! Initiative

Universities throughout the country hold a wealth of information about life on Earth in their natural history museums. For the most part, these collections have only been made available to practicing researchers. Now, a five-year initiative (May 2010 to April 2015) funded by the National Science Foundation called *Advancing Integration of Museums into Undergraduate Programs* (AIM-UP!) is incorporating the collections housed at Harvard and other participating universities into undergraduate instruction.

Each year under the initiative, a different institution takes the lead in presenting a class that highlights the importance of their museum's collection and its potential in undergraduate classes. Classes feature guest lecturers and are made available via videoconferencing to students at each participating university. For the spring 2013 semester, **Scott V. Edwards** led a class that explored the ways in which museum collections and online museum databases can enhance modern studies of genomic and geographic variation.

Additionally, MCZ hosted AIM-UP!'s annual workshop in April 2013, with more than a dozen representatives of the participating institutions in attendance.

While AIM-UP! began as a collaboration among the University of Alaska, Harvard University, the University of California at Berkeley and the University of New Mexico as a way to integrate expertise and data across these institutions, it is expanding to other universities, federal agencies and educators in other countries such as Canada and Uruguay.

In addition to training undergraduates in museum-based field and laboratory research, AIM-UP! also seeks to develop instructional tools for museum databases, increase digitization of collections for easier access, integrate specimen-based questions and lessons into the classroom, conduct outreach to underrepresented students, and include more minority and female scientists, agency biologists, academics, international participants and museums with large public audiences.



Jeremiah Trumble



## Ernst Mayr Library Collaborates on *Bioluminescence* Exhibition

From glowworms that emit sticky threads of light to fireflies that bob through the air on summer evenings, a variety of species have evolved the ability to generate light. But why? From February to June 2013, a unique exhibition in the MCZ's Northwest Building lobby provided illuminating answers to that question and more.

*Bioluminescence* was part of a successful proposal to integrate Library information and faculty research. The project was steered by **Dorothy Barr** of the Ernst Mayr Library and funded by the Harvard Library Lab, which offers infrastructure and financial support to librarians, faculty and students promoting library-related projects. *Bioluminescence* was a collaborative effort of the Ernst Mayr Library, MCZ staff, and faculty in the departments of Organismic and Evolutionary Biology and Molecular & Cellular Biology. The exhibit highlighted the mechanisms, functions and purposes behind dozens of species' ability to emit light. The book that inspired the exhibition—*Bioluminescence: Living Lights, Lights for Living*—was written by

J. Woodland “Woody” Hastings, faculty member in MCB, and Therese Wilson, an MCB Senior Research Associate Emerita.

Work by **Chris Kenaley** of the Lauder lab and a variety of specimens from the MCZ's vast collection were on display, including fireflies, which use their abilities in part to attract mates, deep-sea fishes that use glowing lures to capture prey, and jellyfish, from which green fluorescent protein (GFP)—widely used in molecular and cellular biology—was first isolated.

The MCZ members who contributed to the exhibit included **Karsten Hartel**, Chris Kenaley and **Andrew Williston** of Ichthyology; **Adam Baldinger** and **Gonzalo Giribet** of Invertebrate Zoology; **Murat Recevik** of Malacology; **Phil Perkins** and **Rachel Hawkins** of Entomology; and **Victoria Wilke** of Collections Operations. Dorothy Barr developed the exhibition's companion webguide.



Christopher Kenaley

## Ernst Mayr Library Helps Launch BHL-Africa

Two years ago during a Biodiversity Heritage Library Conference in Chicago, Illinois, the idea to create BHL-Africa was born. On April 15, 2013, BHL-Africa was officially launched as a part of the library's global family. The Ernst Mayr Library contributed content from the South African National Biodiversity Institute to kick off BHL-Africa.

The South African National Biodiversity Institute (SANBI) in Pretoria, South Africa, hosted the launch and three-day workshop, which included presentations by six colleagues from BHL-US/UK programs. **Connie Rinaldo**, the Librarian of the MCZ's Ernst Mayr Library, is Vice Chair of the Executive Steering Committee for the Biodiversity Heritage Library, of which the Ernst Mayr Library is a founding member. She contributed a presentation on copyright, defining public domain, open access and the Creative Commons licenses employed by BHL-US/UK.

A consortium of major natural history museum libraries, botanical libraries and research institutions around the world, the

Biodiversity Heritage Library is an online resource featuring more than 42 million pages of biodiversity literature collected to support the work of scientists, researchers and students in their home institutions and throughout the world. Working with the international taxonomic community, rights holders and other interested parties, BHL ensures that this biodiversity heritage is made available to a global audience through open access principles.

The Africa consortium is now hard at work identifying content for scanning both within and outside of Africa, digitizing that content and building an audience by promoting the project throughout the continent. It is also identifying potential contributors and encouraging them to sign a memorandum of understanding as part of their commitment to provide open access to the biodiversity literature found within African libraries and institutions.



The BHL-Africa group at the Pretoria National Botanical Garden



## The New Public Face of Harvard's Museums

When many hundreds of people gathered together for the Harvard Museums of Science & Culture's summer solstice celebration, it was more than just a party. It was a celebration of the success of the year-old consortium's first major public outreach initiative.



