



COLLEGE OF SCIENCE
BIOLOGICAL SCIENCES
 VIRGINIA TECH

The Department of Biological Sciences is at the center of life sciences research and teaching at Virginia Tech. Our mission is to seamlessly integrate world-class research addressing the grand challenges of the 21st century, from global change to human disease, with preparation of the next generation of scientists.



Dear Friends and Alumni of VT Biological Sciences,

School is out for summer—long days, warm nights, and recently completed graduations. I would like to start by congratulating our graduates—212 B.S.'s, 7 M.S.'s and 11 Ph.D.'s—and welcoming you as alumni. We have been lifted by your hard work and talents, are proud of what you each have accomplished, and look forward to watching your careers and lives unfold. Please stay in touch.

As department head, one of my particular points of pride is the outstanding faculty in the department— faculty who make enormous contributions to our teaching, research, and service missions. This year Professor Emeritus **Jack Webster** and Associate Professor **Cayelan Carey** were recognized with national awards for their research contributions. Dr. Carey and several other faculty were also recognized with College- and University-level awards for outstanding achievements in teaching and service. We also had a large number of faculty promotions—**Tad Seyler** was promoted to Senior Instructor, while Cayelan Carey and **Kendra Sewall** were promoted to Associate Professor with tenure and **Mike Fox**, **Dana Hawley**, **Iulia Lazar** and **Birgit Scharf** were all promoted to full Professor. Especially rewarding for me, was seeing so many of our young faculty receive their first major grants as independent investigators. These grants allow them to vigorously pursue their research interests and train the next generation of research scientists along the way.

I would also like to draw attention to the unsung heroes in our department, our amazingly devoted and talented staff, who go out of their way to make the department run smoothly. Typically working out of the spotlight, they make essential contributions to the success and well-being of all department members. This year, I want to specifically thank our departmental administrator, **Dreama Price**, who made my transition to department head an easy one. She is the consummate professional, handling all problems, big and small, efficiently and without fanfare.

I am delighted to report that we will have two new faculty members joining the department this coming year. **Jeremy Draghi** will be starting this August. His research seeks to understand fundamental questions about how evolution works, with focus on the rapid evolution seen in viruses and bacteria, which can lead to the emergence of new diseases. **Bryan Hsu** will be starting in January. His research program is centered on the human gut microbiome, its role in normal health and disease, and how it can be manipulated with phage therapy. We hope to opening new searches in the fall, and encourage those of you looking for faculty positions to apply!

In this summer newsletter, we also share faculty, administrative, and alumni news; recent happenings around the department; and highlights of some of the research we have published in the last few months. We hope that you enjoy the newsletter and that it stimulates your interest.

—**Bob Cohen**, Professor and Department Head, VT Biological Sciences

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



Researchers discover how 'cryptic' connections in disease transmission influence epidemics

Adapted from a VT News story by Kristin Rose and Tim Stephens

When we think about who we might get sick from, we tend to think of our social groups: family, friends, and co-workers. But, we forget about that brief interaction with an employee at the DMV, a barista at a coffee shop, or shared airspace on public transportation. People are

aware of these interactions, but not how important they are to the spread of epidemics. In the past, these types of hidden interactions have been poorly understood because they are so difficult to quantify.

A new study by researchers of disease transmission in bats has broad implications for understanding hidden or "cryptic" connections that can spread diseases between species and lead to large-scale outbreaks.

By dusting bats with a fluorescent powder that glows under ultraviolet light, Virginia Tech researchers **Joseph Hoyt** and **Kate Langwig** were able to trace the dynamics of disease transmission in bat species that have been devastated by white-nose syndrome, a deadly fungal disease that has killed 6.7 million bats in North America since 2006.

Their findings were recently published in the journal *Nature*. (<https://www.nature.com/articles/s41586-018-0720-z>)

"Our results uncovered and quantified connections, both within and among species, that we never knew about before," said first author Joseph Hoyt, who led the study as a UC Santa Cruz graduate student and completed the analyses at Virginia Tech as a research scientist in the Department of Biological Sciences in the College of Science.

