Biology Students Immerse Themselves in Global Health and Development in Ghana

For six weeks this summer, nine UO undergraduates participated in the inaugural offering of Global Health, Development, and Service Learning in Accra, the capital of Ghana. Biology professor Janis Weeks, who has two decades' experience in science capacity-building throughout Africa, developed the program through the UO study-abroad office, Global Education Oregon (GEO). The program was envisioned to address several specific needs at the UO: the increasing student demand for global health courses; the challenge of fitting an international experience into the rigorous course schedules of science majors; and science students’ desire to earn upper-division credits toward their majors while studying abroad. Global Health, Development, and Service Learning in Accra was to be offered initially during fall term 2014, but was cancelled at the last minute because of the Ebola virus outbreak in nearby countries. This turn of events was disappointing, but on the bright side it provided extra time to convene student focus groups and fine-tune the program before its launch. Moving forward, Global Health, Development, and Service Learning in Accra will be offered as a summer session and fall semester option; the fall semester format accommodates participants from other universities and provides a longer experience for UO students.

In Accra, students spent three days a week at their service-learning placements in local hospitals and medical clinics, and two days in classes on global health and development taught by local Ghanaian experts. Professor Weeks was in residence for 10 days to teach a short course on tropical disease in Ghana. The program also included field trips to observe firsthand public health challenges in local communities and visit cultural and historical sites. An afternoon was spent at the Noguchi Memorial Institute for Medical Research, a world-class center for infectious disease research. To provide full immersion in the vibrant culture of Ghana, students lived with host families and used local transport for their daily commutes. Students who attended the program this summer majored in biology, biochemistry, human physiology, or psychology and ranged from sophomores to seniors. Students from other disciplines are encouraged to apply as well.

Through their service-learning placements, students participated in the daily life of Accra’s medical facilities, witnessing malaria, tuberculosis, HIV infection, malnutrition, and other conditions as well as joyous events such as childbirth. Supervisors praised our students’ preparation, commitment, and work ethic and asked that Continued on page 5

Participants heard research presentations and toured labs at the Noguchi Memorial Institute for Medical Research, hosted by Professor Irene Aya (third from left, Professor Weeks is second from left).

“This program was an invaluable experience that allowed me to immerse myself into tropical diseases as well as witness the social effects of disease.”
Kaitlyn LeBlanc, biology major, class of 2017
Greetings from the Department Head

Our recruitment success over the past year has led to the addition of exciting new research programs, and to more progress in modernizing and improving our approaches to biology education.

It is important to explain why we think growth is good. After all, one of the exceptional features of our life sciences research is our unusually small size and collegial atmosphere. We are unique in being so small and yet having such high quality research. For the past 25 years, we have had roughly 35 research faculty all housed within the Department of Biology. In contrast, life sciences faculties at other prominent research universities often number 100 or more, and they are typically housed within multiple departments that have specialized areas of research. Our faculty may be small in number, but they span a wide range of disciplines: ecology, evolution, marine biology, molecular, cell and developmental biology, and neuroscience. Our small size and breadth of disciplines promotes both interdisciplinary research and collegiality—we can’t afford to hire difficult but nevertheless brilliant individuals that could upset the relatively delicate social dynamics, given our small size. Thus we are special in large part because we are small and unified. We maintain a collegial and collaborative research environment, without the inter-departmental/inter-disciplinary politics that are all too common at other research universities. This is a wonderful place to work because of our unique combination of interactive small size and superb quality.

So why are we excited about this growth? Shouldn’t we perhaps worry about endangering our unique qualities with such dramatic growth? I think the answer to the latter question is definitely no! We will still be relatively small compared to most research universities, and we will remain unified within a single department. As a result, it has become more challenging to compete for graduate students, who find the range of options available at larger institutions appealing. Thus we are growing our key areas of strength, and adding exciting new areas of research. We think this growth will generate productive new collaborations, make us more competitive in recruiting and training young scientists, and sustain our rich, collegial research environment. Indeed, our growth is overdue. And as we grow, we will maintain our honored tradition of hiring successful but engaging individuals who want to be part of a unique research community.

