Biological Sciences

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We welcome comments and items of interest for future newsletters. Please contact Valerie Sutherland (vsutherl@vt.edu) via email, or write to us at the Department of Biological Sciences, Mail Code 0406, Virginia Tech, Blacksburg, VA 24061.

A note from the department head

Welcome to the Biological Sciences newsletter for fall/winter 2017! We've have a great start to the academic year, with our largest entering class ever (468 freshmen and 52 transfer students) joining the undergraduate degree programs in Biological Sciences and in Microbiology. Our graduate program is also growing, with 83 Ph.D. students and 15 M.S. students enrolled in Biological Sciences, and another 13 Ph.D. students in interdisciplinary degree programs. Fortunately, we welcomed four new members to our faculty this fall, in the areas of bioinformatics, disease ecology, and evolution. You'll read about these and others in this newsletter, including Professor Emeritus **Khidir Hilu** and long-time graduate coordinator, **Sue Rasmussen** (page 8), who both recently retired after more than three decades with our department!

The department has continued its emphasis on preparing students for life after college. As you will read on pages 6-7, our alumni do all kinds of wonderful things with their degrees. We launched a new Biomedical Option last fall to help undergraduates better prepare for careers in the health professions and/or biomedical research, with 181 students already enrolled; an option in Ecology, Evolution, and Behavior is being readied for Fall 2018. In a similar vein, we are partnering with Career Services in our First Year Experience and Careers in Biological Sciences courses. The Careers course, launched with the help of our Alumni Advisory Board last year, is helping students to explore the many doors that open to them with a B.S. in Biological Sciences, through visits with alumni and other guests, as well as exploring their strengths with MyPlan, polishing their resumes, participating in a career fair, and learning how to excel at interviewing. The photo below shows students practicing their handshakes and "elevator speeches" with each other during a recent class.

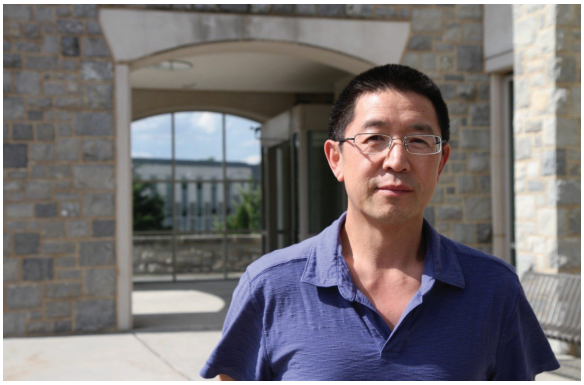
"How can I help?," you may ask. Last year over 40% of our graduates said their main regret was not having more experience related to their major or career goals. Our Alumni Advisory Board is focusing their efforts on internships. You can help the board to identify new opportunities for our students so they can experience first-hand what life is like post-graduation, while offering companies/programs a unique mechanism for finding Hokies who are a great fit for them. If you know of opportunities that are not yet on listed on Career Service's Internship Central site or on Hokies4Hire, please let us know and we'll get them on the radar!

As always, thank you for staying in touch with your Hokie Home Department. Please do send us your news items, large and small, so that we can continue to share in the lives of our 11,000+ current alumni, all of whom make us very proud!

Brenda S.J. Winkel
Professor and Department Head

Enzyme may help bacteria become craftier and more dangerous

By Cassandra Hockman, Communications Coordinator, Fralin Life Science Institute



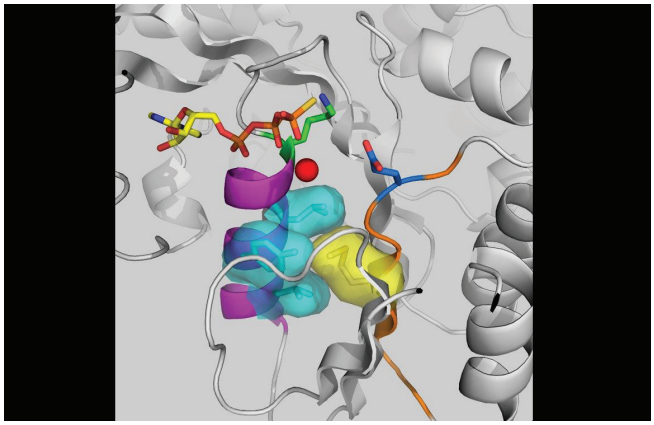
Virginia Tech researchers have discovered a new role for an enzyme that is well known for fueling chemical reactions in bacterial cells. The enzyme, an ATPase known as PilB, is part of a biological chain reaction that allows bacteria to respond to changes in the environment.

The finding, published in Scientific Reports, will help scientists better understand how dangerous bacteria, such as pathogenic *E. coli* and *Pseudomonas*, create biofilms to colonize the human body and medical implants, including pacemakers. Bacteria in biofilms can make infections hard to treat, resulting in serious medical problems.

It was previously known that PilB is used to break down adenosine triphosphate, or ATP, a small energy-storing molecule. But now, researchers know that it can help bacteria process information as well, such as how to respond to changes in their environment.

"There is a hidden way for cells to do things that we didn't know before," said **Zhaomin Yang**, an associate professor of microbiology, Fralin Life Science Institute affiliate, and lead author on the paper. "This is an alternative way signals can be processed, much like cell phones process and transmit signals differently from landlines."

Yang and his colleagues made the discovery while studying how myxobacteria form biofilms. These bacteria, which are commonly found in the environment, colonize by secreting a sticky, glue-like substance that allows them to spread on moist solid surfaces to look for nutrients. Likewise, pathogenic bacteria form biofilms in nutrient-rich environments, such as the human body. In both of these situations, bacteria use environmental signals – the presence or absence of nutrients – to determine whether to produce this matrix material for biofilms.