"We had been seeing explosive epidemics where an entire bat population would become infected with white-nose syndrome within a month or two, and it was a mystery as to how that was happening. We are now able to more accurately explain and track the spread of white-nose syndrome, and our study has strong implications for predicting other epidemics," Hoyt said.

One of the puzzling features of white-nose syndrome is its ability to spread through a community of bats during the winter, when the animals are hibernating 99.5 percent of the time. They rouse from hibernation only very briefly every two to three weeks. Yet the dust studies showed that they move around enough to have many more connections than can be observed in their hibernation groups.

Most striking were the cryptic connections revealed for one species, the northern long-eared bat, which roosts by itself, not in groups. Although classical theory would predict low infection rates for this solitary species, it has been hard hit by white-nose syndrome.

"When we put fluorescent dust on the northern long-eared bat, it would show up on other species that we had never seen them interact with. We would never have predicted that the infection could spread by that route," Hoyt said.

Second author on the study, Kate Langwig, an assistant professor in the Department of Biological Sciences at Virginia Tech, said their study shows that infrequent and indirect connections play a far larger role in the transmission of disease than was previously understood. *(continued on page 7)*

Timing is everything: New discoveries in circadian rhythms provide insight into cancer treatment



Written by Tiffany Trent

In a recent paper in *Science Signaling*, associate professor of cell and microbiology **Carla Finkielstein**, of the Department of Biological Sciences, and her collaborators identified an alternative mechanism to control circadian rhythms in normal cells that is driven by oncoproteins.

This discovery places molecules involved in monitoring and calibrating the response of cells to genomic damage at the center of the machinery driving circadian rhythms.

Anyone who has ever experienced jet lag is familiar with circadian rhythms. Various processes in the human body are governed by circadian rhythms, even down to the individual cell. These processes are tightly controlled by a variety of molecular mechanisms and feedback loops that help the body self-regulate in response to external cues like sunlight and temperature.

Researchers are now discovering that molecules usually implicated in protecting us from cancer initiation and progression are directly involved in regulating the function of our daily circadian rhythms. Not only that, but this molecular interplay seems to regulate how well our body responds to therapeutic modalities seldom delivered to treat certain diseases, such as cancer.

While healthy cells share a circadian rhythm with the rest of the body, tumors often have a different rhythm than the healthy cells surrounding them. Tumors divide differently than healthy cells and at different times. Like a person singing out of tune within a chorus, that one difference can ultimately wreck the entire melody. Or in this case, the healthy functions of cells.

"We know that our cells experience over 10,000 mutations a day," said Finkielstein. "These are usually mitigated by a repair system comprised of a host of protein interactions. However, only a handful of mutations, three to six depending on the type of cancer, are needed for malignant cells to get a foothold. And if one of these mutations occurs in the repair system, then the chances for cancer increase dramatically."

It's obvious, then, that fine-tuning these processes is critical for maintaining normal cell functioning and that either dysregulation of circadian rhythms or alteration in oncoproteins can lead to numerous diseases and disorders. However, the good news is that the interplay among circadian molecules, oncoproteins, and tumor suppressors, as previously discovered by Finkielstein's group, can be used to tailor therapeutics in a more effective way.

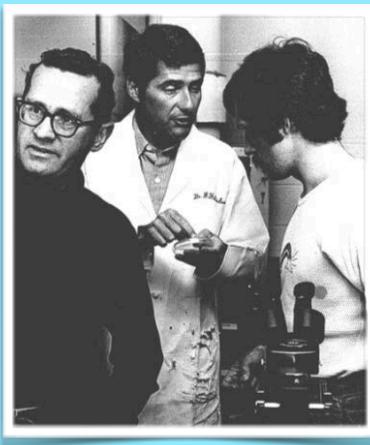
Chronotherapeutics, or the application of therapeutics at times when drugs are most efficacious, have seldom been used in modern treatment plans. But the evidence is mounting that timing is truly everything when it comes to the best treatment plans. Lower and more effective doses translate to fewer side effects for patients, which is particularly relevant to cancer patients who are often given massive doses of very aggressive drugs. What has delayed the application of chronotherapeutics seems to be a lack of molecular foundation for the theory. *(continued on page 7)*

Professor Emeritus **Joseph Falkinham** retired from Biological Sciences at the end of 2018, after 44 years at Virginia Tech.

