



Bio:Life

COLLEGE OF **Arts and Sciences**
BGSU
 BOWLING GREEN STATE UNIVERSITY

DEPARTMENT OF BIOLOGICAL SCIENCES ALUMNI NEWSLETTER

bgsu.edu/biology

Chair's message

Hello Alumni and Friends,

What a great year we have had! We sent more than 15 students to the Ohio Academy of Sciences meeting in spring; many students received funding from the Center for Undergraduate Research and Scholarship (CURS) and presented their research in spring and summer. Mike McKay and colleagues took a large group of students to Hungary during spring break for a limnological study of Lake Balaton, while Matt Partin took a group to the marine field station in Curacao (near Venezuela). A little closer to home Helen Michael's restoration ecology class worked in the Oak Openings with The Nature Conservancy to clear invasive plants. What fabulous experiential learning. And BGSU's investment in the environment through its cluster hiring and development of a center for water and watersheds is being led by new director, Drs. Tim Davis, along with George Bullerjahn, Mike McKay, and others.

We are moving our lab classes into the 21st century with experiential learning by our students in the renovated Moseley Hall. In our foundation courses, with Paul Moore and Kamau Mbutia as lab coordinators, we are having students engage in ecology and molecular biology research through experimentation. They are diving into the process



of discovery the moment they get to campus. We also have obtained a Howard Hughes Medical Institute grant (students isolating viruses and using bioinformatics to characterize them (see related story on page 5). Once students have completed these foundational studies, they move on to further their biology knowledge and experimental expertise by taking Genetics Lab (Dr. Paul Morris), Inland Marine

Research (Drs. Matt Partin and Kevin Neves), or possibly Microbiology with Dr. Hans Wildschutte, who has been leading student-engaged teaching in his class through the Small World Initiative. This is a national program, for which Dr. Wildschutte is co-chair, to bring innovative drug-discovery into the undergraduate classroom. Students in upper division courses like Restoration Ecology (Dr. Helen Michaels), Cell Biology (Dr. Scott Rogers), and Animal Physiology (Dr. Mike Geusz) are extending this intellectual curiosity to their areas of interest. Finally, BGSU has been developing a signature program for undergraduate research experiences as a culminating practice for many students. Through CURS grants, faculty research grants, and independent study experiences with faculty and graduate students as mentors, students are getting the high-level experiences they need to 1) succeed in professional programs, 2) step easily into graduate programs, or 3) have an experience that puts them in strong positions when they compete for jobs in the field.

Our biology alumni are all over the country taking advantage of their BGSU training. Whether it was experiences in specific labs or engagement with faculty and fellow students, we hope you all can reflect on your positive experiences. Now, please reminisce about those experiences and help us train the next generation of scientists, teachers, professionals, environmental biologists, microbiologists, lab technicians and others using critical thinking skills fostered here. Please consider making a contribution to one of our scholarships. There are numerous scholarships for undergraduate students; choose the one that fits your passion the best (see <http://www.bgsu.edu/give>; once in Step 2, click on Fund Options and enter 'BIOL' into the search – then choose your scholarship. If you are an alum of our graduate program then please consider contributing to the Biology Graduate Student Scholarship (https://myziggy.bgsu.edu/ccon/new_gift.do?action=newGift&giving_page_id=90), which has been set up so your donation is immediately available to provide research funds and summer support for your academic cousins.

Thank you from our current and future students. Have a good New Year and remember to recruit for BGSU among your family, friends and colleagues!

