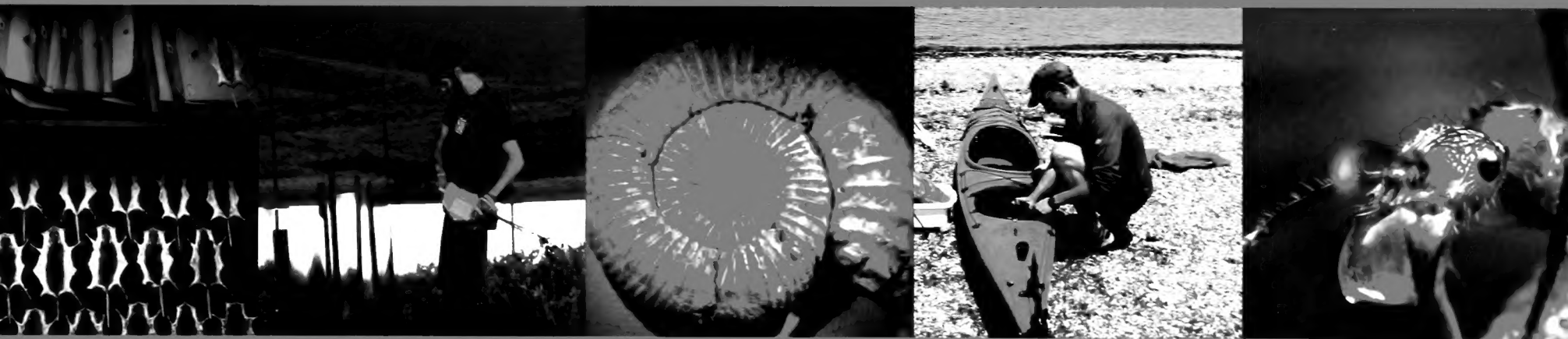
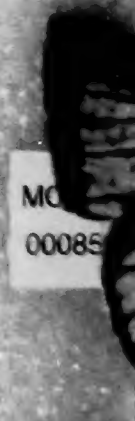
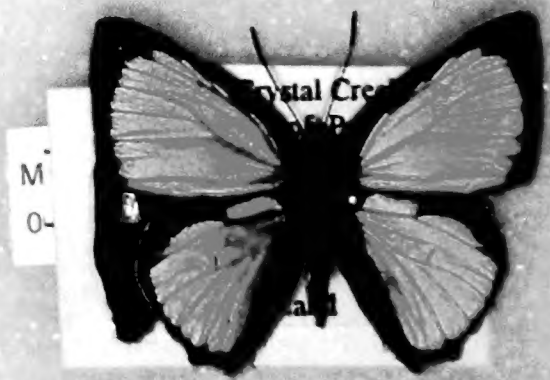
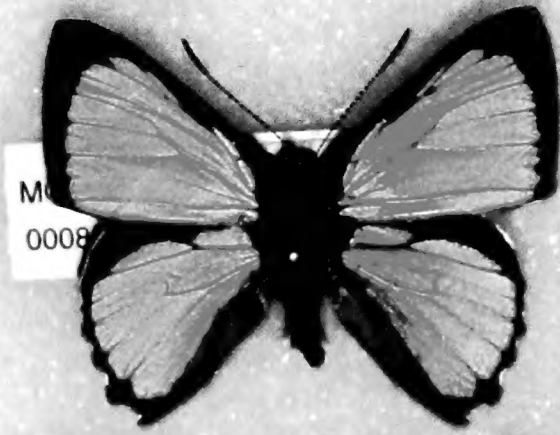
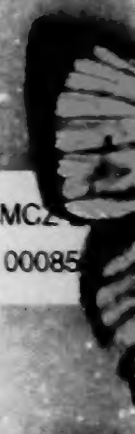
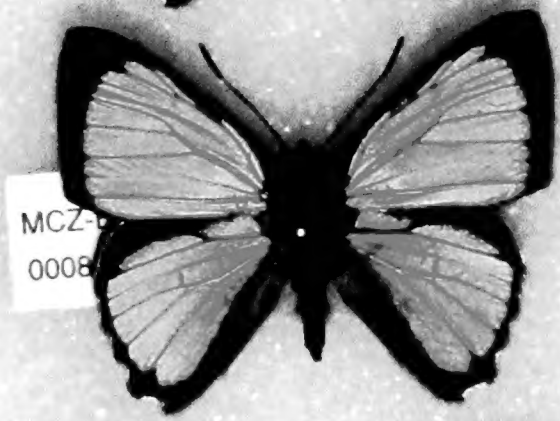
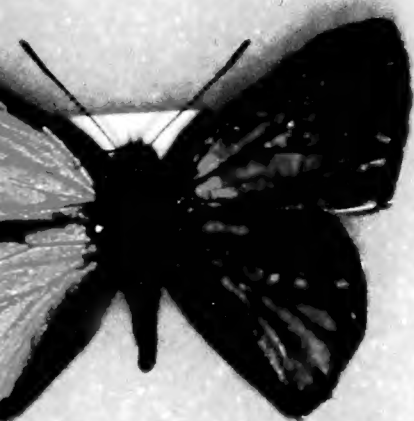
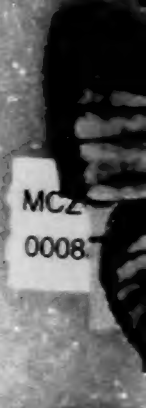
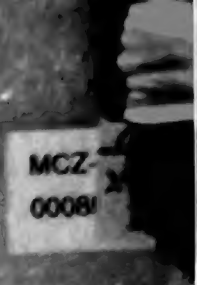




MUSEUM OF COMPARATIVE  
**ZOOLOGY**  
ANNUAL REPORT  
HARVARD UNIVERSITY



2010-2011



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# DIRECTOR'S MESSAGE

Professor Ernst Mayr, arguably the most famous evolutionary biologist of the 20<sup>th</sup> century, served as MCZ's director from 1961 to 1970. For him, the MCZ "is not merely a repository of collections but a biological research institute."

According to Mayr, the MCZ has two explicit tasks: "to study the diversity of living nature and its evolution—the mere accumulation of specimens and the mere description of new species is not our primary task"—and to instruct undergraduate and graduate students. This past year's activities and events show that we are doing our best to promote and realize Mayr's lofty vision and maintain MCZ's standing as the finest university-based natural history museum in the world.

Perhaps the most important ongoing activity of any university-based museum is the hiring and retention of outstanding faculty-curators. Hence, I'm happy to announce that Dr. Hopi Hoekstra, MCZ's Curator of Mammalogy, has accepted Harvard's offer of a tenured professorship in the departments of Organismic and Evolutionary Biology and Molecular and Cellular Biology, and appointment as Alexander Agassiz Professor of Zoology in the MCZ. This is a key "acquisition" for MCZ, and one that will help sustain our intellectual leadership in the field of comparative biology.

Teaching continues to be one of our most valued and rewarding activities, and I am happy to showcase some of the impressive accomplishments of our undergraduate and graduate students within this report. Under the supervision of faculty-curators and with financial support from programs such as the Grants-in-Aid of Undergraduate Research, the MCZ continues to both train new generations of professional zoologists and educate future doctors, lawyers, poets, engineers, teachers and other leaders of tomorrow in the biology of organisms.

This past year saw significant improvements to our physical plant. A new cryogenic lab was installed, which will house a state-of-the-art, liquid-nitrogen-based collection that will come online in November 2011. Build-out of the MCZ's new 50,000-square-foot collections facility in the Northwest Science Building began in spring 2011. Migration of specimens from their current, overcrowded space in the old MCZ will begin in early 2012.

With the acquisition of several grants, MCZ is able to participate in both national and global efforts to digitize collection records, some of which extend back hundreds of years. The resulting online specimen databases provide unprecedented and immediate access to primary biodiversity information by scientists, students, policymakers, conservationists and other data "consumers" anywhere and anytime.

Finally, we were sorry to bid farewell to Elisabeth Werby, Executive Director of the Harvard Museum of Natural History, at the close of the 2009–2010 academic year. We surely will miss Liz, but we also will treasure the magnificent public museum she left behind. While the University develops plans to recruit her successor, David E. Ellis, former president of both Lafayette College and the Museum of Science, Boston, is serving as interim executive director.

The success of the MCZ is only possible because of the earnest commitment and dedication of its faculty, researchers, staff and students. I commend everyone for their hard work and congratulate them for a job well done.

James Hanken  
*Director*



Catherine Weisel

*Cover photo credits:*

*Top, left to right: Luke Mahler; Vlad Dinca; courtesy of Elaine Vo; Gonzalo Giribet; Florence On*

*Bottom, left to right: Lynn Johnson; Naomi Man in 't Veld; Mark Renczkowski; Anna Clark; Jon Sanders*

*Opposite page: Hypochrysops digglesii (Lycaenidae: Theclinae) from Australia by Catherine Weisel*





Adam Clark

## INVESTING IN THE FUTURE

As both a research and a teaching museum, the MCZ maintains an active involvement in, and support of, Harvard's education programs.

Through courses, faculty mentoring and Grants-in-Aid of Undergraduate Research (GUR), the MCZ nurtures and advances the research interests of undergraduate students from the classroom to the lab and field. We are proud to highlight some of the research of recent undergraduates who have been supervised by MCZ faculty-curators.



Elaine Vo

The achievements of **Anh-Thu Elaine Vo**, Class of 2008, provide an excellent example of the combined power of scientific curiosity and initiative, financial support and faculty mentorship. Vo's research, funded in part by a GUR in Winter 2007, measured mercury levels in the endangered Black-footed Albatross (*Phoebastria nigripes*), a wide-ranging aquatic predator in the Pacific region. Guided by Professor Scott Edwards, Vo examined 120 years of feathers (1880–2002) held by MCZ and a second museum to correlate the amount of mercury accumulated in the feathers with increased levels of human-generated atmospheric pollution, especially since WWII and the more recent doubling of emissions due to Asian industrialization.

Vo's work is the first to confirm the rise of mercury levels in the Pacific Ocean and points to the need for further research on the reproductive effects of increased levels of mercury in endangered species such as the albatross. Vo's project garnered a Hoopes

Prize in 2008 to reward excellence in her work as an undergraduate. Her findings were published in *Proceedings of the National Academy of Sciences of the USA* in April 2011.

"Elaine is a very dedicated worker, and with her background in biochemistry and biology, she had a breadth of knowledge that is rare among undergraduates," explained Prof. Edwards. "Her research elegantly combines seabird ecology, ecotoxicology, stable isotopes and the value of museum specimens to reveal conditions in the world in which they lived."

Vo is currently a graduate student at the University of California, Berkeley, where she is pursuing research at the interface of ecological immunology and avian host-parasite ecology.

**Adam Clark**, Class of 2011, is especially interested in ants: the distribution of species across landscapes and how new species establish themselves into existing communities. For the last three years, his research has focused on the ant communities of the Boston Harbor Islands, including sampling and insect identification for the All Taxa Biodiversity Inventory run by the Farrell lab. His work was supported by a GUR in Spring 2009 and his paper "Ant communities of the Boston Harbor Islands National Recreation Area" was recognized with a Hoopes Prize in 2011. His paper, "The effects of biogeography on ant diversity and activity on the Boston Harbor Islands, Massachusetts, U.S.A.," is in press at PLoS ONE.



Clark investigated an invasive ant species, *Paratrechina longicornis*, in the Dominican Republic in 2011. Contrary to earlier local news reports of the danger and devastation this species would wreak, Clark found that, even though widespread, the colonies have



Scott Edwards



Rose Lincoln

Black-footed Albatross in flight and in the MCZ collections



remained relatively small, isolated and docile, and likely do not pose a physical threat to humans.

“Adam is a natural entomologist who also has a deep commitment to applying his research to issues of conservation and sustainable development,” says his advisor, Professor Brian Farrell. “He is an ideal ambassador for the causes of conservation and biodiversity research, both abroad and domestically.”



*Adam Clark*

Recent graduate **Joanna Larson**, Class of 2011, has diverse research interests in both amphibians and mammals that have led to fieldwork around the world, from Florida to Bulgaria to Africa. The MCZ supported Larson with two GUR grants.

