

# OEBnews

*2020-2021*



*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,

I hope that all of you had a restful and safe summer break, you certainly deserved it. As we take some tentative steps back to normalcy on campus, we remain equally (and appropriately) cautious. If there is one thing I have learned over the last eighteen months, it's that our community will persevere and continue to take care of one another. I want to thank all of you for your patience and continued attention in following Harvard's ever-evolving guidance.

Coming back into our offices, labs, collection spaces, and classrooms will be a major transition this fall, for many reasons. A considerable number of staff and two of our faculty colleagues, Donald H. Pfister and Andrew H. Knoll, retired over the last year, all without the well-deserved fanfare and our ability to say goodbye properly. I hope that in the near future, we will be able to come together to recognize these wonderful members of our community and make up for lost opportunities. At the same time, I am thrilled that so many of our students who had been kept away from campus, particularly our international 2020-21 G1s, will be able to join us this fall. Harvard is strongly committed to fully activating the academic endeavor this year and I know we are all looking forward to something approaching normalcy.

Of course, through the last year, we have continued to honor all the usual academic rites of passage – a wonderful class of '21 Integrated Biology (IB) concentrators and all of the phenomenal graduating OEB PhD students. I realize that it's sometimes hard to see the upside of Zoom, but one benefit has been that it is so much easier to share these amazing accomplishments with lab alumni and student family members who might otherwise not be able to attend. I hope that in the future we can find ways to maintain these surprising benefits!

Among other things to look forward to this year, we will be continuing with online OEB seminars. Perhaps the most significant development of the last year is the implementation of our new Diversity, Inclusion and Belonging (DIB) Committee, which has been actively working on a wide range of ideas over the last eight months. We look forward to the implementation of these initiatives and hope that more members of the community will join us in shaping the future of the department as a community that prioritizes both scientific excellence and genuine equity and inclusion.

Please take some time to peruse the entire newsletter, there is more to celebrate within. Remember, you can follow all the latest news from OEB on our [website](#), [Instagram](#), and [Twitter](#) and we always welcome updates on your activities and accomplishments.

Best wishes,  
*Elena Kramer*

# Congratulations to our Graduates!



MEGHAN BLUMSTEIN

“The plastic and adaptive potential of sugar storage in temperate trees under climate change” (N Michele Holbrook, Advisor)



LIMING CAI

“Phylogeny and genome evolution of the flowering plant clade *Malpighiales*” (Charles Davis, Advisor)



RICHARD A RABIDEAU CHILDERS

“Ecology and evolution of the African ant acacia, *Vachellia drepanolobium*, and its multiple symbionts” (Naomi Pierce, Advisor)



SAM CHURCH

“The evolution and development of the insect egg and ovary” (Cassandra Extavour, Advisor)



BRANDON ENALLS

“Environmental controls on microbial ecophysiology” (Peter Girguis, Advisor)



JESSICA GERSONY

“Understanding phloem functioning in the context of water stress” (N Michele Holbrook, Advisor)

# Congratulations to our Graduates!



MIRIAM R. JOHNSTON

“Plant temperature in a Mediterranean woodland savanna: Measurements and models” (Paul Moorcroft, Advisor)



DAKOTA E. MCCOY

“Signaling, cooperation and conflict in animals” (David Haig, Advisor)



JESSICA MITCHELL

“Metabolic versatility of the hydrothermal vent worm *Riftia pachyptila*: Allying transcriptional and metabolic responses to a dynamic environment” (Peter Girguis, Advisor)



ZACH MORRIS

“Developmental and evolutionary origins of the crocodylian snout and amniote face” (Stephanie Pierce, Advisor)



KARI TAYLOR-BURT

“How to waddle with a paddle: A study of duck hindlimb anatomy, kinematics, and muscle function across behaviors and species” (Andrew Biewener, Advisor)



DANIEL UTTER

“Ecology and evolution within the oral microbiome” (Colleen Cavanaugh, Advisor)

# Research Highlights

~ A major transition in animal evolution is the origin of bilateral symmetry, which coincided with the evolution of an organized nervous system. In a study in [Proceedings of the Royal Society B](#), PhD candidate **Ryan Hulett** describes the nervous system of the three-banded panther worm, *Hofstenia miamia* - an acoel worm that can regenerate organs and even whole body parts. *Hofstenia* belongs to a lineage of animals that diverged from other bilateral symmetric animals 550 million years ago. Hulett's study and characterization of *Hofstenia* will enable biological studies of nervous system formation and regeneration, and can help explain the evolution of animal nervous systems.

~ The flowering plant *Aquilegia* is known for the nectar spur, a novel feature that is important for pollination, and for the ecology and evolution of the genus. More uniquely, the species *Aquilegia ecalcarata* (*A. ecalcarata*) is the only known species of *Aquilegia* in which the petals have naturally lost their spurs. A study in [Proceedings of the National Academy of Sciences](#) led by **Evangeline Ballerini** (PhD '10) and co-authored by **Professor Elena Kramer** and PhD candidates **Min Ya** and **Molly Edwards**, crossed *A. ecalcarata* and four spurred *Aquilegia* showing there appears to be a single, recessive gene responsible for spur loss located in a region containing approximately one thousand genes. The team focused on gene

## Faculty Notable Awards

-**Benton Taylor** awarded the 2020 Star-Friedman Challenge for his project, "Volcanic CO<sub>2</sub> vents: Windows into the future of tropical forests."

-**N Michele Holbrook** appointed Harvard Forest Director.

-**Scott Edwards, Cassandra Extavour** and **Pardis Sabeti** among 22 scientists selected for the project "I Am A Scientist" founded by The Plenary's Nabihah Saklayen (PhD '17) and Stephanie Fine Sasse.

-Newly discovered bat species in southern Africa named Wilson's Long-fingered Bat, *Miniopterus wilsoni*, after Faculty Emeritus **Edward O Wilson**.

-**Mansi Srivastava** awarded the Smith Family Foundation: Odyssey Award for her project, "Comparing development and regeneration to uncover mechanisms for maintaining regenerative ability in adult animals."

-**Cassandra Extavour** awarded the Inspiration Award from the African American Female Professor Award Association for her work as an educator and mentor in biology.

-**Pardis Sabeti** elected member of the National Academy of Medicine.

-**Scott Edwards** and **Cassandra Extavour** selected by The Community of Scholars among the "1000 Inspiring Black Scientist in America" by *Cell*

*Mentor* in Cell Press.

-**Mansi Srivastava** recipient of the 2021 Society for Developmental Biology Elizabeth D. Hay New Investigator Award for her work developing the acoel worm, *Hofstenia miamia*, as a model to study whole-body regeneration and uncovering its gene regulatory network.

-**Cassandra Extavour** named Harvard College Professor.

-**Javier Ortega-Hernández** recipient of the 2021 NSF Career Award.

-**Benton Taylor** recipient of the 2021 Jasper Loftus-Hills Young Investigator Award from the American Society of Naturalists.

-**Naomi Pierce** awarded the Climate Change Solutions Fund (CCSF) for her proposal, "Prospecting for functional materials in the entomology collections of the Museum of Comparative Zoology."

-**Benton Taylor** awarded the Climate Change Solutions Fund (CCSF) for his proposal, "Using volcanic vents to combat climate change."

-**Andrew Davies** awarded Harvard's Star-Friedman Challenge for Promising Scientific Research for his proposal, "Anthropocene savannas: The future of humans, wildlife & livestock."

- **Gonzalo Giribet** named Director of the Museum of Comparative Zoology.

expression and found the gene that fit the criteria of being off when the plant had no spur, on when the plant had a spur, and was specifically expressed in developing spurs. They named it POPOVICH after San Antonio Spurs coach and president Gregg Popovich. The study was featured in the [Harvard Gazette](#).

~ Among the many winter survival strategies in the animal world hibernation is one of the most common. Though much is known behaviorally, it is difficult to study in fossils. A study in [Communications Biology](#) led by postdoctoral researcher **Megan Whitney** reports evidence of a hibernation-like state in an animal that lived in Antarctica during the Early Triassic, some 250 million years ago. The creature, a member of the genus *Lystrosaurus*, was a distant relative of mammals. The *Lystrosaurus* fossils are the oldest evidence of a hibernation-like state in a vertebrate animal and indicate that torpor arose in vertebrates even before mammals and dinosaurs evolved.