Jeff Miner
Professor and Department Chair

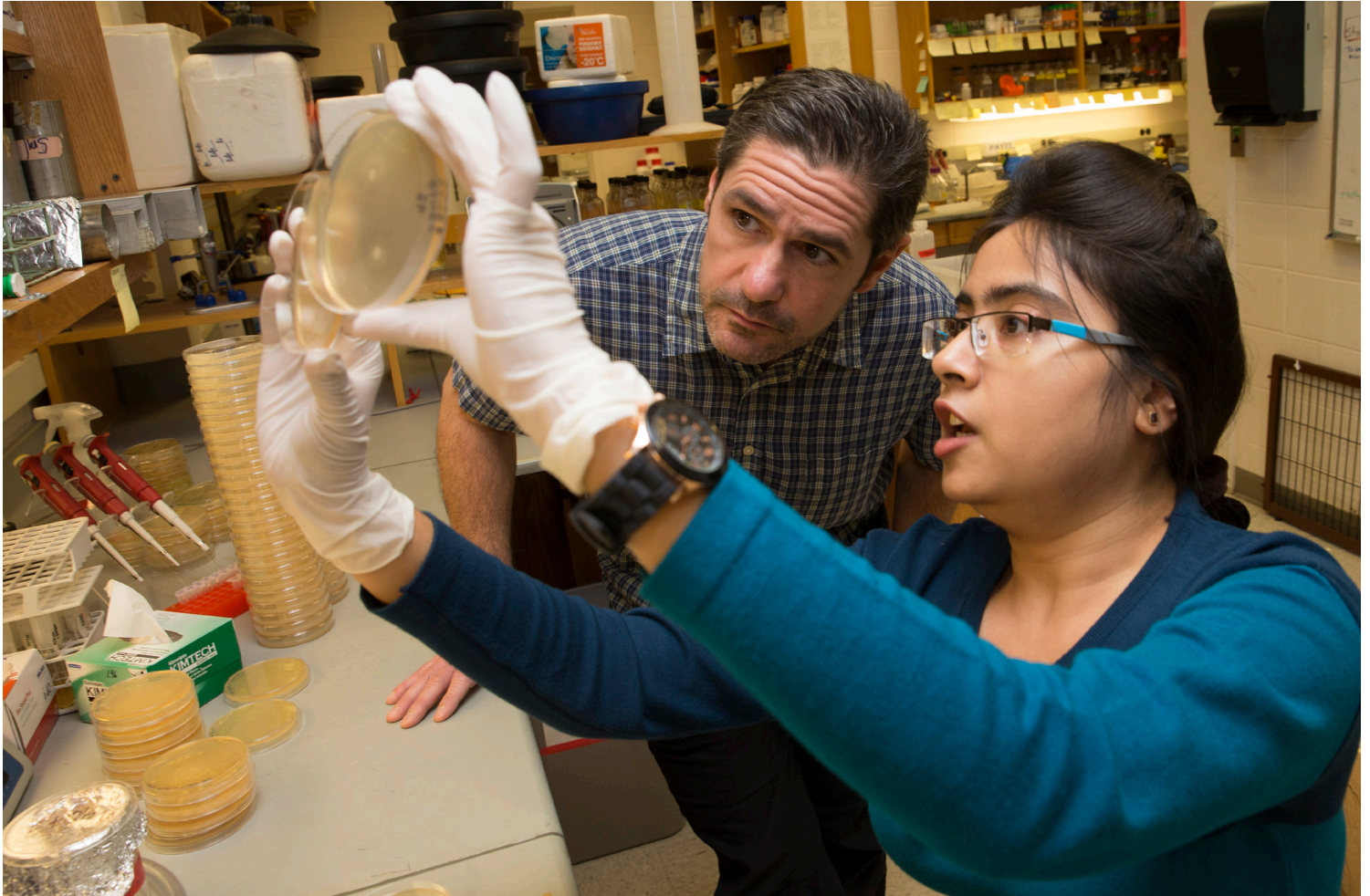
Moseley Hall returns to science roots

Moseley Hall opened for business at the start of the Fall Semester 2017. The extensively renovated Moseley Hall has returned to its science roots as an interdisciplinary science complex that contains state-of-the-art laboratory and classroom spaces. There are eight laboratory classrooms primarily for introductory labs for the Department of Biological Sciences, as well as geology, chemistry, and medical laboratory science.

Moseley Hall was the original science building on the BGSU campus. The building is named for Edwin Lincoln Moseley, the first science professor at Bowling Green Normal School (1914). Dr. Moseley was a distinguished naturalist known for studying the botany of northwest Ohio. He also investigated buried pre-glacial valleys in the Sandusky area.



Wildschutte focuses on antibiotic resistance research



Dr. Hans Wildschutte (left) and Payel Chatterjee study antibiotic resistance.