An amplified image of the binding site of ATP on PilB that is critical for signaling. The colored orange, red, and yellow stick-like figure on the top left is ATP, and the rest are part of the PilB ATPase protein. Alteration of the colored parts of the protein can affect ATP binding and signaling. Courtesy of Zhaomin Yang.

In this study, the myxobacterium *Myxococcus xanthus* was found to regulate biofilm formation and bacterial movement through the PilB ATPase enzyme, which was already known to be essential for bacterial movement on surfaces.

"The surprising finding here that an ATPase can function as a signaling protein will likely impact biological and biomedical research in profound ways," Yang said. "There are typically dozens if not hundreds of ATPases in a given organism. It is exciting to envision the prospect of these enzymes forming the wiring of signal processing networks in a cell, from bacteria to animals."

Scientists have known that ATPase enzymes harvest energy from ATP in order to fuel such processes as movement of a cell or organisms, explained Yang, but prior to this discovery, little was known about whether they could directly function as signaling proteins in biological systems. Other proteins, called G proteins, have been the ones known to play this role.

"Before now, ATPases were thought to provide energy for various reactions in the cell," Yang said. "This could be the beginning of uncovering many new ways cells manage signals, significantly broadening the spectrum of how cells process and respond to signals."

In addition to Yang, other members of the research team include **Wesley Black**, a postdoctoral associate in microbiology; **Lingling Wang**, a visiting scientist from China; and **Birgit Scharf** and **Florian Schubot**, both associate professors of biological sciences in the College of Science and affiliates of the Fralin Life Science Institute, like Yang.

The research was supported in part by the American Heart Association, the National Institutes of Health, and the National Science Foundation.

Scientists funded by NSF develop model to explore scenarios for land, watershed restoration

By Cassandra Hockman, Communications Coordinator, Fralin Life Sciences Institute

Bryan Brown, an expert in aquatic and community ecology, inspects a female crayfish carrying eggs at Sinking Creek in Newport, Virginia.

Aquatic invertebrates found in mountain streams — crayfish, stoneflies and mayflies, among others — are important to ecosystems because they are part of the natural food web and are often used by state agencies as indicators of freshwater health.

Soon, land managers will be able to track the behaviors of these invertebrates using a computer model developed by a research team that includes a Virginia Tech aquatic ecologist.

The model, supported by a National Science Foundation grant, will simulate different possible natural responses to environmental changes by considering the location and shape of a river network and the types and behavior of invertebrate species within it. Land managers will then be able to use it when deciding how to restore watersheds after a disturbance, such as a flood.

"We're thinking about this in terms of river networks, but the model would really apply to any set of populations or communities on the landscape," said **Bryan Brown**, an associate professor of biological sciences in the College of Science and a Global Change Center at Virginia Tech affiliate. "What we envision is for land managers to plug in their scenarios and tweak the parameters so the model responds like nature."

To develop the model, the team will first perform a large-scale analysis of past research that explores how communities of freshwater invertebrates change and disperse over time around rivers and streams. These aquatic communities are made of different species, each with their own distinct life cycles and movement patterns that tie them to the landscape. Mayflies, for example, begin life in headwater streams where they live as larvae for up to two years in stream-bottom sediment. During this stage of their life cycle, they feed on algae and move downstream by drifting. Once larvae complete metamorphoses, the winged adults fly back upstream to lay eggs.

Community park along Sinking Creek in Newport

These movement patterns are affected by the shapes of rivers and tributaries within watersheds, connections between forest fragments, and environmental conditions, such as prevailing winds. Taken together, these invertebrate movements and landscape conditions will be used to create models or "networks" to predict how ecological systems respond to human and natural disturbances. The model will also be used to identify what areas may be most sensitive to those disturbances.

Beginning in the spring, Brown will lead a series of field experiments at the Coweeta Long-Term Ecological Research site in Franklin, North Carolina. There, he and lab members, including new biology Ph.D. student and Interfaces of Global Change Fellow Sara Cathey, will set up artificial streams to compare invertebrate abundance in headwaters to larger intermediate zones. In the process, they will induce natural disturbances to see how invertebrates respond and in what locations the species communities are the most stable.

In a study published in July, Brown and collaborator Chris Swan at the University of Maryland found that the most effective areas to restore are the headwaters, likely because these are isolated sections of watersheds. Although these areas tend to be the most vulnerable to environmental change, they are more likely to sustain stable communities when restored compared to intermediate zones – larger streams that have more well-connected populations of species. The Coweeta field experiments and initial meta-analysis will then be merged and computerized, making one "grand synthetic model," said Brown.

Along with three collaborators, including Virginia Tech alumnus **Eric Sokol**, now at the University of Colorado-Boulder, Brown will simulate networks of hundreds of species communities continuously. The computer model will then allow users to explore possible scenarios based on different watershed shapes, organism types, and novel disturbances that cannot be studied with current research. Users will also be able to consider different parameters, such as temperature and rainfall.

"Understanding how things are responding in different areas or how different shapes of networks respond to different sorts of disturbances, such as increased precipitation, also helps us get a handle as climate starts to fluctuate more and more," Brown said. "Hopefully this [model] can help us predict what areas are going to be more sensitive than others as the climate changes."

The project is funded for $765,000 over three years by NSF's Division of Environmental Biology.

