



Biology

FALL 2018 DEPARTMENT NEWSLETTER





Biology

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Elizabeth Duncan, Assistant Professor
Jakub Famulski, Assistant Professor
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Douglas Harrison, Associate Professor
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Seth Jones, Lecturer
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James Krupa, Professor
Karla Lightfield, Lecturer
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Bruce O'Hara, Professor
Claire O'Quin, Lecturer
Jeffrey Osborn, Professor
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Erin Richard, Lecturer
Edmund Rucker, Scientist IV
Brian Rymond, Professor
Jessica Santollo, Assistant Professor
Robert (Craig) Sargent, Professor
Eve Schneider, Assistant Professor
Ashley Seifert, Assistant Professor
Kausalya Shenoy, Senior Lecturer
Jeramiah Smith, Associate Professor
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Levi Gray, Weisrock Lab
Danielle Herrig, Linnen Lab
Taylor Kessinger, Van Cleve Lab
Jiffin Paulose, Cassone Lab
Jennifer Simkin, Seifert Lab
Vladimir Timoshevskiy, Smith Lab
Oliver Voecking, Famulski Lab

Cover Photo:

Scott Hotaling conducting research in Grand Tetons National Park.

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Stay Connected...

You can keep track of Department events, the Ribble Seminar Series schedule, other alumni events and our contact information via: bio.as.uky.edu

And Keep in Touch!

Please let us know if your address or contact information changes. Send a note, email, or call Jaclyn Gibson, Department Manager Principal.



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Dear Alumni and Friends,

It has been a propitious time to serve as Chair of UK's Biology Department! We are a growing family. We've been able to hire six tenure-track faculty and three lecturers to our family since the 2014–2015 academic year. These superb educators and researchers have

transformed the culture of the Department into a vibrant, intellectually stimulating place, and these young faculty members are creating new knowledge in amazing ways. For example, Dr. Ashley Seifert has discovered a new mouse model for regeneration of skin and cartilage in the African spiny mouse. His studies, funded by the NSF and NIH, have shown a link between the capacity to regenerate tissue and the mouse's immune system. Dr. Jeremy Van Cleve, a theoretical biologist, is exploring the evolution of cooperation and genomic factors that explain sex-specific selection, migration and sociality. Dr. Julie Pendergast is studying the impact of circadian rhythm disruption on mammalian metabolism, showing the effect of our clock on propensity for obesity, and Dr. Jessica Santollo is studying the role of female sex hormones on cardiovascular disease and fluid intake. Other faculty are no slouches, either. Research funding continues to increase in the Department of Biology, even in the face of declining research support nationwide, and publications in the most prestigious of journals, as well as highly regarded books, have increased.

As these accomplishments continue to build, we are equally enthusiastic about the increase in the quantity and quality of our undergraduate and graduate student body. Biology boasts the largest number of majors at UK, nearly 1,600 in 2017, and I would argue these are also of the highest quality. More Biology majors are Honors-eligible than any other major on campus. More Biology graduates attend medical and dental school than any other major, and many of our young charges opt to become scientists themselves, applying for and achieving graduate admissions here and at prestigious universities around the world. The scientific and educational reputation of Biology and of UK is on the rise, and we're proud of it. In addition, the Department is the administrative home for the interdisciplinary degree in Neuroscience, which is rapidly becoming a very popular major. It has already, in the two short years of its existence, become the fourth largest major in the College of Arts & Sciences.

Even so, we are cognizant of the challenges our students face as they transition from high school to the University.

To help retain these students, with the help of funding from the Howard Hughes Medical Institute, we have developed the STEMcats program to provide intellectual community, STEM (science, technology, engineering and mathematics) career guidance and early immersion in hands-on research experience. This program is in its fourth year and is set to sunset in 2019. We hope to continue this program for our students, which we hope to fund, at least in part, from donations and grants.

Successes such as these are important developments for UK, the Commonwealth of Kentucky and our nation. Never has biological thought been so important as it is today. We see many opportunities for biological research to address biomedical and environmental challenges. Biology researchers are working to learn the clues to regenerate new body parts in hopes these clues may provide future medical interventions for individuals who have lost limbs. They are studying the developmental mechanisms that form the human eye. Biologists at UK are learning the ways by which our biological clocks control our sleep, our metabolism and even the bacteria that live in our gut. Understanding the nature of organisms in relation to their environment and in relationship to communities of organisms will be critical for addressing the great challenges of our era, an era of global climate change and increasing human population, which in turn increases urbanization and exposure to new, zoonotic diseases such as AIDS, Ebola, Zika, malaria and others.

To build a biology program like this is a challenge. In spite of our prodigious growth, we are still one of the smallest biology faculty among public, land-grant universities. It is true we address some of these problems with innovative strategies using educational technology and will continue to do so, but it is important to continue to recruit more wonderful scholars to this fine institution, and that takes money. It will be critical to keep these fine faculty here at Kentucky as well, and that takes money, too. In these pages, you will learn about some of the great things we are doing at UK, and I hope you will come visit us to see some of these in person. Give me a call; send me a note. I'd love to hear from you. In the meantime, please read this third edition of our Biology newsletter and learn what we are all about. I encourage you to consider becoming involved in the future of the Department as well. Click here to GiveNow and support Biology. We'd love to hear from you.

Sincerely,

Vincent M. Cassone, Ph.D.

Faculty Achievements

Jakub Famulski's Research May Lead to Treatment for Blinding Disorders

By Jenny Wells



Jakub Famulski, an assistant professor of biology in the University of Kentucky College of Arts and Sciences, has received a grant for over \$1.8 million from the National Institutes of Health to study the early formation of the anterior segment of the eye. The research has the potential to lead to more treatment options for patients with blinding disorders.