Dr. Hans Wildschutte, an associate professor of biology, has his eye on finding answers to the serious global issues of antibiotic resistance and novel drug discovery. The research in Wildschutte's lab focuses on finding environmental bacteria that can kill one or multiple pathogens.

A paper, "Environmental Pseudomonads Inhibit Cystic Fibrosis Patient-Derived *Pseudomonas aeruginosa*," that was accepted by the journal *Applied and Environmental Microbiology*, is another step toward that goal. The Pseudomonads findings are an important discovery in the battle against antibiotic resistance.

Wildschutte also ties his lab's research into his undergraduate Introduction to Microbiology class that follows the Small World Initiative (SWI), which addresses antibiotic discovery through an innovative citizen science curriculum.

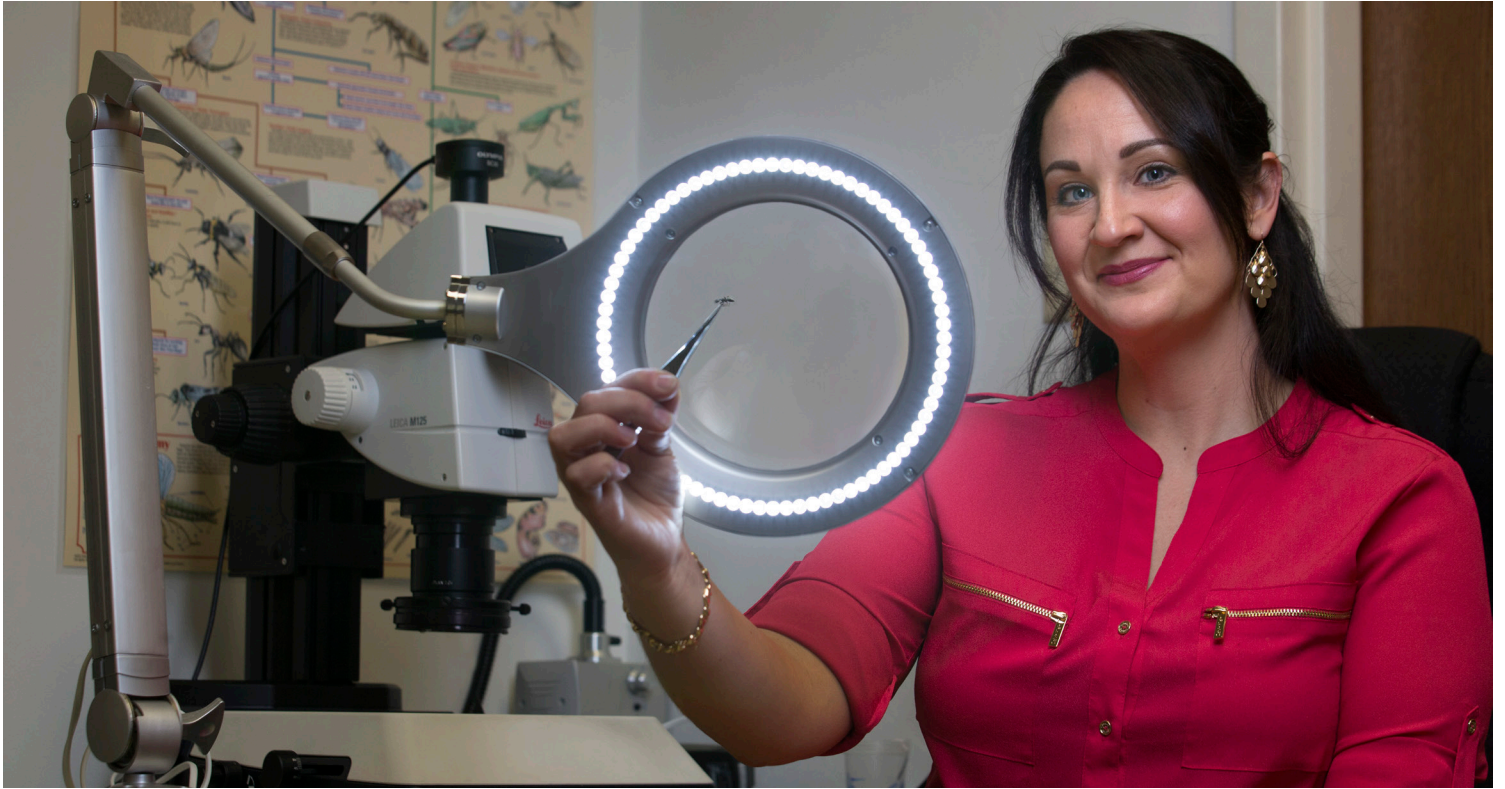
The bacterium *Pseudomonas aeruginosa* infects the lungs of cystic fibrosis patients and causes a serious life-threatening illness. Most strains