Selected New Grants

Resilient Water Systems: Integrating Environmental Sensor Networks and Real-Time Forecasting to Adaptively Manage Drinking Water Quality and Build Social Trust (National Science Foundation, 2 years, $999,998)
Principal Investigator: **Cayelan Carey** (Assistant Professor of Biological Sciences); Co-PI's: Renato Figueiredo (U. of Florida), Madeline Schreiber (VT GEOS), Michael Sorice (VT FREC), Quinn Thomas (VT FREC)

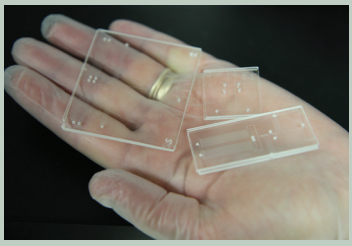
The freshwater lakes and reservoirs that provide the majority of Americans with their drinking water face increasing threats to water quality. Nutrient pollution, contaminants, and land use change can lead to low oxygen concentrations and algal blooms, which can result in elevated metal concentrations, fish and bird kills, thick algal scums, noxious odors, and overall toxic water unsafe for drinking. These adverse outcomes may be prevented if drinking water managers have the information needed to act preemptively. To increase the resilience of water supplies, this project will develop a smart water system that integrates smart and connected (S&C) technology and adaptive management to ensure safe drinking water for communities.

A macrosystems science training program: developing undergraduates' simulation modeling, distributed computing, and collaborative skills (National Science Foundation, 2 years, $299,992)
Principal Investigator: Cayelan Carey (Assistant Professor of Biological Sciences)

Ecologists are increasingly using computer models, involving extensive observations obtained through environmental sensor networks, to study lakes and forests and predict future change. Conducting this modeling, as well as understanding the model results, requires skills in data analysis, quantitative reasoning, and computing. However, modeling and computational skills are rarely taught in undergraduate classrooms, representing a major gap in training students to tackle complex environmental challenges. This project will develop a training program that teaches thousands of students across the U.S. the foundations of macrosystems ecology through simulation modeling.

Determining survival strategies for multiple bat species affected by white-nose syndrome (US Fish and Wildlife Service, 2 years, $177,318)
Principal Investigator: **Kate Langwig** (Assistant Professor of Biological Sciences) Co-PI's: Jeffrey Foster (UNH), Joseph Hoyt (Research Associate, VT Biological Sciences), A. Marm Kilpatrick (UC Santa Cruz)

White-nose syndrome, which is caused by the fungal pathogen, *Pseudogymnoascus destructans*, was first detected in a cave in upstate New York in 2006. It has since caused severe mortality in bat populations across eastern North America. Dr. Langwig's research on the disease is primarily focused on investigating factors that influence transmission and spread of this novel pathogen.



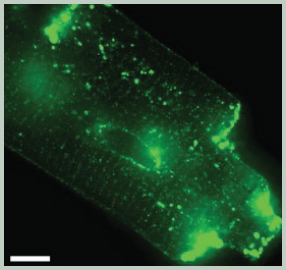
Microfluidic chip for the analysis of cell-surface proteins (National Institutes of Health, 5 years, $1,791,764)
Principal Investigator: **Iulia Lazar** (Associate Professor of Biological Sciences) Co-PI: **Konark Mukherjee** (Assistant Professor of Biological Sciences/VTCRI)

Biomedical research is in need of low-cost, user-friendly instrumentation that will enable rapid explorations of complex biological systems. The objective of this study is to develop a microfluidic platform that will provide novel capabilities for the analysis of cell-surface protein receptors. The study is highly significant because the device will advance the analysis and understanding of signaling processes in cells, to further facilitate the identification of novel drug targets and antigen biomarkers.

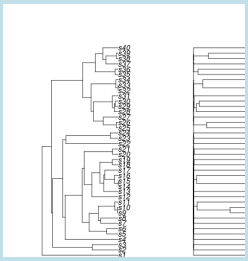
Molecular basis for the reciprocal regulation of *P. aeruginosa* virulence (National Institutes of Health, 2 years, $225,333)
Principal Investigator: **Florian Schubot** (Associate Professor of Biological Sciences)

The bacterium *Pseudomonas aeruginosa* is a major cause of hospital-associated infections and the leading cause of death for people with cystic fibrosis. The signaling kinase RetS is a key facilitator of *P. aeruginosa* infections. The project aims to determine how RetS controls the production of many difference virulence mechanisms to facilitate the development of new therapeutic options for the treatment of *P. aeruginosa*-associated infections.

Translation initiation in cardiac intercellular communication and stress-induced remodeling (National Institutes of Health, 5 years, $1,973,324)
Principal Investigator: James Smyth (Assistant Professor of Biological Sciences/VTCRI); Co-PI's: Robert Gourdie (VTCRI) and Steven Poelzing (VTCRI)



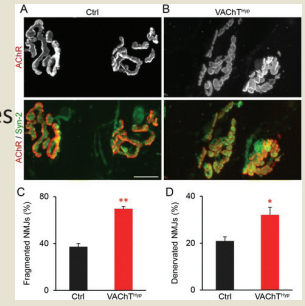
Cardiovascular disease remains the leading cause of death in the United States, yet the cellular mechanisms underlying the electrical defects leading to arrhythmias of sudden cardiac death remain elusive. The Smyth Lab has identified a mechanism by which the very proteins which connect each heart cell are synthesized differently during stress. This new research will generate the fundamental knowledge necessary to harness the protein synthesis machinery and protect diseased hearts from pathological changes in how heart cells communicate.