~ Mallard ducks are capable of nearly vertical takeoffs from both land and water. **Kari Taylor-Burt** (PhD '20) and **Professor Andrew Biewener** examined the hindlimb kinematics and lateral gastrocnemius, a major ankle extensor and knee flexor, during takeoffs from water versus land in mallard ducks. They saw greater muscle force during land takeoffs and almost no motion during water takeoffs. Because different forces and physical properties are used for water and land takeoffs, animals such as mallards may be challenged to tune their muscles for movement across different environments. The study published in the [Journal of Experimental Biology](#) received the coveted cover image.

~ The timing of a tree leaf's developing spring bud dictates the length of the growing season and carbon cycling, it mediates competition among plants, and controls interactions with pests and pathogens. The timing is mainly controlled by environmental cues such as temperature and length of day. However, human-driven climate change is causing spring events to occur earlier in the season and how much these events will continue to advance in the future is unknown. **Ailene Ettinger**, Putnam Fellow at the Arnold Arboretum, postdoctoral researchers **Ignacio**

**Morales-Castilla, Dan Flynn** and **Tim Savas**, PhD candidates **Catherine Chamberlain** and **Daniel Buonaiuto**, and former OEB professor Elizabeth Wolkovich addressed this question and the debate in a study in [Nature Climate Change](#). They found that almost all species show strong responses to three environmental cues, with chilling temperatures being the strongest. [Wolkovich's](#) and [Ettinger's](#) blogs detail the five-year study.

~The water-to-land transition is one of the most important and inspiring major transitions in vertebrate evolution. **Blake Dickson** (PhD '20) and **Professor**



Donald H Pfister, Asa Gray Research Professor of Systematic Botany and Curator of the Farlow Library and Herbarium, retired on June 30, 2021 after 47 years on the faculty. During his years in

OEB he served as Director of the Harvard University Herbaria, Dean of the Harvard Summer School, Master of Kirkland House, and Interim Dean of Harvard College. Among his many accolades over the years he was awarded the Distinguished Mycologist Award of the Mycological Society of America and the William H. Weston Award for Excellence in Teaching.

Andrew H Knoll, Fisher Research Professor of Natural History, Research Professor of Earth and Planetary Sciences, and Curator of the Paleobotanical Collections in the Harvard University Herbaria,



retired on June 30, 2021 after 39 years on the faculty. During his years in OEB he served as OEB Department Chair and Associate Dean of the Faculty of Arts and Sciences. Among his many accolades over the years he was awarded the Charles Doolittle Walcott Medal, the Geological Society of London Wollaston Medal, the 34th International Prize for Biology of Japan Society, the Mary Clark Thompson Medal, and elected as Foreign Fellow of the Royal Society.

**Stephanie Pierce** used high-resolution fossil data to show that although these early tetrapods were still tied to water and had aquatic features, they also had adaptations that indicate some ability to move on land. The study in *Nature* examined 40 three-dimensional models of fossil humeri from extinct animals that bridge the water-to-land transition. They found that terrestrial ability appears to coincide with the origin of limbs and that the earliest tetrapods had a unique combination of functional traits that clustered at the base of the adaptive landscape which indicated increasing performance for moving on land, but the animals had only evolved a limited set of functional traits for effective terrestrial walking. The study was featured in the *Harvard Gazette*.

~ In a study in *Science*, postdoctoral researcher **Gustavo A Bravo**, **Professor Scott Edwards**, and an international team of scientists have produced the first complete, species-level phylogeny of a major group of tropical birds known as the suboscine passerines. The team assembled a data set of 1,940 suboscine genetic samples from specimens housed in 21 museums around the world. The study revealed a paradox of suboscine diversity - new species actually form faster in areas researchers refer to as coldspots than hotspots (areas with immense biological diversity). This paradox is a relatively new concept suggested by recent studies comparing tropical versus temperate regions. The study is the first to uncover the paradox using a complete species-level phylogeny of a group that mostly occurs in the tropics.

~ In the world of dinosaurs, theropods are well known for having blade-like teeth with serrated cutting edges used for biting and ripping their prey. Until recently, the complex arrangement of tissues in these teeth was considered unique to theropods. In a study in *Biology Letters*, researchers led by postdoctoral researcher **Megan Whitney** examined thin fossil slices of gorgonopsian's (a synapsid, a major group of tetrapods that includes mammals) teeth and discovered a similar complex arrangement of tissues. The researchers examined thin sections of fossils from three synapsids from three different time periods to test a theory of the structure of the serrations in this group. The thin sections revealed that the gorgonopsian serrations are composed of tightly-packed serrations

## Rus Hoelzel, Hrdy Visiting Fellow

**R**us Hoelzel joins OEB as the Hrdy Visiting Fellow. Rus comes to OEB from Durham University, Durham, UK. Rus has worked since the early 1990s on the population genetics of southern and northern elephant seals, with particular attention to the impact of population bottlenecks.



**A**s a Hrdy fellow, Rus will focus on two projects. He will sequence genomes from individuals that lived before the bottleneck, just after the bottleneck, and approximately 100 and 130 years later. These sequences will be analysed to detect signals of post-bottleneck selection, and more broadly to reveal in detail how the species



genome was affected by the bottleneck. The second project will revisit the idea of the 'evolutionary significant unit' for conservation. The objective will be to contribute to the deve-

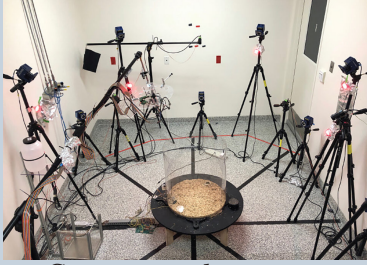
lopment of an effective and simple strategy for incorporating information on adaptive potential into conservation policy and practice, including a metric that could provide a quantitative assessment of adaptive diversity. terrestrial ecosystem processes, and global change.

made of both enamel and dentine, the same complex arrangement of tissues that had previously been considered unique to theropod dinosaurs. The study was featured in the *Harvard Gazette*.

~ In a study in *Genome Biology* researchers led by **Daniel Utter** (PhD '21) and **Professor Colleen Cavanaugh** teamed with researchers at the Marine Biological Laboratory, Woods Hole, University of Chicago, and The Forsyth Institute to apply state-of-the-art sequencing and analysis approaches to get a



# Research Spotlight



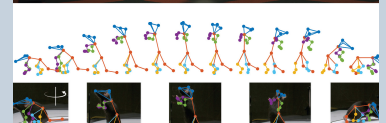
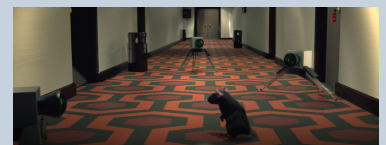
Capture recording arena

Neuroscientists have made major advances in their quest to study the brain. However, there are no tools to precisely measure the brain's principal output - behavior - in freely moving animals. The difficulty in capturing the intricate details of an animal's natural behavior has forced scientists to study very simple and often unnatural tasks, leaving the question of whether the insights gained can really lead to a general understanding of brain function.

Postdoctoral researcher **Jesse Marshall** became fascinated with a concept to monitor behavior in freely moving animals as a graduate student working on a mouse model of Parkinson's disease. "We had developed elaborate approaches to study how the brain is disrupted, but our ability to measure their behavioral deficits was a far cry from the nuanced ways we can assess the impact of Parkinson's on human behavior," said Marshall. Upon joining **Professor Bence Ölveczky's** lab — which studies how skilled movements are learned and generated by the brain — Marshall's concept was met with interest and support.

In a study in *Neuron* researchers led by Marshall and Ölveczky introduced a newly developed behavioral monitoring system, CAPTURE (continuous appendicular and postural tracking using retroreflector embedding), that combines motion capture and deep learning to continuously track the three-dimensional movements of freely behaving animals. The team affixed markers to 20 locations on the animal's head, trunk and limbs to reconstruct the three-dimensional position and configuration of the animal's major joints revealing the movements of its body. They then used CAPTURE to record their natural behavior continuously for weeks. Marshall studied a rat model of Fragile X syndrome, a form of autism, and was able to identify atypical patterns of grooming that hadn't been previously described. Scientists have long suspected that disrupted grooming could be used to model the motor stereotypes observed in autism, but before CAPTURE alterations in grooming patterns have been challenging to measure and reproduce.