“Joanna began her relationship with MCZ as a freshman, when she enrolled in the herpetology course that I teach with Jonathan Losos,” explained Professor James Hanken, her advisor. “The course included a spring-break trip to Costa Rica, and by the end of that week, she was hooked on comparative zoology, natural history and fieldwork. She went on to accomplish great things as an undergraduate.”

Larson’s 2010 summer internship with the Smithsonian’s National Museum of Natural History enabled her to conduct a taxonomic revision of *Petrodromus*, African elephant shrews, and she is currently investigating the genetics of this genus with additional funding from the Smithsonian. During this internship, Larson also investigated hybridization between polar bears and

brown bears, work that she now is preparing for publication.

In December 2011, Larson will begin a research project, “Decoding Species Complexes of Amphibians and Mammals in the Mountains of Tanzania,” on a Fulbright grant. She will be studying small mammal and frog diversity in the mountains, teaching in village schools about local biodiversity and her research, and improving her fluency in Kiswahili, which she studied for two years at Harvard.



*Joanna Larson*

**Alexander Kim**, Class of 2013, is so fascinated by freshwater prawns that he seriously studied them even before his undergraduate career. According to his advisor, Professor Gonzalo Giribet, “Alex has a true passion for learning and is, by far, the most driven undergraduate I have ever met. He was conducting field research on freshwater crustaceans in high school and is already participating in advanced coursework.”

A member of the Giribet lab, Kim’s fieldwork has been funded in part by two GUR grants. In 2010, he traveled to Lake Corpus Christi, Texas, to investigate how a species of prawns that live in saltwater when young but spend their adult lives in freshwater seem to migrate between these environments where a man-made dam should block their path.

In 2011, Kim traveled to the Panama Canal area to investigate a novel cluster of Pacific/Caribbean sister species—closely related prawn species that were separated by land until the construction of the Canal. Because both of these species can tolerate both the saline and freshwater segments of the Canal, they have the potential for invasions far beyond their current habitats, with possible hemisphere-wide ecological repercussions.



*Alexander Kim*



*Alexander Kim*





# 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. To study how and why a wide variety of animals move dynamically in a natural setting, the Biewener lab employs treadmills, wind tunnels, high-speed video and methods of directly measuring the force and movement of the animal's body, limbs and wings.

How musculoskeletal design varies across differing modes and conditions of movement—as well as across diverse species—is of particular interest in understanding the general principles that govern the design of the neuromuscular and skeletal systems of vertebrates. In the Biewener lab, limb and body dynamics of whole animal movement are analyzed in relation to neuromuscular, tendon and skeletal function.

The research of the Biewener lab is designed to answer questions about animal movement, such as:

- What features of the musculoskeletal system developed in response to the demands for powered flight versus those for economical movement over ground?
- How do animals maneuver in their environment and stabilize in response to disturbances?
- How does size affect animal design and performance?
- How can biological systems inform robotics design?

The Biewener lab at the Concord Field Station consists of three postdoctoral researchers, four graduate students, one research associate and three undergraduate researchers.



## 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, using the guiding principles of population genetics and systematics to inform their natural history and behavior. Current projects utilize genomic 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—a common North American songbird—and a recently acquired bacterial pathogen called *Mycoplasma*.



## Brian D. Farrell

*Professor of Biology  
Curator of Entomology*

Prof. Farrell's research is broadly concerned with whether the diversity of species on Earth is a cause or consequence of the diverse roles different species play in ecosystems, particularly between insects and plants.

The Farrell lab serves as a base for the Beetle Tree of Life project, a collaborative and comprehensive phylogenetic study of this most diverse group of animals.

Tony Rinaldo

Stu Rosner





**Gonzalo Giribet**  
*Professor of Biology*  
*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 and for assessing deep molluscan phylogeny, as well as multiple projects involving research on arthropod

systematics and biogeography, sponges, sipunculans, platyhelminthes and onychophorans. He is also interested in philosophical aspects of sequence data analysis, emphasizing homology-related issues.



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

Prof. Hanken utilizes laboratory-based analyses and field surveys to examine morphological evolution, developmental biology and systematics of

amphibians. Current areas of research include the evolution of craniofacial patterning; the developmental basis of life-history evolution; and systematics, taxonomy and evolution of neotropical and Asian salamanders and frogs.

Prof. Hanken also serves on the Executive Committee of the Encyclopedia of Life ([eol.org](http://eol.org)).



**Hopi E. Hoekstra**  
*Professor of 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 uses integrative approaches to understand how biological variation is generated and maintained in natural populations.

### Farish A. Jenkins, Jr.

*Professor of Biology*  
*Alexander Agassiz Professor of Zoology*  
*Curator of Vertebrate Paleontology*

As an anatomist, zoologist and vertebrate paleontologist, Prof. Jenkins is as much intrigued by living vertebrates as by their extinct relatives. Broadly interested in vertebrate evolution, he has never restricted his research to a particular taxon, and his collaborations have ranged from Mesozoic mammals to frogs. Another significant research focus has been functional anatomy: understanding the musculoskeletal mechanisms that animals use to move and breathe.

He maintains active field research in vertebrate paleontology and, in 2006, was part of an expedition that discovered *Tiktaalik roseae*, the missing link between fish and land animals, in the Canadian Arctic. In 2009 he was given the Romer-Simpson Medal, the highest award of the Society of Vertebrate Paleontology, for sustained and outstanding scholarly excellence.

Prof. Jenkins has led courses in vertebrate evolution for 40 years, explaining the anatomical and physiological transformations that transitioned fish to reptiles to birds to mammals—accompanied by detailed and colorful chalkboard illustrations—to cover 500 million years of vertebrate evolution in 26 lectures.

Prof. Jenkins was honored with a Harvard College Professorship in 2011 in recognition of his dedication to undergraduate teaching. In 2010, he received the Everett Mendelsohn Excellence in Mentoring Award for his efforts in supporting graduate students' education, professional and personal development and career plans. Prof. Jenkins was also recognized with The Joseph R. Levenson Memorial Teaching Prize in 2010.





**George V. Lauder**

*Professor of Biology*

*Henry Bryant Bigelow Professor of Ichthyology*

*Curator of Ichthyology*

Prof. Lauder's research examines the structure, function and evolution of vertebrates, particularly fishes and amphibians. His current studies focus on the development of robotic models for understanding the functional and evolutionary diversity of fishes. Additional interests include biological fluid mechanics, theoretical approaches to the analysis of form and function in organisms, and the history and philosophy of morphology and physiology.



**Naomi E. Pierce**

*Sidney A. and John Hessel*

*Professor of Biology*

*Curator of Entomology*

Prof. Pierce's research uses molecular and morphological data to reconstruct the evolutionary history of Lepidoptera. The goal of this research is to clarify the systematics and classification of these insects, and to investigate how host plant and ant associations have shaped their patterns of diversification.



Jon Chase

**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.



Rose Lincoln/Harvard News Office

**James J. McCarthy**

*Professor of Biological Oceanography*

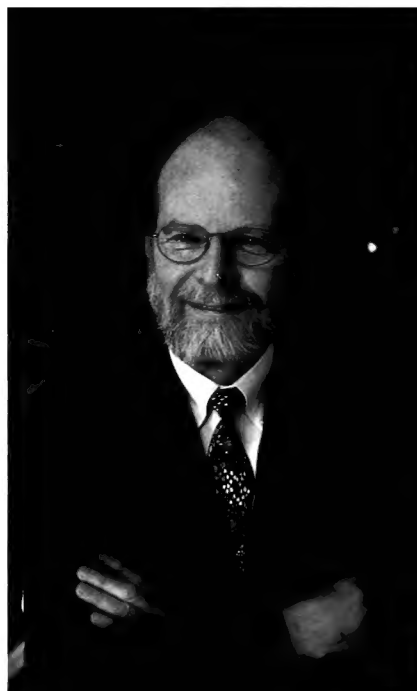
*Alexander Agassiz Professor of*

*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.



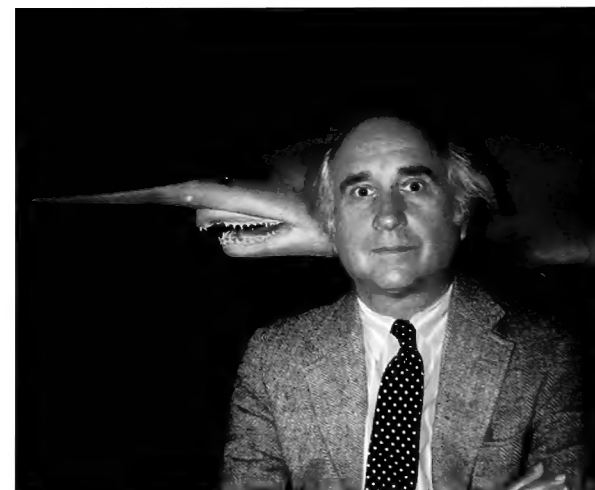
**Robert M. Woollacott**

*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.



Jean-François Bertrand





## MCZ EMERITI

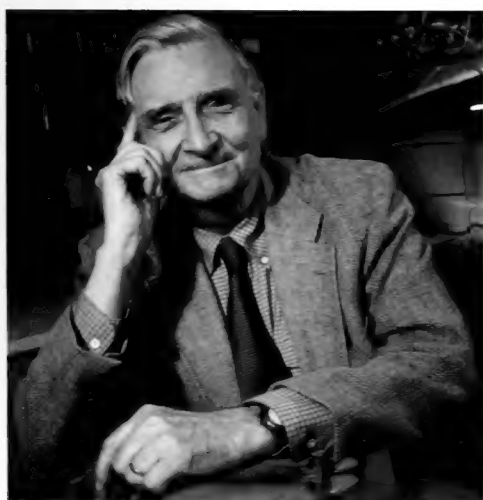
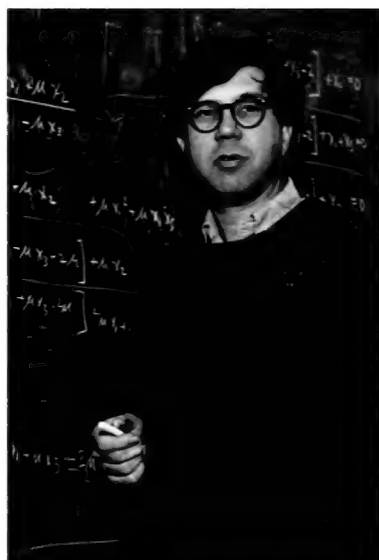


**Kenneth J. Boss**  
*Faculty-Curator Emeritus*  
*Professor of Biology, Emeritus*

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.



**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.

**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.



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





OEB 155r: Biology of Insects

Freshman Seminar 31v: The Beasts of Antiquity and Their Natural History (offered Fall 2011)



# COURSES IN 2010–2011 LED BY MCZ FACULTY-CURATORS

## 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 (and Cassandra G. Extavour)*

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 53: Evolutionary Biology (undergraduate)

*Hopi E. Hoekstra (and Andrew J. Berry)*

Micro- and macro-evolution, ranging from population genetics through molecular evolution to the grand patterns of the fossil record.

### 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 (undergraduate and graduate)

*Andrew A. Biewener, George V. Lauder (and Daniel E. Lieberman, Stacey A. Combes)*

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 121b: Research in Comparative Biomechanics (undergraduate and graduate)

*Andrew A. Biewener, George V. Lauder (and Daniel E. Lieberman, Stacey A. Combes)*

Optional extension of initial project undertaken in OEB 121a into a thesis research project.

### OEB 125: Molecular Ecology and Evolution (undergraduate and graduate)

*Scott V. Edwards*

A survey of theory and applications of DNA technologies to the study of evolutionary, ecological and behavioral processes in natural populations.

### OEB 139: Evolution of the Vertebrates (undergraduate and graduate)

*Farish A. Jenkins, Jr.*

Origination and evolution of the major groups of vertebrates, with emphasis on the anatomical and physiological transformations that occurred during the transitions to diverse lineages of fish, amphibians, reptiles, birds and mammals.

### OEB 155r: Biology of Insects (undergraduate and graduate)

*Naomi E. Pierce (and Michael R. Canfield)*

Introduction to the major groups of insects—life history, morphology, physiology and ecology—through a combination of lecture, lab and field exercises.