Collaborative Research: ABI Innovations: Enabling machine-actionable semantics for comparative analyses of trait evolution
(National Science Foundation, 3 years, $172,356)
Principal Investigator: **Josef Uyeda** (Assistant Professor of Biological Sciences)

The treasure trove of morphological data published in the literature holds one of the keys to understanding the biodiversity of phenotypes, but exploiting the data in full through modern computational data science analytics remains severely hampered by the steep barriers to connecting the data with the accumulated body of morphological knowledge in a form that machines can readily act on. This project aims to address this barrier by creating a centralized computational infrastructure that affords comparative analysis tools the ability to compute with morphological knowledge through scalable online application programming interfaces (APIs), enabling developers of comparative analysis tools, and therefore their users, to tap into machine reasoning-powered capabilities and data with machine-actionable semantics.

Dysregulated cholinergic transmission contributes to aging of the lower motor system (National Institutes of Health, 5 years, $1,650,250)
Principal Investigator: **Greg Valdez** (Assistant Professor of Biological Sciences/VTCRI)



The loss of motor function that occurs with aging is closely associated with adverse health outcomes and to date the contribution of different components of the motor system to age- related motor deficits remain unknown. The purpose of this proposal is to identify the contribution dysregulated cholinergic transmission to aging of the neuromuscular system and test factors that function to maintain healthy skeletal muscles and motor neurons in the spinal cord. If successful, this research could provide novel leads for slowing and preventing muscle wasting that occurs in a variety of conditions, including ALS, during normal aging, Cachexia and muscular dystrophy.

Targeting the fibroblast growth factor binding protein-1 to slow generation of neuromuscular junctions (National Institutes of Health, 1 year, $330,050)
Principal Investigator: **Greg Valdez** (Assistant Professor of Biological Sciences/VTCRI)

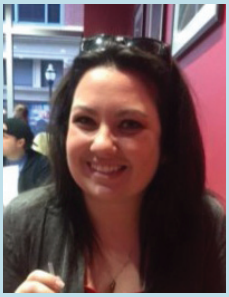
Age and disease related motor deficits have proven to be quite costly in terms of quality of life and the resources required for medical care. The discovery of protective muscle- derived factors could form the basis to slow degeneration of muscles and their NMJs, and thus preserve and restore motor function during aging. Such factors may play a similar function in brain synapses during normal aging and progression of age-related brain disorders, including Alzheimer's disease.

Alumni Spotlights

Phi Vu received a B.S. in Biology from VT in 2004, an M.S. in Microbiology and Immunology from Georgetown University in 2005, and a J.D. from the University of Maryland School of Law in 2015. He is currently the Director of Diagnostics and Personalized Medicine Policy for the Biotechnology Innovation Organization (BIO) in Washington, DC. At BIO, "he promotes a policy environment that encourages innovation of new medical products and tools that advance personalized medicine. He also supports biodefense and infectious disease policy issues" for the organization.

Aimee Hollander received a B.S. in Biological Sciences from Virginia Tech in 2005 and a Ph.D. in Molecular Microbial Pathogenesis from the VCU School of Medicine in 2011. She is currently an Assistant Professor of Biological Sciences at Nicholls State University in Thibodaux, Louisiana. On her faculty website , she lists the following research interests: STEM Education, Active Learning, Evaluation, STEM Outreach, Educational Technology Utilization, Microbial Pathogenesis, and Host/Pathogen Interactions.

Daniel Hallinger received a B.S. in Biological Sciences from Virginia Tech in 2008, and an M.S. in Biology from William and Mary in 2010. He is currently employed as a biologist at the EPA's National Health and Environmental Effects Research Lab (NHEERL) located in Research Triangle Park/ Durham, NC. More specifically, he conducts research in the Endocrine Toxicology Branch in the Toxicity Assessment Division of the NHEERL. An example of his research is this recent publication in *Toxicology in Vitro*: "Development of a screening approach to detect thyroid disrupting chemicals that inhibit the human sodium iodide symporter (NIS)."



Samantha Fenn received a B.S. in Biological Sciences from Virginia Tech in 2014 . While at VT, she participated in the Scieneering program and conducted undergraduate research in the Williams Lab in the Department of Horticulture. She is currently a Biologist for the Biodefense and Emerging Infections (BEI) Research Resources Repository at ATCC in Manassas, VA and a graduate student in the Virginia Tech Masters of Public Administration program, with a concentration in Homeland Security.

Lance Grenevicki received a B.S. in Biology from Virginia Tech in 1989, a D.D.S. from the Medical College of Virginia in 1993, and an M.D. from the University of Missouri-Kansas City in 1997. He dedicated his studies to the head and neck region, with an emphasis on correcting facial deformities. Dr. Grenevicki has operated a solo oral and maxillofacial practice in Melbourne, Florida, since 1999, and is currently the Chief of Staff at Wuesthoff Medical Center-Melbourne.

Tifany Lewis (Felton) received a B.S. in Biology from Virginia Tech in 2002, and an M.S. in Human Genetics from Sarah Lawrence College in 2004. She is currently employed for Virginia Oncology Associates in Hampton Roads, Virginia, as a genetic counselor, working with individuals and their family members who are at risk for hereditary cancer syndromes. Ms. Lewis recently said, "My role as a genetic counselor affords me the opportunity to empower patients with information to make informed decisions regarding genetic testing. Genetic testing is personalized medicine. It was during my sophomore year at VT that I initially learned of genetic counseling as a career choice. During an ecology course, believe it or not, my professor randomly started to discuss the field of genetic counseling. It was his brief mention of the topic that started me down the path of pursuing a master's degree in human genetics. Talk about being in the right place at the right time!"