Rose Lincoln

Jane Pickering

The Harvard Museums of Science & Culture is a partnership created to strengthen, support and promote the six world-class museums that exist within the Faculty of Arts and Sciences. The HMSC officially debuted in July 2012, drawing upon the very successful model of the Harvard Museum of Natural History, the umbrella institution for the public initiatives of the Museum of Comparative Zoology, the Mineralogical and Geological Museum and the Harvard University Herbaria.

The faculty executive board that directed the creation of HMSC was made up of the faculty directors of each participating museum, including MCZ Director **James Hanken**. Professor **James McCarthy**,

former Director of the MCZ, served as the board's initial chair.

Participating museums include the MCZ, the Mineralogical and Geological Museum, the Harvard University Herbaria, the Collection of Historical Scientific Instruments, the Harvard Semitic Museum and the Peabody Museum of Archaeology & Ethnology. The Harvard Museum of Natural History is also a member of the partnership. Together, these diverse organizations will collaborate on public outreach initiatives designed to promote greater understanding through a multidisciplinary approach, while retaining strong connections to their respective academic departments, research, collections and modes of scholarship.

In December 2012 Jane Pickering was appointed Executive Director of the HMSC. As the former Director of Public Programs and Deputy Director at Yale's Peabody Museum of Natural History, she brings nearly 25 years of curatorial and public programming experience to the HMSC. She is responsible for collaborating with faculty leaders of each museum and other stakeholders to develop the public-facing functions of the museums, including exhibits, education, special programs, development, and administration and operations.

Since the HMSC's establishment, a record 240,000 visitors have come to visit the museums, participate in their programs and listen to free evening lectures. The museums also hold classes for grades K-12 and have a wealth of instructional resources for teachers as well as for Harvard faculty and students. For a full list of exhibitions, lectures and other events, visit the HMSC website at [hmsc.harvard.edu](http://hmsc.harvard.edu).

## A Gift for the New Marine Life Gallery

MCZ Faculty member George Putnam III and his wife, Kathy, have made a very generous donation to the Harvard Museums of Science & Culture that will go toward the creation of a new gallery of marine life in the Harvard Museum of Natural History. The exhibit will feature the diverse collections of the MCZ, a full-scale immersive diorama of New England marine communities, historical displays and

interactive multimedia that offer real-time experiences exploring the latest findings of Harvard-based research on ocean life. The work will also include a complete renovation and redesign of the gallery space that currently includes the *Fishes* exhibition and Asia display. The new exhibit will open in May 2015 in time for the next commencement.



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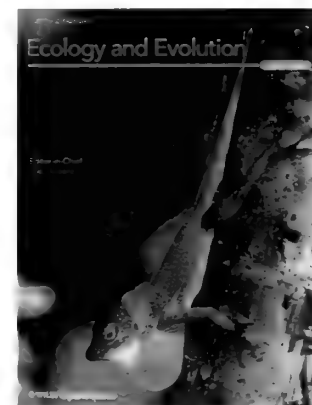
• **Giribet G, Edgecombe GD** (2012) Reevaluating the Arthropod Tree of Life. *Annu Rev Entomol* 57:167-186

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• **Giribet G, Tourinho AL, Shih C, Ren D** (2012) An exquisitely preserved harvestman (Arthropoda, Arachnida, Opiliones) from



For the cover story of *Science*, **Jason Kolbe, Jonathan Losos** and colleagues published "Founder effects persist despite adaptive differentiation: a field experiment with lizards."

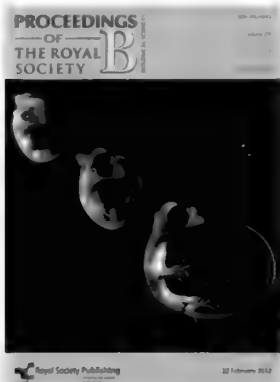


**Jason Kolbe, Jonathan Losos** and colleagues contributed the cover story "Climatic niche shift predicts thermal trait response in one but not both introductions of the Puerto Rican lizard *Anolis cristatellus* to Miami, Florida, USA" to *Ecology and Evolution*.





“Passive robotic models of propulsion by the bodies and caudal fins of fish” by **George V. Lauder**, **Brooke Flammang** and colleagues was the cover story in *Integrative & Comparative Biology*.



**Thom Sanger**, **Jonathan B. Losos** and colleagues contributed “Repeated modification of early limb morphogenesis programmes underlies the convergence of relative limb length in *Anolis* lizards” as the cover story of *Proceedings of the Royal Society B*.



**Talia Moore** and colleagues at the University of California, Berkeley, contributed the cover story “Tail assisted pitch control in lizards, robots and dinosaurs” to *Nature*.