Dr. Falkinham's recent research focused on mycobacteria, legionella, and amoeba in household plumbing; biofilm formation by mycobacteria; isolation and identification of new anti-mycobacterial antibiotics; and mechanism of action of antibiotic dendritic amphiphiles.

Throughout his career, Dr. Falkinham maintained consistent research funding from federal agencies including the National Science Foundation, the National Institutes of Health, the National Oceanographic and Atmospheric Administration, and the National Institute of Allergy and Infectious Diseases.

He authored and co-authored three books, 31 book chapters, and 25 invited review articles for scientific journals, and published 136 peer-reviewed papers in journals. He has presented multiple invited papers and lectures on mycobacteria at national and international meetings and is considered an international authority.



L to R: Professor Emeritus Bruce Parker, Dr. Falkinham, and grad student Steve Wendt, circa 1976

Dr. Falkinham has served on three different professional editorial boards and was editor for the International Journal of Microbiology. He is a Fellow in the Royal Society of Public Health, London, and received the Gardner Middlebrook Award for Mycobacteriology by the American Society of Microbiology.

In the classroom, Dr. Falkinham taught the flagship undergraduate course in genetics and multiple advanced courses in microbial genetics and molecular biology for both undergraduate and graduate students. He has mentored 19 master's degree and seven Ph.D. students and served on multiple graduate advisory committees in the Department of Biological Sciences and other departments.

Congratulations on your retirement, Dr. Falkinham!

Our second Giving Day, March 19-20, 2019, was a very good success, with 74 donors contributing \$9,618 to the Biological Sciences Annual Fund. These are invaluable discretionary funds that the department will use in support of student and faculty recruiting, Research Day, Biology Graduate Student Association picnics, and now, also some new investments in the department's future. A sincere thanks to the many who contributed! The future is indeed bright, thanks to our generous extended family!



ALUMNI SPOTLIGHT

The Virginia Tech College of Science recent inducted alumna **Melanie Pearson Hurley**, who graduated in 1981 with a bachelor's degree in Biology, into its Hall of Distinction.

Hurley brings the total number of honored alumni and friends in the Hall of Distinction to 37. In its sixth year, the Hall of Distinction honors alumni and friends of the college who are science leaders, mentors, advisors, and future employers of Virginia Tech students.



"Hurley has distinguished herself not only in her career success, but also through service to her local communities and Virginia Tech," said **Sally C. Morton**, dean of the College of Science, at the induction ceremony. "She supports our university by giving generously of her time, talent, and other contributions to the college, the university, and more."

Hurley, of Alexandria, Virginia, has worked as an environmental professional at the U.S. Department of Energy (DOE) in Washington, D.C., for the past 28 years. She currently is a project manager responsible for environmental remediation and waste management policy and programs at multiple sites across the DOE.

She began her professional career with Virginia Tech's Occoquan Watershed Monitoring Laboratory in Manassas, Virginia, working with the late Professor Emeritus **Thomas Grizzard**. As an environmental professional in the 1980s, she was the first hazardous material coordinator for Fairfax County in Virginia, implementing programs such as household hazardous waste clean-up centers, which still exists today.



She has received awards from the National Association of Counties; the Assistant Secretary of Energy for Environment, Safety, and Health; and the DOE Office of Environmental Management for her innovation and expertise in environmental programs. She also has advocated for STEM – science, technology, engineering, and mathematics – education, and is a sought-after speaker. In addition to her bachelor's degree, Hurley earned a master's degree in administration from Central Michigan University in 1984.