We love hearing from our alumni! Drop a note to vsutherl@vt.edu to let us know about your time at Virginia Tech, and about what you're doing now!

L to R: Trevor Glaros, Cory Bernhards, Casey Bernhards

There are a number of Virginia Tech graduates currently working at the U.S. Army Edgewood Chemical Biological Center (ECBC) located at Aberdeen Proving Ground, Maryland, including three former members of the Biological Sciences Department: Drs. **Trevor Glaros**, **Cory Bernhards**, and **Casey Bernhards**. ECBC is the United States' primary research and development resource for non-medical chemical and biological defense and is currently celebrating its 100th year anniversary. ECBC couples research and science with engineering and field operations to create new and effective chemical and biological defense solutions. Research focuses include detection, decontamination, protection, and forensics. Trevor, Cory, and Casey are members of the BioSciences Division at ECBC which is part of the Research and Technology Directorate. They utilize the skills and knowledge acquired during their time in the Virginia Tech Biological Sciences Department to help protect the war fighter, nation, and world from chemical and biological threats.

Trevor Glaros graduated from Virginia Tech in 2011 with a Ph.D. in Biological Sciences. Dr. Glaros performed his graduate studies in the lab of **Dr. Liwu Li** where he worked on innate immune cell signaling pathways for inflammatory diseases. Dr. Glaros is now a Principal Investigator (PI) and Director of the Mass Spectrometry Facility at ECBC. He performs a variety of independent research programs and supports multiple investigators throughout the institute. His research interests include biomarker discovery and forensics. The Glaros Lab is supported by the Defense Threat Reduction Agency (DTRA) with more than $5 million in programing over the last three years. He can be contacted at tglaros@vt.edu.

Cory Bernhards received his B.S. degree in Biological Sciences at Virginia Tech in 2007, and remained at Virginia Tech to receive his Ph.D. in Biological Sciences in 2013. He worked in the lab of **Dr. Florian Schubot** studying the proteins that regulate the type III secretion system in *Pseudomonas aeruginosa*. Dr. Bernhards now works as a PI Research Microbiologist at ECBC. His research efforts focus on rapid, field-deployable detection of biothreat agents including detection via isothermal amplification and nanopore sequencing. He recently discovered a way to rapidly detect biothreat agent *Burkholderia pseudomallei* from soil. He can be reached at coryb34@vt.edu.

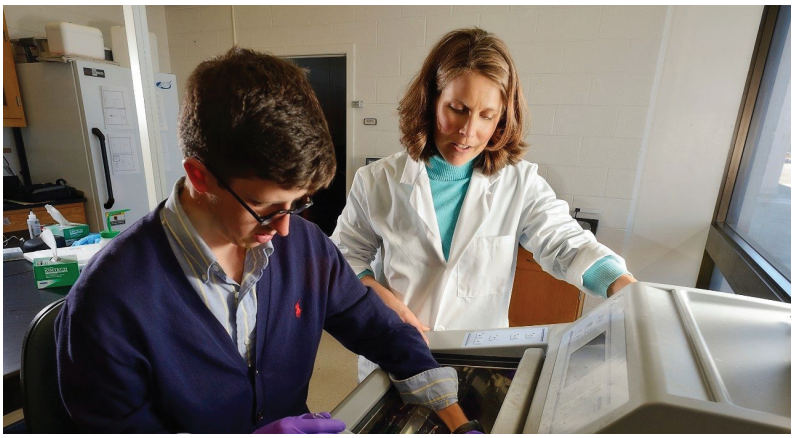
Casey Bernhards received her B.S. degree in Biological Sciences in 2008 and continued at Virginia Tech to receive a Ph.D. in Biological Sciences in 2014. Dr. Bernhards worked in the lab of Dr. Liwu Li as an undergraduate, and she performed her graduate work in **Dr. David Popham's** lab studying the proteins involved in spore germination in *Bacillus anthracis*. She now works at ECBC as a Postdoctoral Research Microbiologist through the National Research Council. Her research has involved the application of synthetic biology to the field of microbial forensics, where unique sequences of DNA, or genetic "barcodes," may facilitate source attribution by serving as artificial markers for Select Agent strains. She is now working to build up a synthetic biology program within the Army. She can be contacted at casey27@vt.edu.

Amanda Melillo received B.S. degrees in Biology and Biochemistry from Virginia Tech in 2003; while at VT, she conducted undergraduate research in **Khidir Hilu's** lab. She went on to earn an M.S. in Microbiology from the Medical College of Ohio (2005), and a Ph.D. in Microbial Disease from Albany Medical College (2010). Amanda is a program director in the NIH-National Institute of General Medical Science Division of Genetics and Developmental Biology, where she administers research grants on cell growth and differentiation and the cell cycle as well as postdoctoral fellowship grants in the areas of genetics and developmental biology.

David Vasquez received a B.S. in Biological Sciences from VT in May 2015. During his undergraduate years, he was a recipient of the **Arthur Buikema and M. Alison Galway Undergraduate Research Award** (2015) and the **Robert Jones Undergraduate Research Excellence Award** (2014). He conducted research in **Dana Hawley's** lab and was supported by the Initiative for Maximizing Student Development and the Louis Stokes Alliance for Minority Participation programs. David is currently a second year Ph.D. student at the University of Georgia conducting disease ecology and animal behavior research in the first cohort of the new NSF-NRT Interdisciplinary Disease Ecology Across Scales Program. He is also the recipient of a NSF Graduate Research Fellowship and an IDEAS Research Grant.

