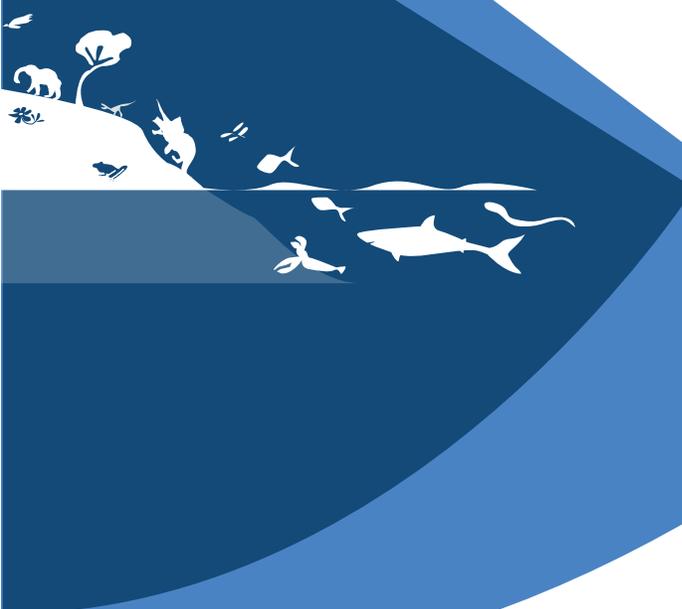


OEBnews

2018-2019

Newsletter of the
Department of Organismic
& Evolutionary Biology
HARVARD UNIVERSITY



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Welcome from the Chair



Elena Kramer

DEPARTMENT CHAIR
BUSSEY PROFESSOR OF ORGANISMIC AND EVOLUTIONARY
BIOLOGY, HARVARD COLLEGE PROFESSOR
INTERIM DIRECTOR, HARVARD UNIVERSITY HERBARIA

Dear Colleagues, Alumni, and Friends,

Another wonderful year has come and gone in OEB, full of excitement, new friends and initiatives, and, of course, fantastic science. Graduation was especially impressive this year as we greeted 42 graduating Integrative Biology (IB) concentrators and 20 PhDs walked in

Commencement on May 29th. As always, our IB concentrators and their faculty and graduate student instructors traveled widely, including class excursions to the dry forests of Brazil and marine environments off the shore of Panama, as well as individual undergraduate researchers who went as far as New Zealand. These amazing learning experiences were made possible by the generous support of MCZ, HUH and OEB departmental endowments. During J term Gonzalo Giribet and David Haig took 13 freshly declared IB concentrators to Australia for the inaugural offering of OEB 11: Introduction to Tropical Biology. The students had a spectacular opportunity to explore diverse biomes, including tropical forests and the Great Barrier Reef while working with OEB faculty as well as staff and students from the University of Sydney. This immersive field experience was supported by the Australia-Harvard Fund and was an incredible adventure for everyone involved.

It has been an equally exciting year in the OEB graduate program. Our graduating PhDs have explored the full breadth of biological science evidenced by the wide range of dissertation titles. The 17th annual G4 Symposium was, as promised, a real blockbuster with 22 student speakers over two full days. We took equal pleasure in celebrating OEB alumni who have done amazing things with their PhDs with the 5th Annual OEB Alumni Career Panel. This year's panel featured Saharah Moon Chapotin ('05), Vanessa Gonzalez ('13), Bernardo Lemos ('07) and Julie Shoemaker ('10), who led an animated discussion about careers across academia, public policy, and collections science. OEB alumni should keep an eye out for invitations to serve on a future panel!

In January we were thrilled to welcome Prof. Javier Ortega-Hernández, an invertebrate paleontologist whose work explores the early evolution of arthropods by integrating fossils, developmental molecular biology, and systematics. Javier is already diving into curatorial work in the MCZ. More recently, we have been joined by another wonderful new faculty member, Prof. Andrew Davies, whose appointment was the product of last year's tenure track search in Global Change Ecology. Andrew's work is very wide ranging, including field work in Africa and southeast Asia with a focus on the three-dimensional aspects of ecosystem processes at landscape scales.

These exciting developments are really only the beginning, so please take some time to peruse the entire newsletter. Remember, you can follow all the latest news from OEB on our [website](#) and we always welcome updates on your activities and accomplishments!

Best wishes,
Elena Kramer

Congratulations to our Graduates!



NICOLE BEDFORD

“A comparative ethology of burrowing behavior in *Peromyscus* mice”
(H.Hoekstra)



TAUANA JUNQUEIRA CUNHA

“Gastropod phylogeny, biogeography and shell shape evolution”
(G.Giribet)



BRUNO DE MEDEIROS

“Evolution of *Syagrus* palms and their insect pollinators” (B.Farrell)



DAVID C. FRONK

“Mechanical branching and channel formation and its relevance to biological systems” (L.Mahadevan)



MORGAN FURZE

“Understanding whole-plant nonstructural carbohydrate storage in a changing world” (N.M.Holbrook)



KADEEM GILBERT

“Evolution and ecological consequences of diverse traits in tropical pitcher plants (*Nepenthes*)” (N.Pierce)



PATRICK GORRING

“Gene to genus: Systematics and population dynamics in lamiini beetles (Coleoptera: Cerambycidae) with focus on *Monochamus* Dejean” (B.Farrell)



PHIL GRAYSON

“The comparative and developmental genomics of flightlessness in birds (Palaeognathae)” (S.Edwards)



KELSEY N. LUCAS

“Physical mechanisms of force production for swimming in fishes”
(P.Girguis and E.Tytell, Tufts)



BRIANNA MCHORSE

“Macroevolution and biomechanics of digit reduction in horses”
(A.Biewener and S. Pierce)

Congratulations to our Graduates!