### OEB 157: Global Change Biology (undergraduate and graduate)

*James J. McCarthy (and Paul R. Moorcroft)*

Examines natural and anthropogenic changes in the earth system and their impact on the structure and functioning of terrestrial and oceanic systems.





**OEB 181: Systematics (undergraduate and graduate)***Gonzalo Giribet*

Theory and practice of systematics, emphasizing issues associated with homology statements and alignments, methods of tree construction and hypothesis evaluation.

**OEB 231: Adaptation (graduate)***Hopi E. Hoekstra*

This discussion-based course covers the latest advances in the study of adaptation, with a focus on controversial issues and integrative approaches.

**OEB 233: Evolution of the Niche (graduate)***Jonathan Losos*

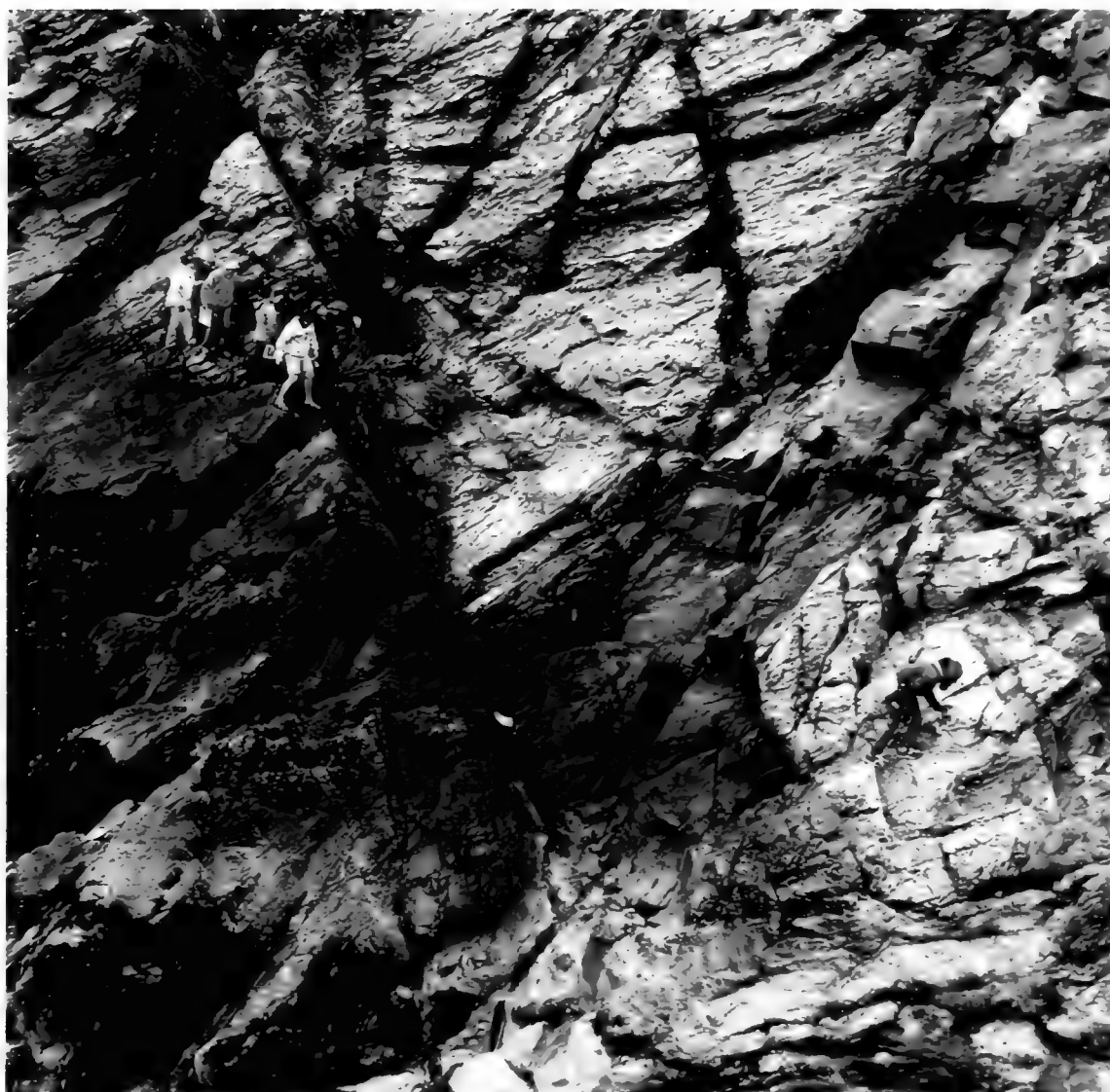
Evolutionary diversification relates directly to how ecological niches change through time.

**OEB 234: Topics in Marine Biology (graduate)***Robert M. Woollacott*

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. Emphasis on identification and quantification of biological and environmental factors important in the regulation of community structure.

**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 323: Advanced Vertebrate Anatomy***Farish A. Jenkins, Jr.***OEB 325: Marine Biology***Robert M. Woollacott***OEB 334: Behavioral Ecology***Naomi E. Pierce***OEB 341: Coevolution***Brian D. Farrell**OEB 234: Topics in Marine Biology***OEB 345: 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 Losos***OEB 370: Mammalian Evolutionary Genetics***Hopi E. Hoekstra***Life Sciences****LIFESCI 2: Evolutionary Human Physiology and Anatomy (undergraduate)***George V. Lauder (and Peter T. Ellison, Daniel E. Lieberman)*

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





OEB 155r: Biology of Insects

## Human Evolutionary Biology

### HEB 1210: Research in Comparative Biomechanics (undergraduate and graduate)

*Andrew A. Biewener, George V. Lauder (and Stacey A. Combes, Daniel E. Lieberman)*

Introduces students to experimental techniques used to investigate the structure and physiology of animals.

Gonzalo Giribet



OEB 51: Biology and Evolution of Invertebrate Animals

## Environmental Science and Public Policy

### ESPP 90f: Global Change and Human Health (undergraduate)

*James J. McCarthy (and Paul R. Epstein)*

Explores hypothesized linkages between changes in ecosystems, climate and the epidemiology of certain infectious diseases resulting from increasing human population and our consumption of natural resources.

### ESPP 90q: Conservation and Evolution (undergraduate)

*Jonathan Losos*

Examines the extent to which conservation and evolutionary biology need to be integrated to preserve the world's biological diversity.

## General Education

### Science of Living Systems 22:

#### Human Influence on Life in the Sea (undergraduate)

*James J. McCarthy, Robert M. Woollacott*

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 Communities (graduate)

*Robert M. Woollacott*

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

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

*Robert M. Woollacott*

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.

### BIOL S-113: Study Abroad at Oxford: Darwin and Contemporary Evolutionary Biology

*Naomi E. Pierce (and Andrew Berry)*

The history of evolutionary biology in the post-Darwinian world, following strands of thought either introduced or ignored by Darwin in *On the Origin of Species* through to the present.



OEB 155r: Biology of Insects





# NEW FACILITIES AND TECHNOLOGIES ENHANCE PRESERVATION AND ACCESS

There are developments all around the MCZ to ensure the preservation of specimens and enhance their access for research, on site and online.

## The Northwest Building

The Northwest Building's below-ground floors are being renovated for state-of-the-art laboratories, special preparations areas, a classroom and climate-controlled collections storage rooms for the MCZ. The building will become the new home for all or part of eight MCZ dry collections, greatly improving storage conditions for these specimens and the preparation and lab areas for their researchers and students.

The Phase One build-out of the building's B2 level—with the prep labs, receiving space and the Mammalogy management and collections space—was completed in summer 2011. "The collection areas and new prep labs are leading-edge facilities, and the collections staff—even those with specimens not moving—are eager to start using the shared facilities," said **Linda Ford**, Director of Collections Operations.



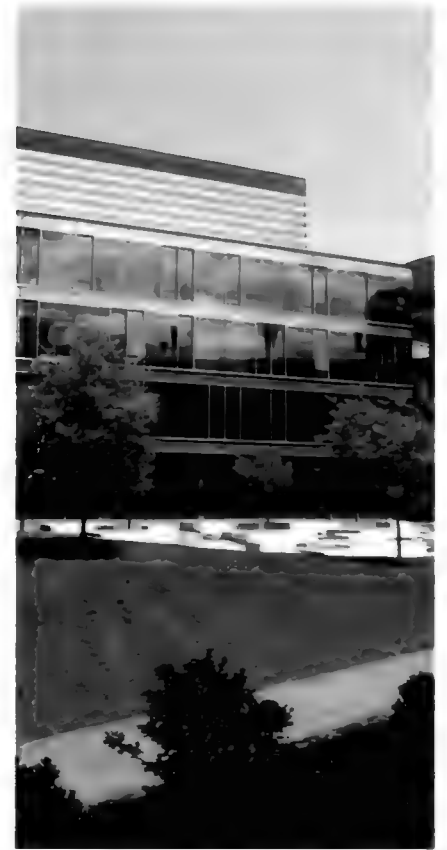
Mark Renczkowski

Curatorial staff have been readying the Mammalogy collections since early 2010 and these collections are scheduled to move to the Northwest Building in early 2012. Phase Two, B3 South, will be the management and collection areas for Ornithology and the management areas for Malacology and Invertebrate Paleontology. Phase Three, B3 Central, will house the collections areas for Malacology, Invertebrate and Vertebrate Paleontology, Marine Invertebrates, Invertebrate Zoology and fossil Entomology, as well as the management area for Vertebrate Paleontology. These two phases have been combined and construction will begin in fall 2011.

Since 2007, **Jessica Cundiff**, Curatorial Associate for Invertebrate Paleontology, has been supervising the preparation of more than a million specimens in anticipation of the move. "It's been quite a bit of work, but we're nearly done. We've cleaned a lot of the specimens, finding that some of the lesser-used ones were black from the days of coal-burning furnaces, and made repairs to stabilize specimens as needed."

Cundiff is also acting Curatorial Associate for Vertebrate Paleontology and will soon turn her attention to preparing that collection. She expects that Vertebrate Paleontology's approximately 100,000 specimens of larger, heavier fossils will take one to two years to get ready—right on schedule for their move.

"The new prep lab space will have many additional pieces of equipment—a dust collector, fume hood and rock saws—that will make our prep and repair work easier and safer," said Cundiff. "We're really looking forward to it."



The Northwest Building

Cyndi A. Wood



Solnhofen specimen before and after repair





## New Cryogenic Collection

The MCZ collections of genetic material—tissue samples for DNA and RNA extraction—have been housed in frozen storage in collections and labs all around the MCZ, complicating tracking and sending curatorial staff scrambling during power outages. To provide a more accessible and reliable system for the storage and preservation of this material, a Cryogenic Collection is being created to centralize sample storage from across the MCZ in liquid nitrogen-cooled cryovats.

**Breda Zimkus**, the Cryogenic Collection Project Manager, has been working on converting former collection storage space in the MCZ Labs in the building's basement. The space is nearly completed and the institution's first liquid nitrogen cryovats will be delivered in September 2011. "For our purposes, cryovats are the superior choice because the colder the storage, the longer the sample remains viable for genetic research," explained Zimkus. "The three cryovats will accommodate 40,000 samples each, enough space for our existing collections with room for growth—and we have floor space for one or two more." All of the centrally stored samples will be barcoded for easy access, resulting in a more efficient workflow that will free up collections staff and improve the handling of the samples. According to Zimkus, "The facility is designed to support the work of all the scientific staff at the MCZ."

During planning, Zimkus discovered that while there were many options in designing a cryogenic facility, there were no right answers for every circumstance and little published information to help evaluate the options. To help rectify this deficiency, she received a grant to develop best practices for genetic resource collections associated with natural history museums. She expects to share her results at the 2012 annual meeting of the Society for the Preservation of Natural History Collections and eventually publish to assist others in the field.

## New Ichthyology Specimen Tanks

Many MCZ specimens are stored in fluid, including most aquatic invertebrates, fishes, amphibians and reptiles. During recent collections renovations, the MCZ purchased 123 custom-designed three-foot stainless steel tanks to replace many old steel-lined wooden tanks, some dating back to the Agassiz years. Multiple new oversized tanks were also purchased, some of which can hold specimens up to 12 feet long, such as sharks, marlin, ocean sunfish (*Mola mola*), grouper and other large spiny fishes.



