CAS
COLLEGE OF ARTS + SCIENCES
FALL 2017
Biology

WIN-WIN for SCIENCE

Elly Transforms Teaching

How is it possible to take something that is mundane and ordinary, like bread, and transform it into a multidiscipline course that truly engages the interest of students? You transform the experience into a hands-on exploration of the chemistry, microbiology, and physics of bread-making. You delve into the underlying science. You cover the full spectrum, transforming seed into bread—from the genetics of wheat to today's politics of wheat and bread production. The course, Bread 101, served as a course development lab for the Science Literacy Program. It also won a national award for food studies pedagogy. The Bread 101 colloquium (HC 441H) is a perfect example of what happens when committed faculty members come together with students to examine a subject in nontraditional ways.

Efforts to make science courses more effective and engaging have been embraced with gusto at the UO. Interest is spreading like wildfire thanks to Elly Vandegrift, director of the Science Literacy Program. Recently, Elly organized the Summer Institute on Scientific Teaching. Professors and postdoctoral researchers from across the country came to campus for a week of evidence-based science teaching workshops. At week's end, the participants had created classroom activities based on active and inclusive teaching and they left with a tangible skill set to develop a new course or improve courses using evidence-based teaching practices.

"My goal is to make science courses interesting, engaging, and relevant for all students."

One of the approaches, active learning, means the students are fully engaged and participating throughout an entire course rather than sitting passively through lectures. There is evidence that students in lecture-based courses are more likely to fail than students who are in active-learning classrooms. Elly leads the program's mission to support student success through the development of excellent science teachers. This involves a weekly Science Education Journal Club, mentoring teaching teams, maintaining a partnership with the Alan Alda Center for Communicating Science, and participating in campus-wide conversations about improving teaching and student success. She loves teaching about the process of teaching. This includes exploring ways to create inclusive classroom experiences and environments that encourage deep involvement with material, sparking curiosity in science (especially among those not majoring in science) so that students will continue to be lifelong science learners.

Elly Vandegrift, winner of the Thomas F. Herman Award for Specialized Pedagogy, holds her myrtlewood apple in the front of her Science, Policy, and Biology (BI 140) course.

"Elly is now bringing us together to explicitly and deliberately focus on how we can systematically improve both our curriculum and our approaches to teaching. Her positive attitude, intelligent fortitude, and steady devotion to improving science education are richly deserving of recognition."

Bruce Bowerman
Head, Department of Biology, University of Oregon

Learn more about the Science Literacy Program at scilit.uoregon.edu

BIO +

Greetings from the Department Head

Bruce Bowerman with rough-skinned newt (*Taricha granulosa*)

Greetings from the Department of Biology at the University of Oregon! The past year has been quite eventful. As part of an ongoing effort by the University of Oregon to expand the size of our science faculty, we successfully recruited four new outstanding professors. Moreover, we lured three of them away from tenured positions at top-quality US institutions: David McCormick, a world-renowned neurobiologist from Yale University; Krista McGuire, a rising star in the field of microbial ecology and rainforest ecosystems from Barnard College, Columbia University; and Andrew Kern, an outstanding genome evolution researcher from Rutgers University in New Jersey. We also recruited Luca Mazzucato, an outstanding young theoretical neuroscientist, as an assistant professor. It is an impressive indication of our growing national and international prominence that we are succeeding in recruiting new faculty members to come here from such prestigious private and public research universities.

Not only do these new colleagues bring exciting, innovative, and modern interdisciplinary research programs to our campus, but they also provide new expertise for teaching our undergraduate and graduate students quantitative skills, one of our top priorities over the past few years. Furthermore, at our recent annual Department of Biology retreat, we reviewed our progress in formulating new courses that focus on quantitative aspects of biology research, and for the first time ever evaluated data from a survey of senior undergraduates assessing the effectiveness of our science teaching. Nicola Barber, the first science education research professor we have ever hired, has undertaken an extensive assessment of our teaching effectiveness, in collaboration with Elly Vandegrift, the director of our Science Literacy Program, which promotes more effective learner-centered teaching methods. With these satisfying new developments, we anticipate improvements in the preparation of our students for the new world of big data, which promises to open up new career tracks for our graduates.