Y. FRANCHESCO MOLINA-HENAO

“Ecological and evolutionary consequences of two distinct modes of speciation in plants” (R.Hopkins)

JENNY YEN PHAM

“Molecular and phenotypic evolution of niche breadth in Escherichia virus T4” (D.Hartl)



BENJAMIN RICE

“The ecology and evolution of *Plasmodium falciparum* malaria among rural communities in Madagascar” (D.Hartl)

JOSÉ I. ROJAS ECHENIQUE

“Functional epistasis and evolutionary dynamics” (M.Desai)



MARY SALCEDO

“An insect wing: Expansion, hemodynamics, and venation patterns” (L.Mahadevan)

SAM SINAI

“Surveying mount improbably: Computation challenges facing evolution” (M.Nowak)



KIRA TREIBERGS

“How does a polymorphic colony divide labor among its modules? Colonial development in the marine invertebrate, *Bugulina stolonifera*” (R.Woollacott)

CARL VELLER

“Essays in evolutionary theory” (M.Nowak)



JOSEPH VITTI

“Identifying and characterizing adaptive regulatory variation in diverse human populations” (P.Sabeti)

DYLAN WAINWRIGHT

“Fish scales: Morphology, evolution, and function” (G.Lauder)



Faculty News

Research Highlights

Robin Hopkins and Postdoc **Federico Roda** investigated the mechanistic link between a plant's ability to reject its own pollen and pollen from another species. Performing over 5000 controlled crosses in a group of native Texas wildflowers, Roda and Hopkins found these two types of pollen rejection systems were highly correlated across individuals and occurred at the same time during pollen development. The study, published in [New Phytologist](#), concludes that these incompatibilities share an underlying mechanism that influences the evolution of pollen rejection within a species.

L. Mahadevan and researchers at the School of Engineering and Applied Sciences (SEAS) have developed a framework to encode memory in the form of Braille-like dimples and bumps onto a blank, lattice-free material. The system could serve as the basis for small-scale mechanical memories. The study, published in [Proceedings of the National Academy of Sciences](#), is a first step in showing that memories can be stored.

Stephanie Pierce and Postdoc **Katrina Jones's** research in [Science](#) suggests the makeup of a spine is one more characteristic that defines a mammal. The study shows mammal backbones are different than the vertebrae of most four-legged animals in that it is made up of different sections that take on different shapes and function separately. Pierce and Jones looked at the fossil record using museum collections from around the world. Examining dozens of fossil spines as well as over 1,000 vertebrae from living animals, they discovered that during mammal evolution, the spine gained regions, unlike the non-mammalian. The study was featured in [Science Magazine News](#), [The Harvard Gazette](#), and [Phsy.Org](#).

The pancrustaceans are the most diverse animal group to ever exist and include familiar kinds of arthropods such as crustaceans (e.g. shrimp, crabs, lobsters) and six-legged insects. **Javier Ortega-Hernández** and Research Associate **Joanna Wolfe** collaborated with colleagues at Yunnan University in Kunming to illuminate details on the evolution of

Notable Awards

-**George Lauder** awarded the Plenary Nelson Lifetime Award.

-**Yun Zhang** and Postdoc **Ana Pereira** awarded the 2018 Dean's Competitive Fund for Promising Scholarship.

-**Andrew Knoll** awarded the 34th International Prize for Biology of Japan Society in the field of Paleontology.

-**Mansi Srivastava** awarded National Institutes of Health, Maximizing Investigators' Research Award (MIRA) for Early Stage Investigators.

-**Scott Edwards** awarded the 2019 Molecular Ecology Prize.

-**Javier Ortega-Hernández** granted the distinction

of Investigado Nacional Nivel 1 by the Sistema Nacional de Investigadores.

-**Peter Girguis** awarded the 2018 Lowell Thomas Award.

-**Scott Edwards** and colleagues awarded the National Science Foundation's Dimension of Biodiversity Program Fund for "US-BIOTA-Sao Paulo."

-**Dan Hartl** awarded the 2019 Thomas Hunt Morgan Medal by the Genetics Society of America.

-**Don Pfister** awarded the Distinguished Mycologist Award of the Mycological Society of America.

-**Robin Hopkins** awarded NSF Early Career Development

these successful invertebrates. The study, published in [Current Biology](#), reveals delicate details of the head and trunk limbs (e.g. antennae, mandibles and epipodites) of the shrimp-like fossil, *Ercaicunia multinodeosa*, diagnostic features observed in existing pancrustaceans. The exceptional fossils of *Ercaicunia* are characterized by their preservation in pyrite, which makes it possible to study the delicate morphology using X-ray based computer tomography to produce 3D images of the otherwise flattened fossils.