Karsten Hartel and Andrew Williston

**Karsten Hartel**, Curatorial Associate for Ichthyology, explained, "The large specimens in the MCZ Ichthyology collection date back to the 1800s and are scientifically valuable in part because many museums don't have facilities to keep fishes of this size." For example, the collection contains the heads of a basking shark and a manta ray, each weighing around 250 pounds. Specimens of these species, and of this size, are very rare in collections.

"As large fishes continue to disappear from the world's waters, it is imperative that museums be able to house representative large specimens for future anatomical and systematic studies. Our new tanks ensure that we will be able to add critical large specimens to our collection and to maintain them in good condition for years to come," said **George Lauder**, Curator of Ichthyology and Bigelow Professor of Ichthyology.





## Database Update

The multi-year migration of all legacy collections databases to the master museum-wide database, MCZbase, has been completed. Data entry from the original specimen ledgers and catalogues is nearly completed as well, and the scanning of these resources is almost finished. Once linked to MCZbase, researchers will be able to call up a specimen record and view the image of the original ledger page where it was recorded.

The MCZ Lepidoptera Rapid Data Capture Project will produce the first Entomology collection to be represented in MCZbase. During the past twelve months, thirty-three undergraduate students and volunteer interns have contributed to this effort, including photographing butterflies and transcribing data in the collection room.

According to project manager **Rod Eastwood**, butterfly data capture has now reached the halfway mark, with approximately 100,000 butterfly specimens and labels imaged. A quarter of these have pin label data transcribed into the Lepidoptera database in preparation for uploading to MCZbase.

“Digitizing the butterfly collection and making the images available online not only makes the collection immediately accessible



*Rodney Eastwood*

to researchers around the world, but also provides a valuable resource for research into butterfly wing shape and color patterning,” said **Naomi Pierce**, Curator of Lepidoptera and Hessel Professor of Biology.

The protocols developed for the butterfly collection will be adapted to image and database other taxa in the insect collections, starting with the large and important MCZ ant collection.

In other developments, MCZbase is currently feeding all of its specimen photos into the Encyclopedia of Life, and the MCZ has contributed specimen data to 4,278 EOL species pages to date. MCZbase is now also calling out to Berkeley Mapper to gather data to create point distribution maps with GoogleMaps and other applications.

*The MCZ Lepidoptera Rapid Data Capture Project*



*Gabe Miller*



# MCZ RESEARCH MAKING HEADLINES

## Lolita and Lepidoptera

In 1945, Vladimir Nabokov, renowned author of *Lolita* and lifelong lepidopterist, proposed a revolutionary theory regarding the butterflies he studied, the *Polyommatus* blues. Without any means more sophisticated than a microscope, he described a bold new theory of how and when the blues arrived in the New World. In the intervening years, however, few scientists seriously considered his hypothesis.

In his paper, Nabokov, a *de facto* curator of Lepidoptera at the MCZ, described the migration of *Polyommatus* blues from Asia over the Bering Strait in five waves, each giving rise to a separate New World group. Using genetic sequencing of newly collected samples, **Naomi Pierce** and her colleagues set out to reconstruct the family tree of Nabokov's blues in research that spanned eight years and involved six expeditions to the Andes to collect the necessary species.

The team used a technique called a "molecular clock" to determine how long ago the various New World species of *Polyommatus* blues evolved. This dating would indicate which of the competing theories—including an alternative

hypothesis that the species diverged upon the breakup of ancient Gondwanaland 80 to 100 million years ago—was correct.

The team's research determined that the butterflies arrived in South America approximately 11 million years ago, within the time frame postulated by Nabokov, when the Bering land bridge still existed and temperatures were favorable for the relatively warm-adapted butterflies to disperse to South America. Moreover, they found that Nabokov correctly predicted the sequence of the subsequent four waves of migration that gave rise to the groups of these butterflies that we now see in North America. The ancestors of each of these groups were increasingly cold-adapted, matching the cooling temperatures occurring across the Bering Straits. Thus, more than 65 years later, Nabokov's revolutionary theory regarding the migration and evolution of his beloved blues has been proved to be astonishingly accurate.

Vila R, Bell CD, Macniven R, Goldman-Huertas B, Ree RH, Marchall CR, Bálint Z, Johnson K, Benyamini D, Pierce NE (2011) Phylogeny and palaeoecology of *Polyommatus* blue butterflies show Beringia was a climate-regulated gateway to the New World. *Proc Roy Soc B* 278:2737-2744.

## Revealing the Role of Seasons in Biodiversity

Earth's biodiversity is higher in the tropics, but why? Is diversity fostered by increased light and heat, or by lower variation in seasonal temperatures? In research published in *Paleobiology*, **Brian Farrell** worked with his former student and MCZ Associate Bruce Archibald and colleagues to seek the answer in deep, geologic time.

They compared insect diversity at two modern locations—the Harvard Forest Ecological Research Site, a temperate forest with high seasonality, and a Costa Rican tropical forest with high levels of light and heat but low seasonality—with the exceptionally well-preserved insects of the McAbee fossil bed in British Columbia. When the McAbee fossils were created 52.9 million years ago, Earth's climate was far less seasonal at all latitudes, allowing tropical species such as palm trees and crocodiles to live in what is now the high Arctic.

The researchers discovered that the ancient Canadian site's insect diversity is similar to that of the modern Costa Rican forest, despite a marked difference in latitude, suggesting that lower variation in seasonal temperatures—rather than heat or light—drives increased biodiversity.

Up through the Eocene epoch—when most of today's organisms were diversifying—the world lacked pronounced seasonality, much like today's tropics. Interestingly, the findings indicate that, in the present day, it is not the heat of the tropics that promotes diversity, but the seasons of the higher-latitude temperate zone that depresses diversity.

Archibald SB, Bossert WH, Greenwood DR, Farrell BD (2010) Seasonality, the latitudinal gradient of diversity, and Eocene insects. *Paleobiology* 36:374-398.



Vlad Dincea





## Biomechanics and Fluid Dynamics

When moving through water, fishes with flexible fins must continually react to the surrounding fluid to maintain stability and steady forward movement. Until recently, the main method of analyzing fish wakes—and therefore the movement and force applied to the water by the fins—has been limited to two-dimensional techniques, which have left considerable room for error. In research published in *Biology Letters*, **Brooke Flammang** and colleagues used a novel 3D laser imaging technique to instantly capture the interaction between fishes and their environment. The research was designed to test assumptions made under two-dimensional methods and to examine the interaction between the dorsal and anal fin wake and the tail fin, which has been technically difficult to do with traditional imaging approaches.

On a “treadmill for fish,” four bluegill sunfish (*Lepomis macrochirus*) and a cichlid fish (*Pseudotropheus greshakei*) swam singly in a recirculating flow tank seeded with plastic particles suspended in the flow. A pulse laser illuminated the fluid downstream of the swimming fish, and the particle position and displacements were captured by a camera and calculated using software. With the new system, researchers are able to analyze

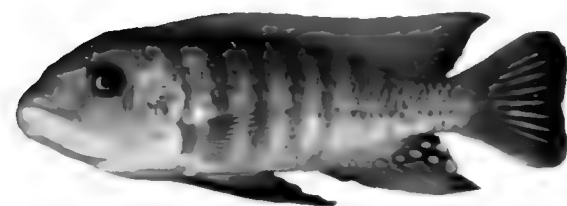
the entire volume of water being moved in each of multiple sequential photographic images.

Flammang, an MCZ postdoctoral fellow at the Lauder lab, discovered that the dorsal and anal fins make a great contribution to the tail fin wake, and thus are additional propellers, not merely stabilizers. Scientists have known that the dorsal and anal fins are important for balance, but have only now been able to show that they also play a significant role in locomotion.

Flammang also used volumetric imaging to examine shark tail hydrodynamics in research to be published in *Proceedings of the Royal Society B*.

Flammang BE, Lauder GV, Troolin DR, Strand TE (2011) Volumetric imaging of fish locomotion. *Biol Lett* 7:695-698.

Flammang BE, Lauder GV, Troolin DR, Strand TE (2011) Volumetric imaging of shark tail hydrodynamics reveals a three-dimensional dual-ring vortex wake structure. *Proc Roy Soc B* 278:3670-3678.



Brooke Flammang

A novel 3D imaging technique uses a pulse laser to capture the displacement of plastic particles in a flow tank.

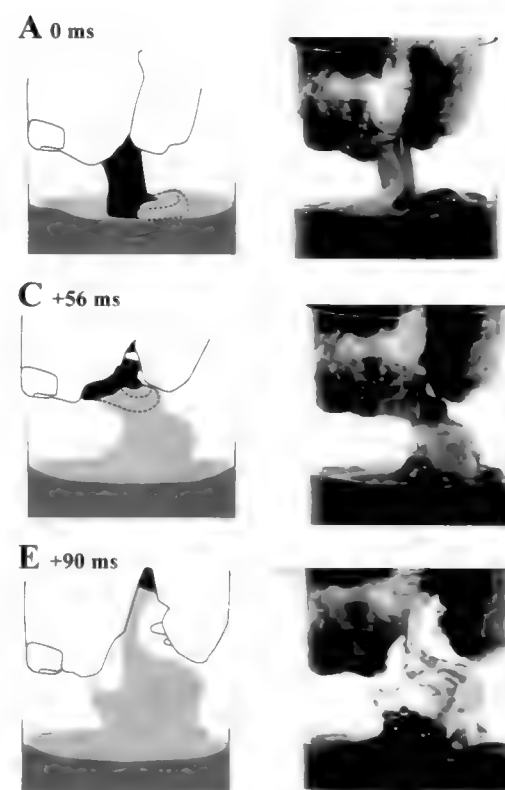
## Tongue Tales: How Dogs Lap

Have you ever watched a dog lapping water and wondered how the liquid gets into its mouth? To a casual observer, the dog's tongue seems to curl under and make a spoon shape, leading some to conclude that dogs scoop up liquid with the underside of their tongues. Cats, however, pull water into their mouths using the upper surface of their tongues. Since the oral cavities of cats and dogs are similarly structured, this lapping mechanism shouldn't be fundamentally different. So how, really, does water get to the dog's mouth?

It has been shown that when cats lap, they curl their tongue backwards until it comes to rest on, but does not penetrate, the surface of the liquid. Then as the cat lifts its tongue, liquid is drawn up into the mouth on the upper surface of the tongue.

Using high-speed light videos and X-ray videos, **A.W. Crompton** and **Catherine Musinsky** recorded a dog lapping broth. The videos show that when the dog dipped its tongue into the broth, it did scoop liquid into a spoon-shaped area on the underside of its tongue. However, when the tongue was withdrawn, the liquid fell out. Instead, a column of liquid was drawn up on the surface of the tongue and then trapped in the mouth as the jaw closed—just as in cats. Their findings were published online in *Biology Letters*.

Crompton AW, Musinsky C (2011) How dogs lap: ingestion and intraoral transport in *Canis familiaris*. *Biol Lett* 7:882-884.





Marie Manceau (left) and Hopi Hoekstra

## Designer Genes

Survival in the wild can be determined by how well an animal's coloration hides it from predators. However, the genetic mechanisms that create color patterns have been little understood. **Marie Manceau** and **Hopi E. Hoekstra** used two populations of deer mice, each differently adapted to be camouflaged in their particular environment, to show how the *Agouti* gene plays a key developmental role in color pattern evolution.

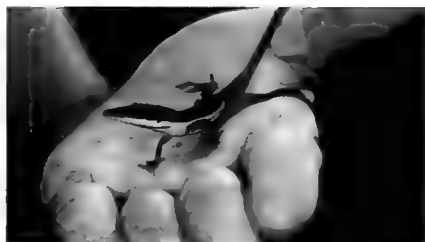
The color pattern in deer mice—a dark back and a light belly—is the most typical in vertebrates. The researchers found that the expression of the *Agouti* gene in the belly of the developing fetus delays the maturation of cells that will eventually produce pigments, and thus the development of color, in that area of the body. In addition, the researchers found that subtle changes in the gene's

embryonic activity can also make a profound difference in the distribution of pigments across the entire body. Their findings were published in *Science*.