of *P. aeruginosa* are multidrug resistant, which complicates cystic fibrosis treatment, leading to failure of the treatment in patients or adverse effects from advanced antibiotic drug regimens.

The study, in collaboration with Dr. John J. LiPuma, a physician treating cystic fibrosis patients at the University of Michigan, looked at 30 different pathogens isolated from the lungs of patients with cystic fibrosis and tested 330 environmental isolates against them. The cystic fibrosis-derived pathogens are useful in research because they are opportunistic and only infect people who have cystic fibrosis or a compromised immune system.

The paper is co-authored by BGSU colleagues Drs. Mike McKay, Ryan Professor of Biology, and Daniel Wiegmann; Drs. LiPuma and David Sherman, both University of Michigan; BGSU graduate students Payel Chatterjee and Elizabeth Davis and Michigan graduate student Fengyan Yu, and then-BGSU undergraduate student Sarah James, who has since graduated.

Pelini lab: Ants provide clues to global climate change



Dr. Shannon Pelini gets close-up look at ants.

The world of forest ants may provide a macrocosm of the complex reactions and interactions among species affected by global climate change, according to a research project involving BGSU biologist Dr. Shannon Pelini.

“As escalating amounts of carbon dioxide are introduced into the atmosphere, a chain reaction is induced, leading to increasingly warmer temperatures,” Pelini said. “This is taking place at an alarming rate, making it more important than ever that we understand how climate change will affect our natural world.”

Many scientists have attempted to tackle this issue by determining the thermal tolerance of various species, then, predicting what will happen to them as our world warms. However, this approach as a way to understand nature has its drawbacks because one species never acts alone. Individuals are constantly interacting with other species and the environment in which they live, so comprehending how global change impacts these interactions is crucial to a holistic understanding.

Pelini and her colleagues have made significant progress in this direction with their new study, “Climatic Warming Destabilizes Forest Ant Communities,” which looks at complex interactions of ant communities and their responses to warming. The study was published last fall in the journal *Science Advances*, and has received wide attention in other publications, including *Harvard Forest*, *Phys/Org* and *Science News*.

Funded by the U.S. Department of Energy Program for Ecosystem Research and the National Science Foundation, the long-term experiment looked at the interactions ants exhibit over nesting structures in two distinctly different geographical areas: Harvard Forest in Massachusetts and Duke Forest in North Carolina.

“It’s one of the biggest climate change experiments in the entire world, which is a really exciting thing to be a part of,” Pelini said. “We were shooting for understanding what goes on with ant communities that exist in a cooler northern latitude and how their responses compare to the same suite of species in populations that occur in the warmer lower latitude.”

Pelini and her colleagues found some interesting and unexpected results. In warmer chambers, there was more occupancy of heat-loving ants, which is intuitive. However, less expected was the amount of time those ants were remaining in one single nest. Typically, ant colonies are constantly competing with each other for prime nest habitat, which promotes resilience to environmental changes within the community. “When one ant species, like the heat-lovers, remains in a nest for a long time, there is less resilience in the community and so it is more likely to fall apart following a disturbance event,” Pelini said.

According to Pelini, these results occurred for two reasons. First, warming will create an environment that preferentially selects organisms with broader or higher thermal tolerances. Second, those species that will do well under warming conditions will also have more opportunities to interact with other species that may or may not do as well under those conditions. The latter is something that current climate change models cannot capture because they do not focus on the community as a whole.

Although the study provided a new understanding of how climate change is going to influence a group of vital invertebrates that inhabit our soil, there is still much more to understand about this system and how it will respond to change.