While at Virginia Tech, Hurley was a trailblazer, being elected the first African American Military Ball Queen in 1979 (left), was a founding member of the Black Student Alliance, and served on the Ring Committee. She has continued to be an advocate and strong supporter of Virginia Tech through recruiting, financial support, and mentorship.

She also is involved in civic and philanthropic organizations, including Alpha Kappa Alpha Sorority Inc., and serves as a board member of the Heart of Gold Sickle Cell Foundation of Northern Virginia, which advocates and supports person suffering from sickle cell anemia.

"Melanie is among the most inspiring examples of Virginia Tech's tradition of scientists, innovators, caregivers, and problem-solvers, exemplifying the best of Ut Prosim," added Dean Morton.

SELECTED NEW GRANTS

Professor **Jeb Barrett** is principal investigator on a collaborative grant from the National Science Foundation / Office of Polar Programs entitled, **"Remote Characterization of Microbial Mats in Taylor Valley, Antarctica, through In Situ Sampling and Spectral Validation."** The project is being funded for two years and is in collaboration with former postdoc, **Eric Sokol**, now at NEON / Battelle Memorial Institute, and Mark R. Salvatore at Northern Arizona University, with \$119,000 coming to the Barrett Lab. This is an exciting new effort that will develop novel remote multispectral imagery technologies for tracking microbial mats, conspicuous cyanobacterial /moss /algal communities at the Antarctic, where they serve as key energy producers and as sentinels of environmental change, including climate variation. This latest grant adds to Dr. Barrett's success with his long-standing efforts on the McMurdo Long Term Ecological Research Project, more recent work at the Coweeta LTER, and a recently-funded (by DOE/NIFA BRDI) project to study the lifecycle of biochar soil amendments.



Assistant Professor **Meryl Mims** is co-principal investigator on a major grant from the National Science Foundation MacroSystems Biology Program. The grant, budgeted for \$3.04 million across five universities, with \$452,000 coming to the Mims Lab, is entitled, **"StreamCLIMES: Scaling climate connectivity and communities in streams."** The study will examine macroinvertebrate (aka "bug") communities in ten regions across the southern, central, and western United States in an effort to understand linkages between climate and physical and biotic factors in intermittent (not continuously flowing) streams, a little-studied area of freshwater ecology. The project involves a very exciting collaboration among groups with quite diverse expertise, with the Mims Lab leading population genetic/genomic studies of 15 species across the study sites, as well as serving as the coordinator for two of the sites, in Northern Virginia and at Oak Ridge. This will be the Mims group's first foray into the realm of macroinvertebrates, applying their leading-edge genetic/genomic tools to understand population dynamics in these very intriguing – and increasingly important - environments. In addition to contributing to the overall goals of the project, the work in the Mims Lab will help advance the emerging field of comparative landscape genetics.

Assistant Professor **Susan Whitehead** recently received a \$300,000 grant from the National Science Foundation Division of Environmental Biology to study the chemical ecology of seed dispersal interactions. The project is entitled, **"Fruit and seed secondary metabolites and animal seed handling: impacts on germination success and seedling survival."** Field work for the project will be based in Costa Rica and will focus on the hyperdiverse tropical plant genus *Piper*, bats in the genus *Carollia* (the primary dispersers of *Piper*) and ants, which rapidly recruit to any seed dropped on the forest floor and either consume, cache, or discard it. Dr. Whitehead will investigate how fruit and seed chemistry impact the fate of seeds, and, in turn, how seed handling by bats and ants impacts the chemistry of the seed and its ultimate germination success. Project personnel will include **Mariana Gelambi** (new Whitehead lab Ph.D. student starting Fall 2019) and a new post-doc (to be determined). The project will also include an outreach component at SEEDS-Nature Center, to be developed in collaboration with **Mike Rosenzweig**, Outreach Director for Biological Sciences.