We continue to focus on improving the education we provide to our students. This newsletter highlights some of the achievements of our wonderful students, and also features articles on some of the new faculty we have hired. Enjoy reading about them, as we continue to grow and improve!

Bruce Bowerman
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Dynamic Duo!

Kyla Martichuski and Andy Siemens both grew up in Salem, Oregon. They graduated as co-graduates of West Salem High School before enrolling at the University of Oregon to study biology.

Their first course at the UO was General Chemistry with Senior Instructor Deborah Exton, and it didn’t take long for them to make their mark in the classroom: they were two of the three students selected to receive the General Chemistry Achievement Award for their success in the General Chemistry sequence.

During the spring term of her freshman year, Kyla joined a research lab on campus led by Professor Jessica Green to study the microbiome of indoor and outdoor environments. She worked on a variety of projects before deciding to study atmospheric fungal communities at Mount Bachelor for her honors thesis. During her junior year, Kyla was recognized as one of the top undergraduate researchers in the country and was selected as a Barry Goldwater Scholar. Building on her success in the research lab and recognition with the Goldwater scholarship, Kyla applied for and was awarded a Fulbright Scholarship to conduct breast cancer research at the Auckland Cancer Society Research Centre in Auckland, New Zealand, while earning a master’s degree in biomedical science.

Andy joined the Green lab during his junior year at the UO and immediately began working on an honors thesis project studying the impacts of ultraviolet and visible light

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Welcome Nicola and Matt Barber

Nicola Barber’s research career began by looking at genetic diversity in sockeye salmon while spending the summer in her hometown of Victoria, British Columbia. Hooked on research, she spent the next three years at Colgate University applying genetics and cell biology to uncover a connection between nuclear pores and cell-division machinery in budding yeast. The project brought her to the National Cancer Institute in Maryland for six months, where she worked with collaborators and a robot named Rascal to perform high-throughput genetic analyses. She returned to the West Coast for her PhD in molecular cell biology at the University of California at Berkeley. In her graduate work, she demonstrated that conserved kinases orchestrate the timely progression of meiotic chromosome segregation in *C. elegans* using a combination of genetic and cell-biological approaches. A turning point in Nicola's career occurred the first time she stepped to the front of the classroom as a graduate student instructor and discovered her enthusiasm for education.

As a postdoctoral fellow, Nicola applied her biology research expertise toward science education research and curriculum development. At the University of Utah’s Genetic Science Learning Center (GLSC), Nicola led a National Science Foundation funded project to develop and test high school evolution curriculum emphasizing real scientific data and practices. Nicola is particularly interested in how engaging students with data analysis and evidence-based argumentation affects student learning.

She also contributed to the GSLC’s acclaimed Learn.Genetics website, led professional development workshops for teachers, and spearheaded a new outreach program in which she mentored graduate students developing interactive science activities for local K–12 classrooms. At Oregon, Nicola is looking forward to continuing to pursue her long-term goal of cultivating scientific thinking and bringing authentic science and education research to the classroom. In addition to undergraduate teaching, Nicola will join the Science Literacy Program (SLP) to establish a science education research platform and build on the SLP’s excellent evidence-based education work. Nicola is very excited to have landed back in the beautiful Pacific Northwest. She enjoys spending time with family and friends at the ocean, as well as skiing, hiking, and exploring new places.

Matt Barber got his start as a biologist tracking down frogs and turtles in the woods of Maryland before moving to Tokyo at the age of 12. He returned to the US to pursue his bachelor’s degree in molecular biology at Colgate University in upstate New York. As an undergraduate, he spent several months with a National Institutes of Health research group studying nutrient acquisition by malaria parasites, an experience that strongly influenced his decision to become a scientist. Upon graduating, he moved west to begin his PhD at Stanford University, where he identified new biochemical and cellular functions of human histone-modifying enzymes.