The University of Oregon, along with the rest of the world, is entering a new era of interdisciplinary and highly quantitive biology research and education. We are very pleased with our continuing success in sharpening this focus within our department, and look forward to further progress in the coming year.

Bruce Bowerman
bowerman@uoregon.edu

New Team Members

Welcome Krista McGuire, Andrew Kern, and Nadia Singh

Krista McGuire

Krista McGuire developed an early interest in ecology growing up in the forests near the Appalachian Trail. After three years of undergraduate research and a college course in Costa Rica, her decision to pursue a PhD in ecology and evolution was solidified. That first passport stamp to the tropics catalyzed a series of subsequent trips and a dissertation proposal that took her to the remote regions of the Amazon. Krista completed her PhD at the University of Michigan while spending half of each year living with an Amerindian community in Guyana. During this time, she researched how fungi in the soils influenced the numbers and types of trees that coexisted in the rain forest.

During her postdoc at the University of California at Irvine, Krista broadened her interests and pursued projects in Panama and Alaska, continuing to research plant-microbial associations and the effects that human activities such as global climate change and agriculture have on these relationships. In 2009, she accepted a faculty position at Barnard College of Columbia University, where she remained for eight years. At Columbia, Krista pursued her interests on the effects of human land use on plant-microbial associations and established projects in Puerto Rico and Southeast Asia, where much of the rain forest has been logged and converted to oil palm agriculture. She also began projects in New York City looking at the microbial ecology of green infrastructure such as green roofs, parks, and other urban vegetated habitats.

At the University of Oregon, Krista is excited to continue her work in the tropics and to begin studying plant-microbial associations locally in the Pacific Northwest. She is also looking forward to exploring the hiking, running, and wine trails of Eugene following a welcome transition from frenetic Manhattan.

Andrew Kern

Andy Kern grew up in New York City, a place not stereotypically thought of as a hot bed of budding biologists. However, despite the lack of woods or fields to run in, Andy was allowed to run around the American Museum of Natural History, where as a boy he was captivated by the natural world, the spectacular mosaic of biological diversity, and the conceptual framework of evolutionary biology.

Andy launched his formal studies in evolutionary biology at Brown University, where he studied paleontology, genetics, physics, music, and found his true calling in population genetics. From there he headed to Central America, where he was awarded a fellowship to study the population genetics of coral reef fish and Caribbean birds at the Smithsonian Tropical Research Institute in Panama. Andy then earned his PhD in population genetics at the University of California at Davis as a Howard Hughes Medical Institute predoctoral fellow, and was a postdoctoral scholar in computational biology at the University of California at Santa Cruz as an NIH Ruth L. Kirschstein National Research Service Award fellow. Since leaving the West Coast, Andy has been a professor at Dartmouth College and, most recently, Rutgers University.

Andy's research combines computational and statistical approaches towards understanding the evolutionary mechanisms that shape variation in our genomes. As an evolutionary biologist, Andy is primarily interested in uncovering the footprints of natural selection in the genome, and in so doing to learn about the adaptive history of our species (among others). A casual look at the natural world leads to the intuition that organisms are superbly well-suited for the environments in which they live—Andy's research aims to understand how this process proceeds at the genetic level.

Andy is thrilled to be joining the Department of Biology and looks forward to being a part of such a vibrant, interdisciplinary community of scientists. In addition, he and his family are excited to be returning to the West Coast and can't wait to explore the natural beauty of Oregon.

Andy, Amy, Leilani, and Raphael also look forward to one of their favorite activities—spazzing out on the beach!