The Research Project Grant (R01), "Comprehensive analysis of periocular mesenchyme composition, specification, and function during anterior segment formation," will be funded by the National Eye Institute over the next five years. Famulski and his team will study the anterior segment of the eye (which includes the cornea, iris, ciliary muscle, drainage canals and pupil) which is critical for collecting and projecting light onto the back of the eye. Deficiencies in these tissues are considered anterior segment dysgenesis (ASD) blinding disorders, and the tissues are also a critical regulator of intraocular pressure, a major indicator for glaucoma.

Famulski and his team will use the embryos of zebrafish to study the very early development of these critical visual components.

"Zebrafish eyes follow a highly-conserved path of development with that of humans and are an excellent system for studying early embryonic development of the visual system," Famulski said.

The project will center on three main goals:

- Identify behavior of the anterior segment cells that will give rise to all of the functional tissues. The team will use state-of-the-art molecular techniques, such as CRISPR, in combination with imaging technologies, such as light sheet microscopy, to achieve this goal.
- Assemble a detailed readout of the molecular identity of these early progenitor cells. Gene expression will be compared between various populations of the anterior segment progenitor cells using RNA sequencing technology. This information will be necessary for any future attempts at stem cell therapy in ASD patients.
- Correlate the findings by screening panels of ASD patients for mutations in genes identified in their work with zebrafish. The screening will be done in collaboration with Michael Walter, a professor in the Department of Medical Genetics at the University of Alberta.

"More than 50 percent of ASD cases have no definitive genetic explanation and we hope our work will lower that number in order to give clinicians more treatment or counseling options," Famulski said.

Catherine Linnen Receives NSF CAREER Award to Promote Genetic Research and Teaching

By Jenny Wells



Catherine Linnen, an assistant professor of biology in the University of Kentucky College of Arts and Sciences, is the recipient of the National Science Foundation's (NSF) prestigious Faculty Early Career Development (CAREER) award. The CAREER program is a foundation-wide initiative that offers NSF's most prestigious awards in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization. The program will provide Linnen with \$950,000 annually over five years to conduct research in evolutionary genetics and develop a teaching program to promote scientific research to students and the community. The two projects will be integrated to support the core goals of the grant.

"Being chosen for a CAREER award is perhaps the biggest honor of my academic career," Linnen said. "The funds provided by this award will enable my lab to pursue cutting-edge research on the origins of biodiversity, while developing complementary teaching and outreach activities that will improve outcomes for STEM majors at UK and increase scientific literacy in our students and community. Together, these activities will help me build the foundation for what I hope will be a lifetime of integrating research and teaching."

Linnen's project will examine how adaptation to different environments can generate barriers to reproduction between species, and how this process leads to the buildup of genetic differences across the genome. She will study two closely-related insect species (the redheaded-pine sawfly and the white-pine sawfly) that are adapted to different species of pine trees.

The first teaching/research project will determine whether different pine trees reduce hybridization between the species. Linnen and her team will examine the insects from different pines and identify them with a genetic test they are developing.

"One limitation of one of our research aims is that we will be trapping insects over a limited area and time frame, and hybridization can change in space and time," Linnen said. "To overcome this limitation, we will recruit volunteer citizen scientists to place and monitor traps around town. Then, UK students will formulate hypotheses about factors that might influence hybridization and then run genetic tests to test their hypotheses."

The second research/teaching project builds upon a research aim that will identify the genetic basis of egg-laying strategies that differ between the two insects.

"My lab will perform genetic crosses between the species to find the genes underlying egg-laying differences," Linnen said. "However, because we are looking at only a handful of egg-laying traits, we could miss many other important differences between the species. To overcome this limitation, UK students will have an opportunity to generate their own hypotheses about adaptations to different pines and how they might reduce gene exchange between the two insect species. Then, they will design experiments and collect data to test their hypotheses and identify genes underlying traits that differ."

By addressing critical gaps in the understanding of the genetic basis of species formation, Linnen says this work will deepen our understanding of the world around us and provide essential knowledge for preserving biodiversity and combating pests.

And from a teaching perspective, Linnen says there is a large body of evidence that indicates that participating in authentic scientific research yields many positive outcomes for STEM majors, non-STEM majors and members of the general public.

"And from a research perspective, having students and citizen scientists generate data allows researchers to vastly increase the scope of data collection and make stronger inferences," Linnen said. "Also, I have already learned from firsthand experience that student ideas can lead to exciting new research directions."

Welcoming New Faculty



Elizabeth Duncan

Dr. Elizabeth (Beth) Duncan will be joining the faculty as an assistant professor in August 2018. She is a chromatin biologist interested in uncovering mechanisms underlying tissue and organ regeneration. Beth performed her doctoral studies at The Rockefeller University where she discovered a novel enzymatic activity that regulates chromatin structure during the differentiation of embryonic stem cells. After earning a Ph.D. in biochemistry and chromatin biology, she then became a postdoctoral researcher at the Stowers Institute for Medical Research. There she developed expertise studying planarians, a type of flatworm with an extraordinary capacity to regenerate complex tissues and organs. Beth is now excited to grow her research program at UK; here, she aims to identify new genes and regulatory mechanisms involved in regeneration.

Outside of the laboratory, Beth is an avid runner who enjoys being outdoors. She looks forward to exploring the Bluegrass region with her husband and children.



Eve Schneider

Dr. Eve Schneider will be joining the faculty as an assistant professor in January 2019. She obtained her bachelor's degree in visual arts from Rutgers University. Her interest in neuroscience began while attempting to make a sculpture about the politics of psychiatry when she realized that she needed to know more about how neurotransmitter receptors worked. Going down that rabbit hole resulted in a second major in psychology, followed by a two-year stint as a lab technician in George C. Wagner's lab at Rutgers University. She received her doctorate in psychology and neuroscience at Princeton University, working in the lab of Samuel S.-H. Wang. Her graduate work used electrophysiology and 2-photon microscopy to reveal novel consequences of stress on dendritic excitability in the cerebellum. She also spent a year working in drug discovery at Otsuka Pharmaceutical Company. She then joined the Cellular & Molecular Physiology Department at Yale University School of Medicine as a postdoc working with Slav Bagriantsev and Elena Gracheva. While at Yale, she received an Arnold O. Beckman Postdoctoral fellowship for her work on mechanosensation (touch) receptors in tactile-foraging birds.