“Cryptic Connections”...continued from page 2) Coauthor A. Marm Kilpatrick, associate professor of ecology and evolutionary biology at UC Santa Cruz, noted that spillover events, when pathogens spread from wild animals to human populations, tend to occur through these kinds of cryptic connections. “We don’t normally appreciate how important they are except retrospectively, when we investigate outbreaks of diseases like Ebola or SARS,” he said.

Unfortunately for bats, the spores of the fungal pathogen that causes white-nose syndrome stay in the environment and remain infectious for years. Once the walls and ceiling of a cave have been contaminated with the spores, bats using the site for hibernation will be exposed to infections year after year.

White-nose syndrome is considered one of the worst wildlife diseases in modern times, having killed millions of bats across North America.

But white-nose syndrome does not appear to pose a risk to human health. It is caused by the fungus *Pseudogymnoascus destructans*, which grows optimally at low temperatures. The United States Geological Survey said, “Thousands of people have visited affected caves and mines since white-nose syndrome was first observed, and there have been no reported human illnesses attributable to white-nose syndrome. We are still learning about the disease, but we know of no risk to humans from contact with white nose-affected bats.”

The Virginia Tech and UC Santa Cruz researchers are part of a coordinated response to white-nose syndrome involving state and federal agencies, universities, and nongovernmental organizations.

In addition to Hoyt, Langwig, and Kilpatrick, the coauthors of the paper include Paul White, Heather Kaarakka, and Jennifer Redell at the Wisconsin Department of Natural Resources; Allen Kurta at Eastern Michigan University; John DePue and William Scullon at the Michigan Department of Natural Resources; Katy Parise and Jeffrey Foster at the University of New Hampshire; and Winifred Frick at Bat Conservation International and UC Santa Cruz. This work was supported by the National Science Foundation, U.S. Fish and Wildlife Service, and Bat Conservation International.

Hoyt and Langwig were hired as part of the Global Systems Science Destination Area in the College of Science at Virginia Tech to address issues of infectious disease. The Global Systems Science Destination Area is focused on understanding and finding solutions to critical problems associated with human activity and environmental change, that, together affect diseases states, water quality, and food production.

“Timing is everything”...continued from page 3). But all the proof needed may come from a small number of regulatory proteins that act as sensors, like the circadian protein PERIOD 2 (PER2), and integrators, like the tumor suppressor p53 and the oncoprotein MDM2. These proteins keep the division of cells regulated and timely. In the past few years, the transdisciplinary team of researchers has been patiently unwinding the crosstalk mechanisms responsible for understanding how the circadian clock and the cell division machinery coordinate processes to specifically understand how their regulation can be exploited therapeutically.

“Our findings were totally unexpected and welcome as they expanded our vision of how the circadian clock is regulated in normal cells to include components of the cell division cycle that are necessary to keep proliferation in check,” said Finkelstein. “As a result, we can now test the hypothesis of how deregulation of circadian rhythms, for example by shift work, could be associated with the etiology of cancer or how mutations in ‘guardian’ genes responsible for proliferative decisions lead to abnormal clocks in cancer cells, a finding of relevance when considering new therapeutic opportunities.”

In the uncharted waters of chronobiological research, Finkelstein and her team are forging ahead to discover not only how cancer occurs but when and why it occurs. Their findings could help us understand when tumor cells are most treatable and deliver more effective treatments at the proper time.

Acknowledgments: **Jingjing Liu** – former graduate student, now at St. Jude Children’s Research Hospital; **Esther Wisdom** – undergraduate in the College of Science; **Tetsuya Gotoh** – former postdoc; **Anne Brown**, assistant professor from Research and Informatics, University Libraries; **Jae Kyoung Kim**, associate professor, Department of Mathematical Sciences, Korea Advanced Institute of Science and Technology, South Korea.

This work was supported by a grant from the National Science Foundation. The authors of the paper are also the recipients of the 2019 J. Shelton Horsley Research Award for the Virginia Academy of Science. The award is the highest honor bestowed by the VAS for original research.