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- **Hoekstra HE** (2012) Genomics: Stickleback is the catch of the day. *Nature* 484:46-47
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- **Kleinteich T, Maddin HC, Herzen J, Beckmann F, Summers AP** (2012) Is solid always best? Cranial performance in solid and fenestrated caecilian skulls. *J Exp Biol* 215:833-844
- **Kolbe JJ, Leal M, Schoener TW, Spiller DA, Losos JB** (2012) Founder effects persist despite adaptive differentiation: a field experiment with lizards. *Science* 335:1086-1089
- **Kolbe JJ, Vanmiddlesworth P, Losin N, Dappen N, Losos JB** (2012) Climatic niche shift predicts thermal trait response in one but not both introductions of the Puerto Rican lizard *Anolis cristatellus* to Miami, Florida, USA. *Ecol Evol* 2:1503-1516
- **Kronauer DJC, Pierce NE, Keller L** (2012) Asexual reproduction in introduced and native populations of the ant *Cerapachys bairi*. *Mol Ecol* 21:5221-5235
- **Kronforst MR, Barsh GS, Kopp A, Mallet J, Monteiro A, Mullen SP, Protas M, Rosenblum EB, Schneider CJ, Hoekstra HE** (2012) Unraveling the thread of nature's tapestry: the genetics of diversity and convergence in animal pigmentation. *Pigm Cell Melanoma R* 25:411-433
- **Küpper C, Augustin J, Edwards SV, Szczykly T, Kosztolányi A, Burke T, James DE** (2012) Triploid plover female provides support for a role of the W chromosome in avian sex determination. *Biol Lett* 8:787-789
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- **Lee JY, Joseph I, Edwards SV** (2012) A species tree for the Australo-Papuan fairy-wrens and allies (Aves: Maluridae). *Syst Biol* 61:253-271
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- **Losos JB, Woolley ML, Mahler DL, Torres-Carvajal O, Crandell KE, Schaad EW, Narváez AE, Ayala-Varela F, Herrel A** (2012) Notes on the natural history of the little-known Ecuadorian horned anole, *Anolis proboscis*. *Breviora* 531:1-17
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- **Maia A, Wilga C, Lauder GV** (2012) Biomechanics of locomotion in sharks, rays and chimeras. In: *Biology of Sharks and Their Relatives, 2nd edition* (Carrier JC, Musick JA, Heithaus MR, eds) 125-151. CRC Press: Boca Raton, Florida
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- **Novo M, Alnodóvar A, Fernández R, Trigo D, Díaz-Cosin DJ, Giribet G** (2012) Appearances can be deceptive: different diversification patterns within a group of Mediterranean earthworms (Oligochaeta, Hormogastridae). *Mol Ecol* 21:3776-3793
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- **Riehl C** (2012) Parental care and reproductive skew in a communally breeding cuckoo: hard-working males do not sire more young. *Anim Behav* 84:707-714
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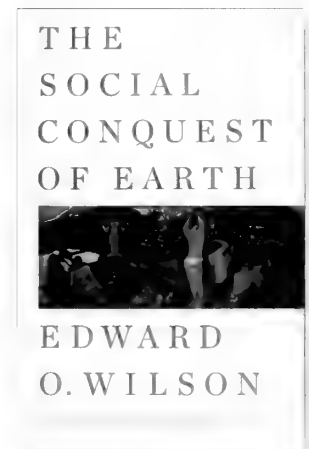
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- **Sanger TJ, Mahler DL, Abzhanov A, Losos JB** (2012) Roles for modularity and constraint in the evolution of cranial diversity among *Anolis* lizards. *Evolution* 66:1525-1542
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- **Sharma PP, Buenavente PAC, Clouse RM, Diesmos AC, Giribet G** (2012) Forgotten gods: Zalmoxidae of the Philippines and Borneo (Opiliones: Laniatores). *Zootaxa* 3280:29-55
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- **Song S, Liu L, Edwards SV, Wu S** (2012) Resolving conflict in eutherian mammal phylogeny using phylogenomics and the multispecies coalescent model. *Proc Natl Acad Sci USA* 109:14942-14947
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- **Stuart YE, Losos JB, Algar AC** (2012) The island-mainland species turnover relationship. *Proc R Soc B* 279:4071-4077
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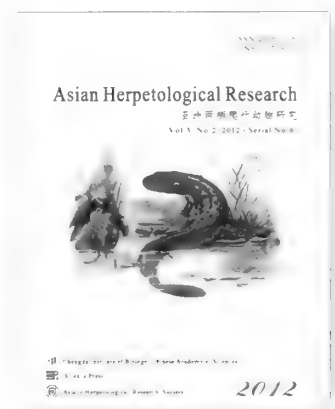
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- **Wake DB, Rovito SM, Maisano JA, Hanken J** (2012) Taxonomic status of the enigmatic salamander *Cryptotriton adelos* (Amphibia: Plethodontidae) from northern Oaxaca, Mexico, with observations on its skull and postcranial skeleton. *Zootaxa* 3579:67-70
- **Wakeling JM, Lee S, Arnold-Rife A, de Boef Miara M, Biewener AA** (2012) A muscle's force depends on the recruitment patterns of its fibres. *Ann Biomed Eng* 40:1708-1720
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- **Wheeler QD, Knapp S, Stevenson DW, Stevenson J, Blum SD, Boom BM, Borisy GG, Buizer JL, de Carvalho MR, Cibrian A, Donoghue MJ, Doyle V, Gerson EM, Graham CH, Graves P, Graves SJ, Guralnick RP, Hamilton AL, Hanken J, Wilson EO, et al** (2012) Mapping the biosphere: Exploring species to understand the origin, organization, and sustainability of biodiversity. *Syst Biodivers* 10:1-20
- **Whiteman NK, Gloss AD, Sackton TB, Groen SC, Humphrey PT, Lapoint RT, Sønderby IE, Halkier BA, Kocks C, Ausubel FM, Pierce NE** (2012) Genes involved in the evolution of herbivory by a leaf-mining, drosophilid fly. *Genome Biol Evol* 4:900-916
- **Wilga CD, Maia A, Nauwelaerts S, Lauder GV** (2012) Prey handling using whole body fluid dynamics in batoids. *Zoology* 115:47-57
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- **Worsaae K, Sterrer W, Kaul-Strehlow S, Hay-Schmidt A, Giribet G** (2012) An anatomical description of a miniaturized acorn worm (Hemichordata, Enteropneusta) with asexual reproduction by paratomy. *PLoS ONE* 7:e48529
- **Wu S, Wu W, Zhang F, Ye J, Ni X, Sun J, Edwards SV, Meng J, Organ CL** (2012) Molecular and paleontological evidence for a post-Cretaceous origin of rodents. *PLoS ONE* 7:e46445
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- **Wu Y, Wang Y, Hanken J** (2012) New species of *Pachytriton* (Caudata: Salamandridae) from the Nanling Mountain Range, southeastern China. *Zootaxa* 3388:1-16
- **Zhang Q, Edwards SV** (2012) The evolution of intron size in amniotes: a role for powered flight? *Genome Biol Evol* 4:1033-1043
- **Zinkus BM, Lawson L, Loader SP, Hanken J** (2012) Terrestrialization, miniaturization and rates of diversification in sub-Saharan frogs (Anura: Phrynobatrachidae). *PLoS ONE* 7:e35118