Following CAPTURE, Marshall and Timothy W. Dunn, Duke University, led a study in *Nature Methods* that introduced a 3D deep-neural network, DANNCE (3-Dimensional Aligned Neural Network for Computational Ethology). CAPTURE yielded an unprecedented detailed description of how animals behave. However, it required using specialized hardware and attaching markers to animals, making it a challenge to use. DANNCE works without using markers across a broad range of species and is reproducible across laboratories and environments, ensuring it will have a broad impact on animal, and even human, behavioral studies.



DANNCE video projections of every third frame (bottom) of a markerless mouse

The team collaborated with multiple groups at various universities to demonstrate the generality of DANNCE in various environments and species including marmosets, chickadees, and rat pups as they grow and develop. With DANNCE researchers could examine the microstructure of animal behavior well beyond what is currently possible with human observation. They also demonstrated the ability to carefully trace the emergence of behavior over time, opening new avenues in the study of neurodevelopment. Marshall and the team also note the value these tools hold for autism-related and motor-related studies, both in animal models and in humans. The study was partially funded by the Simons Foundation Autism Research Initiative.

better picture of the oral microbiome. They examined 100 genomes that represented four species of bacteria commonly found in the mouth and used them as references to investigate their relatives sampled in hundreds of volunteers' mouths from the Human Microbiome Project. They found a tremendous amount of variability, but were shocked by the patterning of that variability across the different parts of the mouth. Researchers also identified specific ways

free-living bacteria in people's mouths differed from their lab-grown relatives. These findings could potentially be the key to unlocking targeted probiotics that could land beneficial microbes in a specified habitat. The study was featured in the *Harvard Gazette*.

~ **Professor Andrew Biewener** collaborated with colleagues at Simon Fraser University to examine varying muscle functions in humans during different motor activities. The study in the *Journal of Experi-*

## Graduate Students Notable Awards

-**Katherine Angier** (N Pierce) appointed Ashford Fellow in the Graduate School of Arts and Sciences.

-**Min Ya** (E Kramer) selected to serve on the Strategic Planning Committee: Professional Development for the Botanical Society of America.

-**Anju Manandhar** (NM Holbrook) recipient of the 2020-2021 Simmons Award from Harvard Center for Biological Imaging for her project, "Structural and mechanical characterization of stomatal movement."

-**Min Ya** (E Kramer) recipient of the 2020-2021 Simmons Award from Harvard Center for Biological Imaging for her project, "Live confocal imaging in *Aquilegia* floral meristem."

-**Liming Cai** (C Davis) recipient of the Dorothy M Skinner Award from the Society of Integrative and Comparative Biology for her presentation, "Deeply altered genome architecture in the iconic endoparasitic flowering plant *Rafflesiaceae*."

-**Nikhil Chari** (B Taylor) recipient of the Harvard Forest Long Term Ecological Research Program Award for his project, "Assessing the impacts of root exudation on soil mineral-associated organic matter dynamics."

-**Molly Edwards** (E Kramer) awarded Vlogbrothers Sponsorship for her YouTube series Science IRL to partner with Team Halo, a UN initiative.

-**Jacob Suissa** (W Friedman) recipient of the 2021 Derek C. Bok award for Excellence in Graduate Student Teaching of Undergraduates.

-**Sophie Everbach** (NM Holbrook) recipient of the Harvard Forest Long-Term Ecological Research (LTER) award for her project, "Eastern hemlock root resource allocation response to hemlock woolly adelgid."

-**Samantha Royle** (J Hanken) awarded the Harvard Medical School Scientific Citizenship Initiative Fellowship.

-**Jacob Suissa** (W Friedman) received Honorable Mention for the Donald R. Kaplan Award in Compar-

ative Morphology for his proposal, "Bumps in the node: The effects of vascular architecture on hydraulic integration in fern rhizomes."

-**Amaneet Lochab** (C Extavour) awarded the Harvard Graduate School of Arts and Sciences Merit Fellowship for her proposal "Germ cell migration through a developing embryo."

-**Dakota McCoy** (D Haig) recipient of the Linnean Society of London's The Trail-Crips Award in recognition of outstanding contribution to microscopy.

-**Benjamin Goulet-Scott** (R Hopkins) and **Jacob Suissa** (W Friedman) awarded funding through the European Society for Evolutionary Biology's Outreach Initiative Fund for their outreach project, "Let's Botanize," an Instagram-based science communication series using plant life to teach about ecology, evolution, and biodiversity.

-**Zhe He** (NM Holbrook) recipient of the Botanical Society of America (BSA) Bill Dahl Graduate Student Research Award for her project, "Pit membranes and plant resistance to cavitation."

-**Vanessa Knutson** (G Giribet) recipient of the American Malacological Society's Constance Boone Award for Best Student Presentation for her presentation, "Most Cephalaspidea have a shell, but transcriptomes can provide them with a backbone."

-**Wendy Valencia** (N Pierce) recipient of the Xerces Society for Invertebrate Conservation's Joan Mosenthal DeWind Award.

-**Kristel Schoonderwoerd** (W Friedman) awarded Harvard Library's Philip Hofer Prize for her essay, "Winter twig keys: Manuals for tracing time."

- **Misha Gupta** (M Desai) awarded the Fellowship for Students from India for highly accomplished students pursuing studies in the Graduate School of Arts and Sciences in honor of the accomplishments of Harvard Professor Amartya Sen.

- **Richard J Knecht** (J Ortega-Hernández) awarded Harvard Effective Altruism Arete Fellowship.

*mental Biology* measured muscle contractions of animals that were then used to develop musculoskeletal simulations of human cycling. The study showed that although cycling is often considered a seemingly simple, reciprocal task, leg muscles shift their function according to changes in demands placed on them by shifting into higher gears and pedaling faster. When gears were increased in torque and slower pedalling was used, leg muscles were activated more strongly to increase their work and power output. Whereas, at lower torque and fast pedalling, muscles shifted to a more 'spring-like' behavior, actively stretching and then shortening to improve their economy and reduce their power output.

~ PhD candidate **Alex Heyde** and **Professor L Mahadevan** developed a mathematical model to help explain how termites construct their intricate mounds. The study in *Proceedings of the National Academy of Sciences*, mapped the interior structures of two nests using CT scans and quantified the spacing and arrangement of floors and ramps. Adding to the complexity of the nests is the fact that not only do termites build simple ramps to connect floors, they also build spiral ramps to connect multiple floors. Combining these visualizations and previous findings, Heyde and Mahadevan constructed a mathematical framework to explain the layout of the mound. In addition to partially solving the mystery of how these mounds are built and work, the research may well have implications for swarm intelligence in a range of other systems and even understanding aspects of tissue morphogenesis.

~ In a study in *Current Biology*, an international team of researchers led by **Liming Cai** (PhD '20) and **Professor Charles Davis** presented the most complete genome yet assembled of one of the major Rafflesiaceae lineages, *Sapria himalayana*. The genetic analysis revealed an astonishing degree of gene loss and surprising amounts of gene theft from its ancient and modern hosts. The analysis sheds light on a species of flowers whose evolutionary and genomic history is largely unknown because they lack a traditional body, spend most of their lives inside their hosts, and lack the machinery to perform photosynthesis. At the same time, the data demonstrated an underlying evolutionary convergence to becoming a parasite because

## Welcome 2021 G1s!

- Andrea Appleton (Kramer Lab)
- Carina Berlinger (Taylor Lab)
- Cheshta Bhatia (Olveczky Lab)
- Catriona Breen (Srivastava Lab)
- Jack Edwards (Desai/Wakeley Labs)
- Kelsie Lopez (Edwards Lab)
- Alexandria Pete (Friedman/Kramer Labs)
- Valeria Schmidt (Extavour Lab)
- Catherine Strong (S Pierce Lab)
- Brooke Travis (Girguis Lab)

*Sapria* and the parasitic plants the researchers compared them to lost many of the same types of genes despite evolving separately. The study was featured in the *Harvard Gazette*.

~ In a study in *Science Advances* postdoctoral researcher **Julia Molnar** and **Professor Stephanie Pierce** led an international team of researchers that examined three-dimensional digital models of the bones, joints, and muscles of the fins and limbs of two extinct early tetrapods (*Acanthostega* and *Pederpes*) and a closely related fossil fish (*Eusthenopteron*) to reveal how function of the forelimb changed as fins evolved into limbs. For comparison, they also built similar models of the pectoral fins of living fishes (coelacanth, lungfish) and forelimbs of living tetrapods (salamander, lizard). They found the fore-

## Commencement 2021

Harvard held the 2021 Commencement ceremonies online. We were sorry our amazing graduating PhDs were unable to walk and celebrate with their mentors, peers and the community. To honor their work and tremendous achievement, faculty sent videos of well wishes and congratulations which were combined with a montage of each student's image and dissertation title to create a celebratory video. Congratulations graduates! We are so very proud of you!