Nadia Singh

Nadia Singh's first foray into research was in the fourth grade science fair, where she tested the effects of pH on paramecium. Although electron microscopy was surely overkill for that project, her data clearly showed that increasing or decreasing pH above or below seven leads to paramecium death. Nadia's interest in science and research continued to develop; she participated in the NIH summer high school apprentice program, during which she was able to work on the parasite that causes schistosomiasis and its snail host. Nadia spent three of her undergraduate years conducting research in a marine ecology and evolution lab at Harvard University, and ultimately was introduced to molecular evolution, population genetics, and evolutionary genetics through this experience. She hasn't looked back.

After a year of working as a technician at Harvard School of Public Health with the Program for Human Population Genetics, Nadia started graduate school at Stanford University. Her work there focused on understanding how genomes change in the absence of natural selection both within and between species. It was during her time at Stanford that she turned to *Drosophila* as a model system. As a postdoc at Cornell University, Nadia continued to use *Drosophila* to probe fundamental questions in the fields of evolutionary genomics, population genetics, and evolutionary genetics.

Nadia started an assistant professor at North Carolina State University in fall 2010. Her lab focused largely on genetic recombination, with specific interest in identifying triggers of recombination-rate variation and determining the significance of this variation. The ultimate goal of her research in this area is to understand the maintenance of variation in recombination rate within and between species.

Nadia continues to be excited about questions relating to the causes of recombination-rate variation and its consequences for genome evolution, and in the longer term expects to investigate causes and consequences of mutation-rate variation as well. Her work addresses a basic need in modern biology: deciphering genome-level patterns of genetic change. At the Institute of Ecology and Evolution, Nadia will continue to use a combination of experimental, bioinformatic, and computational tools to investigate these and related questions. She is thrilled to be joining the faculty at the University of Oregon.

Graduate Spotlight

Madeline Chase

Although I'm originally from the UK, I've grown up in Eugene and went to the University of Oregon for my undergraduate degree. I received my BA in biology in 2015, with minors in chemistry and French. In my junior year, I started volunteering in the Streisfeld Lab in the Institute of Ecology and Evolution, studying adaptation and speciation in the Californian bush monkey flower. This often comes as a surprise to my friends and family, but I have a fairly poor track record of keeping plants alive. This might be why my honors project involved letting plants slowly wilt to study the genetic architecture of drought tolerance—thought to be important in local adaption.

Graduation snuck up on me and I realized that although I had been planning on taking a year off, I didn't want to stop working in a lab. I decided to stay at the UO, and I started a master's program in the Streisfeld Lab in fall 2015. Now, I am about to start my final term. As an undergraduate, my work focused on two closely related ecotypes of *Mimulus aurantiacus* that grow in San Diego. Over the past couple of years, however, I have started to look at the evolutionary history of the rest of the species complex, which grows across California. I've been using genomic approaches to try to understand the origins of adaptive traits, such as flower color.

Last spring I finally got to see the plants I study in the field when we spent a week collecting tissue in Southern California. While there I got to see between two and six of the species we study, depending on who you ask. I also spent a lot of time staring at my feet, certain I was going to step on a rattlesnake. More recently, I gave my first talk at the evolution conference in Portland, where I presented some of the most recent work from my thesis.

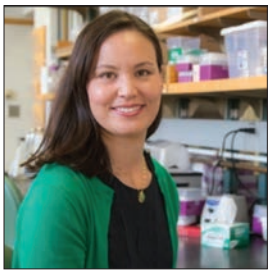
As I enter my last term at the UO, I'm grateful for the opportunities I've had and the decisions I've made along the way. From studying abroad in the Amazon rain forest to leading undergraduate labs and presenting my own research to a lot of really smart people, I've done a lot of things I never thought I would feel comfortable with. After I finish my master's, I hope to continue studying speciation, and I plan to pursue a PhD. Other future goals include keeping my office plants alive (so far, so good!) and, I hope, being a contestant on Jeopardy.

Awards and Recognition

Biology professor **Chris Doe** has been elected to the National Academy of Sciences in recognition of his work in cell development, including neural stem cells and the development of the central nervous system in fruit flies.