For the cover story of *Genome Biology and Evolution*, **Naomi Pierce** and colleagues published "Genes involved in the evolution of herbivory by a leaf-mining, drosophilid fly."



*The Social Conquest of Earth* is a new book by **Edward O. Wilson**.



As the cover story of *Asian Herpetological Research*, **Yunke Wu** and **James Hanken** published "Comparative osteology of the genus *Pachytriton* (Caudata: Salamandridae) from southeastern China."



# MCZ GRANT RECIPIENTS

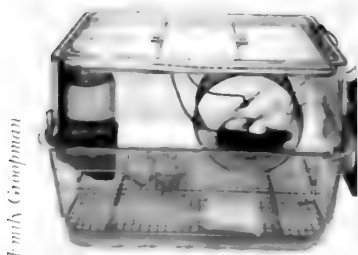
## ACADEMIC YEAR 2012–2013

### Grants-In-Aid of Undergraduate Research (GUR)

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



Danko Cattaras



Emily Gropman



Suzanne Scahill

Recipient	Faculty Sponsor/ Academic Dept.	Project Title	Amount
Saad Amer	Charles C. Davis/ Organismic and Evolutionary Biology	Ecology and evolution of the microsoroid ferns of French Polynesia	\$2,032
Armaghan N. Behlum	Bence P. Olveczky/ Organismic and Evolutionary Biology	Calibrating the dosage of Muscimol necessary to temporarily suppress cortex	\$2,300
Mia S. Bertalan	Lauren O'Connell/ Center for Systems Biology	Poison dart frog toxins as anti-microbial/ anti-fungal agents	\$1,250
Emily A. Burke	Gonzalo Giribet/ Organismic and Evolutionary Biology	Phylogeny of Bdellouridae: genetic diversity and population structure of commensal flatworms	\$2,500
Inanna L. Carter	Charles Davis/ Organismic and Evolutionary Biology	Insect herbivore community of Hawaiian lobeliads	\$2,233
Alexander J. Cunha	Andrew Richardson/ Organismic and Evolutionary Biology	Marine nutrient flux in the Klamath River	\$2,500
Tyler W. Gamble	Jonathan B. Losos/ Organismic and Evolutionary Biology	Structural microhabitat use in Utilan anoles ( <i>Norops bicaorum</i> , <i>N. utilensis</i> , <i>N. sericeus</i> )	\$2,500
Emily E. Gropman	Richard W. Wrangham/Human Evolutionary Biology	Energetic consequences of food processing on lipid and protein-rich foods	\$2,412
Fiona V. Jevon	J. William Munger/ School of Engineering and Applied Sciences & Andrew Richardson/ Organismic and Evolutionary Biology	Red maple decline at the Harvard Forest	\$700



Suzanne Scahill





Dudem Sarikaya

Recipient	Faculty Sponsor/ Academic Dept.	Project Title	Amount
Courtland A. Kelly	Charles C. Davis/ Organismic and Evolutionary Biology	Climate change and flowering time in New England	\$2,500
Alexander M. Kim	Gonzalo Giribet/ Organismic and Evolutionary Biology	From the Gulf of Guinea to the bridge of the world: transoceanic dispersal and human- mediated invasion in a pantropical genus of freshwater prawns	\$1,043
Sang Il Kim	Brian D. Farrell/ Organismic and Evolutionary Biology	A systematic review of the <i>Dorcus velutinus</i> species group (Coleoptera: Lucanidae) through an integrative taxonomic approach [Fall Cycle]	\$1,260
Sang Il Kim	Brian D. Farrell/ Organismic and Evolutionary Biology	Undiscovered diversity in the stag beetle populations of the <i>Dorcus velutinus</i> species group (Lucanidae: Coleoptera) [Spring Cycle]	\$1,645
Mai T. Le	Scott V. Edwards/ Organismic and Evolutionary Biology	The evolution of genetic pathogen ( <i>Mycoplasma gallisepticum</i> ) resistance in the North American house finch	\$2,500
Sarah J. Scalia	Hopi E. Hoekstra/ Organismic and Evolutionary Biology	<i>In situ</i> hybridization to understand burrowing behavior of <i>Peromyscus</i>	\$1,411
Alexandra Stote	George V. Lauder/ Organismic and Evolutionary Biology	Disc-suction performance of echeneid fishes	\$2,500
Tristan W. Wang	Charles C. Davis/ Organismic and Evolutionary Biology	Physiology and distribution of filmy ferns of French Polynesia	\$2,032
<b>Total Awards</b>			<b>\$33,318</b>