Neurobiologist receives NSF funding for animal cognition research, education, and outreach

By Lindsay Key, Communications Director, Fralin Life Science Institute



Neurobiologist Kendra Sewall (right) works with graduate student Tre Mills to prepare samples for an immunohistochemistry assay, which will allow them to visualize specific proteins of interest that are involved with learning and memory.

Is overcrowding in cities bad for your brain? Do children in preschool learn better because of the social enrichment? Are animals at zoos learning and behaving the way they would in the wild even if they aren't in normal group sizes?

These are the types of questions behind the research of a Virginia Tech neurobiologist who studies the impacts of the social environment on the brain.

Kendra Sewall, an assistant professor of biological sciences in the College of Science and an affiliated faculty member of the School of Neuroscience, recently received a National Science Foundation CAREER grant to expand her studies of the "sweet" spot of optimum social interaction — the point at which brain function is improved.

The research uses zebra finches, a songbird that shows social relationships and vocal learning that is surprisingly similar to humans. Prior research has shown that social birds living in larger flocks have super cognitive abilities and greater neuron growth. But if socializing becomes stressful over time, perhaps due to overcrowding or competition, the birds produce stress hormones called glucocorticoids that, in high amounts, are known to impair neural plasticity and compromise learning. The new funding will allow Sewall to continue this line of research, as well as increase education and outreach in the field.

She will teach a new course titled Animal Cognition through the Department of Biological Sciences in the College of Science. The course, available to undergraduate and graduate students, will involve working with local high school classes interested in animal cognition research, and will be available beginning in fall 2018.

Sewall will also work with K-12 teachers to develop an animal cognition module in line with the Virginia Standards of Learning for regional high school classes to use. Four teachers will visit Sewall's lab in summer 2018 to develop a one-week module that they can take back to their classrooms.

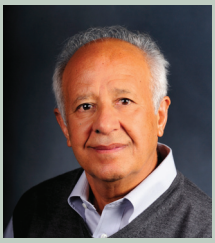
Sewall, who is also affiliated with the Global Change Center at Virginia Tech, an arm of the Fralin Life Science Institute, said the research is important for understanding how changes in resource availability due to climate change or habitat degradation could impact bird social dynamics and ultimately, individuals' learning and brain function. But, because zebra finches are a model for human language learning, the research also shines a light on how lifestyle impacts human cognition.

"With the incidence of brain-related disorders, such as anxiety, depression, and autism, on the rise, understanding the brain's reaction to environmental factors is incredibly important," said Sewall.

"This research project is an example of science focused on a single organism and topic — here, a common songbird and how stress impacts it — with the potential to produce results that tell us more about vast groups of creatures, including humans," said Jodie Jawor, program director for the Behavioral Systems Cluster at the National Science Foundation. "The National Science Foundation's animal behavior program supports integrative work, such as this, that can help us piece together the rules governing all life."

The CAREER grant is the National Science Foundation's most prestigious award, given to creative junior faculty considered likely to become academic leaders of the future. Sewall is one of three College of Science faculty to receive a CAREER Award this year, the first time that three faculty in the college have won such funding in more than 10 years. The other two faculty members are Julianne Chung, of the Department of Mathematics, and F. Marc Michel, of the Department of Geosciences.

Dr. Sewall's grant is funded for $830,000 over five years by NSF's Division of Integrative Organismal Systems.



Professor Emeritus **Khidir Hilu** retired from Biological Sciences this fall after 36 years at Virginia Tech. Dr. Hilu taught the Virginia Tech's flagship undergraduate courses in plant taxonomy and plants and civilization, and a number of other courses, including a study abroad summer course in the Swiss Alps and Mediterranean coast of Italy. His research has focused on molecular systematics and evolution of flowering plants and crops and on molecular differentiation of genes that include the allergen genes in peanuts. Dr. Hilu authored and coauthored 116 peer-reviewed publications with a 5,926-citation record, and has been involved in approximately $7 million in federal, state, university, and foundation grant funds that included the National Science Foundation's Assembling the Tree of Life program and the VT HokieSpeed supercomputer grant. He also served on the editorial boards for the South American Journal Kurtziana, the Journal of Systematics and Evolution, and the international review board of the Annals of Botany.

Dr. Hilu held a Fulbright scholarship to train graduate students and faculty in techniques of DNA fingerprinting at University of Bin Zuhor, Morocco, and also used U.S. Agency for International Development grants to establish a molecular lab at Egerton University, Kenya, to promote the breeding of their native crop finger millet. He was an invited scientist at the Commonwealth Scientific and Industrial Research Organisation in Australia, the departments of genetics at Cairo University, University of Florence, Italy, and Estação Agronómica Nacional, Oerias, Portugal. He has presented more than 140 invited research talks at symposia and society meetings in the United States and in some 20 countries around the world. During his career at Virginia Tech, Dr. Hilu mentored 24 graduate students, six post-doctoral appointees, and approximately 60 undergraduate students involved in research projects. He won teaching awards from the Department of Biological Sciences and the College of Science. Congratulations on your retirement, Dr. Hilu!

Sue Rasmussen retired this past summer after more than 37 years with the department. Ms. Rasmussen joined the Department of Biology part-time in September, 1980 and was hired full time as a "clerk-typist" in 1983. Some of her duties at the time included the use of "mimeograph, ditto, collator, stencil burner, and thermofax machine;" by the time she retired she had served as the department's Graduate Coordinator for more than two decades, overseeing the implementation of countless innovations including recently the launching of e-Portfolio and an online program for graduate applications.