Mammals use their forelimbs for many activities including swimming, jumping, flying, climbing and digging. But how they evolved to do so is a mystery. **Stephanie Pierce** and Postdoc **Sophie Regnault** studied a highly-detailed musculoskeletal model of an echidna forelimb to shed light on how extinct mammals might have used their forelimbs. Echidnas are egg-laying mammals with many anatomical features in common with earlier mammal ancestors and can help bridge the gap between extinct and other modern-day mammals. In their study in [Royal Society Open Science](#) Pierce and Regnault describe their virtual model, made using CT scans, and how the model not only brings insight into the little-studied echidna, but also guides reconstructions of extinct mammals. The study was featured in [The Harvard Gazette](#).

Set in Nebraska's Sand Hills, an on-going study led by **Hopi Hoekstra** and former Postdoc Rowan Barrett (McGill University) reveals evolution in real time. Hundreds of deer mice (*Peromyscus maniculatus*) were released into massive, custom-built outdoor enclosures to track how light- and dark-colored mice survived in light- and dark-colored habitats. The results reveal real-time evolution in one generation and pinpoint a genetic mutation related to survival in the gene *Agouti*, which specifically affects pigmentation. The study, published in [Science](#), is the first of its kind to replicate previous work with microbes in a lab in real time with vertebrates in a natural environment. The study was featured in [The Atlantic](#), [NOVA](#), and [The Harvard Gazette](#).

How the centimeter-sized termite is able to build

meter-sized structures all over the world has long puzzled scientists. **L. Mahadevan** and PhD student **Alexander Heyde's** study in [Proceedings of the National Academy of Sciences](#) developed a simple model that shows how differences in the environment lead to the distinct morphologies of termite mounds in Asia, Australia, Africa and South America. The model not only demonstrates the link between environmental physics and animal behavior to create complex structures in nature, but also sheds light on the question of swarm intelligence and may assist with designing more sustainable human architecture.

Mansi Srivastava and lab members **Andrew Gehrke**, **Emily Neverett**, **Yi-Jyun Luo**, **Lorenzo Ricci** (Postdocs) and **Ryan Hulett's** (PhD student) study in [Science Magazine](#) illustrates how some animals have the amazing ability to regenerate, and uncovers a number of DNA switches that appear to control genes for whole-body regeneration. The team used three-banded panther worms to test the process and discovered that a section of noncoding DNA controls the activation of a "master control gene" called early growth response (EGR). Once active, EGR controls a number of other processes by switching other genes on or off. In order to understand the panther worm's genome, the team undertook the

Emeritus News



Professor Emeritus **Alfred Crompton** and his faculty assistant Catherine Musinsky published a study in [Science](#), that suggests suckling was part of the original mammalian package. The ability to suckle milk is a defining characteristic of mammals. Yet, one branch of mammals, egg-laying monotremes, which include the platypus and echidna, do not. Monotreme babies instead lap or slurp milk from patches on the mother's skin.

Their work was presented at the 5th International Paleontology Conference in Paris, France.

great task of assembling its sequence and were able to release the full genome sequence of the species, which is the first from this phylum. The team's work was featured in [The New York Times](#) and [The Harvard Gazette](#).

Species from widely divergent taxa can experience similar changes in traits. What underlying genetic drivers cause these parallel changes remains an open question. **Scott Edwards**, Tim Sackton (Director of Bioinformatics and former Postdoc) and PhD student **Phil Grayson** used a new method developed by collaborators in the Harvard Statistics Department to look across groups of birds that have repeatedly lost flight. The team showed there is convergence in the regulatory regions associated with genes related to flight, but not within the protein coding regions. In the study in [Science](#) researchers used a process that aligned the genomes of more than three dozen bird species - both flying and flightless - and found the regulatory regions appear to play a key role in the body-scaling changes that go along with flight loss. The relationships among these birds imply at least three (and probably more) independent losses of flight. The study was covered by [The Harvard Gazette](#).

L. Mahadevan and SEAS researchers have developed a new model to describe how bacteria spread in different forms. The study in [eLife](#) combines mechanics, hydrodynamics and transport to describe the dynamics of growth and formation of thin bacterial swarms and biofilms, revealing the spread in both forms of microbial community are limited by the constraints of water and nutrient availability. The researchers continue their work to develop their model to next help identify potential strategies for limiting the spread of harmful bacteria.

Stephanie Pierce collaborated with London's Royal Veterinary College to help explain how tetrapods arose from animals that were fish with fins and lived in water. The team examined fossil evidence using the innovative technique, anatomical network analysis (AnNA), and found a pattern not before seen. The study, published in [Science Advances](#), helps to explain how sea-dwelling creatures' fins became specialized

Welcome Andrew Davies

Andrew Davies joined OEB as Assistant Professor of Organismic and Evolutionary Biology.



Davies is an animal ecologist whose research examines how animals interact with the environment and each other to affect ecosystem processes at landscape scales. His work draws on the fields of community and ecosystem ecology, animal behavior, and remote sensing to explore multiple facets of animal-ecosystem interactions in a spatially explicit manner. A key component of Davies's work investigates how anthropogenic pressures, including climate and land-use change, alter animal-driven processes and influence the direction of their effects. Davies integrates field measurements, GPS telemetry, and remote sensing products (including LiDAR, hyperspectral, and satellite data) to answer questions ranging from the role of animals in shaping vegetation and modifying nutrient cycles, to how land-use changes that alter habitat heterogeneity affect animal behavior and subsequent ecosystem impact.

limbs made to use on dry land and was featured in [The Harvard Gazette](#).