During graduate school, Matt became increasingly fascinated by evolution and sought a way to blend molecular and evolutionary biology in his future research. As a postdoctoral researcher at the University of Utah, Matt’s recent work has focused on evolutionary conflicts between bacteria and their primate hosts arising over nutrient iron. Because iron is essential for nearly all life, hosts are able to defend themselves from invasive microbes by sequestering this nutrient within cells or transport proteins. Bacteria, in turn, encode surface receptors and secreted molecules to engage in “iron piracy,” stealing this precious metal from the host. Matt’s work has revealed how rapid evolution of primate iron transport proteins prevents bacteria from accessing this critical resource, and the impact that such molecular “arms races” for nutrients may have on infectious disease in diverse animals.

Matt continues to be excited by various questions at the intersection of molecular evolution and host-microbe biology. How has host protein evolution impacted immune function? How do bacteria evolve and adapt within the host environment? How do interactions between microbes and animals give rise to new biological innovations? At the Institute of Ecology and Evolution, Matt’s group will use a combination of molecular and evolutionary approaches to pursue these and other related questions.

Matt is looking forward to sampling all the hiking, skiing, beaches, wineries, and breweries that Oregon has to offer. He also enjoys spending time with his family and playing with his lively daughter and son.
on the viability of dust in the indoor environment. In addition to conducting research in the Green lab and being a full-time student at the UO during his senior year, Andy dual-enrolled at Lane Community College to earn his basic, advanced, and intermediate emergency medical technician licenses.

Kyla and Andy graduated from the University of Oregon this past spring, again as co-valedictorians with honors in biology and minors in chemistry and business administration. In addition, they were both inducted into the Phi Beta Kappa national honor society and were awarded summa cum laude honors from the UO.

Shortly after graduation, Kyla and Andy—who were high school sweethearts—got married. They look forward to attending a few more football games at Autzen Stadium this fall before moving to Auckland in December. After returning from New Zealand in 2018, Andy hopes to enroll in the MD program at Oregon Health and Science University, and Kyla hopes to earn a PhD from the OHSU Knight Cancer Institute.

Graduate Students
Kimberly Jones and Fern Bosada

**Kimberly Jones**, a Eugene native, completed an associate of arts transfer degree at Lane Community College before receiving a BS in biochemistry from the University of Oregon in 2011. She worked in the lab of Andy Berglund, focusing on the molecular mechanisms of the disease myotonic dystrophy. During the summer of 2010, she participated in the UO Summer Program for Undergraduate Research, which solidified her desire to continue her scientific education. Coming back to the UO for her PhD in biology, she recently finished her third year in the lab of Professor Ken Prehoda.

**Fern Bosada** is originally from Chihuahua, Mexico. She immigrated to the USA, where she completed high school and attended the University of Nevada at Reno, graduating with a BS in biochemistry. At Nevada, her research experience was made possible largely by underrepresented student-supported research programs such as McNair Scholars and the Idea Network of Biomedical Research Excellence Undergraduate Research Opportunity Program. As a PhD student at Oregon in the lab of Associate Professor Kryn Stankunas, she has achieved a deeper understanding of the molecular etiology of congenital heart disease by combining mouse genetics with cell, systems, and molecular biology approaches. Fern recently defended her PhD thesis and will begin a postdoctoral appointment this fall in the lab of Vincent Christoffels at the Academic Medical Center in the Netherlands.

In the winter of 2014, Kimberly completed a rotation in the Stankunas lab, where she worked with Fern to better understand the roles of canonical Wnt signaling in heart valve development. She used a mouse model to assay the consequences of Wnt overactivation in valvulogenesis. This project contributed pertinent information to Fern’s thesis research and has recently been published in Development (Bosada et al., 2016).

Kimberly now works in the Prehoda lab studying the establishment of Par-mediated cell polarity, a highly conserved process essential for animal tissue architecture and stem cell regulation, using a fruit fly model. In particular, she is using genetics to study how atypical protein kinase C (aPKC), the main regulator of this pathway, is controlled in terms of activity and localization. Although she does not currently work with the Wnt pathway, it is interesting to note that components of this pathway do have described roles in regulating polarity.