Ms. Rasmussen saw hundreds of Biology/Biological Sciences graduate students through to their degrees over the years, offering expert advice – and often critical moral support - in the process. She also contributed in many other ways to the department's success, including assisting with the assembly and proofing of manuscripts for University Distinguished Professor **Bruce Wallace** and serving on the "New Biology Building Subcommittee" that oversaw the early process of launching Life Sciences I. Ms. Rasmussen took a lot of accumulated expertise and knowledge with her when she retired - we are keeping her on our speed dial!

John Tyson, University Distinguished Professor of Biological Sciences, has been elected to the inaugural class of Fellows of the Society for Mathematical Biology. The Fellows Program allows the society to honor members who exemplify excellence in the field of mathematical biology. Tyson was honored at the 2017 Annual Meeting of the Society for Mathematical Biology, held at the University of Utah in Salt Lake City in July.

Dr. Tyson's research currently focuses on molecular mechanisms underlying the control of cell growth, division, and death. He approaches his biological systems research from a mathematical perspective, a lowing him to create models that provide a better understanding of cell physiology. His previous research focused on oscillations and wave propagation in chemical reaction systems.

He is an affiliate faculty member with the Fralin Life Science Institute and a Senior Fellow at the Biocomplexity Institute of Virginia Tech.

Among his many awards is the 2011 Arthur T. Winfree Prize by the Society for Mathematical Biology. According to its website, the Society for Mathematical Biology's mission is to "promote the development and dissemination of research and education at the interface between the mathematical and biological sciences." Tyson and other recently elected Fellows are "recognized by the scientific and scholarly community as distinguished contributors to the discipline," the society stated. Congratulations, Dr. Tyson!

Meet our newest faculty members!

Assistant Professor **Frank Aylward** joined our department in August as a faculty member specializing in Microbiome Systems Biology. He is also an affiliated faculty member with the Virginia Tech Global Change Center. His major fields of interest include microbial ecology, microbial diversity, genomics, and metagenomics. His current research focuses on understanding the processes that shape the structure and function of microbial communities.

Dr. Aylward received B.Sc. degrees in Biochemistry & Molecular Physics and Molecular & Cellular Biology from the University of Arizona in 2008, and a Ph.D. in Microbiology from the University of Wisconsin-Madison in 2013. He held postdoctoral positions at the Massachusetts Institute of Technology, and, most recently, the University of Hawai'i at Mānoa. Welcome, Dr. Aylward!

Assistant Professor **Kate Langwig** joined our department in August as a faculty member specializing in Infectious Disease Dynamics. Her research interests include the ecology and evolution of host-pathogen interactions; heterogeneity in susceptibility, vaccine effects, pathogen dose, and infectiousness, and their implications for transmission and disease impacts; disease as a driver of species extinctions; and seasonality and pathogen transmission. She recently received an NSF grant to study the transmission and spread of white-nose syndrome among North American bats. (See page 4.)

Dr. Langwig received a B.S. in Neuroscience from Union College in 2008, and a Ph.D. in Ecology and Evolutionary Biology from the University of California, Santa Cruz, in 2015. Most recently, she was a Postdoctoral Fellow at the Harvard T.H. Chan School of Public Health. Welcome, Dr. Langwig!

Assistant Professor **Martha Muñoz** joined our department in August as a faculty member specializing in Evolutionary Biology. She is also an affiliated faculty member with the Virginia Tech Global Change Center. Her research interests include: connecting micro- and macroevolutionary patterns; evolutionary physiology, with a focus on responses to climate change; and understanding morphological diversity through evolutionary biomechanics. She was a recipient of a 2017 Jasper Loftus-Hills Young Investigator Award from the American Society of Naturalists.

Dr. Muñoz received a B.A. in Biology from Boston University in 2007, and a Ph.D. in Organismic & Evolutionary Biology from Harvard University in 2014. Prior to joining our department, she worked as a Postdoctoral Researcher at The Australian National University and, most recently, at Duke University. Welcome, Dr. Muñoz!

Assistant Professor **Josef Uyeda** joined our department in August as a faculty member specializing in Evolutionary Biology. He is also an affiliated faculty member with the Virginia Tech Global Change Center. His primary research aim is to develop novel approaches that integrate cross-disciplinary data and theory to unite microevolutionary processes with macroevolutionary patterns. This enduring challenge to evolutionary biology has important implications for understanding the creation and maintenance of biodiversity in the face of global change. He recently received an NSF grant entitled, "ABI Innovations: Enabling machine-actionable semantics for comparative analyses of trait evolution." (See p. 5).

Dr. Uyeda received a B.A. in Biology from Willamette University in 2006, and a Ph.D. in Evolutionary Biology from Oregon State University in 2012. Most recently, he was a Postdoctoral Fellow at the University of Idaho. Welcome, Dr. Uyeda!

Postdoc **Vinny Farallo** and Ph.D. student **Brooke Bodensteiner** from the Muñoz Lab are both finalists for the upcoming Raymond Huey Best Student Presentation Award through the Division of Ecology and Evolution of the Society for Integrative and Comparative Biology (SICB). This award is given to Ph.D. students or recent graduates whose research encompasses a broad and consequential topic in evolution and ecology, and who deliver an excellent presentation at the annual SICB meeting. This year was the most competitive yet for the Huey Award Symposium, with only seven finalists and over 35 applications. Brooke and Vinny will compete in the Award Symposium on January 4, 2018 at the annual SICB meeting. Congratulations and good luck to both!