U.S. Armed Services Blood Program posthumously honors Professor Bill Hann

Dr. William Hann, a longtime BGSU biological sciences professor, had a history of helping others. Before his death in 2009, he taught biology for 25 years, was a dedicated volunteer to numerous local organizations, including the Boy Scouts, served as a military leader for 37 years in the National Guard and U.S. Army Reserve and transformed the military blood bank that has helped save the lives of service members worldwide.

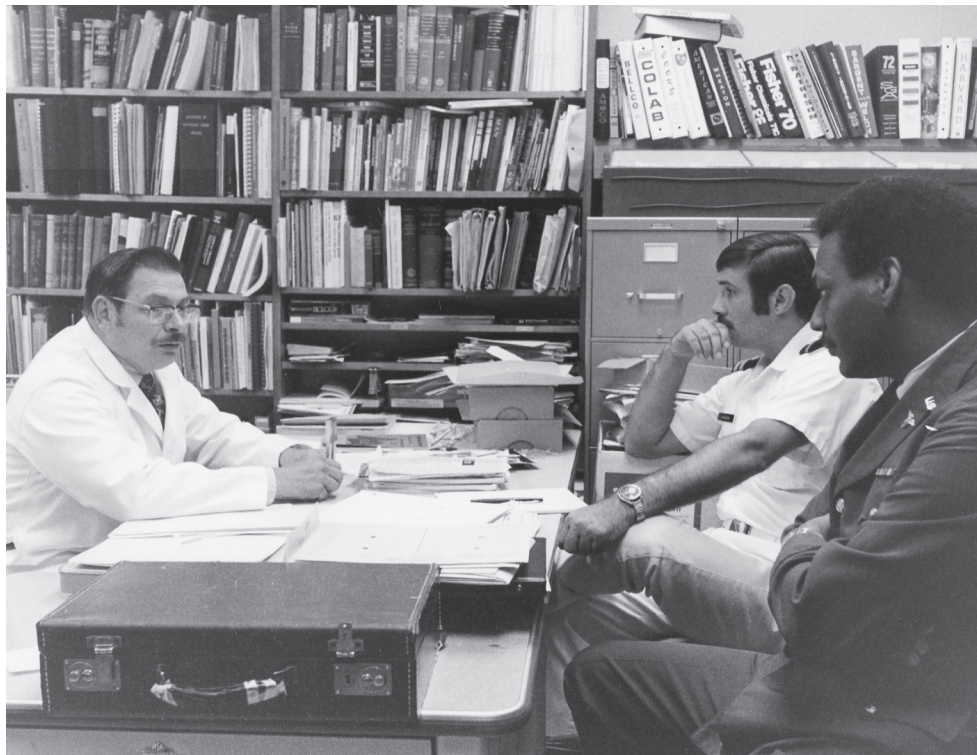
His dedication to the Armed Services Blood Program (ASBP) earned him a Lifetime Achievement Award, which was presented posthumously at the ASBP's annual meeting in 2016. His widow, Emma Hann of Bowling Green, accepted the award on his behalf, remarking how much he loved his work at BGSU and with the blood bank program. At BGSU, he taught bacteriology, microbiology and virology and was involved in developing the medical technology and blood bank programs at the University.

According to Navy Capt. Roland Fahle, ASBP director, Hann was "a trailblazer" who "opened a door that never closed for many blood bankers." He was best known for his work with ASBP's Specialist in Blood Banking Fellowship Program, which trains clinical laboratory officers from all three branches of the Armed Services in the advanced, specialized blood bank topics necessary in the health care industry.

As a mentor to hundreds, if not thousands, of biology students, he was known for excellent clinical and pedagogical skills. Four of his former students — Col. (Ret.) Anthony Polk '74; Dr. W. Patrick Monaghan '72, '74, '75; Col. (Ret.) James Berger '83, '85; and Dr. Jerry Holmberg '84, '85 — nominated Hann for the lifetime achievement award. They each had successful careers in the military blood bank program and previously earned the ASBP lifetime achievement awards for their own contributions.

"His personal efforts resulted in convincing key members of the U.S. Army and the administration of Bowling Green State University into a formalized relationship in supporting research, training and education," his nominators stated.

Dr. William Hann talks to students Patrick Monaghan and Anthony Polk.