Outside of the lab, Fern and Kimberly have held leadership positions in the University of Oregon Women in Graduate Science, a student-led organization that strives for gender equality in the sciences through professional development of women at all levels.

These collaborations, both scientific and professional, show how the connection of students in various aspects contributes materially to the graduate school experience fostered here at the UO.
The best advice I received in high school was that I should make the most of my education, at any school I decided to attend. I cannot agree more. My time at the UO has been fantastic, and some of my greatest experiences and challenges came from the Department of Biology.

One course, General Biology II: Organisms (BI 212), pushed me to a new level of what it means to be a student. I became a teaching assistant for the course, and discovered that I love teaching. The BI 212 teaching staff is a community, a group of self-identified nerds who have a really good time together. In the spring of my sophomore year, I was lucky enough to take a course in neotropical ecology and travel to Ecuador for three weeks of field school. This adventure had a really good mix of type one and type two fun—the kind of fun you recognize in the moment, and the kind of fun you can look back on and say, “Now that wasn’t too bad! I sure learned a lot. Wow, I can do anything now.”

Over the course of my junior and senior year, I took phenomenal courses in microbiology, microbial ecology, mycology, forest biology, just to name a few. All the professors invest an incredible amount of time in their classes, and the result is fantastic courses. I have been on field trips and mushroom-foraging trips. I wrote a research proposal and participated in a mock-funding discussion. I could probably plate bacteria in my sleep. Thank you to all of my professors. My time here has been just the best.

Note: Amelia Fitch will be going to Great Britain on a Gates Cambridge Scholarship, one of the most prestigious postgraduate scholarships in the world, and the first-ever to be awarded to a UO student. A double major in biology and environmental science, Amelia will spend a year earning a master’s degree at the University of Cambridge. Her interest is in conservation biology, looking in particular at how land-management practices affect the chemical composition and microbial communities in the soil of tidal wetlands.
New Team Members

Welcome Peter Ralph and Jeffrey McKnight

**Peter Ralph** grew up in coastal Northern California in a family of biologists. Throughout his undergraduate and graduate study in mathematics, probability, and statistics, he has always been interested in understanding what’s going on in the natural world. His first research experiences described vole home range sizes and banana slug movements. Today, he is working again on how organisms move across the landscape, but with more theory and a lot more data. This long-standing interest, along with biology courses and journal clubs, served him well in his transition to the biology departments of the University of California at Davis and the University of Southern California, where he’s been for the last seven years.

Geography plays a strong role in how many species evolve, as it restricts gene flow and presents a diverse array of environmental conditions. Peter is working to bring geography more firmly into population genetics by developing tools for describing geographically sampled data and theory to predict how adaptation and speciation might occur across landscapes. His goal at the moment is to draw a map of how a species moves across a landscape using sequenced genomes, but he also has side projects in phylogenetics, speciation, and exploratory data analysis.

He is looking forward to starting new collaborations in Oregon, and building a research group to describe and explore new models and methods of data analysis.

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**Jeffrey McKnight** grew up on the east coast, where he knew from a very early age that he either wanted to be a professional fisherman or a biochemist. To keep both options open, he did his undergraduate work at Bucknell University, a small liberal arts college on the Susquehanna River in central Pennsylvania. As he spent a majority of his free time working in a molecular virology laboratory and then an organic polymer synthesis laboratory, his science enthusiasm eventually outpaced his desire to reel in fish for a living.

He continued his scientific training as a graduate student at Johns Hopkins University in the lab of Gregory Bowman. There, Jeff developed a passion for basic research and became mildly obsessed with understanding the biochemical mechanisms through which molecular motors known as chromatin remodeling factors facilitate the packaging of DNA. Jeff credits his graduate advisor for instilling an insatiable desire to understand epigenetics and chromatin biology.