Her hobbies include beekeeping, bird watching and surfing, only two of which she will continue in Kentucky.

Undergraduate News

Passion for Science Earns A&S Biology Junior Astronaut Scholarship

By Whitney Hale



A desire to become a physician-scientist has led University of Kentucky biology junior Joshua Preston to not only excel in the classroom and lab, but also garner one of the nation's most coveted STEM scholarships as well as entry into several undergraduate research programs during his college studies.

Preston is UK's most recent recipient of the Astronaut Scholarship from the Astronaut Scholarship Foundation (ASF). He is one of 45 recipients of the prestigious \$10,000 scholarship, which is presented annually to outstanding college students majoring in STEM. Candidates must be nominated by faculty of the participating universities based on their display of initiative, creativity and excellence in their chosen field.

The ASF is a nonprofit organization established by the Mercury Astronauts in 1984. Its goal is to aid the United States in retaining its world leadership in science and technology by providing scholarships for exceptional college students pursuing degrees in these fields. More than 80 astronauts from the Gemini, Apollo, Skylab and Space Shuttle programs have joined in this educational endeavor.

To date ASF has awarded more than \$4 million to more than 400 deserving students around the United States. UK students have earned a total of \$181,000 from the ASF since 1998.

In addition to his Astronaut Scholarship, Preston was also one of 1,350 interns out of a pool of more than 7,500 selected for the National Institutes of Health Summer Internship Program in Biomedical Research in 2017. As

an intern, Preston spent last summer working at the NIH's National Institute on Aging (NIA) side-by-side with some of the leading scientists in the world, in an environment devoted exclusively to biomedical research.

Preston was excited about the opportunity to work in the experimental gerontology lab of Rafael de Cabo. "This fellowship helped me develop my skills as a researcher and allowed me to experience the intensity of NIH research. It also helped me broaden my horizons to research in the field of translational gerontology and helped me network with other scientists outside of UK. Lastly, this experience set me on a trajectory towards becoming a physician-scientist."

This July, Preston will give a presentation on his NIH NIA work at the 14th International Symposium on Neurobiology and Neuroendocrinology of Aging in Bregenz, Austria. The son of Nicholasville residents Cynthia and Dr. David Preston, associate professor of urology at UK and chief of urology at Lexington VA Medical Center, Preston is a 2015 graduate of West Jessamine High School. At UK, the Lewis Honors College member is majoring in biology and minoring in mathematics and history.

Since Preston started at UK, he has been active in undergraduate research working in the lab of Kevin Pearson, an associate professor in the UK College of Medicine.

"The overarching goal of our lab here is to use animal models — and use human models — to basically pinpoint what certain behaviors could be for pregnant women to

Continued on page 8 »

give their offspring the highest chance of having the best health," Preston said.

Preston completed a summer research project in 2016 in the Pearson lab through a summer undergraduate research grant from UK. The study examined the mechanisms of how prenatal nicotine exposure can "program" offspring obesity and diabetes risk in a mouse model. As part of his research, he authored a first-author literature review regarding the developmental origins of health span and life span. Preston will return to the Pearson lab this summer to continue work on some of his projects.

The junior is also a UK Superfund Research Center undergraduate trainee on Project #2: Postnatal Complications of Perinatal Polychlorinated Biphenyl Exposure. He will give a presentation on this research over Spring Break at the Society of Toxicology annual meeting in San Antonio, Texas.

In addition to his work with Pearson, Preston has had the opportunity to shadow Dr. Daniel Reese since high school in the operating room at the Lexington VA Medical Center, which further piqued his interest in pursuing medicine. A love of science started early for Preston and continues

to grow. "Growing up, I was heavily influenced to pursue medicine by my father. The interest I had throughout my childhood to pursue medicine, my shadowing experience and my experience in the lab have all combined to make me want to pursue an MD PhD degree and a career as a physician scientist."

Preston applied for the Astronaut Scholarship through the UK Office of Nationally Competitive Awards, part of the Chellgren Center for Undergraduate Excellence within the Division of Student and Academic Life at UK. The Office of Nationally Competitive Awards assists current UK undergraduate and graduate students and recent alumni in applying for external scholarships and fellowships funded by sources (such as a nongovernment foundation or government agency) outside the university. These major awards honor exceptional students across the nation. Students who are interested in these opportunities are encouraged to begin work with the office's director, Pat Whitlow, well in advance of the scholarship deadline.

Two UK Biology Undergraduates Win First Place at the American Physiological Society, Kentucky Chapter, on April 7, 2018

Poster Presentation Winner: Oscar Istan

Istan, O., Greenhalgh, A., Paneitz, Z., Casto Jr. W., Gilbert, S., Katta, P., Amaya, A., Conrad, G., Criswell, O., Hieneman, S., Middleton, J., Murphy, J., Ordono, C., Roach, H., Thornberry, H., McNabb, M., Byrd L., Cooper, R.L. (2018) The effects of a bacterial endotoxin on sensory perception in a *Drosophila* model. Annual Meeting of the Kentucky Chapter of the American Physiological Society, University of Louisville, Shelbyville Campus, April 7, 2018.

Oral Presentation Winner: Danielle Hawthorne

Hawthorne, D., Grau, E., Kinmon, C., Bradley, A., Cantrell, D., Eversole, S., Grachen, C., Hall, K., Ortiz-Guerrero, P., Patel, B., Samuels, K., Suryadevara, C., Valdes, G., Wycoff, S., Weinbeck, K., Conlin, S., Ray, A., Fleckenstein, L., Piana, E., and Cooper, R.L. (2018). Investigating potential mechanisms of clove oil (eugenol) in model crustaceans. Annual Meeting of the Kentucky Chapter of the American Physiological Society, University of Louisville, Shelbyville Campus, April 7, 2018. (oral presentation).