# Graduate Student Spotlight



Recent graduate Brandon Enalls (PhD '21) is a geobiologist who works to understand how organisms function in the context of their environments. During his years in Peter Girguis's lab, Brandon participated in deep sea expeditions onboard the *R/V Falkor* collecting communities of microbes from hydrothermal vents that he examined to understand their role in the aggregation of minerals that lead to the formation of hydrothermal vent chimneys and in consuming the greenhouse gas methane. Brandon was a member of Harvard Microbial Sciences Initiative (MSI) Graduate Consortium, OEB G3 Representative, and 2019 and 2020 Head Peer Mentor for the OEB E3 REU summer program. He represented Harvard at the USA Science and Engineering Festival, the academic conferences ABRCMS and SACNAS, and worked with the Leadership Alliance to moderate several presentation sessions during their 2020 Virtual National Symposium. Brandon also served as President of the Harvard LGBTQ@GSAS Association. During his two years as President, Brandon revived the organization by securing a budget and a program designed to build community among LGBTQ+ identifying students within GSAS. In 2020, Brandon worked with other graduate students of color across the University to form the Harvard Coalition for Black Lives. With their "Match Me Harvard" Campaign, the Coalition called on Harvard to make the campus a safer and more inclusive space for black and underrepresented members of the community. We reached out to Brandon for a Q&A.

**OEB:** Tell us the highlight(s) of your years in OEB?

**Brandon:** My favorite OEB event is the G4 symposium. The talks are always fun and engaging and it's nice to hear what other students have been working on. The number of scientific disciplines that OEB students work on is shockingly large and I always walk out learning so much about the world. I've had a lot of good experiences in the Girguis lab, but one day I'll never forget was at sea during a field expedition on the *R/V Falkor*. We used a remote operated vehicle (ROV) to investigate and collect samples from a whale fall about 1000m below the seafloor and I was able to work directly with the engineers piloting the ROV. The dive was also live streaming for viewers around the world and I interacted with viewers and incorporated some of their suggestions into our explorations in real time. It was in that moment that I realized how cool of a job I had. I've seen a lot of ocean exploration footage in many documentaries, but this was the first time I was the other side of the screen actually doing the exploring.

**OEB:** What was most rewarding about your time working with the Harvard community?

**Brandon:** When I started working with Harvard LGBTQ@GSAS Association, I wanted to build a community where queer identifying students could meet and build friendships that would last throughout, and hopefully beyond, grad school. It's nice to see a near-defunct organization transform into one where we regularly reached capacity at our monthly happy hours in less than a year. Witnessing new friendships develop over the years definitely made all of the effort to reform the organization worthwhile for me. I stepped down as president to focus on my dissertation, but I left the group in great hands. I'm impressed with how much they've been able to accomplish despite having to operate remotely for more than a year. This year, for the first time, Harvard held a University-Wide Lavender Graduation Ceremony honoring graduating queer students and celebrated Pride on their official social media platforms. These things wouldn't have happened without the work and advocacy of our queer student leaders within GSAS. It feels good to know that the group I had a hand in restarting has evolved into something that's had university-wide effects.

limbs of all terrestrial tetrapods passed through three distinct functional stages: a "benthic fish" stage that resembled modern lungfish, an "early tetrapod" stage unlike any extinct animal, and a "crown tetrapod" stage with characteristics of both lizards and salamanders. Their results show that early tetrapod limbs were more adapted for propulsion rather than weight bearing.

~ In a study in [Cell](#), researchers led by **Brent Hawkins** (PhD '20) examined what's occurring at the genetic level to drive different patterns in the fin skeleton versus the limb skeleton. Researchers performed forward genetic screens in zebrafish looking for mutations that affect the fin skeleton. To their surprise, Hawkins and colleagues found mutants that modified their fins into a more limb-like pattern by adding new bones, complete with muscles and joints. These results reveal that the ability to form limb-like structures was present in the common ancestor of tetrapods and teleost fishes and has been retained in a latent state which can be activated by genetic changes. The study was featured in [Science Blog](#) and [Hakai Magazine](#).

~ The colors in a flower patch appear completely different to a bear, a honeybee, a butterfly and humans due to opsins - light-sensitive proteins in the retina of our eyes which determine the colors we see. In a study in [Proceedings of the National Academy of Sciences](#) researchers led by postdoctoral researcher **Marjorie Liénard** and **Professor Naomi Pierce** developed a novel method to express long wavelength invertebrate opsin proteins *in vitro* and detail the molecular structure of redshift (long-wavelength) and blueshift (short-wavelength) in the opsins of the iconic tropical lycaenid butterfly, *Eumaeus atala*. The study discovered previously unknown opsins that result in red-shifted long wavelength sensitivity in the visual system of *Eumaeus atala*. With this method researchers could pinpoint the specific base pair changes responsible for the spectral tuning of these visual proteins and reveal how vision genes evolved. The study was featured in the [Harvard Gazette](#).

~ PhD candidate **Jacob Suissa** and co-authors Michael Sundue, University of Vermont, and Weston Testo, University of Gothenburg, Sweden, assembled the first global assessment of fern diversity. The study

## Postdoc Notable Awards

- **Paula Rodriguez Flores** (G Giribet) awarded LinnéSys: Systematics Research Fund from the Linnean Society of London and the Systematics Association for her project, "Speciation and connectivity in deep-sea cosmopolitan and vicariant squat lobsters."

- **Fatma Gomaa** (C Cavanaugh) awarded NASA Exobiology fund to study symbiosis in foraminifera in anoxic deep-sea environments.

- **Arvid Agren** (D Haig) awarded the Wenner-Gren Foundation Fellowship.

- **Kiah Hardcastle** (B Ölveczky) awarded The Jane Coffin Childs Memorial Fund for Medical Research for her project, "Investigating how dorsal striatum selects and modifies actions across contexts."

- **Vikram Chandra** (M Srivastava) awarded a Jane Coffin Childs postdoctoral fellowship for his project "The evolution of complex chemosensation."

- **Arvid Agren** (D Haig) awarded John Templeton Foundation Fund for his project "The paradox of the organism."

- **Elsa Goerig** (G Lauder) awarded Fonds de Recherche Nature et Technologies du Quebec fellowship for her project, "Locomotion of native and exotic fishes: Implication for selective fishway design and conservation of populations."

- **Bohao Fang** (S Edwards) awarded Finnish Cultural Foundation fellowship for his project, "Genomics, transcriptomics, and epigenomics of a pathogen-driven evolution in the House Finch."

in the [Journal of Biogeography](#) integrated digitized herbarium data, genetic data, and climatic data to determine where most fern species occur and why. They built a database of over one million fern specimens occurring all over the world. They discovered that 58 percent of all fern species occur in eight principally montane hotspots that comprise only seven percent of Earth's land area. They also found that within these hotspots, patterns of heightened diversity were amplified at elevations greater than 1000 meters above sea level and that within each hotspot there was a strong correlation between increased climatic space and increased species richness and diversification.

~ In 2018 researchers discovered that little skates,

which scuttle along the sea floor on two leg-like fins, use the same motor neurons and genes that help humans and other land vertebrates walk. The study's findings suggested the neural networks required for walking may have been present in the common ancestor of skates and mammals about 420 million years ago. But how these ancient ancestors walked remained a mystery. In a study in [Journal of the Royal Society of Interface](#) Fabio Giardina, John A. Paul School of Engineering and Applied Sciences (SEAS), and **Professor L Mahadevan** (OEB and SEAS) developed a mathematical framework to explain how underwater walking may have evolved. They found that the ancient ancestors of skates and humans could have achieved efficient underwater walking using the available body morphology with very little energy and simple controls.