Beyond color patterning, this study highlights how even small changes in *Agouti* gene expression in embryos can establish a completely new color pattern in adults. In deer mice, natural selection drives changes in the amount and place of *Agouti* expression, which in turn results in new color patterns that can camouflage animals from predators in habitats ranging from dark forests to sandy beaches.

Manceau and Hoekstra plan to continue their research with animals having more complex color patterns, such as chipmunks, to determine if the same pre-patterning mechanisms seen in deer mice are also involved.

Manceau M, Domingues VS, Mallarino R, Hoekstra HE (2011) The developmental role of *Agouti* in color pattern evolution. *Science* 331:1062-1065.



## Physical Evolution Keeps Pace with Ecological Opportunity

Adaptive radiation—where a single ancestral species gives rise to many descendants, each adapted to a different part of the environment—is possibly the single most important source of biodiversity in the world. One of the best-studied examples of adaptive radiation is the *Anolis* lizards, which arrived in the islands of the Caribbean around 40 million years ago from South America and evolved into numerous species of dramatically differing body sizes and limb lengths.

In theory, ecological opportunity—the availability of resources, such as food and territory, and the amount of competition for those resources—is the primary factor regulating the pace of species diversification, so the rate of diversification should slow as opportunity declines. However, does this theory also hold true for the diversification of body size and shape?

To investigate the relationship between ecological opportunity and morphological evolution, **D. Luke Mahler**, **Jonathan B. Losos** and colleagues employed genetic methods and data from body measurements of around 100 species of Caribbean anoles from Cuba, Hispaniola, Jamaica and Puerto Rico.

They found that the earliest species with the greatest resources and little or no competition developed the widest variety of body types and sizes—from foot-long giants that travel the treetops to slender lizards that live in bushes. But as the number of *Anolis* species increased and their ecological niches became smaller, the resulting adaptations in body type slowed and became more subtle. The research was published in *Evolution*.

Mahler DL, Revell LJ, Glor RE, Losos JB (2010) Ecological opportunity and the rate of morphological evolution in the diversification of Greater Antillean anoles. *Evolution* 64:2731-2745.



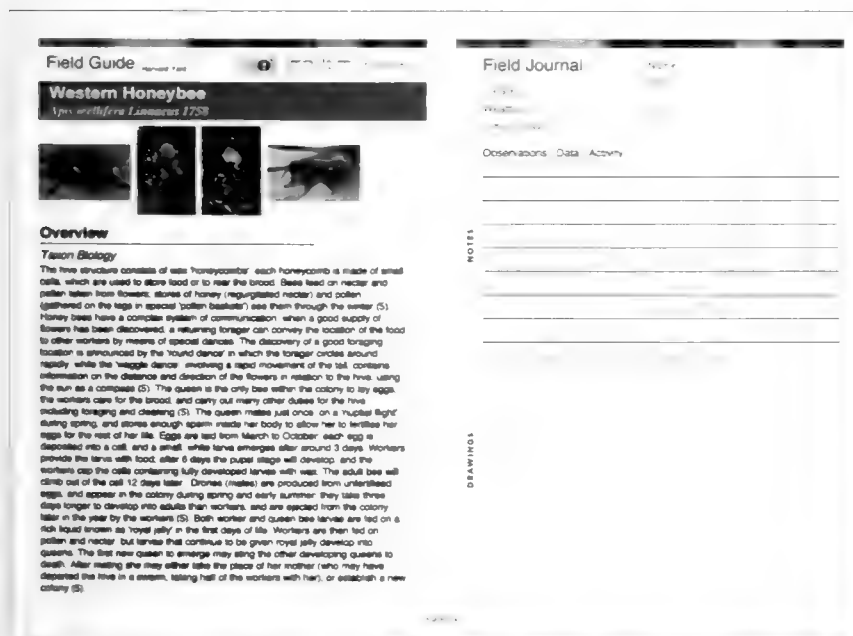
# PROJECTS & INITIATIVES

## Encyclopedia of Life

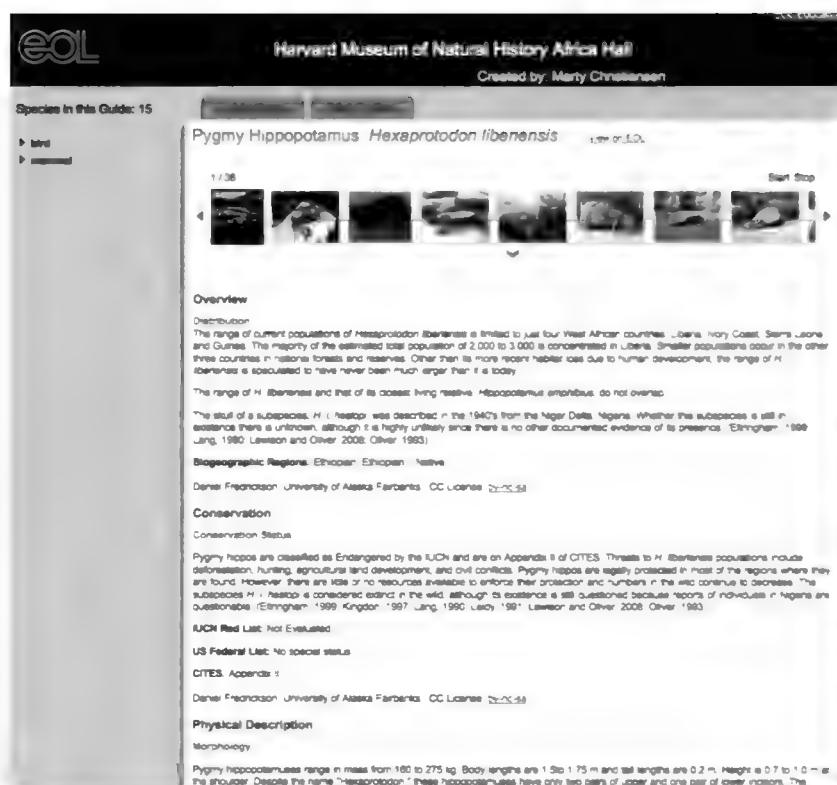
The second version of the Encyclopedia of Life ([eol.org](http://eol.org)) debuted on September 5, 2011. The free, online collaborative resource is vastly expanded, offering information on more than one-third of all known species on Earth. EOL Version 2 (EOLv2) features a new design and tools that make it easy for users to find organisms and create personalized collections of photos and information.

As an EOL cornerstone institution, Harvard University is extensively involved in building EOL. The MCZ-based EOL Learning + Education Group has initiated several new collections of Harvard contributions ([www.eol.org/collections/5923](http://www.eol.org/collections/5923)). These collections include LifeDesks created by the MCZ's EOL Fellows, **Gisele Kawauchi** and **Breda Zimkus**; field guides customized for the Harvard Museum of Natural History exhibitions; and podcasts by E.O. Wilson and others. In addition, Harvard undergraduates have created species accounts as part of their biology courses and published them to EOL via Education LifeDesks, Mushroom Observer and AmphibiaWeb.

The MCZ has contributed data from its ten research departments to 4,278 EOL species pages, and MCZbase, the museum-wide specimen database, is currently feeding all of its specimen photos into EOL. The MCZ's Ernst Mayr Library belongs to the Biodiversity Heritage Library, whose members have scanned around 35 million pages of biodiversity literature and made them available to users worldwide through EOL.



The EOL Learning + Education Group ([education.eol.org](http://education.eol.org)) is charged with developing tools to facilitate the use of EOL's data. Their Field Guide tool, currently in beta testing, is a way to organize species information for a particular project. For example, a field guide was made for a species inventory in Harvard Yard.



The group is also tasked to work with stakeholders to better understand and develop new ways that EOL can be integrated into biodiversity learning. To better understand and prioritize EOL's core functionality, the Learning + Education Group sponsored two workshops to gather requirements from EOL users and partners. In September 2010, 20 representatives of museums, nature centers, zoos, aquariums and other settings in the U.S. and abroad attended *Using EOL in Public Exhibits* to explore ways in which EOL, through its content and associated tools and services, can be used to support and enhance the visitor experience in informal science institutions. During the *International EOL Learning and Education Workshop* (March 31–April 1, 2011), representatives of EOL regional partners from the Arab region, Australia, China, Costa Rica, The Netherlands and South Africa discussed the goals, opportunities and challenges of working together and the EOL content, tools and services needed to advance biodiversity learning worldwide.

In another international initiative, the Learning + Education Group received a grant from the David Rockefeller Center for Latin American Studies to help implement Cyberhives, an online Spanish-language educational program developed by the National Biodiversity Institute of Costa Rica (INBio). In 2010, INBio became an EOL regional partner to serve Central American species information in Spanish. Cyberhives is an online project that uses science and technology to encourage and support middle school children to learn about biodiversity in their own communities. With the Central American EOL portal in place, it will be possible to implement Cyberhives in other countries in the region. The grant will enable participants from EOL's Learning + Education Group, INBio (Costa Rica) and the Ministries of Education and non-governmental organizations in Panama, Nicaragua and El Salvador to develop a plan to implement and test the Cyberhives learning model regionally.





Catherine Weisel

## Zofnass Family Gallery Debuts with New England Forests Exhibition

The generous gift of Paul J. Zofnass, Harvard alumnus and member of the MCZ Faculty governing board, has made possible a new gallery and exhibition at the Harvard Museum of Natural History. The largest donation in the museum's history has created the Zofnass Family Gallery and the permanent exhibition *New England Forests*, both of which debuted on May 21, 2011.

*New England Forests* explores the natural history and ecology of the regional forests, their responses to human activity and their environmental significance. The exhibition highlights three facets of the region's woodlands—the forest primeval, the transitional forest and the New England wetland habitat—and the rich natural history collections of the Museum of Comparative Zoology are featured in all three forest landscapes.



Patrick Rodgers

Paul Zofnass and family at the Gallery's opening. From left: sister Joan Zofnass, daughter Rebecca Zofnass, Paul Zofnass and wife Renee Ring.

Curatorial staff from the ornithology and mammalogy collections helped select specimens that would accurately reflect the fauna found in New England forest habitats. "Given the incredible diversity of bird species and specimens to choose from, we wanted to ensure that the exhibit displayed familiar but key species found in those habitats," said **Jeremiah Trimble**, Curatorial Associate in Ornithology. Specimens from the MCZ collections include current and former forest residents—moose, caribou, wolves, foxes, skunks, porcupines, hawks and woodpeckers—as well as invasive species such as coyotes.

The exhibition conveys current research about how forest communities work, cycle water and carbon, interact with climate and respond to invasive species, drawing on the expertise of evolutionary biologists, botanists, ecologists and system scientists from across the University to tell the forest's story. Visitors are encouraged to observe and "read" the local landscape for clues about its past and to contemplate the challenges and choices we face in planning our forests' future.

Multimedia displays in the exhibition will be updated as new research from the MCZ and others enriches understanding of the forests and the organisms that live there.



Patrick Rodgers



## Quality Control for Species-Occurrence Data

MCZ Director **James Hanken** is the principal investigator for “Filtered Push: Continuous Quality Control for Distributed Collections & Other Species-Occurrence Data.” The National Science Foundation awarded the three-year, \$1.6 million grant in fall 2010. **Paul Morris**, Biodiversity Informatics Manager, will be leading efforts on the behalf of the MCZ.

Species-occurrence data associated with biological collections—which species was observed at a geographic location at a given time—have historically been used mainly by taxonomists. With the advent of digital aggregation technologies these data have become readily available for many other uses, such as modeling species distributions and assessing the effects of climate change on biological diversity.

Through aggregation, large quantities of species-occurrence data can be gathered simultaneously from many distributed sources.

This process, however, has highlighted the frequency of problems regarding the accuracy, completeness, consistency of representation and timeliness of those data. Accordingly, researchers often are uncertain about whether these data are suitable for use in their work.

Data quality and fitness for use will be addressed through Filtered Push Continuous Quality Control software, which allows data providers and consumers to define potential errors in data, develop metrics for those errors, analyze distributed data to detect potential errors, and close the quality management cycle by sending corrections back to the curators of the original data sets.

The project will specifically benefit aggregators that serve species-occurrence data to the public and other research domains, such as the Encyclopedia of Life and the Global Biodiversity Information Facility.