Recent Defenses

Spring / Summer / Fall 2018

M.S.: **Anamul Haque** (Jensen Lab) "Differential Expression Analysis of Type II Toxin-Antitoxin Genes of *Pseudomonas aeruginosa* PAO1 under Different Environmental Conditions."

Ph.D.: **Zhixiong "Kevin" Sun** (Xie/Lawrence Labs), "EGR1 recruits TET1 to shape the brain methylome during development and upon neuronal activity"

Ph.D.: **Katherine Broadway** (Scharf Lab) "Novel perspectives on the utilization of chemotactic *Salmonella typhimurium* VNP20009 as an anticancer agent"

Ph.D.: **Daniel Medina Lopez** (Belden Lab) "Assessing Diversity, Culturability, and Context-dependent Function of the Amphibian Skin Microbiome"

Ph.D.: **Jordan Mancl** (Schubot Lab) "Molecular Investigations of Protein Assemblies Involved in Prokaryotic Virulence"

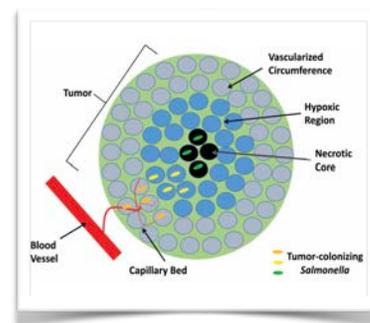
Ph.D.: **Chen Liang** (Mukherjee Lab) "Mechanism of CASK-linked ophthalmological disorders"

Ph.D.: **José Rodríguez-Corrales** (Winkel/Brewer/Josan Labs) "Evaluation of potential photodynamic therapy agents and patient-relevant biomarker combinations for the selective targeting of cancer"

Ph.D.: **Carl Wepking** (Barrett/Strickland) "Soil microbial function in a time of global change; effect of dairy antibiotics on soil microbial communities and ecosystem function"

M.S.: **Matt Aberle** (Hawley Lab) "Effects of bird feeder number on the behavior and ecology of a feeder-dependent songbird;"

M.S.: **Sadia Ahmed** (Winkel Lab) "Investigation of in-situ nanoimprinting of cell surface receptors: potentials of a novel technique in biomarker research"



Winter / Spring 2019

M.S.: **Bryan Lehner** (Tholl Lab) "Aggregation Pheromone Biosynthesis and Engineering in Plants for Stink Bug Pest Management"

M.S.: **Sarah Powers** (Barrett Lab) "Microbial Mat Abundance, Activity, and Biogeochemical Cycling in the McMurdo Dry Valleys, Antarctica"

M.S.: **Brynn O'Donnell** (Hotchkiss Lab) "Flow Regime of Function: Influence of Flow Changes on Biogeochemical Processes in Streams"

Ph.D.: **Ariel Leon** (Hawley Lab) "Exposure heterogeneity, host immunity and virulence evolution in a wild bird-bacterium system"

Ph.D.: **Alicia Kerr** (Fox Lab) "Cell-Specific Roles for CASK in the Pathology of Optic Nerve Hypoplasia"

M.S.: **Phillip McElmurray** (Brown Lab) "Natural History and Ecological Observations of a Population of Conhaway Crayfishes and their Symbiotic Branchiobdellidan Associates"

Ph.D.: **Andrew Muchlinski** (Tholl Lab) "Characterization and Functional Analysis of Terpenoid Specialized Metabolism in *Panicum virgatum* in the Interaction with Biotic Factors"

Ph.D.: **Cameron Sayer** (Popham Lab) "Identification and Analysis of Germination-Active Proteins in Bacillus Spores"





Rich Walker, Associate Professor and Associate Department Head for Biological Sciences, is one of the winners of this year's William E. Wine Award, in recognition of "a history of university teaching excellence." During his 25 years as a faculty member in our department, Dr. Walker's impact on students has been truly exceptional. Not only has he excelled in his role as an individual course instructor, but he has also had a profound and positive influence on the teaching and advising programs of Biological Sciences, one of Virginia Tech's largest undergraduate degree-granting and core teaching units, thus influencing the learning of thousands of students each year.