~ A study in [Proceedings of the Royal Society B](#) led by University of Bristol and co-authored by **Professor Stephanie Pierce** found that ancient crocodiles were more diverse than modern crocodiles due to rapid evolution. Researchers examined over 200 skulls and jaws, including fossils from the entire 230-million-year history of crocodiles and their extinct relatives. They found that extinct crocodile groups evolved very fast over millions of years, undergoing great changes to their skulls and jaws. The study also showed that living crocodiles (crocodiles, alligators and gharials) are more conservative and have evolved steadily for the last 80 million years. However, they are not slowing their evolution and are no longer considered 'living fossils'. Modern crocodiles live in rivers, lakes and wetlands, but ancient crocodiles flourished on land and in the oceans. The study shows that these very different ways of living evolved incredibly fast, allowing extinct crocodiles to rapidly thrive and dominate novel ecological niches over many millions of years.

~ **Professor Peter Girguis** teamed with researchers at the University of Minnesota to examine collected samples of carbonate rocks from the Del Mar East methane seep. The study published in [The ISME Journal: Multidisciplinary Journal of Microbial Ecology](#) discovered that deep-sea bacteria are dissolving the rocks, releasing excess carbon into the ocean and atmosphere. The study findings will help scien-

## Derek Bok Certificate of Distinction in Teaching

### FALL 2020

-**Certificates of Excellence for Lecturers and Preceptors:** Collin Johnson (OEB 10)  
-**Certificates of Distinction for TFs, TAs and CAs:** I-Ting Huang (FRSEMR 24Q), Kristel Schoonderwoerd (FRSEMR 52C), Richard Rabideau Childers and Zhengyang Wang (GENED 1029), Amber Rock (LIFESCI 2), Wendy Valencia Montoya (MCB 112), Brock Wooldridge (OEB 10), Bridget Bickner (OEB 50), Jacob Suissa (OEB 54), Shoyo Sato (OEB 112), Isabel Baker and Zane Wolf (OEB 119), Sophie Macrae Orzechowski (OEB 125), Daniel Buonaiuto (OEB 137), Evan Hoki (OEB 155R), Mia Miyagi (OEB 252), Nicholas Herrmann (OEB 399).

### 2021 AWARD FOR EXCELLENCE

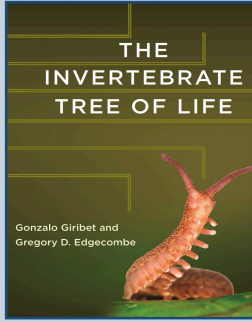
- **Jacob Suissa** (N Friedman) presented the 2021 Derek C. Bok Award for Excellence in Graduate Student Teaching of Undergraduates.

tists more accurately estimate the amount of carbon dioxide in the Earth's atmosphere.

~ **Nathan Ranc** (PhD '20) and **Professor Paul Moorcroft** collaborated with researchers at the Fondazione Edmund Mach, Italy, to examine the foraging decisions of large mammals in nature by attaching GPS-based telemetry collars to 18 roe deer and tracking their movements during a food manipulation experiment. The study published in [Proceedings of the National Academy of Sciences](#) shows that the foraging decisions of roe deer are guided primarily by memory, and not sensory perception alone. According to the authors, understanding how animals respond to changing environmental conditions such as resource availability is critical to designing effective wildlife conservation and management strategies.

~ The bud scales of resting buds of temperate trees are thought to provide essential winter protection. However, naked buds (buds without bud scales) are often considered rare occurrences in temperate climates. In a study in [New Phytologist](#) PhD candi-

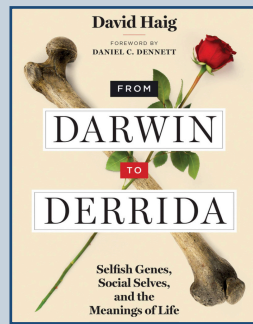
# What We're Writing



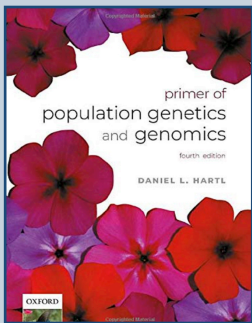
~**The Invertebrate Tree of Life, Gonzalo Giribet and Gregory D. Edgecombe.** In the most up-to-date book on invertebrates, Gonzalo Giribet and Gregory Edgecombe, leading authorities on invertebrate biology and paleontology, utilize phylogenetics to trace the evolution of animals from their

origins in the Proterozoic to today while providing a new framework for understanding their place in the tree of life.

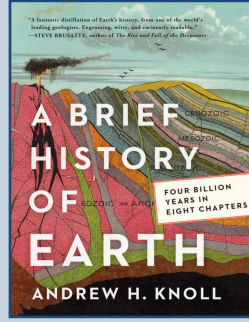
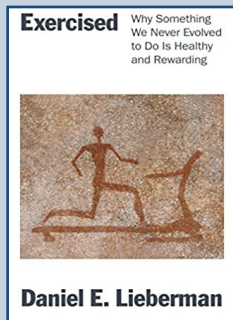
~ **From Darwin to Derrida: Selfish Genes, Social Selves, and the Meanings of Life, David Haig.** Evolutionary biologist David Haig explains how a physical world of matter in motion gave rise to a living world of purpose and meaning.



~ **Primer of Population Genetics and Genomics, Daniel L. Hartl.** In his fourth edition primer, Daniel Hartl, Higgins Professor of Biology, encourages readers with a broader familiarity with, and understanding of, population genetics and genomics as a whole.

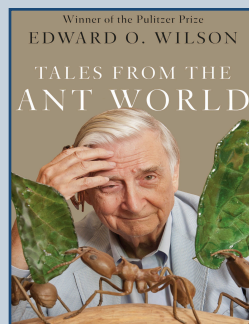
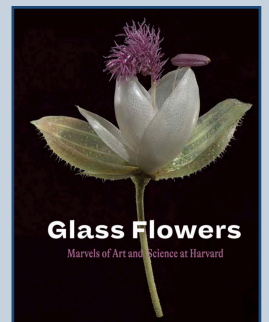


~ **Exercised: Why Something We Never Evolved to Do Is Healthy and Rewarding, Daniel E Lieberman.** In this myth-busting book, Daniel Lieberman, Professor of Human Evolutionary Biology at Harvard University and a pioneering researcher on the evolution of human physical activity, tells the story of how we never evolved to exercise—to do voluntary physical activity for the sake of health.



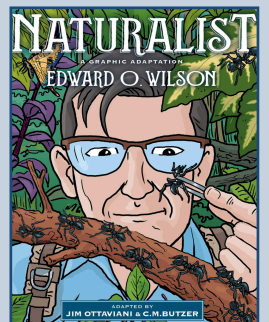
~**A Brief History of Earth: Four Billion Years in Eight Chapters, Andrew H Knoll.** Drawing on decades of field research and up-to-the-minute understanding of the latest science, renowned geologist Andrew Knoll delivers a rigorous yet accessible biography of Earth, charting our home planet's epic 4.6 billion-year story. *A Brief History of Earth* is an indispensable look at where we've been and where we're going.

~**Glass Flowers: Marvels of Art and Science at Harvard, Donald Pfister et al.** Father and son Leopold and Rudolf Blaschka created a stunning array of glass models of plants from around the world and worked exclusively for Harvard University in the late 19th and early 20th centuries. *Glass Flowers* features new photographs of the unique and astonishing Ware Collection of Blaschka Glass Models of Plants located in the Harvard Museum of Natural History.



~**Tales From the Ant World, Edward O Wilson.** Edward O. Wilson recalls his lifetime with ants, from his first boyhood encounters in the woods of Alabama to perilous journeys into the Brazilian rainforest.

~ **Naturalist: A Graphic Adaptation, Edward O Wilson.** A vibrant graphic adaptation of the classic memoir by world famous biologist, Edward O. Wilson. Adapted by *New York Times* comics writer Jim Ottaviani and illustrated by C.M. Butzer.



date **Kristel Schoonderwoerd** and **Professor Ned Friedman** show that there are many more species with naked buds in temperate climates than previously documented and that they are widely distributed, both taxonomically and biogeographically. Interestingly, the study did not detect an association between the distribution of taxa with naked buds and the severity of winter temperatures.

~ Army ants form some of the largest insect societies on the planet. Their raids are a coordinated hunting swarm of thousands and, in some species, millions of ants, but the evolution of these raids is unknown. A study in [Proceedings of the National Academy of Sciences](#) led by postdoctoral researcher **Vikram Chandra** shows that army ant mass raiding evolved from a different form of coordinated hunting called group raiding through the scaling effects of increasing colony size. The researchers used a custom computer vision software developed in the lab named anTraX that tracked and identified the clonal raider ant, *Ooceraea biroi*, a relative of army ants. They recorded nests of ants ranging in size from 25 to 5,000 and saw that as colony size increased, the number of scouts sent to forage increased and became more coordinated in their search activities.