## Linking Field Notes to Specimens and Published Literature

The California Academy of Sciences is partnering with the MCZ’s Ernst Mayr Library and Ornithology department along with other natural history institutions to develop a system for integrating biological researchers’ field and specimen notes with the corresponding museum specimens and electronically published literature. The project will provide enhanced and integrated access to biological data that will serve a wide variety of users and connect to other ongoing projects, such as the Biodiversity Heritage Library.

As a part of a larger grant from the U.S. Institute of Museum and Library Services, the MCZ has been awarded funds to pursue the pilot project: “Archives and Specimens from the *Birds of the Cambridge Region* by William Brewster.”

A curator at the MCZ from 1885 to 1902, William Brewster published *Birds of the Cambridge Region* in 1906. In the pilot project, the MCZ’s Ornithology department and the Ernst Mayr Library will digitize the historical materials and specimens associated with

Brewster’s ornithological studies in and around Cambridge. The collection comprises more than 1,850 specimens collected by Brewster, 2,800 specimens he acquired and 9,000 pages of archival materials, including field notebooks, correspondence, manuscripts and photographs. The entire body of work will present Brewster’s detailed observations, pioneering studies, notes and assertions about living nature—particularly birds—as he understood them.

Inclusion of Brewster’s unpublished observations and writings will enhance contemporary ornithological studies. As the specimens and notebooks are scanned and cataloged or entered into a database, the metadata will be improved by adding digital tags that will include names (taxonomic and personal), dates, localities and other contextual information. Once the records are complete, the materials will be exported to the Biodiversity Heritage Library and there linked to the published literature and to specimen data via the Encyclopedia of Life.



William Brewster, 1883

Courtesy of the Ernst Mayr Library, Special Collections



## Ernst Mayr Library

In 1861, the MCZ's library was founded when Louis Agassiz purchased Belgian paleontologist Laurent Guillaume de Koninck's collection of books. Together with much of Agassiz's own private collection, these volumes formed the core of the new library. Now celebrating 150 years of information provision, the Ernst Mayr Library has grown to around 300,000 volumes of books and journals and is an integral part of the MCZ. "The Library is a key historical zoological collection that has evolved along with the MCZ and has a vibrant digitization program contributing to the Biodiversity Heritage Library," explained **Constance Rinaldo**, Librarian of the Ernst Mayr Library. "The Library, with the merger of the Biological Laboratories Library, is now a key support for life sciences programs at Harvard."

Even with its ongoing scanning efforts, not all information is available online. People come from around the world to conduct deep research using the Library's historic volumes and artifacts. "In this increasingly fast-paced, digital world it is easy to lose sight of the significance of a comfortable library space, opportunities for browsing serendipitously and the tactile value of an important, yet beautiful, scientific work," said Rinaldo.

The Ernst Mayr Library is one of the founding members of the Biodiversity Heritage Library (BHL), a group of organizations making biodiversity literature openly available via the Internet.



Constance Rinaldo

This digitization effort is important for taxonomists, who traditionally had to travel extensively to physically access the literature, and especially valuable to scientists around the world who may not have the means to make these journeys. The BHL scanning effort has produced more than 36 million scanned pages of biodiversity literature to date, and this number is continually increasing. BHL Brazil, the latest of several global BHL efforts, was launched December 1, 2010. [biodiversidade.scielo.br/php/index.php](http://biodiversidade.scielo.br/php/index.php)

In recognition of the work in building the digital library, the BHL was awarded the John Thackray Medal in 2010 by the Society for the History of Natural History. The John Thackray medal recognizes significant achievements in the history or bibliography of natural history, specifically "making available ... collections and/or information in new and novel ways."

## International Congress on Invertebrate Morphology

In June 2011, the MCZ and the Department of Organismic and Evolutionary Biology hosted the second International Congress on Invertebrate Morphology. Invertebrates—including sponges, flatworms, insects, clams, snails and other non-vertebrate life—include

around 1.2 million described species and 96% of the total known animal diversity. **Gonzalo Giribet** is the incoming president of the International Society of Invertebrate Morphology, which organized the event.

More than 230 delegates from 23 countries gathered to hear presentations and engage in discussions related to invertebrate form, function and development. Speakers included **Christopher Laumer** and **Alicia Pérez-Porro**, graduate students in the Giribet lab. **Adam Baldinger**, Curatorial Associate of Invertebrate Zoology, **Gonzalo Giribet**, and postdocs **Marta Novo**, **Ana Riesgo**, **Sonia Andrade** and **Alexander Ziegler** presented posters at the event.

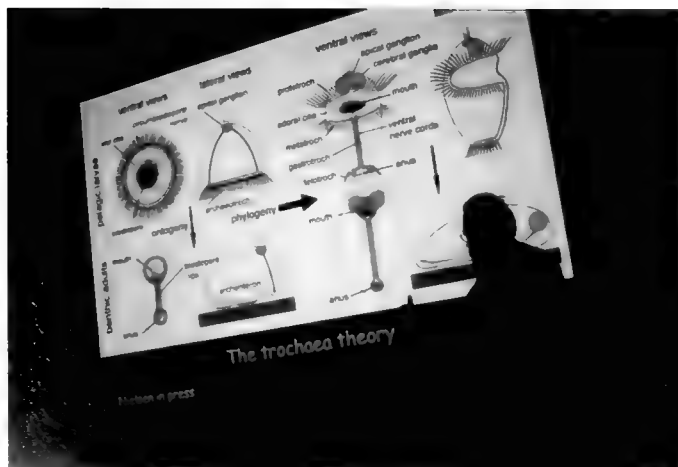
In addition to the presentations, attendees were invited to examine special collections at the MCZ and the Ernst Mayr Library and view the Blaschka glass sea creatures.



Courtesy of the Ernst Mayr Library



Courtesy of the Ernst Mayr Library



Katherine C. Cohen





- **Altipis SW, Giribet G** (2010) A phylogeny of Vetigastropoda and other "archaeogastropods": re-organizing old gastropod clades. *Invertebr Biol* 129:220-240
- **Archibald SB, Bossert WH, Greenwood DR, Farrell BD** (2010) Seasonality, the latitudinal gradient of diversity, and Eocene insects. *Paleobiology* 36:374-398
- **Balakrishnan CN, Ekblom R, Völker M, Westerdahl H, Kotkiewicz H, Godinez R, Burt DW, Graves T, Griffin DK, Warren W, Edwards SV** (2010) Gene duplication and fragmentation in the zebra finch major histocompatibility complex. *BMC Biol* 8:29
- **Barrett RDH, Schluter D** (2010) Clarifying mechanisms of evolution in stickleback using field studies of natural selection on genes. In *In Search of the Causes of Evolution: Field Observations to Mechanisms* (Grant P, Grant R, eds) 332-346. Princeton University Press: Princeton, NJ
- **Barrett RDH** (2010) Adaptive evolution of lateral plates in stickleback: A case study in functional analysis of natural variation. *J Fish Biol* 77:311-328
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- **Collin R, Giribet G** (2010) Report of a cohesive gelatinous egg mass produced by a tropical marine bivalve. *Invertebr Biol* 129:165-171
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• **Giribet G** (2010) A new dimension in combining data? The use of morphology and phylogenomic data in metazoan systematics. *Acta Zool (Stockholm)* 91:11-19

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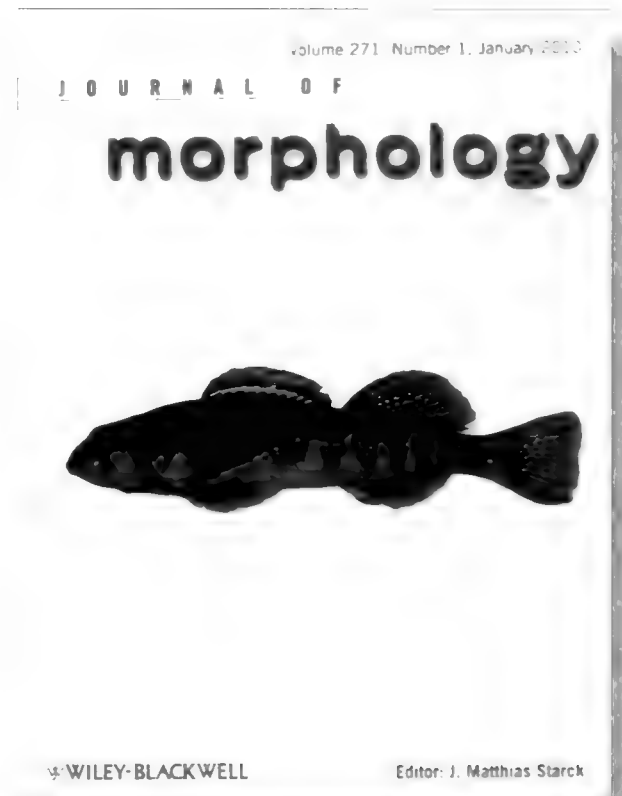
• **Goodbody-Gringley G, Vollmer SV, Woollacott RM, Giribet G** (2010) Limited gene flow in the brooding coral *Favia fragum* (Esper, 1897). *Mar Biol* 157:2591-2601

• **Gottlieb JR, Tangorra JL, Esposito CJ, Lauder GV** (2010) A biologically derived pectoral fin for yaw turn maneuvers. *Appl Bionics Biomech* 7:41-55

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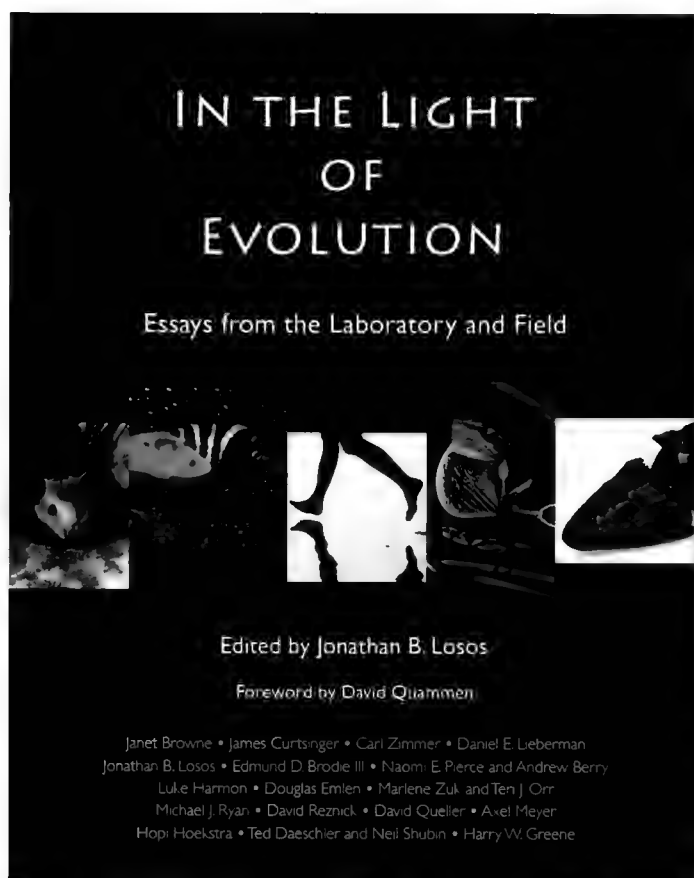


George V. Lauder and colleagues contributed "Computational modeling and analysis of the hydrodynamics of a highly deformable fish pectoral fin" to the *Journal of Fluid Mechanics*.



In the *Journal of Morphology*, George V. Lauder and RL Carlson published "Living on the bottom: kinematics of benthic station-holding in darter fishes (Percidae: Etheostomatinae)."





**Jonathan B. Losos** edited *In the Light of Evolution: Essays from the Laboratory and Field*. In addition to Losos, contributors included **Hopi Hoekstra** and **Naomi Pierce** from the MCZ and Harvard's **Andrew Berry**, **Janet Browne** and **Daniel Lieberman**.