Doe has spent most of his career examining the stem cells of the developing fruit fly brain. His work showed how spatial patterning cues create different types of stem cells, how stem cells divide irregularly to regenerate the stem cell while continuously producing neurons, and how stem cells possess a "molecular clock" that allows them to make different types of neurons over the life of the stem cell. Most recently he has been investigating how neurons from different stem cells "wire up" to make neural circuits that generate different fruit fly behaviors.

"More important than awards is the training of the next generation of scientists—from the middle school and high school students to the postdocs and graduate students," Doe said. "Thinking about the 30, 40, 50 people out there who have come through the lab and are still doing science . . . the biggest thing for me is training all of these great people who can do so much more than any one individual."



Biologist and DNA researcher **Diana Libuda** has been named a 2017 Searle Scholar.

The award is handed out each year to 15 "exceptional young faculty [members] in the biomedical sciences and chemistry," according to the Searle program description. Searle Scholars each receive $300,000 in flexible funding to support independent research over three years.

Libuda's lab focuses on how DNA is repaired during sperm and egg development to ensure genome inheritance from one generation to another and utilizes the roundworm *C. elegans* as a model system. Libuda was selected from a field of 196 applicants from 143 universities and research institutions.

Libuda received her doctorate from Harvard University and her bachelor's degree (graduating summa cum laude) at UCLA in molecular, cell, and developmental biology with a music history minor. She is a key member of the Center for Genome Function, a group of molecular biologists studying fundamental problems in genetics and epigenetics.

Undergraduate Spotlight

Sandra Dorning

As a Portland native, I have gone tidepooling on the Oregon coast throughout my entire life. I have fond memories of my brother and me peering into small, rocky basins, watching hermit crabs scuttle along the sandy bottoms. However, in invertebrate zoology at the Oregon Institute of Marine Biology, an entire world was revealed to me in each of these pools. Beyond the sea anemones, crabs, and bright orange and purple starfish that I was used to spotting, I discovered an intertidal zone rich with pink coralline algae, cup corals, brittle stars, sea cucumbers, urchins, bryozoans, and more. I even found an octopus in one pool early in the course, a feat which astounded me. For a woman who'd dreamed of marine biology from the age of 11, this was heaven.

I arrived at OIMB eager to dive into research—after a year in a microbiology lab in Eugene, I felt eager to work more closely in my broad interest in marine ecology. My early research experience had already earned me an NOAA Ernest F. Hollings Undergraduate Scholarship, and I spent the summer of 2016 in Cape Cod, studying the acoustic behavior of whales. Before that, however, I developed independent research skills at OIMB by conducting an independent project that would become my honors thesis. I had long been interested in studying marine species and ecosystems under threat, and I worked feverishly for two years to improve our understanding of how an invasive sea squirt, *Botrylloides violaceus*, affected the Coos River Estuary.

In my time in the Young Lab, I learned to be a meticulous problem-solver. In the field, I learned to be observant, and to speak with confidence about my work to those passersby who would ask, curiously, why I was lying on a dock and sticking a camera into the water. In Eugene, political science and biology professors inspired me to challenge my preconceived notions of science and its role in society so that I might work to reconcile clashing arguments among stakeholders in marine conservation issues. Through all of these experiences, I began to come into my own as a person, as a burgeoning scientist, and as a thinker.

Now, as I pursue further education and work on the sustainable management of our oceans, I leave the University of Oregon campus hoping to continue this development: to look for the finer details in people and places that feel familiar, and to ask the big questions about our world.