Oscar Istan, second from left, and Danielle Hawthorne, third from left would like to thank their Biology faculty mentor, Dr. Robin Cooper, for his endless efforts in engaging students in science!

UK's NeuroCATS Excel in Community Outreach

By Stephanie Swarts



The University of Kentucky's NeuroCATS, an undergraduate student organization founded last year, strives to achieve its mission to educate the younger generation about neuroscience through community outreach.

Created with the UK College of Arts and Science's newly established neuroscience program, NeuroCATS provides a place for neuroscience majors and minors to meet, socialize and get involved with the community.

Through a program they created called NeuroKIDS, they visit local schools and share basic neuroscience principles and scientific methods with children. This new six-week after-school initiative for fourth- and fifth-grade students at Veterans Park Elementary School and E7 Kids Café educates young kids about the central nervous system and gets them excited about science. The program allows kids to participate in interactive lectures, engaging experiments, activities and discussions.

"We are currently working on putting together a NeuroKIDS summer camp, as well as trivia and game nights for members," said Meghan Turner, neuroscience senior and founder and president of NeuroCATS. "We are also working on curriculum to take into middle and high schools next year."

Other activities NeuroCATS have put on include the Girls STEM (science, technology, engineering and mathematics) fair at Dunbar High School, Southern Elementary School outreach, Yates Elementary School outreach and "All About Science Night" at Coventry Oak Elementary School.

Meghan Turner, second from left, and other UK neuroscience students talk to children at Veterans Park Elementary in Lexington about the human brain and nervous system.

"These students are having a tremendous impact on young people in Central and Eastern Kentucky by educating them about amazing scientific and career opportunities available to them at UK," said Mark Prendergast, director of UK's neuroscience program and faculty sponsor of NeuroCATS.

In addition to their school programs, members of NeuroCATS collaborated with Loris Sherman, pre-medical advisor at Somerset Community College, to host a lecture on Alzheimer's disease and traumatic brain injuries. The event consisted of a lecture, followed by participation in neurophysiology demonstrations.

"Around 115 students and members of the community attended the lecture, and several whose family members were affected by Alzheimer's disease expressed gratitude for the opportunity to hear about the latest research happening here on our campus," Turner said.

They also created NeuroSTUDY, a free peer-tutoring program offered to all NeuroCATS members. It is held from 3 to 5 p.m. Wednesdays, at the Jacobs Science Building in Room 357. This offers a quiet place to study and ask questions about related courses.

Students interested in becoming a member of NeuroCATS can join through Orgsync using NeuroCATS, email to neurocats.uky@gmail.com or by signing in at a meeting.

Graduate Student Degrees and Awards

Spring 2017

Brandon Franklin, Ph.D.: "Ion Channel Regulation of Critical Cellular Dynamics: Implications on Wound Healing, Regeneration, and Cancer" (Jeffrey Osborn) (Genesis Biotechnology Group, Inc.)

Shreyas Joshi, Ph.D.: "Identification of novel sleep related genes from large scale phenotyping experiments in mice" (Bruce O'Hara) (Yale University)

Summer 2017

Robin Bagley, Ph.D.: "Examining the Role of Host Use on Divergence in the Redheaded Pine Sawfly, *Neodiprion Leconte*, Across Multiple Spatial Scales" (Catherine Linnen) (University of Iowa)

Paul Hime, Ph.D.: "Genomic Perspectives on Amphibian Evolution across Multiple Phylogenetic Scales" (David Weisrock) (University of Kansas)

Scott Hotaling, Ph.D.: "Genetic Perspectives on Biodiversity in Rocky Mountain Alpine Streams" (David Weisrock) (Washington State University)

Justin Kratovil, Ph.D.: "Mitochondrial and Nuclear Patterns of Conflict and Concordance at the Gene, Genome, and Behavioral Scales in *Desmognathus* Salamanders" (David Weisrock) (University of Kentucky)

Fall 2017

Melissa Keinath, Ph.D.: "Characterization of a Large Vertebrate Genome and Homomorphic Sex Chromosomes in the Axolotl, *Ambystoma Mexicanum*" (Jeremiah Smith) (Carnegie Institution for Science)

Spring 2018

Michelle Giedt, Ph.D.: "Jak/Stat Signaling Regulates Gametogenesis and Age-Related Reproductive Maintenance" (Doug Harrison) (University of Iowa)

Graduate Awards

American Heart Association Fellowship

Megan Rhoads
Chelsea Weaver

Arts and Sciences Dean's Graduate Fellowship

Brittany Slabach

Biology Merit Fellowship

Varun Dwaraka
Allyssa Kilanowski

Lyman T. Johnson Fellowship

Cagney Coomer
Kristen LaRue
Katherine Sasser
Kayla Titialii
Megan Weaver

Morgan Graduate Fellowship

Emily Bendall
Rose Marks

Todd Rounsaville, Ph.D.: "Invasion Dynamics of the Exotic Liana Euonymus Fortunei (Turcz.) Hand.-Mazz. (wintercreeper)" (Mary Arthur) (Poly Hill Arboretum, West Tisbury, MA)

Cole Malloy, Ph.D.: "Profiling the Action of Acetylcholine in the *Drosophila Melanogaster* Larval Model: Heart, Behavior, and the Development and Maintenance of Sensorimotor Circuits" (Robin Cooper) (NIH)

Jonathan Moore, Ph.D.: "Sexual Dimorphism in the Moss *Bryum Argenteum* and Its Implications for Sex Ratio Bias" (Nicholas McLetchie) (Campbellsville University)

Schyler Nunziata, Ph.D.: "Using Genomics to Understand Population Demographics in the Context of Amphibian Conservation" (David Weisrock) (University of Maryland)