Katie Broadway, a Ph.D. student in the Scharf Lab, won a trainee award for an oral presentation she gave at the 1st Annual Commonwealth of Virginia Cancer Research Conference held at the University of Virginia this September. Her presentation, entitled, "Contribution of *Salmonella enterica* serovar Typhimurium VNP20009 chemotaxis on 4T1 mouse mammary carcinoma progression," was part of the "Novel Approaches for Cancer Detection and Treatment" session. Congratulations, Katie!

Ellen Garcia, a Ph.D. student in the Cimini Lab, attended the 6th Annual Meeting of the American Society for Cellular and Computational Toxicology, held in September at the Institute for *In Vitro* Sciences in Gaithersburg, MD. At the meeting, Ellen was recognized with the Edward Carney Predictive Toxicology Award (consisting of a certificate and a $500 money prize) for her poster presentation entitled, "Characterization of two lung cell lines for use in cell division focused, single-cell toxicity assays." Congratulations, Ellen!

Aboozar Monavarfeshani , a Ph.D. student in the Fox Lab, has been selected as a recipient of a 2017 Trainee Professional Development Award (TPDA) from the Society of Neuroscience. The award recognizes undergraduate and graduate students and postdoctoral fellows demonstrating scientific merit and excellence in research with the chance to present an abstract at a poster session, meet peers and network with senior scientists, and participate in learning opportunities at the annual meeting. Recipients of the Trainee Professional Development Award will receive complimentary registration to attend the annual meeting. An award in the amount of $1,000 will be given to recipients based at institutions within North America. Recipients based at international institutions will receive an award in the amount of $2,000. Congratulations, Aboozar!

Brynn O'Donnell, a Ph.D. student in the Hotchkiss Lab, was one of three winners at the 2nd Annual Nutshell Games, an event sponsored by the VT Center for Communicating Science, in conjunction with the VT Science Festival. The Games provided an opportunity for graduate students to share their research with a public audience. Brynn's talk was entitled, "Ghost Streams." Congratulations, Brynn!

Arianna Krinos, a junior triple major in biological sciences, computer science, and computational and data analytics, is the first student from Virginia Tech to received an $10K Astronaut Scholarship Foundation Award from NASA. According to the Astronaut Scholarship Foundation website, the goal of the scholarship is to "aid the United States in retaining its world leadership in technology and innovation by supporting the very best and brightest scholars in science, technology, engineering, and mathematics; $4 million in scholarships have been awarded since 1984. The foundation was started more than 30 years ago by members of the famed Mercury 7 team. Arianna was presented with the award on October 19th by NASA astronaut and UVA faculty member Kathryn Thornton, who also gave a public lecture at VT.

In the past, Arianna conducted ecological research in the Belden Lab connecting the likely role of fungal pathogens to the decline of global amphibian populations. Her current undergrad research in the Carey Lab focuses on the intersection of computer science and biological science through the use of computer models and quantitative tools, such as bioinformatics and data analytics to describe and predict changes in freshwater ecosystems.

After graduation, she plans on pursuing a doctorate in limnology or oceanography with a biological and computational emphasis.

Congratulations, Arianna!

Each year, the College of Science gives two Graduate School Doctoral Assistantships (GDSA Fellowships) to Biological Sciences. As has become our custom, we are use these fellowships to recognize the efforts of four of our outstanding graduate students, as identified by the Graduate Review Committee, by providing them each with a semester of Graduate Research Assistant support. This year's awardees are **Ariel Leon** (Hawley Lab) and **Tuo- Xian Tang** (Capelluto Lab) for Fall 2017, and **Jordan Mancl** (Schubot Lab) and **Jingren Deng** (Lazar Lab) for Spring 2018. Congratulations to all four!

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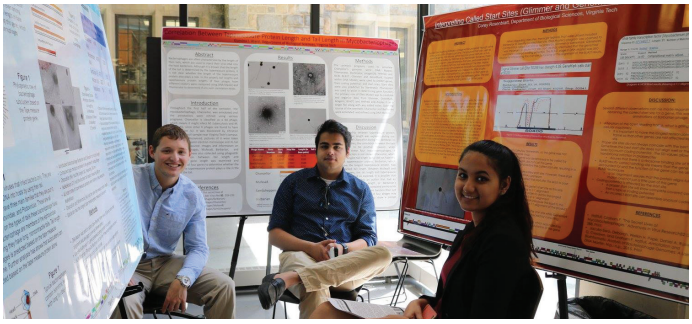

One person can make a big difference!

The Department of Biological Sciences is the hub for life sciences research and teaching at Virginia Tech, with interdisciplinary connections that span the entire university and a commitment to training the next generation of scientists at the forefront of the discipline.

Our faculty tackle the world's most challenging problems through both basic and applied research, from human disease to the effects of global change. As one of the university's largest departments, we were honored this year with the University Exemplary Department Award for our outstanding teaching efforts and innovative learning environments.

Your support is critical to our future success. Contributions from our alumni, parents and friends help our many deserving students, provide state-of-the-art facilities, expand research activities, and allow our students explore a wide array of career opportunities. Gifts made without restriction allow departmental leaders to respond to opportunities immediately and to allocate resources where they can have the greatest impact.

When you receive your College of Science Annual Fund letter or phone call, please earmark your support for the Department of Biological Sciences Annual Fund. Simply make a notation on the gift card or let the caller know that you want to direct your donation to Biological Sciences. To make an immediate contribution, you may visit the university's web site at givingto.vt.edu or contact the Office of Gift Accounting at (800) 533-1144.

For more information or to learn about other ways to support the College of Science, please contact **Wade Stokes**, Assistant Dean of Advancement, at (540) 231-4033 or lwstokes@vt.edu. We thank you in advance for your support!