Jim Hanken and PhD student **Mara Laslo** collaborated with professors at Tokyo Tech and Yamagata University to discover the amount of oxygen surrounding the embryo could have been crucial for the appearance of interdigital cell death in tetrapods during evolution. The study in [Developmental Cell](#) looked to understand the role of environmental oxygen in the evolution of the limbs of tetrapods. Using coqui frogs that live in a lab colony in the Museum of Comparative Zoology, the team found their answer: the data revealed that ecological features - where the embryos are and how much oxygen surrounds them - can have a direct effect on the presence of cell death in the limbs during development.

Graduate News

Research Highlights

Izzy Baker (Girguis Lab) conducted research on the R/V Falkor off the coast of Oregon exploring methane seeps in the Cascadia Margin, for the expedition, "*Hunting Bubbles: Understanding Plumes of Seafloor Methane*." Izzy explored the microbial communities that live in and around these seeps in order to better understand the role microbes may play in transforming the chemistry at these ocean sites. Izzy maintained the blog, "*The Tiny Extremists in Deep Sea Mud*," covering her work on the expedition.

Jacob Peters, Mary Salcedo (Mahadevan Lab) and **Prof. L. Mahadevan** teamed with Prof. Orit Peleg, University of Colorado-Boulder, to research the collective mechanical adaptation in honeybee swarms. The study, published in *Nature Physics*, shows the swarm of bees act as a superorganism that responds to physical stress by changing shape. Using both physical experiments and computer modeling, the

team showed that the inverted cone shape of the swarm flattens in high winds as bees near the tip of the cluster climb up towards the base. The study was covered in *Science Magazine News* and *Nature YouTube* features a video of the swarming bees.

Nathan Ranc (Moorcroft Lab) studies wildlife movement ecology and follows the staggering expansion of the golden jackal. Ranc and Miha Krofel, a conservation biologist at the University of Ljubljana, lead 37 volunteer scientists and naturalists in monitoring the golden jackal throughout Europe. Ranc and Krofel's research was featured in the *New York Times*. NYT reporter James Gorman followed along as the team searched for jackals in Slovenia. At a population of 117,000, jackals greatly outnumber Europe's wolves, estimated around 17,000. The medium-sized predator has captured scientific interest in Europe, which is trying to assess the ecological

Notable Awards

-Jasmin Camacho (H.Hoekstra) awarded the American Association of University Women 2018 American Fellowship for her project, "*Developmental, Cellular, and Genetic Mechanisms Underlying Striking Craniofacial Variation in New World Leaf-Nosed Bats*."

-Min Ya (E.Kramer) awarded the Katherine Esau Award for outstanding paper in developmental and structural botany at the annual meeting of the Botanical Society of America.

-Sofia Prado-Irwin (S.Edwards) and **Jacob Suissa** (W.Friedman) awarded the 2018 Society of Systematic Biologists Graduate Student Research Award.

-Richard J. Knecht (J. Ortega-Hernández) awarded 2018 NSF Graduate Research Fellowship.

-Caitlin Baker (G.Giribet) awarded 1st place for best student talk in Evolution, Systematics, and Biogeography at the 21st International Congress of Arachnol-

ogy, New Zealand.

-Min Ya (E.Kramer) awarded the Society of Developmental Biology Emerging Models Grant.

-Mary Salcedo (L.Mahadevan), and **Chris Tomkins-Tinch** (P.Sabeti) awarded the 2019 NSF Graduate Research Fellowship Program (GRFP) grant.

-Cody Mccoy (H.Haig) winner of Bowdoin Prize for Graduate Essay in the Natural Sciences for her project, "*Cheating Darwin: Germline Parasites and the Paradox of Transplant Rejection*."

-Richard J. Knecht (J. Ortega-Hernández) awarded 2019 Crustacean Society Fellowship in Graduate Studies.

-Shayla Salzman (H.Hoekstra, N.Pierce) and **Dylan Wainwright** (G.Lauder) awarded the NSF Postdoctoral Fellowship in Biology.

issues of such a huge expansion. The current increase in populations began in the 1950s and has accelerated over the past 20 years due to the targeted campaigns to eradicate wolves, as jackals avoid areas well populated by wolves. Nathan's work was also featured in [The Harvard Gazette](#).

A new study led by **Zachary Morris** (S.Pierce Lab) and **Stephanie Pierce** examines how evolution modified the long-surviving reptiles's snouts. The study published in [Proceedings of the Royal Society B](#), shows the evolutionary history of crocodiles, alligators, and their kin, once thought to be unchanged for millions of years, has actually altered developmental patterns during evolution leading to the diversity of skull shapes found today. Their work was featured in [The Harvard Gazette](#).

Dakota McCoy (Haig Lab) documented a remarkable convergence of form, between nature and engineering, and function, between two groups of highly ornate, sexually selected animals in a study of peacock spiders published in [Proceedings of the Royal Society B](#). Peacock spiders, known for their elaborate mating dances, use incredibly dark, “super black” patches on their body to enhance nearby colors. This makes colors look impossibly bright, or even glowing, an optical illusion also used by birds-of-paradise. The spider evolved microlenses on its body surface, which manipulate light in the same way human-made materials do. McCoy's work was featured on the cover of the journal.