Eric Hogan, Advanced Instructor and Director of Teaching Labs for Biological Sciences, has been selected by the College of Science as a recipient of the 2019 College of Science Certificate of Teaching Excellence award. Dr. Hogan was one of our first faculty members to "flip" his courses and he has taken a leadership role in spreading the use of modern pedagogical practices across our curriculum and in training the next generation of teachers. Dr. Hogan is also recognized for his outstanding contributions to our undergraduate advising program and for increasing the education reach of our department through his creation of online courses as well as courses specifically intended for non-science majors.



Jeff Walters, Harold Bailey Professor and Graduate Director for Biological Sciences, has been selected by the College of Science as the winner of its 2019 Outstanding Mentor Award. The award was created by the Graduate School to recognize one faculty member from each college for their role in supporting, encouraging, and promoting a positive and inclusive scholarly and teaching environment, and for contributing to the professional and personal development of graduate students. This is one of the most prestigious competitive awards the college sponsors; it is a great achievement and truly deserved.



Professor Emeritus **Jack Webster** is the recipient of the 2019 Warren A. Hall Medal from the Universities Council on Water Resources. The medal is a memorial established by friends and family of Warren A. Hall to recognize exceptional accomplishments and distinction of an individual in the water resources field. The UCOWR Board of Directors officially instituted it in July of 1992. The Hall Medal is UCOWR's most prestigious award and is presented to those who have demonstrated a career-long commitment to exemplary interdisciplinary scholarship and academic excellence in water resources.



Associate Professor **Cayelan Carey** has been honored by Association for the Sciences of Limnology and Oceanography as a Cayelan Carey as a 2018 ASLO Fellow. "The ASLO Fellows program was initiated in 2015 to honor ASLO members who have advanced the aquatic sciences via their exceptional contributions to the benefit of the society and its publications, meetings, and other activities. The commitment and service of these individuals to the organization have enabled our society to advance the sciences of limnology and oceanography."



Assistant Professor **Frank Aylward** has been awarded a \$540K Simons Foundation Early Career Investigator in Marine Microbial Ecology and Evolution Award. His project is titled, "Revealing the tempo and mode of prokaryotic genome evolution in the ocean." From the project description: "Bacteria and Archaea have played a central role in shaping the chemical environment of the ocean throughout the history of Earth, and they continue to drive biogeochemical cycles in marine environments. Although diverse prokaryotes can be found in seawater, roughly a dozen prominent lineages —'major clades'—play a disproportionately large role in shaping community composition and activities... This project aims to develop and apply novel computational pan-genomic approaches to produce in-depth evolutionary genomic reconstructions of the major clades that will describe how and when these groups emerged and diversified into the ocean."



Mary Lofton, a Ph.D. student in **Cayelan Carey's** lab, has been awarded the 2019 College of Science Dean's Roundtable Make a Difference Scholarship for Graduate Study. The scholarship honors an outstanding graduate student who will make a difference in the college and the world through research and devotion to scientific excellence. Mary's research goal is to help find ways to sustainably provide high-quality freshwater resources to all communities. Through her Ph.D. research, she aims to facilitate clear, relevant, and scientifically accurate communication about water resources among scientists, engineers, water managers, and the public. This year, Mary also received the Mary and George Schaeffer Stream Ecology Award and the Research Day 2nd Place Poster Award.

Holly Packard, a Ph.D.

student in **Ann Stevens's** Lab, has been named the 2019 recipient of the Arthur Buikema and M. Alison Galway Outstanding Teaching Assistant Award. Holly has served as a GTA for the Phage Hunters course, General Biology Lab, General Microbiology Lab, and Bioinformatics Methods. In addition to her teaching load, she has also served as a mentor to undergraduate researchers and new graduate students in her lab since 2015. She has also participated in outreach activities in local PreK-12 schools and with the VT Microbiology Club. In 2018, she completed the VT Center for Excellence in Teaching and Learning (CETL) GTA Teaching Certificate program. This year Holly also received the Annie Liberati Memorial Scholarship, a Graduate Research Development Award, and the Virginia Branch American Society for Microbiology Graduate Student Oral Presentation Award.