Kyle O'Connell



Alexander Kim

### Robert G. Goelet Summer Research Awards

Goelet Awards support MCZ graduate student summer research projects. Funds support travel to field sites and related subsistence expenses incurred in pursuit of research objectives. These grants are made possible through a gift from Mr. Robert G. Goelet.

Recipient	MCZ Department	Project Title	Amount
Nicole L. Bedford	Mammalogy	The natural history of burrowing in the oldfield mouse, <i>Peromyscus polionotus</i>	\$3,275
Zachary Lewis	Herpetology	Field collection of lungless salamander embryos	\$1,625
<b>Total Awards</b>			<b>\$4,900</b>

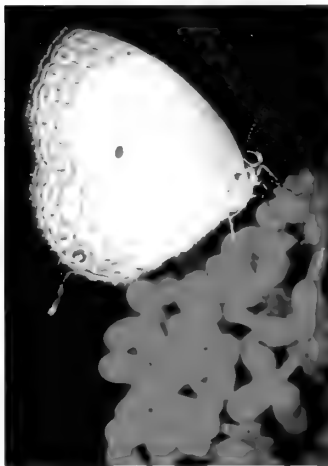


Rosann Barrett





Roman Baranov



Marianne Espeland



V. S. D. S. J.



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## 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.

Recipient	Institutional Affiliation	Project Title	Amount
Viktor Baranov	National Academy of Science, Ukraine	Underestimated groups of non-biting midges (Diptera, Chironomidae) in Bergen University Museum collection	\$1,000
Brendan E. Boudinot	University of Utah	The male ants of Central America; keys to and diagnoses of the subfamilies and genera	\$1,500
Adam J. Brunke	University of Copenhagen	A world revision of <i>Bolitogyrus</i> (Coleoptera: Staphylinidae: Staphylininae)	\$1,500
Caroline Chaboo	University of Kansas	Systematics of leaf beetles (Coleoptera: Chrysomelidae): immature stages, fossils, faunistics, and genera revisions	\$1,200
Elisandra A. Chiquito	Universidade de São Paulo, Brazil	The genus <i>Nectomys</i> Peters, 1860 (Cricetidae: Sigmodontinae): systematics and biogeography	\$1,400
Susan M. Drymala	North Carolina State University	Taxonomic assessment of a new paracrocodylomorph (Archosauria, Suchia) from the Late Triassic of North Carolina	\$1,500
Michael Elias	University of New South Wales	Systematics of <i>Orthotylini</i> (Insecta: Heteroptera: Miridae) of the southwest Pacific	\$1,500
Georg Fischer	California Academy of Sciences	Taxonomy of <i>Pheidole</i> from Madagascar	\$1,500
Andrey V. Frolov	Russian Academy of Sciences	Revision of Madagascar Orphninae	\$1,450
Francisco Hita Garcia	California Academy of Sciences	Taxonomic revision of the myrmicine ant genus <i>Tetramorium</i> Mayr (Hymenoptera: Formicidae)	\$740
Igor Khorozyan	Georg-August Universität Göttingen, Germany	Using computed tomography to study the skull of the holotype Anatolian leopard <i>Panthera pardus tulliana</i> (Valenciennes, 1865)	\$1,200
Tomáš Lackner	Czech University of Life Sciences	Systematic revision of the genera of the Saprininae subfamily	\$1,500
Francisco Tiago M. Melo	Federal University of Pará, Brazil	Revision of species in the genus <i>Diplectanum</i> Diesing, 1858	\$1,500
Mark T. O'Shea	University of Wolverhampton, UK	The systematics and distribution of the endemic New Guinea forest snakes of the genus <i>Toxicocalamus</i> (Serpentes, Elapidae)	\$1,500
Daniel N. Proud	University of Louisiana at Lafayette	Taxonomic work on Cosmetidae and other harvestmen (Opiliones) of Central America	\$1,500
Jacob R. Saucier	University of Wyoming	Characterizing genetic and morphological variation in the <i>Cantorchilus modestus</i> complex	\$1,500
Marianna V.P. Simões	University of Kansas, Lawrence	Systematics of tortoise beetle tribe Dorynotini Monrós & Viana, 1949 (Coleoptera, Chrysomelidae, Cassidinae)	\$1,062
Theodore Sumnicht	University of Utah	Taxonomic revision of <i>Cerapachys</i>	\$1,250
Carly M. Tribull	Richard Gilder Graduate School, American Museum of Natural History	Taxonomic revision of the subfamily Gonatopodinae (Hymenoptera: Dryinidae)	\$1,500
<b>Total Awards</b>			<b>\$25,802</b>