At 45 pounds and just over two feet tall, adult European roe deer are much smaller than American deer and closer in size to a greyhound. Unlike their cousin species, red deer or elk, roe deer like to be solitary, spending most of their lives within a range of one square kilometer. **Nathan Ranc** (Moorcroft Lab) wants to know the reason for this mystery. In the Alps of northern Italy, Nathan and colleagues are trying to build a model that explains the factors determining why particular deer choose to live where they do. His ongoing work with roe deer was covered in [Harvard Magazine](#).

Welcome 2019 G1s!

- Bridget Bickner (Hopkins Lab)
- Zhe He (Holbrook Lab)
- Evan Hockridge (Davies Lab)
- I-Ting Huang (Cavanaugh Lab)
- Shraddha Lall (de Bivort Lab)
- Jingting Liang (Zhang Lab)
- Sophia MacRae Orzechowski (Edwards Lab)
- Marc Mapalo (Ortega-Hernández Lab)
- Alief Moulana (Desai Lab)
- Amber Rock (Srivastava Lab)
- Wendy Valencia Montoya (N. Pierce Lab)
- Connor White (Lauder Lab)
- Mark Wright (S. Pierce Lab)

Alumni News

As a graduate student in Naomi Pierce's lab, **Leonora Bittleston** (PhD '17) traveled to Nepenthes Camp in the Maliau Basin, an elevated conservation area in Malaysian Borneo to collect pitcher plants. The carnivorous pitcher plants trap, drown and digest their animal prey to supplement nutrient-poor soils. Bittleston collected samples of the liquid inside the pitchers to compare to pitcher plants in Massachusetts and along the Gulf Coast. Though unrelated, both plant families had similar adaptations for trapping prey and are a perfect example of convergent evolution. Bittleston wondered if the microbe and animal communities housed in the liquid were as similar as the traps themselves. Bittleston and co-researchers, Anne Pringle (University of Wisconsin-Madison) and **Naomi Pierce** discovered that indeed the communities created inside the pitcher plants converge just as the shape and function of the plants do. Their work is published in the journal [eLife](#) and featured in [The Harvard Gazette](#).

PostDoc News

Research Highlights

Postdoc **James Crall** led former PhD student **Callin Switzer** ('17, Hopkins Lab) and OEB professors **Benjamin de Bivort** and **Naomi Pierce** in investigating the effects of neonicotinoid pesticides on bumblebees' nest behavior. Previous studies showed the pesticides reduced colony size, but how the reduction occurred was not known. In the study in *Science*, Crall used an automated, robotic platform for continuous monitoring of worker's behavior in the colony. The team discovered that the exposure had profound effects on social behaviors. Bees spent less time nursing larvae and were less social with other bees, often shifting from the nest's center to the periphery. The exposure also impaired the bees' ability to warm the nest and to build insulating wax caps around the colony. The study was featured in *The Harvard Gazette*.

Postdoc **Emily Meineke**, former Postdoc **Barnabas Daru** (Davis Lab) and **Prof. Charles Davis** teamed with Prof. Jonathan Davies, University of British Columbia to serve as co-editors of a special issue of *Philosophical Transactions B*. The issue is dedicated to looking at the creative ways researchers around the world have used biological collections. Scientists can extract DNA from collections obtained by botanists and naturalists more than a century ago to shed light on the effects of global change, pathogens, and fungal-driven amphibian extinctions. The editors argue for preservation of the collections for future generations, who will have new technologies available for possibly even better understanding of the secrets the collections hold. The journal also features a [Q&A with Meineke](#).

Scientists have long assumed that the hundreds of species of salamanders that lack lungs breathe instead through their skin and the lining of the mouth.

Derek Bok Certificate of Distinction in Teaching

SPRING 2018

Postdocs and Associates: Ligia Benavides Silva (MCB 68), Mark Cornwall (OEB 55), Stacy Farina (OEB 130), Ana Pimento Goncalves Pereira (OEB 223)

Teaching Fellows: Izzy Baker (MCB 64), Meghan Blumstein (OEB 50), Philip Grayson (OEB 50), Vanessa Knutson (OEB 51), Morgan Furze (OEB 52), Min Ya (OEB 52), Kristel Schoonderwoerd (OEB 52), Nicholas Herrmann (OEB 57), Avantika Mainieri (OEB 57), Liming Cai (OEB 103), Zane Wolf (OEB 130), Miriam Johnston (OEB 157), Mara Laslo (OEB 167), Sofia Prado-Irwin (OEB 167), Kari Taylor-Burt (OEB 173), Jonathan Schmitt (OEB 190), Blake Dickinson (OEB 217R), Nathan Edelman (OEB 230), Anju Manandhar (ESPP 90Y)

FALL 2018

Postdocs and Associates: Steven Niemi (OEB 104), Kathleen Pritchett-Corning (OEB 104)