~ Water availability is essential to terrestrial plants, especially tall canopy trees. Satellite observations at microwave frequencies make it possible to assess total canopy water content and plant stress. However, leaf surface water is often overlooked when interpreting changes in water content. In a study in [New Phytologist](#), postdoctoral researcher **Xiangtao Xu** and **Professor Paul Moorcroft** demonstrate the large contribution of leaf surface water to diurnal changes in satellite vegetation optical depth (VOD) data. The study found that leaf surface water accounts for over 60% of diurnal variations in canopy water content despite being less than 10% of the total pool of water in tropical forest canopy. The study featured [commentary from New Phytologist](#).

~ Methane is a strong greenhouse gas that plays a key role in Earth's climate. Researchers are finding more and more methane beneath the seafloor, yet very little ever leaves the oceans and gets into the atmosphere. Researchers led by former postdoctoral researcher **Jeffrey J Marlow** and **Professor Peter**

## REU: Evolution, Ecology, Environment (E3)

This year, OEB completed its third successful year of the NSF Research Experiences for Undergraduates (REU). As in 2020, this year was also conducted remotely. The [E3 REU](#) is aimed at training highly motivated young scientists and preparing them for successful careers in the broad fields of evolution, ecology, and environmental biology. OEB hosted seven undergraduates from around the world.

### [2021 Participants:](#)

- Ana Betancourt, University of Puerto Rico, Rio Piedras
- Nicole S López Vega, University of Puerto Rico, Rio Piedras
- Alison Mangano, De Anza College
- Frances Marie S Panday, University of Maryland, College Park
- Desiree Pante, Hunter College
- Marilena Papavassiliou, University at Buffalo, The State University of New York
- Makaleh Smith, The New School

**Girguis** discovered microbial communities that rapidly consume the methane, preventing its escape into Earth's atmosphere. The study in [Proceedings of the National Academy of Sciences](#) collected and examined methane-eating microbes from seven geologically diverse seafloor seeps and found that the carbonate rocks from one site in particular hosts methane-oxidizing microbial communities with the highest rates of methane consumption measured to date. Samples gathered from the deep-sea site Point Dume off the coast of southern California showed the microbes living in the carbonates consume methane 50 times faster than microbes in the sediment. In some cases, these microbes are surrounded by pyrite, which is electrically conductive. The electrical conduit pyrite provides may account for the high rates of methane consumption by allowing the microbes to have higher metabolic rates and consume methane quickly.



# OEB Diveristy, Inclusion & Belonging

## History of the OEB DIB Committee:

In Fall of 2020, the FAS Division of Science asked their departments to complete a climate survey. OEB was among eight departments that requested the involvement of Harvard College Institutional Research in developing, administering, and analyzing a department-specific climate survey. In October OEB held the Climate Survey Town Hall which presented the survey's major results followed by an open Q & A with the OEB community.

A major topic of discussion at the town hall was the creation and empowerment of a new departmental committee to be called the OEB DIB Committee. This standing committee is composed of representatives from all departmental constituencies and its goal is to help OEB create a more inclusive community. The committee held its first meeting on January 20 2021, followed by regularly held monthly meetings.

## Mission Statement of the OEB DIB Committee:

The department-wide, permanent OEB Diversity, Inclusion and Belonging (DIB) Committee aims to acknowledge, address, and repair systemic injustice within our community and throughout science, technology, engineering, and mathematics (STEM). Through the misapplication of the theory of Darwinism to explain social phenomena, use of collections as a tool for colonialism, and promotion of discriminatory ideas such as eugenics, our field of biology has helped propagate systems of oppression against Black, Indigenous, and people of color, people with (dis)abilities, women, and LGBTQ+ communities, among others. As a community we acknowledge that we have contributed to this problem and have much to learn. We are dedicated to the work that is necessary to create meaningful and lasting change in our department and beyond.

We commit to: 1) Researching and documenting areas of discrimination and inequity within our community; 2) Educating ourselves and our departmental community about the value of diversity and best practices to reduce prejudices, and; 3) Cultivating and actively fostering a more inclusive environment. These commitments will be applied to areas such as recruitment and retention, inclusive excellence,

mentorship, departmental values, accountability, and outreach. Our committee members include students, staff, and faculty associated with OEB and affiliated institutions, including museums. With input from all constituencies, we aim to identify, develop, and implement resources, trainings, and initiatives focused on promoting diversity, inclusion, and belonging. With significant effort, we envision a future community where everyone feels welcome, heard, and supported within our department.

## Committee Members

- Lucrecia Aguilar, PhD Candidate
- Katherine Angier, PhD Candidate
- Molly Edwards, PhD Candidate
- Ella Frigyik, IB Concentrator
- Molly Gabler, Postdoctoral Researcher
- Claire Gallagher, Staff Assistant
- Kanchi Nataranjan Gandhi, Senior Nomenclatural Registrar
- Jessica Gersony, PhD Candidate
- Peter Girguis, Professor
- Gonzalo Giribet, Professor
- Aaron Hartmann, Research Associate
- Robin Hopkins, Associate Professor
- Esther Jules, Administrator, Faculty and Research Support Services
- Wenying Liao, Postdoctoral Researcher
- Dave Matthews, PhD Candidate
- Catherine Musinsky, Faculty Assistant
- Michelle Kennedy, Collections Information and Database Specialist, Collections Operations
- Jacob Suissa, PhD Candidate
- Ellie Taylor, Curatorial Assistant
- Genevieve Tocci, Senior Curatorial Technician
- Breda Zimkus, Acting Director, Collections Operations

## Ex Officio Members

- Elena Kramer, Chair of the Department
- Rebecca Chetham, Executive Director
- Sarine Der Kaloustian, Associate Director

# Integrative Biology

## IB Awards & Honors



**Ella Frigyik** (G Giribet) awarded the [2021 Hoopes Prize](#) in Faculty of Arts and Sciences for her senior thesis, "Phylogeographic investigation into the New Zealand harvestman genus *Algidia* (Arachnida: Opiliones: Triaenonychidae)."

**Sorcha Ashe** invited to join Phi Beta Kappa in the Junior 24 group.



**Skylah Reis** (N Friedman) awarded the Erasmus Mundus Scholarship which provides EU-funded scholarships to study in Europe. Skylah will study marine biology for two years in Europe.

**Laura Jenny** (N Pierce), 2019 HKS Cheng Fellow, founded [You\(th\) Matter](#), a youth-led advisory committee that meets to discuss issues such as police brutality, immigration, and child-family services. Members work with leaders of the committee to provide recommendations for policy initiatives, and police training reforms carried out by Strategies for Youth. You(th) Matter also works to gather and publish youth stories in print, visual, and audio mediums. While an IB student, Laura served as a Case Manager for the youth homeless shelter Y2Y, the director of the community service board of Eleganza, and a Peer Advising Fellow.



## Congratulations 2021 IB Graduates!

- Mushtaaq Ali (Andrew Davies)
- Kim Boerrigter (Stephanie Pierce)
- Ella Frigyik (Gonzalo Giribet)
- Marissa Garcia (Holger Klinck and Andrew Berry)
- Laura Jenny (Naomi Pierce)
- Jenny Liu (Gonzalo Giribet)
- Jude Okonkwo (Samir Mitragotri)
- Ben Rhee (Mathias Lichterfeld and Andrew Berry)
- Arianna Romero (Stephanie Pierce)
- Joey Toker (Marco Mineo and Andrew Berry)
- Erin Wright (N. Michele Holbrook)
- Alex Zaloga (Kristen Koenig)
- Luann Zerefa (Stephanie Pierce)

### IB POSTER SESSION:

The 2021 Senior Thesis Poster Session took place on Zoom! Eleven posters - 3 minutes, 3 slides!

**Integrative Biology**

**Proudly Presents**

**ThesisFest '21**

**Thurs Apr 29th 5pm Eastern**



# IB Student Spotlight



**M**ushtaaq Ali ('21) is one of 13 graduating IB concentrators and a member of Professor Andrew Davies' lab. During her time in IB Mushtaaq served on the board of the Harvard College Conservation Society and was elected 2019 cohort of the Doris Duke Conservation Scholars program at the University of Santa Cruz, CA. We reached out to Mushtaaq for a Q&A about her time in OEB and her new position as Senior Manager of GIS and Data Science at American Forests.