## 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. and Mrs. George Putnam, Jr., '49.

Recipient	MCZ Department	Project Title	Amount
Rowan D. H. Barrett	Mammalogy	Evolution in action in the Sand Hills of Nebraska	\$11,080
Leonora S. Bittleston	Entomology	The insect communities of convergently evolved pitcher plants in Borneo	\$7,140
Scott V. Edwards	Ornithology	Genetics and winter incidence of the pathogen <i>Mycoplasma gallisepticum</i> on house finches and other birds	\$5,690
Marianne Espeland	Entomology	Phylogeny of the <i>Euchrysops</i> section (Polyommatainae): Biogeography and the evolution of feeding habits and wing coloration	\$7,436
Rosa M. Fernández	Invertebrate Zoology	Exploring cryptic diversity in soil animals: a case study in earthworms and harvestmen	\$10,385
Patrick S. Goring	Entomology	Systematics and determinants of diversity in <i>Monochamus</i> (Coleoptera: Cerambycidae)	\$4,120
Emily H. Kay	Mammalogy	Habitat and temporal isolation in two <i>Peromyscus</i> sister species	\$6,557
Sarah Lemer	Invertebrate Zoology	Collecting bivalves of the family Pinnidae in the Philippines	\$10,192
Jonathan B. Losos	Herpetology	Field studies of the evolutionary diversity of Colombian <i>Anolis</i> lizards	\$9,710
Ricardo Mallarino	Mammalogy	The genetic and developmental basis of adaptive traits: coat color variation in <i>Peromyscus</i> of the Tularosa Basin, New Mexico	\$5,842
Christina Pauline Riehl	Ornithology	Evolution of parasitic and cooperative strategies in a communally breeding cuckoo	\$5,000
Bruno A. Souza de Medeiros	Entomology	Insect-host interactions and rates of evolution in a community of palm weevils	\$4,750
		<b>Total Awards</b>	<b>\$87,902</b>



Marianna Simões



Theo Stuenkel



Francisco Hita Garcia

## Miyata Grants

The Ken Miyata Fund for Field Research Awards are intended to enable herpetological fieldwork by MCZ graduate students and postdoctoral fellows. Non-herpetological fieldwork may be eligible when there are no deserving herpetological projects. These grants are made possible by a gift from Dr. Barbara Jil Wu, Ph.D. '81 and Mr. Eric Larson, A.B. '77.

Recipient	MCZ Department	Project Title	Amount
Katherine E. Boronow	Herpetology	The impact of an intraguild predator, <i>Anolis equestris</i> , on prey behavior and evolution	\$4,200
Ambika Kamath	Herpetology	Can anthropogenic change drive variation in mating systems in the South Asian agamid lizard <i>Sitana ponticeriana</i> ?	\$4,320
		<b>Total Awards</b>	<b>\$8,520</b>



Ambika Kamath



# AWARDS & RECOGNITION

Mike Buvada © National Geographic



Edward O. Wilson with paleontologist Louise Leakey

## Emeritus

**Edward O. Wilson** was one of three recipients of the 2013 Hubbard Medal from the National Geographic Society. The medal, which recognizes distinction in exploration, discovery and research, is the Society's oldest and most prestigious award.

## Faculty

**Scott Edwards** will serve a two-year term as the Director of the Division of Biological Infrastructure at the National Science Foundation. DBI empowers biological discovery by supporting the development and enhancement of biological resources, human capital and centers.

## Staff

**Stefan Cover**, Curatorial Assistant in the entomology collection, and **Pedro Ramirez**, Research Assistant at the Concord Field Station, were each honored by Harvard for 25 years of service to the University.

Congratulations to **Alison Pirie**, Faculty & Collections Assistant in Mammalogy and Ornithology, on her retirement after nearly 38 years of service to the MCZ. We thank her for her unwavering positive attitude and dedication to the MCZ and wish her the best!

**Marie Studer**, EOL Learning + Education Director, and **Linda S. Ford**, Director of Collections Operations, were recognized with Impact Awards for their sustained, superior performance and exceptional effectiveness in the Faculty of Arts and Sciences.



Victoria Wilke

Linda Ford

**Catherine Weisel**, Museum Project Coordinator, received a Dean's Distinction Award, which recognizes outstanding citizenship and exceptional contributions in support of the Faculty of Arts and Sciences' mission.

## Postdoctoral Fellows

**Rowan Barrett** was the recipient of the 2013 Theodosius Dobzhansky Prize in recognition of his accomplishments and future promise of an outstanding young evolutionary biologist. The award is given by the Society for the Study of Evolution.

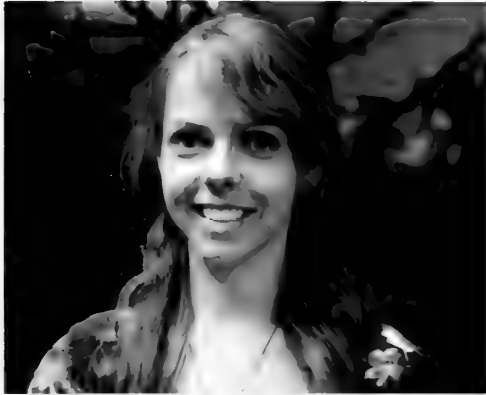


Hopi Hoekstra

**Hopi Hoekstra** has been selected as a Howard Hughes Medical Institute Investigator, beginning in the fall of 2013. The appointment provides the flexible support necessary to move an investigator's research in creative new directions. Prof. Hoekstra is also the recipient of the 2013 Estela Medrano Award from the Pan American Society for Pigment Cell Research, which recognizes a young scientist "that has made, or has the potential to make, transformative contributions that span traditional discipline boundaries relevant to pigment cell biology." In January, she was featured in *The New York Times* "Profiles in Science."