Yuchen Zhu, Ph.D.: "The Effect of Cold on the Physiology of *Drosophila* Larva Heart and on Synaptic Transmission at Crayfish Neuromuscular Junctions" (Robin Cooper)

Chanung Wang, Ph.D.: "A Comparative Study of Sleep and Circadian Rhythms Between the House Mouse (*Mus musculus*) and African Spiny Mouse (*Acomys cahirinus*)" (Bruce O'Hara) (Washington University School of Medicine)

Outstanding TA Award

Justin Kratovil
Chanung Wang

Gertrude F. Ribble Travel Awards

Nicholas Carrera
Jeff Chalfant
Sepideh Dadkhah
Ren Guerriero
Laura Krueger
Rose Marks
Warlen Piedade
Sruthi Purushothaman
Megan Rhoads
Tim Salzman
Brittany Slabach
John Terbot
Kayla Titialii
Kristyn Van Der Meulen
Chanung Wang
Courtney Waterbury
Chelsea Weaver

The Ribble Endowment's Transformative Impact

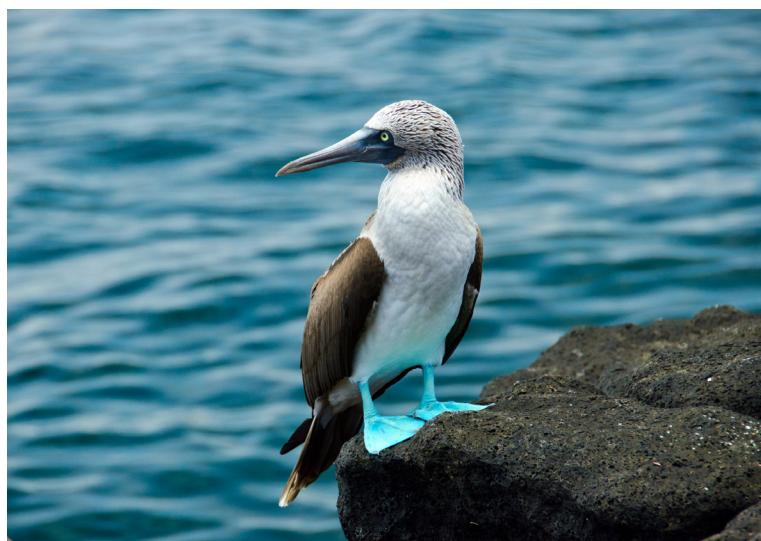
By Dr. Vincent Cassone

The Gertrude Flora Ribble Academic Endowment was established in 1998 at the bequeathal of \$1,137,000 to the University of Kentucky Thomas Hunt Morgan School of Biological Sciences by the Estate of Mrs. Gertrude Flora Ribble, a long-time Lexington resident and UK alumna. Mrs. Ribble was very active in charitable and political organizations throughout her life. She founded the Young Democrat Club of Fayette County, was president of the American Association of University Women, was a member of the Kentucky Historical Society and participated in many more local and national causes. This bequest was matched by the Kentucky Research Challenge Trust Fund, commonly referred to as "Bucks for Brains," which has grown to a more than \$2.4 million endowment.

The Ribble Endowment has transformed the School of Biological Sciences and its successor, the Department of Biology, by impacting University of Kentucky students at all levels of their education. First, the endowment sponsors an excellent seminar series in which eminent scholars from around the world are invited to present their scientific accomplishments to the students, staff and faculty of the Department as well as scholars from across campus and community. Secondly, the endowment provides scholarships to undergraduate and graduate students to conduct original research within the laboratories of faculty in the Department. Thirdly, the endowment provides funds for Biology students to travel for research purposes as well as participation in national and international scientific meetings.

Gifts such as the Gertrude Flora Ribble Academic Endowment make a vibrant academic and intellectual environment that attracts scholars from around the world as students and as faculty. The impact on the Department of Biology, on the College of Arts and Sciences and on UK is incalculable, far beyond the value of the gift itself. Gifts at any level are much appreciated and very valuable.

Evolutionary Ecology in the Galapagos Islands



To increase opportunities for Biology majors to have diverse international experiences, the Department of Biology will be offering a summer course on "Evolutionary Ecology in the Galapagos Islands," taught by Professor James Krupa, starting in the summer of 2019. In collaboration with the College of Biological and Environmental Sciences at the Universidad San Francisco de Quito (USFQ), students will travel to Ecuador and the Galapagos Islands, where they will tread the paths and scale the hills that Charles Darwin explored on his fateful trip on the Beagle in 1832. As did Darwin, students will see the marine and land iguanas, giant tortoises, many different seabirds and, of course, the famous Galapagos finches that were so important in the formation of Darwin's Evolutionary Theory, all while experiencing Ecuadorian culture.

We Appreciate Your Support

The Department of Biology and the College of Arts & Sciences gratefully acknowledges the following alumni and friends whose generosity over the past four years enables the future growth of the Department and strengthens its mission to advance the understanding and appreciation of biology through basic research and education within the Commonwealth and globally.

Biology Development Fund

Mr. Michael Dean Adams
Mr. Shishir Kumar Biswas
Ms. Lisa K. Blackadar
Mr. Benjamin Edward Cloud
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Mr. Luc Arnaud Dunoyer
Ms. Sarah R. Fitzgerald
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Dr. Pat Rucker
Mr. Marc A. Sabin and Dr. Sarah F. Sabin
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Dr. Sarah E. Snell
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Mr. John W. Terbot
Dr. Jeremy Van Cleve
Ms. Julie Vasquez
Dr. Randal Voss and Mrs. Maynie Voss
Mr. Gerald B. Watson
Mrs. Donna Roman Wilson
Mr. David A. Young

Josephine K. & W.D. Funkhouser Scholarship

Josephine K. & W. D. Funkhouser Trust

Biology Axolotl Gift Fund

NeXtGen Biologics, Inc.