To develop computational biology and genomics skills, Jeff then did his postdoctoral work in the laboratory of Toshio Tsukiyama at Fred Hutchinson Cancer Research Center in Seattle. He recently uncovered a previously-unknown global role of a conserved chromatin regulator in driving transcriptional quiescence, which could help explain how some cancers become resistant to conventional chemotherapies. He has also developed a strategy to engineer specific chromatin rearrangements in living systems, a molecular tool that will aid basic chromatin research and could potentially lead to new therapeutic strategies for “correcting” cancerous states.

The McKnight Lab will continue the development, optimization, and implementation of an engineered chromatin remodeling system to probe biological processes. In addition, they will focus on determining how conserved chromatin regulators naturally facilitate chromatin rearrangement in two- and three dimensions to help understand how the same genetic material can give rise to disparate biological outputs under changing environmental conditions. Initial work will combine biochemistry, molecular biology, genetics, genomics, and engineering using budding yeast as a model system. Jeff is excited to begin his independent career at the University of Oregon and is equally thrilled to bring his wife and daughter to Eugene. They look forward to a life of science and salmon!
The syllabus for BI 468, Amphibians and Reptiles of Oregon, should probably mention a required four-day camping trip with no indoor plumbing and 900 miles of driving. But why spoil the surprise? On a sunny afternoon in July, we caravan 200 miles southeast to the Chewaucan River. We stop inside a cottonwood canyon, a campground with water pump, picnic tables, and pit toilets. This is stylish compared to what awaits us.

Morning is overcast. A rutted road leads to our site near Paisley Caves, the oldest documented human occupation in western North America. While clouds pile up over Winter Rim, our group splits. Some search for snakes and lizards on the desert floor, others climb to rocky habitats on the nearby ridge. Two hours later we reconvene to share our finds. There are stubby Desert Horned Lizards with orange and beige backs blending perfectly with pebbly soil. From the rocks came prickly Western Fence Lizards with black backs and true-blue belly patches. Snakes are scarce, but a Northern Pacific Rattlesnake is a live prop for discussing venom, heat sensing, and the place of rattlesnakes in this ecosystem.

Afternoon brings a four-hour drive to Alvord Desert, the driest place in Oregon. We bounce south from Steens Mountain along a washboard road to Mickey Hot Springs. Our campsite is only a flat area near hot pools and hissing steam. In the morning, clouds and a tentative sun accompany us on the short drive to our field site, barely enough warmth for heat-loving lizards. But as we stop, a speedy Western Whiptail darts under a thorny saltbush, escaping down a rodent burrow. Later, we find Long-nosed Leopard Lizards with dark dorsal spots, the females sporting exclamatory orange dots on their flanks. A Great Basin Collared Lizard has three black-then-white-then-black bands encircling her neck, and skin like emery paper. A gentle Pacific Gopher Snake is the star, sliding calmly from hands to shoulders. Even snake-wary students want to touch his dry, shiny skin.

Afterward, our tribe of dusty lizard hunters turns north to Burns for fuel and ice. Our last stop is Glass Buttes, two small mountains of obsidian between Burns and Bend. We camp amid a litter of human-made obsidian chips. Wind is whipping from the west. By morning the rain has caught us. There will be no more lizards or snakes this trip. We head for home, where bathrooms with indoor plumbing await.

Ed. Note: Tom Titus is the instructor for the Amphibians and Reptiles of Oregon.

(Images: top) A beautiful Western Juniper in Eastern Oregon.
(middle) Long-nosed Leopard Lizard.
(bottom) Happy travelers returning from searching for amphibians and reptiles of Oregon.
The Future Starts Now
University of Oregon launches Phil and Penny Knight Campus for Accelerating Scientific Impact

The UO’s Phil and Penny Knight Campus for Accelerating Scientific Impact is an ambitious initiative to fast-track scientific discoveries into innovations that improve quality of life for people in Oregon, the nation, and the world. The Knight Campus will work to reshape the state’s public higher education landscape by training new generations of scientists, engaging in new interdisciplinary research, forging tighter ties with industry and entrepreneurs, and creating new educational opportunities for graduate and undergraduate students.