New Team Members

Welcome David McCormick

David McCormick spent his childhood taking electrical and mechanical devices apart and frantically trying to put them back together again. Growing up in a family of engineers, he always imagined he would follow in the same footsteps. However, his mother's frequent epileptic seizures, resulting from a farming accident, brought to the forefront the realization that circuits in the brain underlie all that we are—our thoughts, emotions, behavior, and personality. Understanding the neural circuits of the brain became his lifelong passion. During his graduate work at Stanford University, David was the first to reveal the mammalian neural circuits mediating a simple learned, classically conditioned response. As a matter of interest, David is the scientific great-great-grandson of Ivan Pavlov, who discovered this form of simple learning (Pavlov's dogs). As a postdoctoral fellow in the Department of Neurology at Stanford University, David detailed the mechanisms by which neural circuits control the brain—preparing it for sleep, arousal, or attention. Over the next 30 years, David's laboratory at the Yale School of Medicine systematically uncovered the precise brain circuits and mechanisms that generate brain activity during sleep, how this activity may be perverted into absence epileptic seizures, and how the neurotransmitter systems underlying arousal and attention control the brain. In recent years, his laboratory has turned its focus to the neural mechanisms of variation in waking state. Using state-of-the-art methodologies such as two-photon imaging and optogenetics, his laboratory is uncovering the neural circuits that control our ability to focus, attend, and perform optimally. These findings will have implications for many aspects of our behavior, from the ability to focus in the classroom to the neural basis of disrupted engagement in a variety of disorders. David is a fellow of the American Association for the Advancement of Science, the American Academy of Arts and Sciences, and the National Academy of Medicine. He has been actively involved in community outreach: for the last seven years, he lived in a residential college with 400 undergraduate students at Yale University, and during the last four, he traveled to Tibetan monastic universities to teach neuroscience to monks. He is excited to join the University of Oregon as the director of the Institute of Neuroscience and as an undergraduate faculty fellow. He is joined by his wife, Lanch McCormick, director of student engagement, and his Samoyed, Sasha, who has been given the title "director of fluffiness."

New Team Members

Welcome, Lauren Hallett

Lauren Hallett got her start in plant ecology at the Konza Prairie Biological Station at Kansas State, working on an experiment that manipulated climate variability to test its effect on grassland diversity. She was intrigued by the theoretical and applied questions the project tackled: What maintains the diversity of species on Earth? How will this diversity respond to global change? These questions have continued to fascinate her and guide her work. This first foray into fieldwork had an enormous impact on her career trajectory, and she has observed that early research opportunities often become gateways to science careers. Lauren's seminal experience at Konza would not have been possible without the mentorship of Mendy Smith—one of the few female professors she had encountered at that point. Cognizant of this, Lauren also has a strong interest in fostering diversity in science. Over the following years, Lauren combined her initial interest in plant-climate dynamics with a budding interest in restoration ecology. Working with Richard Hobbs and Rachel Standish at the University of Western Australia, she developed tools for restoring old fields to woodlands in increasingly arid western Australia. As a graduate student and postdoc with Katie Suding at the Univeristy of California at Berkeley, she returned to study climate effects on grasslands—modeling climate effects on the population dynamics of rare species and experimentally testing strategies to manage California grasslands for climate change. Working in highly modified landscapes such as California has also given Lauren an interest in the philosophy of restoration in a human-dominated age: how do you set and achieve goals when returning to the past is not possible? Lauren will continue to work at the intersection of plant community and restoration ecology. She is looking forward to starting new collaborations in Oregon, and building a research group that can ask and answer emerging questions in ecology and land management.

David Conover

Vice President for Research and Innovation

David Conover became the UO's vice president for research and innovation in August 2016. He previously served as the vice presidnet for research, dean of marine and atmospheric science, and professor of marine science at Stony Brook University. He also served a four-year stint as director of the Division of Ocean Sciences at the National Science Foundation. He is the recipient of numerous awards including an Aldo Leopold Leadership Fellowship. He is a fellow of both the American Association for the Advancement of Science and the American Fisheries Society.

David's own research interests involve the ecology and evolutionary biology of fishes and fisheries science. He is the first to show that sex determination in fishes is influenced by temperature during larval development. Most of this work has been specific to the Atlantic silverside, but the phenomenon is now known to be widespread.

David remains interested in the long-term consequences of harvesting as a selective force that alters the evolution of life history traits in fishes. His lab conducted a 10-year empirical simulation experiment leading to the discovery of rapid evolutionary responses to size-selective harvest. This discovery has resulted in a dramatic expansion of research on "fisheries induced evolution" and the consequences for managing fish stocks.