Thomas Hunt Morgan Endowment

Dr. Arthur R. Baluyut and Dr. Karen E. Pollok
Dr. William A. Hay, Jr. and Mrs. Jane L. Hay

Giving Opportunities

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- The **Biology Development Fund** provides critical resources to respond to student needs, attract world-class faculty, and provide innovative opportunities to enable our students to compete in the global marketplace.
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Ancient Bloodsuckers:

Jeramiah Smith Gathers Genetic Clues from Sea Lampreys

By Dana Talesnik

Fishermen in the Great Lakes probably wish there were more researchers like Dr. Jeramiah Smith, who studies sea lampreys. These slimy, parasitic little suckers feed on adult fish, wreaking havoc on the lake trout population and often evading control efforts. In some parts of the world, they're a delicacy; elsewhere, a predatory pest. Lampreys also happen to be fascinating fish that offer insights into evolutionary biology, tissue regeneration and maybe even cancer.

Smith, associate professor of biology at the University of Kentucky, has loved going fishing since his childhood days. Growing up in eastern Wyoming and the Black Hills of South Dakota, he spent much of his time outdoors in an area with a rich geological past. Fascinated by the abundance of fossils native to the area, he often dreamt of becoming a paleontologist. These interests in the deep history of life ultimately led Smith to study lampreys, considered living fossils that diverged from the vertebrate lineage 600 million years ago.

"They're important in terms of understanding the evolution of basically everything that makes us vertebrates," said Smith at the National Institute of General Medical Sciences (NIGMS) Director's Early-Career Investigative Lecture recently in Natcher Conference Center. The lecture, part of a series designed to inspire undergrads to pursue careers in biomedical research, was followed by a Q&A chat with NIGMS director Dr. Jon Lorsch.

"Because lampreys share the deep ancestry of the rest of other vertebrates," Smith said, "we can reconstruct changes that have, over time, given rise to our own development."

The species has changed little in its outward appearance over the last 340 million years, yet lampreys have unusual traits that continue to intrigue scientists. For example, the lamprey's mouth opens to form a large, sucking disk with razor-sharp teeth. It has no jawbone and its skeleton is mostly cartilage. But it does have a spinal cord that, if severed, can regenerate itself within several months.

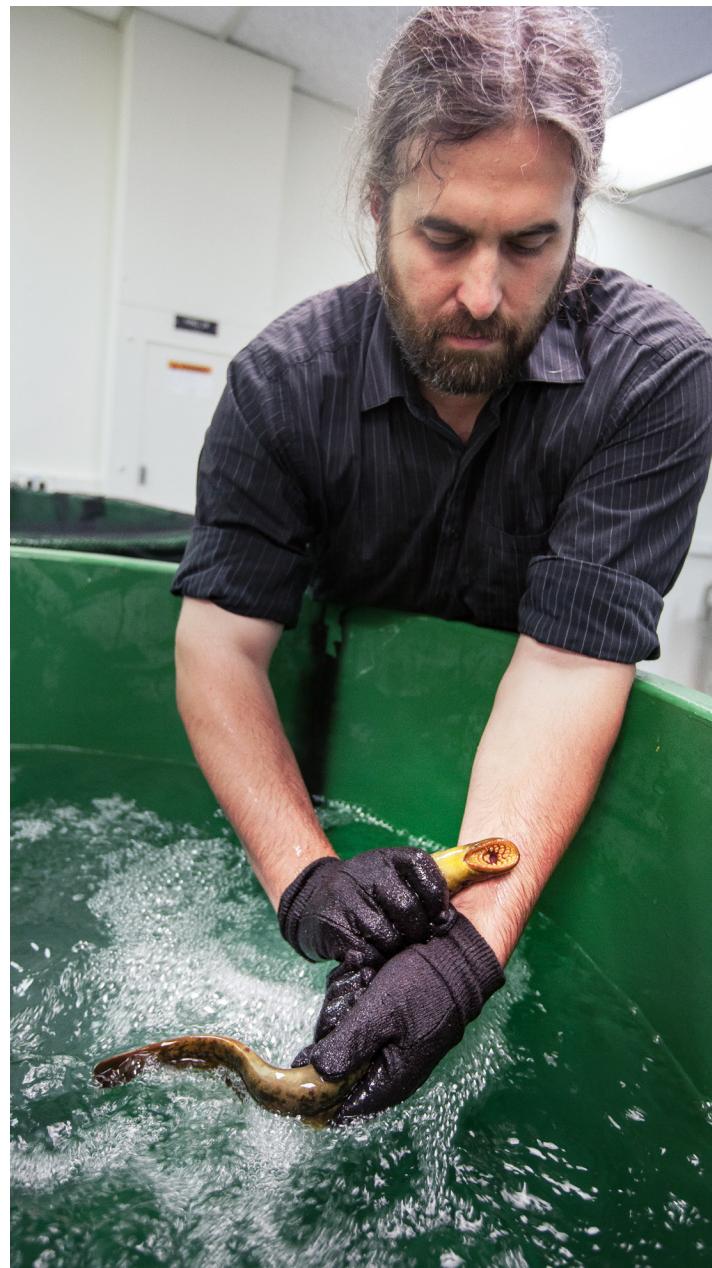
"Lampreys have genes that are homologous to genes we have in our own genome," said Smith. Some of the lamprey's cellular processes, however, such as those that contribute to spinal cord regeneration, may have been lost at some point during the evolution of most vertebrates.