**OEB:** What was the most rewarding aspect of the IB program?

**Mushtaaq:** I loved being an IB major! There's a sense of unabashed and enthusiastic curiosity that is very present in undergrads and people in the department that I really admire. There's nothing like asking people about their interests and hearing all the details about a certain organism or ecosystem that they are passionate about.

**OEB:** How did a concentration in IB and working in an OEB lab help steer you towards your career?

**Mushtaaq:** My sophomore spring I took OEB 55 and decided I wanted to be an ecologist. I didn't intend to use GIS for my senior thesis, but as I spent the year working in QGIS, I found I really enjoyed it. I knew when I went to grad school, I wanted to use GIS and remote sensing work in ecology. My time in IB also helped me decide that I wanted to work in conservation. When I was job searching, I never thought I'd be so lucky as to continue using GIS for a conservation non-profit, so I'm very thankful for this opportunity.

**OEB:** How was your experience with the Harvard College Conversation Society and as a Doris Duke cohort?

**Mushtaaq:** Being on the board with other members who were so incredibly dedicated to their work and the causes we cared about was just wonderful. I had a lot of important discussions and experiences in that group as well as within the Doris Duke program. The Doris Duke program was an integral part of me becoming a scientist, an environmental justice advocate, and a conservationist. I'm so eternally grateful for the staff and students in that program. The experience made me realize how life-changing it could be to have people actively rooting for you, and I really hope I can be a person who roots for others who want to enter and thrive within these spaces.

**OEB:** Tell us about your job and some highlights of your work.

**Mushtaaq:** I thought I would be an MCB concentrator and end up working at Pfizer. Then I realized I wouldn't be happy unless I was working to make ecosystems healthier and more equitable for all living things. American Forests is doing a lot of work that is close to my heart. My job involves lots of GIS and Data Science work from using maps to helping restore thorn forests in the Lower Rio Grande Valley, to visualizing the inequity in tree cover distribution across urban spaces. I'm working on a lot of cool projects and I'm super excited about it!



## Courses During COVID

### FS 41U: Museums in the Age of COVID Instructor: James Hanken

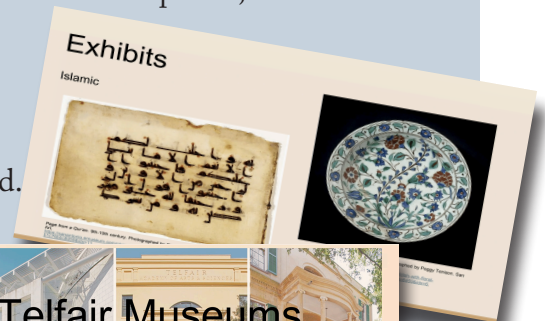
#### MFA from Home

Video Library, MFA YouTube, Online Education Events, Collection Search, App  
Updated map of what's open →  
<https://www.mfa.org/visit/plan-your-visit>



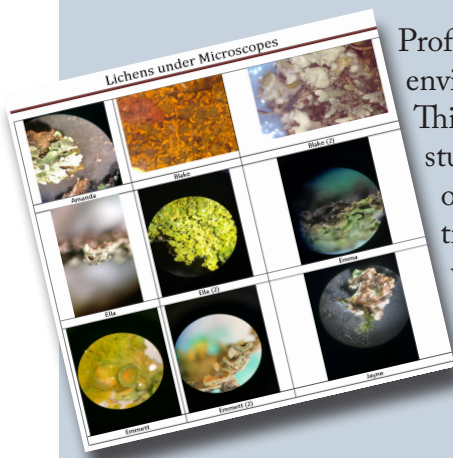
Students in Professor Hanken's freshman seminar "Museums" typically visit museums at Harvard and the greater Boston area. When COVID forced many museums to close their doors to the public, Hanken revised his freshman seminar to address the impact and to explore museums beyond Massachusetts. Each class included a guest who worked for the museum that students virtually toured.

Students visited San Diego Museum of Natural History, Redpath Museum (Montreal, Canada), Guggenheim Museum (NYC), Museum of Fine Arts (Boston), High Museum of Art (Atlanta), Mystic Seaport Maritime Museum, Isabella Stewart Gardner Museum and Telfair Museums (Savannah, Ga.). As a final project, students prepared presentations covering their favorite museum.



### FS 24Q: Microbial Symbioses: From the Deep-Sea to the Human Microbiome Instructor: Colleen Cavanaugh

Professor Cavanaugh normally takes FS 24Q students on field trips to local environs including the Boston Harbor Islands and the New England Aquarium. This year, Cavanaugh arranged for all students to have dissecting microscopes courtesy of the teaching labs. Students went on field trips outside their homes and dorms collecting various symbioses. Labs were conducted online sharing findings and microscopic images.

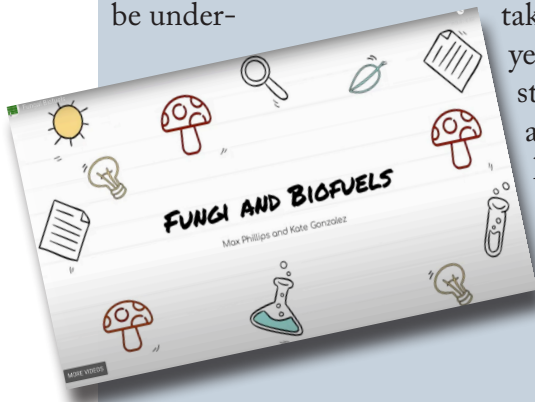


## Courses During COVID

### OEB 54: Biology of the Fungi Instructor: Donald Pfister

Professor Pfister sent OEB 54 students microscopes, lab equipment, lichens, and mushroom growing kits. Thirty students from Lithuania, Chile, Hawaii, Geneva, and the U.S. connected on Zoom to see and share fungal biodiversity from all over the world. Pfister remodeled the course to incorporate the many interactions people have with fungi in their daily lives. Labs were organized around activities that could be under-

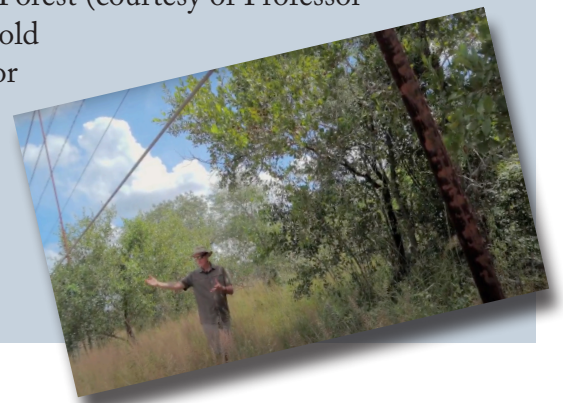
taken at home. Students were given yeast, recipes, and videos, which students used to make sourdough bread and ginger beer. Each year students in the course hold a Fungus Fair in the Harvard Museum of Natural History (HMNH). This year student teams made videos which were presented in a well-attended public forum. Some videos are available for viewing on the [HMNH](#) site.



### OEB 55: Ecology: Populations, Communities, and Ecosystems Instructors: Andrew Davies, Paul Moorcroft, and Benton Taylor

Students in OEB 55 examine the relationships of organisms to their environments at the individual, population, and community level. Due to COVID, students could not experience ecology in the field with instructors. Instead, Professors Davies, Moorcroft, and Taylor took OEB 55 students on three virtual field trips: one to the savannah in South Africa (courtesy of Professor

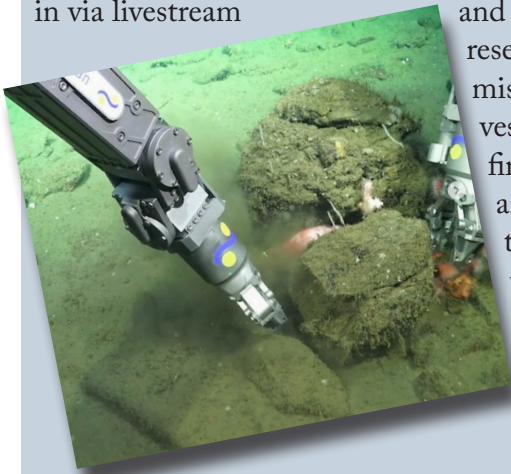
Davies), one to Harvard Forest (courtesy of Professor Moorcroft), and one to the Arnold Arboretum (courtesy of Professor Taylor). Instructors conducted the tours live in the field including the South Africa tour!