Teaching Fellows: Dave Matthews (LIFESCI 2), Alyssa Hernandez (OEB 10), Sang Il Kim (OEB 10), Inbar Maayan (OEB 10), Kira Treibergs (OEB 10), Benjamin Goulet (OEB 50), Benjamin Rice (OEB 50), Brock Wooldridge (OEB 50), Julian Kimura (OEB 58), Kadeem Gilbert (OEB 114), Jessica Gersony (OEB 120), Miriam Johnston (OEB 120), Nicole Bedford (OEB 145), Samuel Church (OEB 155R), Sofia Prado-Irwin (OEB 155R), Eadaoin Harney (OEB 252), Michael Miyagi (OEB 252)

However, a new study in *Proceedings of the Royal Society B* led by Postdoc **Zachary Lewis** and **Prof. Jim Hanken** provides the first concrete evidence for how the lungless salamanders do "breathe." The authors show that a gene that produces surfactant protein c — a key protein for lung function — is expressed in the skin and mouths of lungless salamanders, suggesting it also plays an important role for cutaneous respiration. The study was part of Lewis's dissertation work as a PhD student ('16) and was featured in *The Harvard Gazette*.

Prof. L. Mahadevan and Postdoc **Jacob Peters** have developed a framework that explains how bees use environmental signals to collectively cluster and continuously ventilate the hive. The study published in *Journal of the Royal Society Interface* looked at European honey bees (*Apis mellifera*), which live in large congested nest cavities with a single opening that limits passive ventilation. When the temperature is too elevated, the bees self-organize to form groups that station at the nest entrance and actively ventilate the nest by fanning their wings.

Postdoc **Valentina Di Santo** (Lauder Lab) examined the effect of ocean acidification and warming on mineralization of fish skeleton. Previous studies have focused on the effect of these climate-related stressors on calcification rates of the exoskeleton, or shell of marine invertebrates, as well as the ear stone of fishes. However, Di Santo's study is the first to look at the consequences of these two important stressors on the mineralization of fish skeleton. The study in *Proceedings of the Royal Society B* exposed embryonic little skates (*Leucoraja erinacea*) to different conditions of CO₂ and temperature to simulate current and future ocean conditions. Using μ CT scanning, Di Santo found that mineralization increased with ocean acidification in the cartilage of crura (modified pelvic fins) and jaws, while temperature significantly decreased mineralization of the pectoral fins. Di Santo's study is the first of its kind to show that changes in temperature and pH of the oceans have complex effects on fish skeletal morphology. The study was featured in *The Harvard Gazette*.

Mark J Margres Hrdy Visiting Fellow

Mark Margres joins OEB as the Hrdy Visiting Fellow. Mark comes to OEB from Washington State University School of Biological Sciences where he was researching the emergence, transmission and evolution of Tasmanian devil facial tumor disease. Mark is an evolutionary biologist with a focus on adaptation and conservation. His research addresses fundamental questions related to adaptation dynamics in two co-evolving systems: (1) Tasmanian devils and devil facial tumor disease, and (2) venomous snakes and their prey. Mark's work on rattlesnake venoms explores how migration and selection interact to lead to local adaptation, particularly in island populations



As a Hrdy fellow, Mark will focus on the Tasmanian devil-cancer system - a species-specific transmissible cancer that threatens the Tasmanian devil with extinction - and determine how multiple mutations in a single tumor affect disease fitness and transmission. He hopes his work will ultimately lead to more robust predictions regarding cancer and pathogen evolution, which have direct biomedical and conservation implications.

Notable Awards

Carolyn Elya (de Bivort Lab) awarded the 2018 HHMI Hanna Gray Fellowship for Early Career Scientists. Elya was chosen for her work studying how microbes hijack insect nervous systems. Her neural and molecular probing of parasitic mind-control is advancing understanding of how animal brains produce behavior, with potential long-term applications for mental health treatment.

Integrative Biology News

Student Spotlight



Camille Desisto (Charles Davis Lab) is one of 42 graduating IB concentrators. Camille spent two summers in Madagascar's tropical forests studying invasive plant dispersal from lemur poop (the island nation's lemurs eat the plants' fruit and poop out the seeds). Camille's research was featured in [The Harvard Gazette](#) student profiles. We reached out to Camille with a Q&A about her time in OEB and her experience as an IB concentrator.

OEB: What led you to concentrate in IB?

Camille: I decided to concentrate in Integrative Biology because I have always been fascinated by nature and I knew that OEB would empower me to understand and conserve Earth's biodiversity. I love that the IB concentration is broad while allowing me to delve deeply into ecological topics. Also, OEB classes are an absolute blast. After one conversation with Undergraduate Advisor, Andrew Berry, I knew OEB was the concentration for me!

OEB: What was most rewarding about being an IB concentrator?

Camille: The most rewarding part of being an OEB student was being surrounded by such passionate people. I learned an incredible amount from my OEB peers, professors, and TFs. These people really opened up my eyes to new ways of thinking and have been huge sources of inspiration. I am especially grateful for my OEB advisors: Professor Charles Davis (my PI), Dr. Onja Razafindratsima (a past Hrdy Fellow (2016-17) who has become my mentor), Dan Park (a postdoc in the Davis lab), and Andrew Berry (my academic advisor).

OEB: Where are you going now and how did your work in IB help in making those plans?

Camille: After spending another summer conducting research in Madagascar, I will spend a year in Guayaquil, Ecuador, to study carbon dynamics of mangrove forests as a Fulbright Scholar. My experience with the Davis Lab instilled in me a passion for research and fieldwork. The OEB courses that I took (conservation biology, plants and climate, trait-based ecology, plant systematics, etc.) have greatly inspired my project goals for this upcoming year. I am excited to harness what I've learned as an OEB student and tackle this new challenge!