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- **Kawauchi GY**, **Giribet G** (2010) Are there true cosmopolitan sipunculan worms? A genetic variation study within *Phascolosoma pertucens* (Sipuncula, Phascolosomatidae). *Mar Biol* 157:1417-1431
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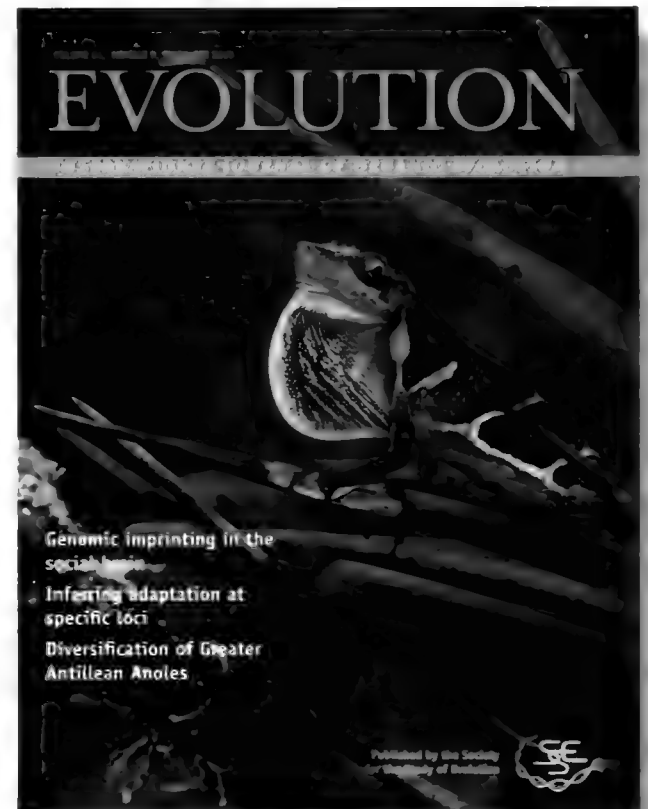
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In the cover story of *Evolution*, **D. Luke Mahler**, **Jonathan B. Losos** and colleagues published "Ecological opportunity and the rate of morphological evolution in the diversification of Greater Antillean anoles." Mahler received the R. A. Fisher Prize for an outstanding Ph. D. dissertation paper published in *Evolution*.





# MCZ GRANT RECIPIENTS

## ACADEMIC YEAR 2010–2011

### 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.

Recipient	Faculty Sponsor	Project Title	Amount
Annabel C. Beichman	James J. McCarthy & Peter R. Girguis	The North Atlantic Right Whale Microbiome Project	\$2,300
Joseph Brancale IV	Arkhat Abzhanov	Morphological analyses of beak diversity in the family Thraupidae	\$1,800
Andrew H. Chen	N. Michele Holbrook	Ecology, taxonomy and adaptation of the invasive species <i>Myoporum aff. laetum</i> in California	\$1,500
Natalie L. Jacewicz	Jonathan B. Losos	Proposal to study feeding and mating behavior in <i>Anolis</i> lizards with diverse head shapes: a field study on Cayman Brac	\$1,795
Alexander M. Kim	Gonzalo Giribet	A phylogenetic survey of trans-Isthmian freshwater prawns: vicariance and invasion at the crossroads of the two Americas	\$530
Bianca M. Lec	Scott V. Edwards	Laying the foundation for study of MHC and mate choice in Leach's storm petrel	\$2,424
Kathy S. Lin	Naomi E. Pierce	The pattern of caterpillar aggregation in a butterfly/ant mutualism	\$1,215
Kevin H. Lin	Hopi E. Hoekstra	Evolution of tail length variation in <i>Peromyscus</i>	\$1,400
Julian Moll-Roczek	N. Michele Holbrook	Logging and Brazil nut conservation in Amazonian Peru	\$1,000
Linda Y. Pan	Hopi E. Hoekstra	Ontogeny of burrowing behavior in deer mice ( <i>Peromyscus</i> )	\$2,060
Riva Riley	Saul Nava	Effects of environment on learning in fish: a study at Los Amigos field station	\$1,238
Hanny E. Rivera	Robert M. Woollacott	Effects of micro-grazers on the larval recruitment and survival of the brooding coral <i>Porites astreoides</i>	\$2,500
Elizabeth K. Schold	Scott V. Edwards	Phylogeographical analysis of North American Warbling Vireo ( <i>Vireo gilvus</i> ) populations	\$2,000
Guo Xuan Teo	Jacques Dumais	Elucidating the "trap mechanism" of <i>Porroglossum</i> orchids	\$1,500
Grace X. Xiong	George V. Lauder	Senior thesis research on the kinematics and fluid mechanics of anal fin propulsion in the clown fish, <i>Notopterus chitala</i>	\$2,500
Serena Y. Zhao	Anne Pringle & Naomi E. Pierce	Biodiversity of Laboulbeniales	\$815
		<b>Total Awards</b>	<b>\$26,577</b>



Thom Sanger



Rouan Barrett



Annabel Beichman



Reva Riley



## 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.

Recipient	MCZ Department	Project Title	Amount
Rowan D. H. Barrett	Mammalogy	Selection on genes in the wild: An experimental approach to determine the influence of ecology on evolutionary processes	\$8,360
Maude Baldwin	Ornithology	Detecting sugar: functional and evolutionary studies of avian sensory perception	\$3,760
Gilberto Neves Bento	Mammalogy	Diversity and adaptation in mouse burrowing behavior	\$5,137
Scott V. Edwards	Ornithology	Diversification and phylogeography of Palearctic birds: an expedition to eastern Mongolia	\$15,956
Heidi Fisher	Mammalogy	Adaptive sperm morphology in <i>Peromyscus</i> rodents	\$5,706
Gonzalo Giribet	Invertebrate Zoology	Exploring the South African petalid diversity	\$6,474
Evan Kingsley	Mammalogy	Uncovering the genetic architecture of convergent local adaptation in forest deer mice	\$6,320
Sarah Kocher	Entomology	Genetics of social behavior in Palearctic halictids	\$4,845
Jonathan B. Losos	Herpetology	Taking advantage of a human introduction to study the genetics and behavioral significance of anole dewlap color	\$7,370
Martha Muñoz	Herpetology	The thermal ecology and evolution of Hispaniolan trunk-ground anoles (Squamata: Iguanidae)	\$9,710
Jon Sanders	Entomology	How many bacteria are in canopy ants? Quantifying one solution to Tobin's Paradox	\$5,900
Yoel Stuart	Herpetology	Investigating the genetic basis of dewlap color in <i>Anolis distichus</i>	\$5,140
Ian Wang	Herpetology	Modeling environmentally associated morphological and genetic variation	\$6,450
Jesse Weber	Mammalogy	Examining natural variation in oldfield mouse ( <i>Peromyscus polionotus</i> ) burrowing behavior	\$5,316
Breda M. Zimkus	Herpetology	Proposed expedition to survey the herpetofauna of Batéké Plateaux National Park in southwestern Gabon	\$7,260
		<b>Total Awards</b>	<b>\$103,704</b>



Martha Muñoz



Sarah Kocher



Rowan Barrett



## 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 using the MCZ's collections.

Recipient	Institutional Affiliation	Project Title	Amount
José Sebastián Barrionuevo	Museo Argentino de Ciencias Naturales	Taxonomy of <i>Telmatobius</i> (Anura: Ceratophrydae)	\$1,500
Aylin Alegre Barroso	Instituto de Ecología y Sistemática, Cuba	Systematics of Biantidae, Thorell, 1879 and review of the <i>incertae sedis</i> <i>Anamota</i> Šilhavý 1979 and <i>Turquininia</i> Šilhavý 1979 in Cuba (Arachnida: Opiliones: Laniatores)	\$1,500
Bhart-Anjan S. Bhullar	Harvard University	Uniting macroevolution and microevolution using deep fossil record: the zone of variability in the archosaur lineage	\$1,395
Tharina Louise Bird	Colorado State University	A generic revision of the arachnid family Solpugidae	\$1,500
Bonnie B. Blaimer	University of California, Davis	Taxonomic revision of the acrobat ant <i>Crematogaster</i> (Hymenoptera: Formicidae) in Madagascar	\$665
Marek L. Borowiec	University of California, Davis	Generic revision of dorylomorph ants (Hymenoptera: Formicidae)	\$400
Kevin W. Conway	Texas Agrilife Research, Texas A&M	Taxonomic revision of the New World clingfishes (Gobiesocidae: Gobiesocinae)	\$1,475
Bernice B. DeMarco	Michigan State University	Phylogenetic analysis of the ant genus <i>Aphaenogaster</i> (Formicidae: Hymanoptera) in North America using morphology and DNA	\$1,180
César G. Durán-Barrón	Universidad Nacional Autónoma de México	Taxonomic review of <i>Chrosiothes</i> Simon, 1894 (Araneae: Theridiidae)	\$1,160
Dimitri Forero	University of California, Riverside	Monographing the bee assassins: Systematic revision of the assassin bug genus <i>Apiomerus</i> (Heteroptera: Reduviidae: Harpactorinae)	\$1,500
James Herrera	State University of New York, Stony Brook	Species delineation in the subfossil lemur assemblage; how many species have gone extinct?	\$1,200

Julien Ayroles



Martha Muñoz



Rouan Barrett



Arvid Buchman



Thom Sanger

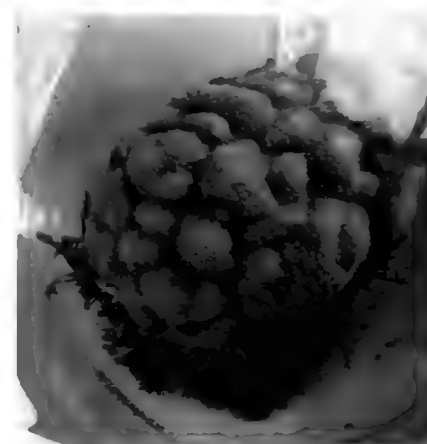




Recipient	Institutional Affiliation	Project Title	Amount
John M. Leavengood, Jr.	University of Kentucky	Revision of the genus <i>Phyllobaenus</i> (Coleoptera: Cleridae: Hydnocerinae)	\$1,500
Anna A. Namyatova	University of New South Wales, Australia	Systematics, biogeography and host plant associations of the true bug subtribes Monaloniina and Odoniella (Heteroptera: Miridae: Bryocorinae: Dicyphini)	\$1,200
Jean Claude Rakotonirina	Madagascar Biodiversity Center	Taxonomic assessment of the ponerine ant genus <i>Leptogenys</i> (Hymenoptera: Formicidae) from the Malagasy region, located at the MCZ	\$1,400
Vivian E. Sandoval-Gómez	Universidade Federal de Viçosa, Brazil	Taxonomic revision of minute tree-fungus beetles of the genus <i>Xylographus</i> Mellié, 1847 (Coleoptera: Tenebrionidae: Ciidae)	\$1,500
Eduardo Fernando Santos	Universidade de São Paulo, Brazil	Study of Pompilidae (Insecta: Hymenoptera) types deposited in the MCZ	\$540
Fabio Laurindo da Silva	Universidade Federal de São Carlos, Brazil	Systematic and biogeography of <i>Labrundinia</i> Fittkau, 1962 (Diptera: Chironomidae: Tanypodinae): a morphological and molecular approach	\$1,500
Sarah M. Smith	Michigan State University	Revision of the New World <i>Scolytus</i> Geoffroy (Coleoptera: Curculionidae: Scolytinae)	\$1,500
Andrés H. Veléz	University of Puerto Rico at Mayagüez	Revision and phylogeny of the neotropical subfamily Nyciborinae (Dictyoptera: Blattaria: Blattellidae)	\$1,250
Lidiana Nogueira Zamprogno	Universidade Federal do Espírito Santo, Brazil	Taxonomic identity of <i>Pristocera</i> (Hymenoptera: Bethyidae)	\$1,500
Tatyana Sergeyevna Vshivkova	Russian Academy of Sciences, Institute of Biology and Soil Sciences	World revision of the genus <i>Limnephilus</i> (Trichoptera: Limnephilidae)	\$1,500
		<b>Total Awards</b>	<b>\$26,865</b>



Jon Sanders



Hanny Rivera



Riva Riley



Hanny Rivera



Sarah Kochen



# AWARDS & RECOGNITION

Kris Snibbe



*Farish Jenkins, Jr.*

## Emeritus

**Edward O. Wilson** received the BBVA Foundation's 2010 Frontiers of Knowledge Award in the area of Ecology and Conservation Biology and the PEN New England Thoreau Prize. In the words of the BBVA prize jury, Wilson is "one of the most influential thinkers of our time, an exceptional biologist and a world-class natural historian."