In 1972 during a visit to the U.S. Army Medical Research and Development Command, Hann, who was also a colonel in the U.S. Army Reserves, recognized the possibility of establishing a professional relationship between academia and the training provided by the U.S. Army in the tri-service Blood Bank Fellowship.

Because of the partnership, the University incorporated the military blood bank fellowship training program into the curriculum with attendant credits. Thereafter, military blood bank students could use their hard-earned credits as part of a graduate degree program and go on to obtain their doctorate as well. Hann helped develop stringent course work and intensive training which ensured that the students graduated from the program as true specialists.

For 18 years, fellowship students could apply to the graduate school at the University and receive formal credit toward their graduate degrees. More than 100 officers received graduate credit hours, many of whom earned a master's degree in applied biology (immunoematology),

and five completed their research and earned doctoral degrees.

"Dr. Hann helped so many military students attain their graduate degrees. I remember the many dinner parties he and his wife hosted for all of his students, always keeping the Blood Bank Fellowship program family-oriented. He was a good mentor and had a heart of gold," Monaghan said.



Dr. William Hann

BGSU invited to partner with Howard Hughes Medical Institute

Faculty involved with HHMI are (from left) Drs. Xu, Halo Wildschutte, Zeilstra-Ryalls, Larsen, and Phuntumart.

Bowling Green State University is one of 10 institutions invited to partner for the next five years with the Howard Hughes Medical Institute (HHMI). This alliance offers a discovery- and course-based research experience open to incoming freshmen of all majors.

Starting this fall, five biological sciences faculty members are offering Science Education Alliance Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES). This educational initiative introduces freshmen to science at the foundational level with a highly accessible research project presented as a two-semester laboratory course. Headed by Dr. Jill Zeilstra-Ryalls, the team includes Drs. Julia Halo Wildschutte, Ray Larsen, Vipa Phuntumart and Zhaohui Xu.

According to Zeilstra-Ryalls, “This innovative approach exposes students to research in a way that excites them, even if they haven’t had any research experience.”

The challenge posed for the students will be to find and characterize new viruses that infect bacteria. Termed “phages,” these bacterial viruses are virtually everywhere, playing key roles in ecosystem vitality.

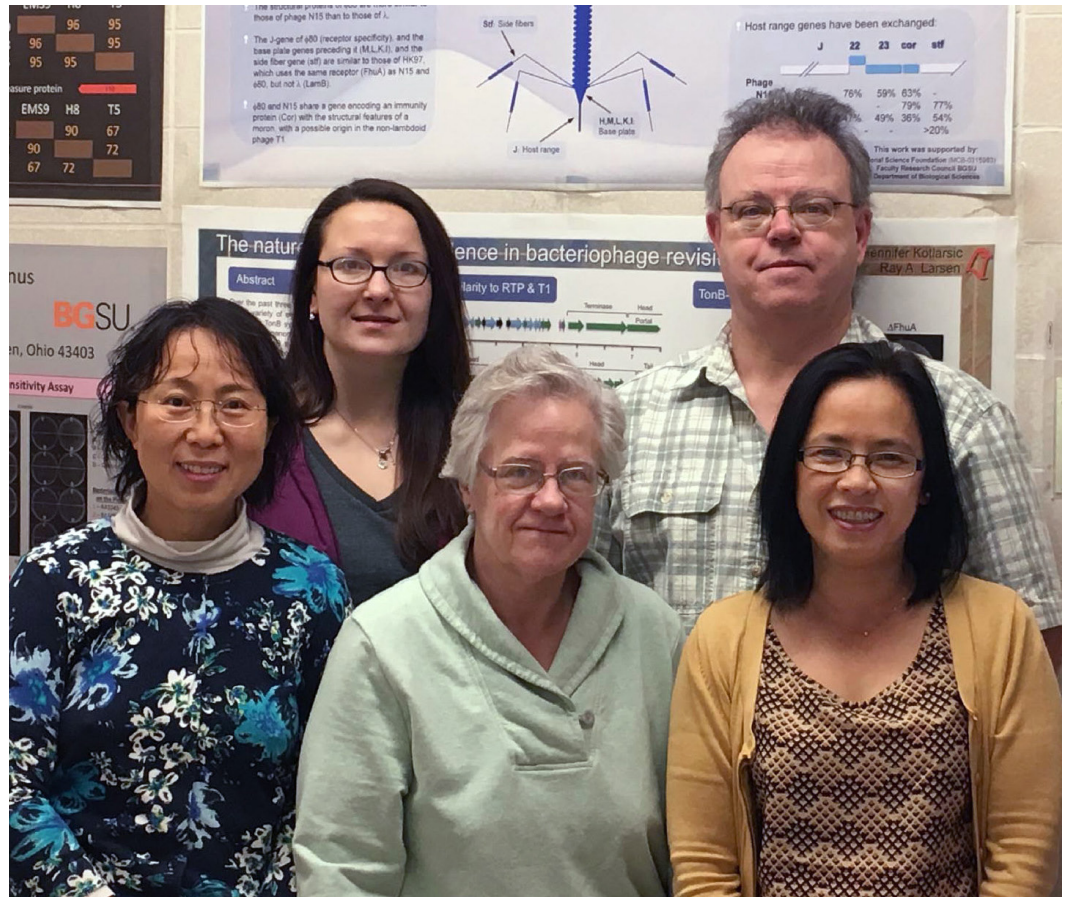
Phuntumart pointed out the diversity that exists among viruses, and “each has its own story to tell.”