The lamprey also is one of few vertebrate genomes that toss out unwanted genes. By undergoing programmed

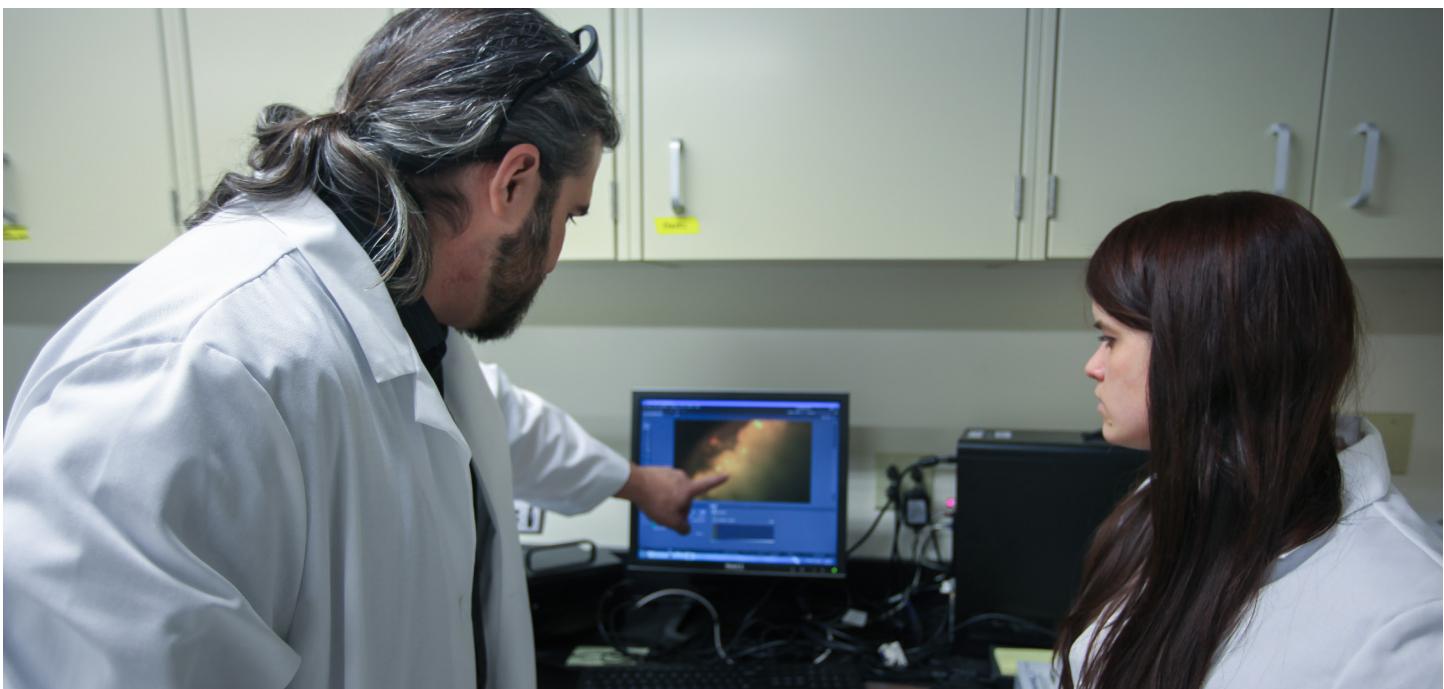
genome rearrangement (PGR), the lamprey discards 20 percent of its DNA while still an embryo.

This begs the question, quipped Smith, "How does the lamprey manage to re-engineer its genome when it's not a scientist?"

He showed a slide of two balls of cells in a petri dish that thrived and developed into his now 6-year-old twin sons.



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"Each one of these cells has the same genome," said Smith. "Each of the cells [in one of the embryos] has exactly the same material as every cell in Jack's body. The amazing thing is: the cells that make [Jack's] hair and his skin and his liver, and the cells that will make my grandchildren, all look very different from one another despite the fact that they share the same genome." That's because these identical cells can turn genes on or off.

Most vertebrates turn off or silence genes chemically but, Smith said, lampreys shut cells off by disposing of them. What's more, the lamprey has two distinct genomes.

When Smith's lab first sequenced the lamprey genome, they found that many genes, normally present in germline cells (eggs and sperm), were absent from its blood. They continued finding genetic sequences that only existed in the lamprey's reproductive cells but not in any other tissue. There was a second, smaller genome found in all other cells of its body. Studies have used the genome to identify genes that enable lampreys to regrow severed spinal cords. Humans also have these genes, but use them differently.

"What we think we're learning from lampreys is that they delete these genes to regulate their function," said Smith. "These genes are kept in the germline genome over evolutionary time—so they must be important for reproduction at some level—but they're not allowed to be in most of the cell types, so perhaps they're dangerous and that's the way the lamprey regulates these genes."

It's known that turning on certain silenced genes can contribute to development of cancer. Studies are ongoing to determine whether the lamprey disposes of certain genes to protect itself from this disease.

In one experiment, DNA should have been migrating with the rest of the genome during normal cell division, but instead lagged behind and formed structures that are not typically seen in healthy cells. Thanks to 3-D imaging, Smith's lab could see that, during PGR, as the lamprey shed genes over several cell divisions, in the 7th division there was abnormal material characteristic of aggressive cancer cell types.

"Over evolutionary time, lampreys have done more experiments than us and maybe know a little more about the genes that contribute to the development of cancer," said Smith.

Sequencing lamprey genomes is tough in part because there's repetition in many places, said Smith. Using Cas-9 gene editing, his lab can knock out specific genes to learn more about their role in the lamprey's DNA elimination process and other notable characteristics.

"If an experiment doesn't go as expected, don't get discouraged," Smith told a college student asking for career advice. "See what else it's telling you. In many ways, we move forward from seeing the unexpected."

The student was among 20 undergraduates from Morgan State University in Baltimore who attended as part of the NIGMS-sponsored ASCEND Center for Biomedical Research. The program promotes diversity and entrepreneurship among young scholars.

Smith concluded, "I hope I've given you some sense of the importance of funding basic research that's not necessarily disease focused, but which helps us understand general principles that underlie disease."