Conover is committed to enhancing research excellence and strengthening the role of research, scholarship, and creative activity. Working alongside President Schill, he will explore ways to bolster existing academic research programs and develop new partnerships and collaborations. Conover oversees the majority of the UO's multidisciplinary research centers and institutes, strategic research initiatives and partnerships, research infrastructure and administration, compliance and regulatory environment, and innovation and commercialization efforts, and he works with the UO donor community to support research initiatives.

BEE POSITIVE Thanks to Jim Murez, UO Communications

School Buzz

These curious kindergartners got as close to bees as a person can get without getting stung. As they filed into the classroom, their eyes as wide as saucers, they gravitated toward the wooden-and-glass box in the back of the room. There, they saw them: the bees. Hundreds of bees in constant motion, crawling about the honeycomb in their hive. Multitudes of "oohs" and "aahs" ensued.

The observation hive was the big draw for students from Eugene's Corridor Elementary School. They came to campus to learn about honeybees at the invitation of Misty McLean-Schurbon, senior lab preparator for the Department of Biology. "We have this great hive, and I thought it would be cool if we could use it for outreach, too," Misty said. "It's great to take something kids are afraid of, like bees, and show them all the good things they do."

The observation hive is about the size of a carry-on suitcase with glass sides for watching the bees inside. The hive is linked to the outside world with a clear plastic hose in which the bees pass back and forth. The hive is used to study honeybee behavior, including how they communicate and organize their hive to keep it running smoothly. It is a fun way to expose youth to science, planting within them the seed of curiosity.

Misty organized four stations on honeybees—their hive, their anatomy, their methods of communication, and how they fit into nature. To say the 30-plus visiting students and parents were mesmerized would be an understatement. They were drawn to the hive like a bee to honey, especially to look for the queen bee, whose larger size distinguished her from the others. Senior biology major Kristie Parsons helped the students find the queen and point out the other bees' responsibilities in the hive.

"They thought it was cool to hear the buzzing, and see the honey and pollen packed into the combs, but they were most excited about seeing the queen bee," Parsons said. "One little girl had really wished the queen bee was wearing a crown."

As other students waited their turn, they kept occupied with a chunk of old honeycomb that had been placed on a tray for examination. "It feels so good on your hands," said Dylan Canfield, as he pressed his palms into the empty comb. "I don't want to take my hands off." "It smells like a candle," added a classmate.

In another classroom, students watched a projection of a bee onto a large screen as Misty identified the insects' body parts and their purposes. The students then made drawings and diagrams of what they had learned. Outside, a third group learned how bees use dances to communicate with one another and what each dance means, and then the students took turns acting out the dances.

The field trip was supported by the office of President Michael Schill, the Urban Farm, the athletics department, and the Oregon State University Honeybee Lab, which keeps the UO's hive for part of the year. "I think the kids came away from this with a new appreciation for honey bees," Parsons said, "and, I hope, are a little less afraid of them."

Students examine a piece of old honeycomb (photo: Jim Murez)

A tray of mounted bee specimens captures the attention of students (photo: Jim Murez)

Kristie and student searching for queen bee in observation hive

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Peter O'Day with SPUR 2016 program students

Peter O'Day Fellowship in Biological Sciences

For undergraduates interested in biological research, there has been no better friend than Peter O'Day.

The associate professor of biology has long helped students explore the biological sciences, primarily through summer programs that enable them to participate in ongoing research in the department's life sciences laboratories. O'Day retired recently, but his commitment to students has been commemorated with a new fellowship opportunity.

The Peter O'Day Fellowship in Biological Sciences, which supports research over the summer, provides $5,000 to an undergraduate student and $5,000 to a graduate student mentor. Awarded to four pairs of students each summer, the support provides immersive opportunities for highly motivated undergraduates to perform research in the department's diverse laboratories. Read more about the Summer Program for Undergraduate Research (SPUR) at **spur.uoregon.edu**.