2019 Undergraduate Awards and Scholarships

Arthur Buikema and M. Alison Galway Outstanding Senior Award (Established by Alumni Distinguished Professor Emeritus Art Buikema and wife Alison Galway; presented to a graduating senior in recognition of academic achievement, leadership and service): **Andrew Pregnall**

Arthur Buikema and M. Alison Galway Undergraduate Research Award (Established by Alumni Distinguished Professor Emeritus Art Buikema and wife Alison Galway; presented to outstanding undergraduate researchers): **Arianna Krinos**

Ralph E. Carlson Memorial Freshman Scholarship (Established by the late Elizabeth Bailey Carlson in honor of her husband, Ralph E. Carlson, former professor in the Pamplin College of Business; awarded to first-year students in Biological Sciences with high academic achievement): **Madeline Hoffman**

Ralph E. Carlson Memorial Scholarship in Ornithology (Established by the late Elizabeth Bailey Carlson in honor of her husband, Ralph E. Carlson, former professor in the Pamplin College of Business; awarded to Biological Sciences students pursuing careers in ornithology): **Miles Goodall, Taryn Smith, Rachel Willis**

Joe and Barbara Cowles Scholarship (Established by Professor Emeritus of Biological Sciences and Former Department Head Joe Cowles and his wife and former Associate Director of the VT University Honors Program, Barbara Cowles; awarded to undergraduate students who are planning to enter the fields of nursing, teaching, professoriate, or research): **Zachary Baker**

Rachael Hill Memorial Scholarship (Established in honor of student Rachael Elizabeth Hill, who died during the tragic April 16, 2007 shooting at Virginia Tech; awarded to rising sophomore undergraduates with an high academic achievement and a record of University or community involvement): **Arianna Krinos, Andrew Pregnall, Isabelle Wal**

Robert Jones Undergraduate Research Excellence Award (Supported with a fund established by former Professor of Biological Sciences and Department Head Robert H. Jones; awarded to outstanding undergraduate researchers in Biological Sciences): **Collin Ocampo**

Deborah Ayers Koller Scholarship (Established by alumna Deborah A. Koller; awarded to Biological Sciences students with high academic achievement who are aspiring to pursue a career in research): **Tracey Myers, Annmarie Taheny**

Stephen D. Lutz Scholarship (Established by alumnus Stephen Lutz; awarded to Biological Sciences students who are Virginia residents and have high academic achievement): **Amber Abbott**

I.D. Wilson Memorial Scholarship (In honor of Dr. I.D. Wilson, former head of the Department of Biology; awarded to undergraduate Biological Sciences majors who are in their last year of study and plan on pursuing a career in veterinary medicine): **Katriona Lane**

2019 Graduate Awards and Scholarships

Arthur Buikema and M. Alison Galway Graduate Student Teaching Award (Established by Alumni Distinguished Professor Art Buikema and wife Alison Galway; awarded to graduate teaching assistants for excellence in instruction): **Holly Packard** (Stevens Lab)

Noel Krieg Graduate Fellowship (Established by a group of former students in honor of Alumni Distinguished Professor Emeritus Noel Krieg; awarded to an outstanding graduate student pursuing research on microbial systems in biological sciences): **Brooke Bodensteiner** (Muñoz Lab), **Tuo-Xian Tang** (Capelluto Lab)

Robert and Marion Paterson Scholarship (Established in honor of Robert Paterson, Professor and Department Head of Biological Sciences, and wife Marion; awarded to an outstanding graduate student in Biological Sciences): **Fadoua El Moustaid** (Johnson Lab) and **Tuo-Xang Tang** (Capelluto Lab)

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Department of Biological Sciences Annual Fund

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.

Our faculty tackle the world's most challenging problems through both basic and applied research, from human disease to the effects of global change.

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 (881317). 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!

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