Melissa Aja



Hillary Maddin

**Hillary Maddin** was awarded Canada's Banting Postdoctoral Fellowship. The fellowship provides funding to the very best postdoctoral applicants, both nationally and internationally, who will positively contribute to the country's economic, social and research-based growth.

**Ian Wang** received a 2013 Jasper Loftus-Hills Young Investigators' Award from the American Society of Naturalists. The award recognizes outstanding and promising work by investigators early in their postdoctoral career.

**Graduate Students**



Christopher Laumer

**Shane Campbell-Staton** received an NSF Doctoral Dissertation Improvement Grant for his project titled, "Temperature-dependent phylogeography and limits of thermal tolerance in *Anolis carolinensis*."

**Emily Jacobs-Palmer** won the Hamilton Prize for best student presentation at the 2013 Evolution Meetings for her work on the genetics of sperm morphology in deer mice.

**Emily Kay** was the recipient of the George W. Barlow Award from the Animal Behavior Society for the top-ranked research proposal to encourage excellence in graduate student research in the field of animal behavior.

**Christopher Laumer** received an NSF Doctoral Dissertation Improvement Grant for his project titled "Scalable phylogenomics at the species level: a novel target-gene approach to tracing the global diversification of prothynchid flatworms (Platyhelminthes)."

**Zachary Lewis** received the Sigma Xi Grant in Aid of Research for his proposal titled "The developmental genetic basis of lung loss in lungless salamanders." Lewis also claimed first prize in the campus photography competition *Glimpse into Life Science: Scientific Artwork by Harvard Graduate Students*, hosted by the Harvard Integrated Life Sciences.

**Martha Muñoz** is the recipient of a John Parker Merit Fellowship and a Graduate Student Council Conference Grant, both from Harvard. She also received a Broadening Participation Award from the Society for Integrative and Comparative Biology.

**Yunke Wu** received a postdoctoral fellowship from the United States Department of Agriculture. Wu will be continuing his research at Cornell University.



Kate Eldridge

Scott Edwards and Alison Pirie



Shea Lambert

Martha Muñoz



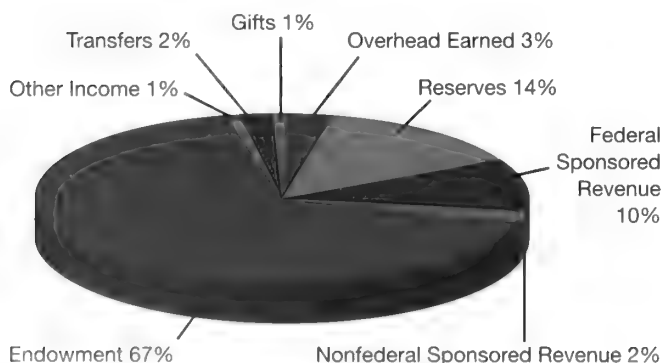
# FINANCIAL DATA

These charts describe the income and expenses of the Museum of Comparative Zoology in fiscal year 2013.

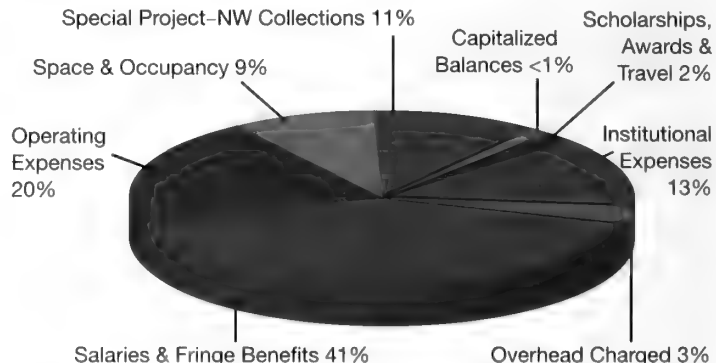
Endowment income funds much of the Museum’s activities, including acquisition and maintenance of collections, most faculty and staff salaries, capital projects, facilities renovation and maintenance. Included in **Endowment** income is the annual distribution, revenue generated from assets purchased through endowments and endowed funds decapitalized per donor request. **Transfers** include Harvard University-funded faculty research, 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 other cost recovery from other MCZ-sponsored activities. **Reserves** represent the amount of carry-forward balances used to cover an operating deficit. **Overhead** is funding paid from MCZ-based sponsored projects to the MCZ to cover facilities and administrative costs for those

projects. It is shown as both income (**Overhead Earned**) and expenses (**Overhead Charged**). **Special Project–NW Collections** includes deployment of collections to the newly constructed space in the Northwest Building. Building expenses such as maintenance, facility improvements and utilities are captured in the **Space & Occupancy** category. **Operating Expenses** consist of equipment purchases, supplies, consultant and conference fees, as well as annual subventions to the Department of Organismic and Evolutionary Biology (OEB) for administrative services. 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, the Harvard College Library, and general operating support to the Harvard Museum of Natural History.