Reprinted with permission from NIH Record, June 29, 2018

Alumni Spotlight:

Owens Family Traditions: Biology, Optometry and Basketball

By Julie Wrinn

Fulton City High School's 1972 yearbook shows a photograph of Mr. Milner's Advanced Biology students dissecting a shark. One of those students was Mark Owens (Biology '76), and he loved his biology labs: "We had sharks and cats and worked on all kinds of stuff in the laboratory. I thought it was fascinating, the things that we did."

Thanks to Mr. Milner's engaging labs, by the time Mark was in 11th grade he knew he wanted to follow in his father's footsteps into optometry. He saw the comfortable living his dad made in Fulton City, a small town near the southwestern Kentucky-Tennessee border, and he greatly enjoyed his biology classes with Mr. Milner. Dr. Shelton Owens was a WWII veteran who attended Murray State University on the G.I. Bill and went to the Illinois College of Optometry in Chicago. He played basketball for Brewers High School in Marshall County and played in the state tournament in 1944. That love of basketball led Dr. Owens to bring his children to Lexington on a regular basis to watch its heralded men's basketball team, and Mark especially remembers watching Dan Issel play.

From those experiences, Mark Owens' path became clear: he would attend UK, major in biology, and become an optometrist. He knows such clarity is rare today: "I ask patients all the time, young people, what they want to do, and most of them don't have a clue. Of course today there are a lot more choices than there were in 1972."

Owens' particular enjoyment of lab work steered him into biology as a major, though he believes that a strong background in physics, optics, and math are also crucial, especially math. "Math in my opinion is the basis of everything as far science goes. If you can understand math you can pretty well get through anything and understand what they're talking about," he said.

At UK, Owens found a new favorite biology teacher, Dr. Bob Keane, whose limnology (freshwater biology) course was a memorable experience. It was a different era, as Owens reminisced: "On Fridays he would have us all over to his house. It was a 500-level class, and we had only about 8 to 10 people taking it." Among these advanced students, Owens remembers the satisfaction of Prof. Keane treating them more like peers than students. "Not only did you learn a lot, but you were treated with respect by the professor. It was like, 'you do happen to know something, so let's enjoy the study of this together,'" he said.

After optometry school in Memphis, Owens returned to Fulton and entered a profession on the cusp of dramatic change. His father had begun practicing in 1951, and Owen began in 1980. "At the time we couldn't write prescriptions for drugs, couldn't treat glaucoma, couldn't do the things that we take for granted today," he said. Prescribing privileges and surgical procedures formerly reserved for ophthalmologists were gradually opened to optometrists. First came the ability to administer drugs for diagnostic use in the late 1970s. Next came privileges for prescribing antibiotics to treat diseases of the eye. Next came laser surgery privileges.

Kentucky was at the forefront of these changes. With its rural populations in the eastern and far western regions of the state, there weren't enough ophthalmologists to meet the needs of patients in those regions, and legislators responded. Today, Kentucky is one of only three states, along with Oklahoma and Louisiana, that permits optometrists to perform laser surgery. Owens observed, "In my examination room today there are only a couple things that my father had at the end of his career. Everything is totally different from that era. Phoropters, computers, retinal cameras that flash up on the computer. There's been tremendous change."

Owens' patients never have to wonder where his loyalties lie. "I wear blue scrubs with UK on them every day to the office. I have a wildcat on my back. It's big time Kentucky around here," he said. His waiting room has a stuffed animal Wildcat with Kentucky basketball and football schedules in its paw. After years of attending athletics fundraisers that included golf tournaments hosted first by Rick Pitino and then by Tubby Smith, it dawned on Owens and his wife, Theresa (E.D. '76), that their charitable dollars could be directed towards the primary mission of the school.

"We've got to have an education first. It's not for the basketball team, which I love. But the reason we're there is to teach and to learn," he said. At various social events in nearby Paducah they began hearing about the UK Fellows Society, which recognizes donors who are helping the university advance its mission, and decided to commit. The UK family traditions are being carried on by the Owens' children, John (B.B.A. '07 in Business, M.B.A. '11) and Emily (B.S. '07 in Communications). "I couldn't have asked for a better education for myself and my wife and my children. Very, very happy with what we got at UK, and we still love to come there," Owens said. "The campus is 100 percent changed from when I lived in Haggin Hall years ago, and we're proud of that. We want it to be and continue to be the best university in the state and among the best in the country, as far as we're concerned. My profession's been great to my family for nearly 70 years now. And it all started with training that I got in Lexington."



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Upcoming Events

Gertrude Flora Ribble Seminar Series

This series features distinguished scholars covering a range of topics in biology as well as perspectives on pedagogy and outreach, especially those reflecting the particular interests of our faculty, students, and postdocs. The seminars are held Thursdays at 3:30 p.m. throughout the fall and spring semesters. For more information visit: <https://bio.as.uky.edu/seminars-events>.

10th Annual Thomas Hunt Morgan Lecture Series: September 4–5, 2018

The 10th Annual Thomas Hunt Morgan Lecturer will be Dr. Marianne Bronner. Dr. Bronner is a developmental biologist who serves as an Albert Billings Ruddock Professor of Biology at the California Institute of Technology and directs her own lab there called Bronner Laboratory. She has made great contributions to the field with her research on the neural crest, studying the cellular events behind the migration, differentiation, and formation of neural crest cells. Dr. Bronner will give two talks:

- Public Talk: "Riding the Crest: Stem Cells on the Move," Tuesday, September 4, 5:30 p.m., Jacobs Science Building, Room 321
- Scientific Lecture: "Gene Regulatory Interactions During Neural Crest Development and Evolution," Wednesday, September 5, 3:00 p.m., Thomas Hunt Morgan Building, Room 107

College of Arts & Sciences Hall of Fame Induction Ceremony

Congratulations to Biology Emeritus Professor Dr. Sheldon M. Steiner (Microbiology M.S. '64, Ph.D. '67), who will be inducted in the College of Arts & Sciences Hall of Fame on Friday, October 19, 2018.