IB RESEARCH:

National Geographic's *Open Explorer* followed **Liz Roux** (Giribet Lab) as she traveled to southern Florida collecting flatworms (*Bdelloura candida*) living on Atlantic horseshoe crabs in order to research phylogeography and symbiosis around the Florida peninsula. Liz also presented a TedxYouth Talk, "[*Run For, Not From.*](#)"



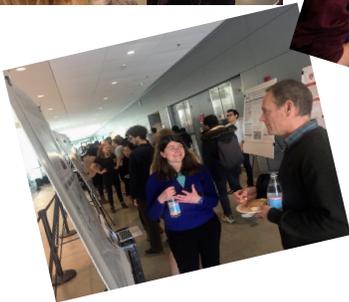
IB AWARDS:



Rewan Abdelwahab was presented the 2019 Spirit of Harvard College Award by the Dean of Students Office. Rewan is one of three students to receive the award for showing a commitment to the ideals articulated in the Mission of Harvard College over the past academic year.

IB POSTER SESSION:

The 2019 Senior Thesis Poster Session took place April 10th in the Northwest Labs and featured twenty-two senior thesis posters.



Congratulations IB Graduates!

- Nina Armstrong
- Kevin Bao
- Zeke Benshirim
- Andrea Brown
- Bethsaida Cardona
- Eric Chin
- Johnathan Clark
- Isabella Colocci
- Francesca Cornero
- Emmanuel D'Agostino
- Brendan Zhi Min Dean
- Camille Desisto
- Matthew Diaz
- Katja Diaz-Granados
- Cecilia Eberhard
- Ryan Friedman
- Evelynne Fulda
- Liam Hackett
- Jackie Ho
- Brandon Kim
- Lexie Laing
- Charlie Lee
- Lily Lu
- Kathryn Nunes
- Maria Park
- Matthias Pergams
- Meagan Popp
- Maximillian Prager
- Allison Rabe
- Sophia Ramsey
- Connor Richardson
- Liz Roux
- Thomas Saide
- Zeyn San
- Dann Stevens
- Sarah Stevens
- Angelica Torres
- Daniel Um
- Olivia Velasquez
- Aaron Viser
- Sophie Westbrook
- Ellen Zhang

Field Trips!

OEB 51: Biology and Evolution of Invertebrate Animals. **Instructors: Gonzalo Giribet & Cassandra Extavour**

OEB 51 spent spring break in the Archipelago of Bocas del Toro, in the Caribbean side of Panama, close to the border with Costa Rica, for its 14th year! This archipelago is home to a state-of-the-art laboratory from the Smithsonian Tropical Research Institute and is located in an area of high marine biodiversity including mangroves and coral reefs. In addition, it always offers sheltered localities for working in the water even for those students who have never snorkeled before. There, students explore different marine ecosystems, from mangroves to coral reefs and sponge reefs, as well of areas of high and low currents. This offers students the opportunity to study a great variety of invertebrates from most animal phyla both in situ and in the lab.



OEB 52: Biology of Plants. **Instructors: Elena Kramer & N. Michele Holbrook**



OEB 52 takes four field trips each spring - an overnight to Harvard Forest as well as afternoon trips to the Arnold Arboretum, Ponkapoag Bog, and Garden in the Woods. All these trips are full of fun, food, and most importantly, flora! The lynchpin of the course is the overnight trip to Harvard Forest, helping everyone get to know each other through botanical charades, long hikes in the woods, and conversation over shared meals. Once again, the weather mostly cooperated and our great class of undergrads made every field trip special.

OEB 103: Systematics and Evolution. Instructor: Charles Davis

OEB 103 students had another great spring break trip to the Chapada region of eastern Brazil, in the state of Bahia! OEB 103 students joined students from the Federal University of Bahia and the State University of Santa Cruz. Professor Charles Davis and students studied the rich vascular plant diversity of the Chapada region, and performed lab activities investigating the phylogenetic, morphological, and ecological diversity among the plants.

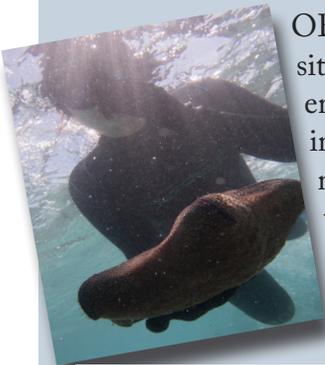
Highlights of the trip were the amazing scenery, strange new plants, and the camaraderie of the week!



OEB 11: Introduction to Tropical Biology. Instructors: David Haig & Gonzalo Giribet

OEB 11 spent J-term in Australia together with undergraduates from Sydney University. The course, focusing on Australian biology, explored Sydney and its environments, and conducted terrestrial ecology work in Sydney Harbor and in Chichester Forest, in northern New South Wales. We then traveled to the One Tree Island Research Field Station in the Great Barrier Reef, to complete the marine component of the trip. The students were able to experience first-hand the local

biodiversity and the research related to aspects of diversity, ecology and evolution, while interacting with their Australia counterparts and learning about the local culture. This was the first time the field course was offered and it was a great success!