## Faculty

**Farish A. Jenkins, Jr.**, was elected a member of the Academy of Arts and Sciences Class of 2011. Prof. Jenkins was also honored with a Harvard College Professorship, honoring his achievement in research activities, his excellence in undergraduate teaching and his contribution to advising and mentoring students.

**James Hanken** was elected to the Board of Directors of the American Institute of Biological Sciences and was appointed to the Encyclopedia of Life's Executive Committee.

**Brian D. Farrell** was named 2011–2012 Fulbright Scholar to the Universidad Autónoma de Santo Domingo. In addition to his research, he is building a laboratory and training local students in museum management techniques.

**Hopi E. Hoekstra** was elected Vice President of the American Society of Naturalists.

**Scott V. Edwards** was elected President of the American Genetic Association and will also assume the presidency of the Society for the Study of Evolution in January 2012.

**Gonzalo Giribet** was named a distinguished visitor to Adelaide University and awarded a Visiting Professorship at the Capital Normal University in Beijing. He also became President of the International Society for Invertebrate Morphology and was elected Vice-President of the Spanish Malacological Society.

**Naomi Pierce** was among the ten people selected to be a Fellow of the Entomological Society of America. She was nominated for this honor by her students.



*Jessica Cundiff*

## Staff

**Jessica Cundiff**, Curatorial Associate in Invertebrate Paleontology and Acting Curatorial Associate in Vertebrate Paleontology, received a Harvard University Faculty of Arts and Sciences Impact Award for "sustained superior performance and outstanding contributions."

**Breda Zimkus**, Genetics Resources Facility Project Manager at the MCZ, received a grant from CollectionsWeb to work on "Developing best practices for genetic resource collections associated with traditional natural history collections."

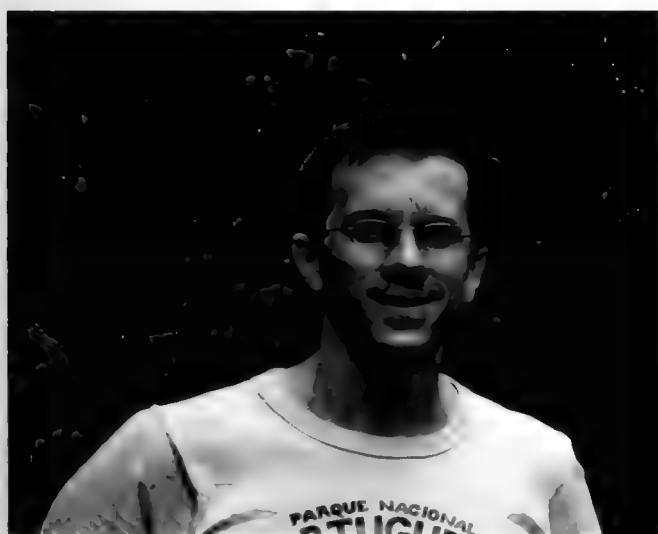


## Postdocs

**Frank Rheindt** received a National Geographic Society Committee for Research and Exploration Grant for the investigation of undescribed bird taxa on the island of Sulawesi.

**Vera Domingues** received the International Travel Award from the Society for the Study of Evolution.

**Rowan Barrett's** work as a graduate student was recognized with the Governor General of Canada Gold Medal for the most outstanding academic record in the graduating class for the doctoral degree. He also received the University of British Columbia Faculty of Science Prize and the Howard Alper Prize, given to the top postdoctoral candidate in Canada.



Luke Mahler

## Graduate Students

**Luke Mahler** has been awarded the 2011 R. A. Fisher Prize by the Society for the Study of Evolution. The prize is awarded for an outstanding Ph.D. dissertation paper published in the journal *Evolution*.

**Dino Martins** was named one of National Geographic's 2011 Emerging Explorers. The award recognizes visionary young trailblazers who push the boundaries of discovery, adventure and global problem-solving early in their careers.

**Hillery Metz** was awarded a Summer Institute in Statistical Genetics Scholarship.

**Prashant Sharma** received 2<sup>nd</sup> place prize for student presentation at the 18<sup>th</sup> International Congress of Arachnology.

## Ricardo Godinez Moreno

received a Harvard University Presidential Instructional Technology Fellowship to work in collaboration with EOL to develop a tree of life viewer to teach Harvard undergrads about tree thinking and evolution.

Congratulations to the following graduate students for predoctoral fellowships:

- **Zachary Lewis**, NSF Graduate Research Fellowship, "A developmental understanding of lung loss in salamanders"
- **Emily Kay**, NSF Doctoral Dissertation Improvement Grant, "Behavioral and genomic evidence for sexual isolation between two sister species of *Peromyscus*"
- **Maude Baldwin**, NSF Doctoral Dissertation Improvement Grant, "Function and evolution of sweet taste receptors in birds"
- **Jon Sanders**, NSF Doctoral Dissertation Improvement Grant, "Functional ecology and evolution of an ant gut microbiome"
- **Leonora Bittleston**, NSF Graduate Research Fellowship, "Comparing the defense of ant-associated plants by two mutualistic symbioses: Do ants and endophytes have antagonistic or complementary roles?"

## Undergraduates

**Joanna Larson '11** received a 2011–2012 Fulbright Grant for her research project "Decoding species complexes of amphibians and mammals in the mountains of Tanzania."

**Adam Clark '11** was awarded the Thomas Hoopes Prize for his senior thesis, "Ant communities of the Boston Harbor Islands National Recreation Area."



Dino Martins

Cheryl Zook/National Geographic Society





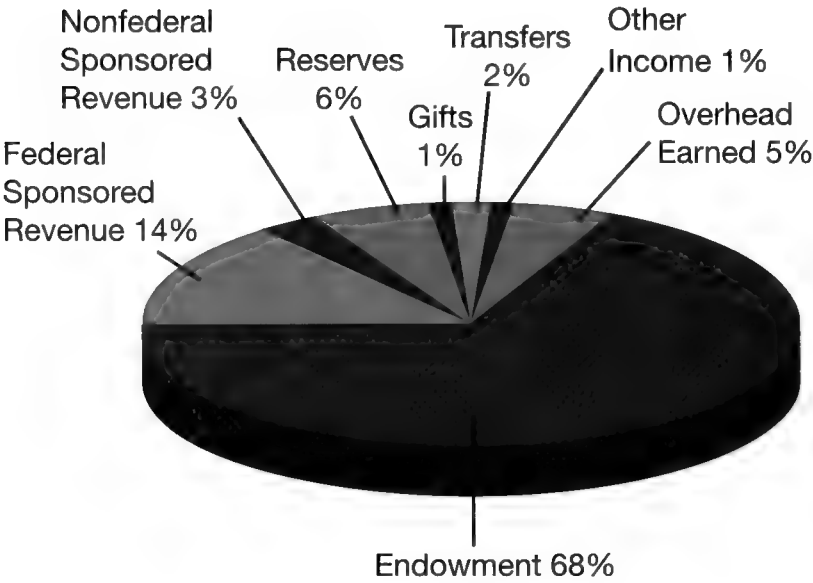
# FINANCIAL DATA

These charts describe the income and expenses of the Museum of Comparative Zoology in fiscal year 2011.

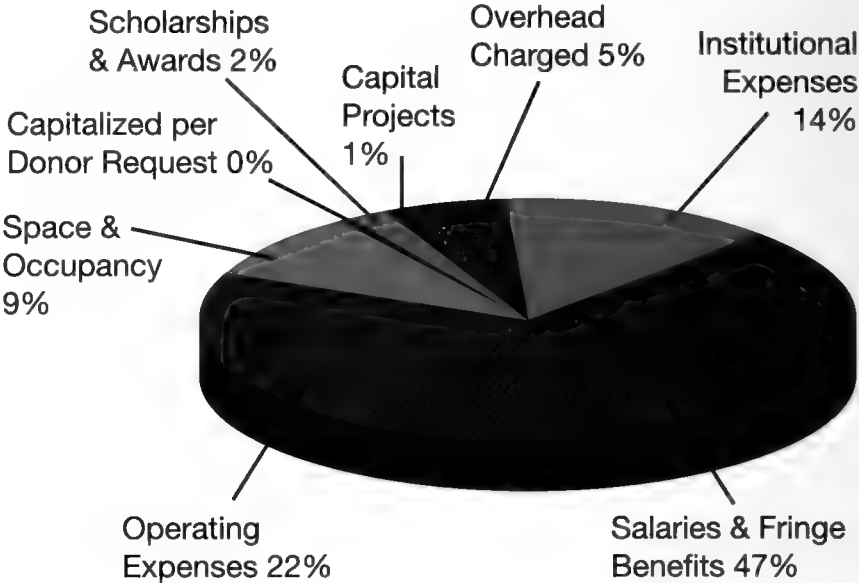
**Endowment** includes the annual distribution from endowed funds, revenue generated from assets purchased through endowments and endowed funds decapitalized per donor request. **Transfers** include Harvard University-funded faculty research, financial support for the Ernst Mayr Library and other Harvard-funded projects. **Other Income** comprises miscellaneous income from publications, royalties, sales and fees, and cost recovery from other MCZ-sponsored activities. **Reserves** represent carry-forward balances used to cover an operating deficit. **Overhead** is funds paid from MCZ-based sponsored projects to cover associated facilities and administrative costs. It is shown as both income (**Overhead Earned**) and expense (**Overhead Charged**).

**Capital Projects** include renovation of the MCZ Laboratories building for a cryogenics facility. Building expenses such as maintenance, facility improvements and utilities are captured in the **Space and 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 and Awards**. **Institutional Expenses** fund other FAS and University initiatives and provide general operating support for the Harvard Museum of Natural History.

Income



Expenses and Non-Operating Funds



Income	
Endowment	\$12,638,069
Federal Sponsored Revenue	\$2,639,998
Reserves	\$1,155,510
Overhead Earned	\$928,128
Nonfederal Sponsored Revenue	\$507,704
Transfers	\$448,907
Gifts	\$154,250
Other Income	\$127,527
Total	\$18,600,093

Expenses	
Salaries and Fringe Benefits	\$8,803,949
Operating Expenses	\$4,005,603
Institutional Expenses	\$2,614,310
Space and Occupancy	\$1,698,761
Overhead Charged (Sponsored)	\$928,128
Scholarships and Awards	\$341,635
Capital Projects	\$130,000
Capitalized per Donor Request	\$77,707
Total	\$18,600,093

**Faculty-Curators**

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

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

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

Gonzalo Giribet  
*Professor of Biology; 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; 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**

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Adam Algar  
*Herpetology, Losos Lab*

Bei An  
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Sónia Andrade  
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Nicholas Crawford  
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Jessica Cundiff  
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Vertebrate Paleontology*

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*Serials Acquisitions Assistant,  
Ernst Mayr Library*

Joseph DeVeer  
*Head of Technical Services,  
Ernst Mayr Library*



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*Director, Collections Operations*

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Brendan Haley  
*Senior Database Manager*

Karsten Hartel  
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Kathleen Horton  
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Amie Jones  
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Maureen Kelly  
*IT Specialist, Biodiversity Informatics*

Richard Knecht  
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Laura Leibensperger  
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Lisa Litchfield  
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Mara Lyons  
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Joseph Martinez  
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*Collection Assistant, Ichthyology*

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*Laboratory Technician, Entomology*

Jessica Mitchell  
*Intern, Ernst Mayr Library*

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*Biodiversity Informatics Manager*

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### 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.

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Mr. George Putnam, III  
Dr. Barbara Jil Wu  
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President Drew Gilpin Faust

### Acknowledgements

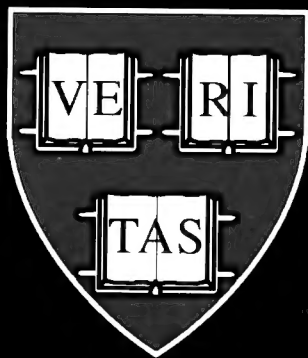
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