**Income**



**Expenses**



**Income**

Endowment	\$13,838,180
Reserves	\$2,877,361
Federal Sponsored Revenue	\$1,941,582
Overhead Earned	\$663,289
Nonfederal Sponsored Revenue	\$464,415
Transfers	\$441,937
Gifts	\$181,900
Other Income	\$121,662
<b>Total</b>	<b>\$20,530,326</b>

**Expenses**

Salaries & Fringe Benefits	\$8,487,000
Operating Expenses	\$4,102,685
Institutional Expenses	\$2,712,515
Special Project–NW Collections	\$2,228,675
Space & Occupancy	\$1,902,236
Overhead Charged (Sponsored)	\$663,289
Scholarships, Awards & Travel	\$419,276
Capitalized Balances	\$14,650
<b>Total</b>	<b>\$20,530,326</b>





**Faculty-Curators**

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

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

Brian D. Farrell  
*Professor of Biology; Curator of*  
*Entomology*

Gonzalo Giribet  
*Professor of Biology; Alexander Agassiz*  
*Professor of Zoology; Curator of*  
*Invertebrate Zoology*

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

Hopi E. Hoekstra  
*Professor of Biology; Professor of*  
*Molecular and Cellular Biology;*  
*Alexander Agassiz Professor of Zoology;*  
*Curator of Mammalogy*

Farish A. Jenkins, Jr.  
*Professor of Biology; Alexander Agassiz*  
*Professor of Zoology; Curator of*  
*Vertebrate Paleontology*

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

Jonathan B. Losos  
*Monique and Philip Lehner Professor*  
*for the Study of Latin America;*  
*Curator of Herpetology*

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

Naomi E. Pierce  
*Sidney A. and John H. Hessel Professor*  
*of Biology; Curator of Entomology*

Robert M. Woollacott  
*Professor of Biology; Curator of Marine*  
*Invertebrates*

**Emeritus Faculty**

Kenneth J. Boss  
*Faculty-Curator, Emeritus;*  
*Professor of Biology, Emeritus*

A.W. "Fuzz" Crompton  
*Faculty-Curator, Emeritus; Fisher*  
*Professor of Natural History, Emeritus*

Herbert W. Levi  
*Faculty-Curator, Emeritus; Alexander*  
*Agassiz Professor of Zoology, Emeritus*

Richard C. Lewontin  
*Professor of Biology, Emeritus;*  
*Alexander Agassiz Professor of Zoology,*  
*Emeritus*

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

**Postdoctoral Fellows,  
Research Associates  
& Visiting Scholars**

Sonia Da Silva Andrade  
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Allison Arnold-Rife  
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Niclas Backström  
*Ornithology, Edwards Lab*

Rowan D. H. Barrett  
*Mammalogy, Hoekstra Lab*

Andres Bendesky  
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Yünke Wu  
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Somer O'Brien  
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Margaret Starvish  
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Catherine Weisel  
*Museum Projects Coordinator*

Ken Wilcox  
*Building Superintendent, Concord Field Station*

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Andrew Williston  
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Jonathan Woodward  
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Robert Young  
*Special Collections Librarian, Ernst Mayr Library*

Breda Zimkus  
*Project Manager for Genetic Resources*

### Temporary Staff

Sarah Cohen  
*Malacology*

Ann Downer-Hazell  
*EOL Learning + Education Group*

Gwendolyn Fougy Henry  
*Ernst Mayr Library*

Jyhjong Hwang  
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Richard Knecht  
*Invertebrate & Vertebrate Paleontology*

Jessica Mitchell  
*Ernst Mayr Library*

Valerie Root  
*Ernst Mayr Library*

Kaitlin Sheridan  
*Invertebrate Zoology*

Robert Stymest  
*Ornithology*

Tatiana De Souza Vargas  
*Collections Operations*

### Encyclopedia of Life, Learning + Education Group

Tracy Barbaro  
*Project Coordinator*

Jeffrey T. Holmes  
*Digital Learning Editor*

Marie M. Studer  
*Learning + Education Director*

### Administration for the Department of Organismic & Evolutionary Biology

Krista Carmichael  
*Senior Research Administrator*

Rebecca Chetham  
*Executive Director*

Irv Dumay  
*Building Manager*

Paul Dwyer  
*Mailroom Staff Assistant*

Jeannette Everitt  
*Administrative Coordinator*

Jason Green  
*Accounting Assistant*

Philip Norton  
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Kristin Pennarun  
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*Web Project Manager*

Geoff Tierney  
*Associate Director of Finance & Research Administration*

Laura Tomaino  
*Human Resources Coordinator*

*The MCZ deeply appreciates the additional support and contributions of numerous interns and undergraduate students during the 2012–2013 academic year.*

### MCZ Faculty

The MCZ's charter, signed in 1859, mandates that the Museum's activities will be overseen by a governing board, the Faculty of the Museum of Comparative Zoology.

Dr. John D. Constable

Mr. Robert G. Goelet

Mr. George Putnam, Jr.

Mr. George Putnam, III

Dr. Barbara Jil Wu

Mr. Paul J. Zofnass

President Drew Gilpin Faust

### Acknowledgements

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### Editors

James Hanken, *Director*

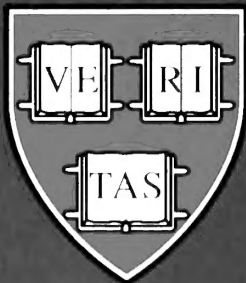
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