Event Highlights

OEB Seminar Series

The 2018–2019 seminar season had a successful year with an incredible lineup of speakers from all over the world.

Fall 2018: Paul Moorcroft, OEB, Harvard University; Erika Edwards, Yale University; Steven Haddock, Monterey Bay Aquarium Research Institute; Daniel Matute, The University of North Carolina at Chapel Hill; Peter Girguis, OEB, Harvard University; Ted Farmer, Université de Lausanne; N. Michele Holbrook, OEB, Harvard University.

Spring 2019: Lindy McBride, Princeton University; Felicity Jones, The Friedrich Miescher Laboratory of the Max Planck Society; Betsy Arnold, The University of Arizona; Mark A. Kirkpatrick, The University of Texas at Austin; Becca Safran, The University of Colorado; Tom Gilbert, University of Copenhagen.

PBI Symposium

The 14th Annual Plant Biology Initiative Symposium “*Mate Choice In Plants*” took place May 7th at the Arnold Arboretum Weld Hill Research Building. This year’s event was hosted by Professors Robin Hopkins, Elena Kramer and Ned Friedman.

Invited Speakers:

- Tia-Lynn Ashman, University of Pittsburgh
- Patricia Bedinger, Colorado State University
- Diane Campbell, University of California, Irvine
- Lila Fishman, University of Montana
- Emma Goldberg, University of Minnesota
- John Pannell, Université de Lausanne
- Mario Vallejo-Marin, University of Stirling
- Stephen Wright, University of Toronto

Upcoming Events 2019-2020

OEB Seminar Series

- **September 5:** Robin Hopkins, OEB, Harvard University
- **September 12:** George Lauder, OEB, Harvard University
- **September 19:** Mansi Srivastava, OEB, Harvard University
- **October 10:** Doug Altshuler, The University of British Columbia
- **October 24:** Martha Muñoz, Yale University
- **November 7:** Adrienne Roeder, Cornell University
- **November 21:** Cassie Stoddard, Princeton University
- **January 30:** Neil Shubin, The University of Chicago
- **February 6,** Benjamin de Bivort, OEB, Harvard University
- **March 12:** Marie Dacke, Lund University
- **March 26:** Iñaki Ruiz-Trillo, Universitat de Barcelona
- **April 23:** Lauren Buckley, University of Washington

2019 Prather Lecture Series

- The [2019 Prather Lecture Series](#) will take place November 12-14 with Dr. Harmit Malik, Fred Hutchinson Cancer Research Center

2020 PBI Symposium

- The [15th Annual Plant Biology Symposium](#) will take place on May 4-5, 2020, with an on-campus lecture on May 4th and a full-day symposium on May 5th at Weld Hill Research Building

OEB Staff News

Welcome New Staff!

- Tracy Barbaro, OEB
- Eva Biedron, MCZ
- Kala Brzezinski, HUH
- August Easton-Calabria, OEB
- Cyrus Green, MCZ
- Esther Jules, OEB
- Christopher Kirby, OEB
- Crystal Maier, MCZ
- Madeleine Mullon, MCZ
- Nicole Pittoors, OEB
- Rona Razon, MCZ
- Emily Reynolds, OEB
- Hafsa Sadiq, OEB
- Ellie Taylor, HUH
- Clayton Ziemke, MCZ

Community Outreach

OEB participated in the 2018 Mayor's Summer Youth Employment Program (SYEP). Building on Harvard's longstanding tradition of partnering with Boston and Cambridge to hire local teens, SYEP offers a unique six-week experience for hiring managers and students alike. OEB Administrative offices hosted Cambridge Rindge and Latin High School (CRLS) senior, **Katherine Dam**, and East Boston High School seniors, **Angelica D. Acosta** and **Myah Morales**.

For the fifth year in a row, OEB participated in the School-to-Work (STW) program, a collaboration among the HUCTW, the Cambridge Office of Workforce Development, Harvard University and Cambridge Rindge Latin School. OEB Administrative offices hosted CRLS senior, **Katherine Dam**, for 2018-2019 STW.

Milestones In Service

30 Years of Service:

- Anna Salvato, OEB

25 Years of Service:

- Gretchen Wade, HUH

20 Years of Service:

- Bridget Power, OEB
- Joseph Martinez, MCZ
- Christy Robson, HUH

15 Years of Service:

- Saima Javed, HUH
- May Huang, PED
- Genevieve Tocci, HUH

10 Years of Service:

- Brian Franzone, HUH
- Melissa Aja, MCZ
- Mark Renczkowski, MCZ

5 Years of Service:

- Michelle Kennedy, MCZ
- Keleigh Quinn, OEB

Notable Awards

Congratulations to the recipients of the 2019 FAS Dean's Distinction Award!

- **Jeannette Everitt**, Administrative Manager, HUH
- **Jason Fleming**, Senior Research Administrator, OEB
- **Nikki Hughes**, Faculty Assistant (Hoekstra, Mallet and Wakeley Labs), OEB

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Acknowledgements and Credits:

Editor

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Design

Wendy Heywood

Catherine Musinsky



OEBnews

NEWSLETTER OF THE
DEPARTMENT OF ORGANISMIC & EVOLUTIONARY BIOLOGY
HARVARD UNIVERSITY

2018-2019