## Courses During COVID

### OEB 119: Deep Sea Biology Instructor: Peter Girguis

Professor Girguis didn't let remote teaching stop his students from exploring the ocean's depths! OEB 119 students virtually followed researchers 3,000 meters under the sea! More than 40 students patched in via livestream



and a satellite call to a team of researchers leading an exploration mission by the marine research vessel Nautilus. Students saw first-hand deep-sea exploration and could ask real-time questions of the team controlling the vessel's remote operated vehicle (ROV), Hercules, as it dove 3,000 meters into sea!



### OEB 130: The Biology of Fishes Instructor: George Lauder

OEB 130 explores fish diversity, their ecology, behavior, and physiology. The hands-on course includes labs with dissections of multiple species and regions of the fish body. Although COVID kept the labs closed, it didn't stop the students from dissecting. Professor Lauder sent students to their local markets to purchase

fish to dissect in their home using whatever instruments they had available in their kitchens. TFs assisted the students with dissections over Zoom. In late

Spring the University granted permission to hold an outdoor field trip to the Charles River for local students to collect fishes using a beach seine. TFs Zoomed the activity from the Banks of the Charles using cell phones for students who could not attend in person.

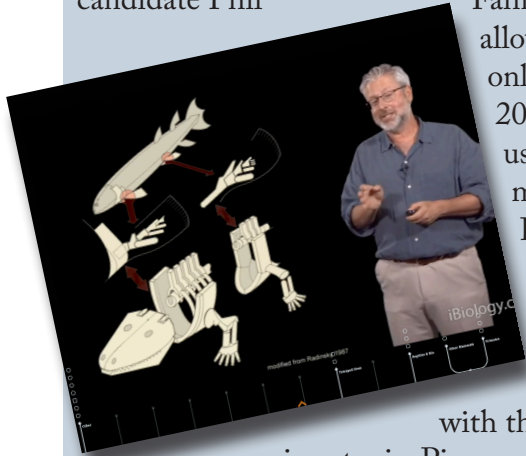


## Courses During COVID

# OEB 207: The Fishy Aspects of the Human Body

Instructor: Stephanie Pierce

When COVID began in 2020, Professor Pierce was teaching OEB 126: Vertebrate Evolution, a very hands-on class. PhD candidate Phil



Fahn-Lai created Lab 3D which allowed students to conduct labs online using 3D fossils. OEB 207 is also very hands-on and usually pairs readings with museum specimens, so Fahn-Lai made a spin off of Lab 3D for OEB 207. With the new app, students had an interactive website that paired



with the week's readings and seminar topic. Pierce worked with TFs to upload and design ten unique pages of specimens that complimented each lesson and that students could examine in detail. Funding to design the website was provided by the Office of Undergraduate Education.

# OEB 218: Ecosystem Restoration

Instructor: David Moreno Mateos

OEB 218 teaches students about the restoration of degraded ecosystems through lectures and field trips to marine and forest habitats. With COVID restrictions preventing in-person gatherings, Professor Moreno Mateos sent students on self-guided field trips. Students were asked to find a restored ecosystem site in their area, and tour and film the site. Student presented three-minute videos of the sites, sharing restoration efforts taking place in Brazil, South Korea, China, New Zealand, and various locations in the United States.

## Black's Nook In-Pond Restoration Project



Fresh Pond Advisory Board  
19 September 2019



An aerial view of Ninigret salt marsh immediately after the restoration and elevation enhancement. Notice the mud-flat appearance on the restored areas. (Photo: J.F. Brennan)



Ninigret salt marsh in the fall of 2017, after planting were added in the spring (Photo: CRMC)

# Event Highlights

## OEB Seminar Series

The 2020-2021 seminar season had a successful fall and spring with an incredible lineup of speakers from all over the world. Due to COVID, all seminars were held online.

### Fall 2020

- **Erica Bree Rosenblum**, University of California, Berkeley
- **John Silvanus Wilson**, Harvard University
- **Paul S Shamble**, John Harvard Distinguished Science Fellow
- **Donna L Maney**, Emory University
- **Iñaki Ruiz-Trillo**, Institut de Biologia Evolutiva, Universitat de Barcelona
- **Sharlene E. Santana**, University of Washington

### Spring 2021

- **Kristen Koenig**, John Harvard Distinguished Science Fellow
- **Andrew Biewener**, OEB, Harvard University
- **Mandë Holford**, Hunter College
- **Beronda L Montgomery**, Michigan State University
- **Julia A Clarke**, The University of Texas at Austin
- **Patricia Wittkopp**, University of Michigan
- **Marie Dacke**, Lund University, Sweden.

## PBI Symposium

The 15th Annual Plant Biology Initiative Symposium "*Fungi and Plants: Ecology and Interactions*" took place May 3-4, 2021. The event, originally scheduled for May 2020, was rescheduled and included previously scheduled speakers from 2020. The event, hosted by Professor Donald H. Pfister and Professor Elena Kramer, took place online over the course of two-days with 492 participants. C Kevin Boyce kicked off the event as Key Note Speaker. The symposium talks are available for viewing on the [OEB YouTube Channel](#).

### Invited Speakers:

- **C Kevin Boyce**, Stanford University,
- **Catherine Aime**, Purdue University
- **Elizabeth Arnold**, The University of Arizona
- **Gregory Bonito**, Michigan State University
- **Timothy James**, University of Michigan
- **Peter Kennedy**, University of Minnesota
- **Teresa Pawlowska**, Cornell University
- **Kabir Peay**, Stanford University
- **Anna Rosling**, Uppsala Universitet
- **Matthew Smith**, University of Florida

## 2021-2022 OEB Seminar Series

- **September 2:** Stephanie E Pierce, OEB, Harvard University
- **September 30:** Andrea L Sweigart, University of Georgia
- **October 14:** Kakani Katija, Monterey Bay Aquarium Research Institute
- **October 21:** Sandy Hetherington, University of Oxford
- **November 4:** Lúcia Garcez Lohmann, Universidade São Paulo
- **December 2:** Graham Coop, University of California, Davis
- **January 27:** Veronica Hinman, Carnegie Mellon University
- **February 10:** Anjali Goswami, Natural History Museum, London
- **March 10:** Lauren Buckley, University of Washington, Seattle
- **March 24:** Jessica Ware, American Museum of Natural History
- **April 7:** Toby Kiers, Vrije Universiteit, Amsterdam
- **April 21:** Anurag Agrawal, Cornell University

Visit [OEB Seminars](#) for updates



# OEB Staff News

## Welcome New Staff!

- Sarah Arnold, Research Assistant, Srivastava Lab
- Manju Barua, Laboratory Technician, Zhang Lab
- Janelle Batista, Financial Associate, OEB Admin
- Gerardo Barreda, Faculty Coordinator, Giribet and Holbrook Labs
- Carina Berlinger, Research Assistant, Taylor Lab
- Tiara Borneman, HR Coordinator, OEB Admin
- Tulika Deb, Research Assistant, MCZ
- Anupreksha Jain, Laboratory Technician, de Bivort Lab
- Karla Haiat Sasson, Research Assistant, Girguis Lab
- Brooke Travis, Research Assistant, Girguis Lab

### Promotions:

- Mike Barrett promoted to Plant Technologist
- Wendy Heywood promoted to Communications Specialist

## Milestones In Service

### 35 Years of Service:

- Janet Sherwood, Greenhouse Coordinator, Plant Sciences

### 25 Years of Service:

- Wendy Heywood, Communications Specialist, OEB Admin

### 5 Years of Service:

- Matthew Gage, Curatorial Assistant, MCZ
- Jared E Hughes, Faculty Assistant, OEB

## Retirement

- Elena Lozovsky, Principal Staff Scientist, Hartl Lab
- Kalsang Namgyal, Research Assistant, Fly Facility, MCZ
- Anna Salvato, Manager of Financial Operations, OEB Admin

## Acknowledgements and Credits:

### Editor

Wendy Heywood

### Design

Wendy Heywood  
Catherine Musinsky

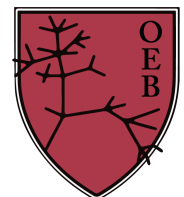


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HARVARD UNIVERSITY

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