“Yes,” added Halo Wildschutte, “Not only do we learn about the virus, but we also learn more about the cell it infects — from bacterial to plant to human.”

The first semester is the discovery phase, with students collecting environmental samples and isolating new phages, which they are learning how to grow and characterize, and ultimately extract and purify their DNA. That DNA is completely sequenced and assembled.

During spring semester, students use bioinformatics methods to annotate their phage’s genome sequence. A significant outcome from the students’ work, and one that benefits HHMI, is “the students’ information that is collected is added to a growing phage genome database. Thus, the work of the students contributes to a larger information set and supports studies of virus diversity and evolution,” Zeilstra-Ryalls said.

A unique feature of the SEA-PHAGES program here at BGSU is that the students have direct guidance from faculty who have research experience in



viral research (Larsen, Zeilstra-Ryalls, and Halo Wildschutte) and bioinformatic computational expertise (Phuntumart and Xu).

“At the institutional level this is a big deal for us and for the students,” Zeilstra-Ryalls said. “This HHMI program is in its 10th year, and has a proven record of scientific achievements by novice student investigators. Now we can provide this opportunity as part of the BGSU experience.”

“This gives students ownership and lets them be active participants in a real-world research experience; they don’t know what they’ll find — that is how science works,” Larsen added.

“And while science majors reap the rewards of the course with the research experience, even non-majors benefit by gaining a better understanding of how science works; they become important voices when it comes to communicating to the public about the significance of this type of research,” Zeilstra-Ryalls explained. “Our mission is to put the infrastructure in place to open the gates for all incoming freshmen to offer an experience with an emphasis on exposure to research.”

DEPARTMENT NEWS

NEW FACULTY

Timothy Davis, Ph.D., joined the biological sciences faculty in August 2017. His primary area of research focuses on plankton ecology with an emphasis on cyanobacterial harmful algal blooms (cHABs) in aquatic ecosystems. Lakes and coastal regions all over the world are plagued by cHABs including, some of the largest and most socio-economically important, such as the North American Great Lakes, Lake Victoria, Lake Taihu, Lake Okeechobee, and the Baltic Sea, to name a few. Davis uses advanced molecular techniques such as -omics (genomics – metabolomics) and qPCR to study these events. These techniques allow for the generation of a comprehensive population response, which is critical for understanding how ecosystem function and services are impacted by cHABs. He currently has projects investigating these questions in several systems including Lake Erie, Lake Huron, Lake Okeechobee (Florida), and Dianshan Lake (China).

Dr. Timothy Davis



Dr. Paul Moore



Paul Moore named Fulbright Scholar for 2017-18

The sparkling freshwater lakes and streams of southern Sweden are the current research sites for Paul Moore, Ph.D. He was named a Fulbright Scholar for 2017-18, and is at Lund University, through February 2018. Lund is the highest-ranked university in Sweden with a group of world-class limnologists (who study the biology, chemistry and geology of inland waters). The director of BGSU's

Laboratory for Sensory Ecology, Moore specializes in crustaceans' sensory abilities and the role that chemical signals play in their ecological function. The opportunity allows him to expand his research, learn new techniques and systems and stimulate new research endeavors.

Larsen excels at mentorship role

Dr. Raymond Larsen was recognized by the Center for Undergraduate Research and Scholarship for outstanding mentorship of undergraduate students.

Larsen is a longtime advocate for undergraduate research. He enthusiastically involves students in numerous research projects and says he "appreciates the opportunity to have undergraduates in the laboratory; their zest and engagement drives a lab community that fosters creativity and diversity of thought."

The Larsen laboratory focuses on the mechanisms of energy transfer between bacterial membranes, with projects addressing the contributions of membrane energization to the susceptibility of bacteria to viruses, the transport of toxins, and resistance to antimicrobial agents. More than 40 undergraduate members of

the Larsen lab have completed independent research projects, resulting in presentations at regional and national meetings and in publications.

"Dr. Larsen is undoubtedly the epitome of an ideal faculty mentor," according to one of his students. "He is beyond gracious with his time, the research opportunities and experiences he has provided. Dr. Larsen makes each of us feel as though we are a priority and that our research is as important as those vying for the master's or Ph.D. I wish that everyone could have the opportunity to work with such a motivating, kind, and intelligent faculty mentor so that they too could find enjoyment and interest in research."

Dr. Jeffrey Miner (left), chair of the biology department, presents award to Dr. Raymond Larsen.



Biological Sciences earns Excellence Awards

Early Career & Blinn awards go to Hans Wildschutte

Dr. Hans Wildschutte received the 2017 Outstanding Early Career Award and the Elliott L. Blinn Award for Faculty-Undergraduate Student Innovative Basic Research/Creative Work.

Wildschutte has excelled in scholarly research during his six years at BGSU. He has secured funding from the National Institutes of Health and the Cystic Fibrosis Foundation. He has established strong collaborations, including those with colleagues from the Department of Biological Sciences as well as across the region throughout the international community. He has published significant research that has appeared in high-impact journals, further attesting to the quality of his scholarly work.

“Dr. Wildschutte has effectively adapted his research as a tool to engage biology majors by integrating the Small World Initiative into the general microbiology curriculum,” said his nominators. His contributions to curricular development through active learning opportunities have provided his students with memorable learning experiences. He also is emerging as a leader in the study of bacterial population dynamics in the environment where he has developed an innovative, population-based approach to studying interactions between microbial communities.

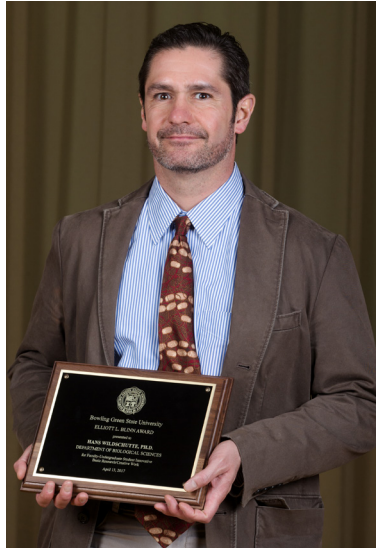
Since his arrival at BGSU, Wildschutte has continued to build on these methods with marine vibrio, but is also adapting the approach to begin examining *Pseudomonads*, a direction that offered synergies with research efforts ongoing with several groups in the department.

Pseudomonads are bacteria that are well known for the production of highly diverse secondary metabolites known to affect the breakdown of complex compounds and inhibit the growth of other organisms, including human pathogens, pathogenic fungi and plant pathogenic oomycetes. Several species of *Pseudomonas* are also well known to promote biological ice nucleation, which is where Wildschutte began his internal collaborations at BGSU.

The Blinn award recognizes innovative basic research/creative work conducted by individual faculty members in collaboration with undergraduate students and supports collaboration with additional students. Wildschutte has provided numerous undergraduate students the unique opportunity to be directly involved in the discovery of new antibiotic resources and to replace the growing number of antibiotic-resistant drug treatments for infection. Students work with him to isolate bacteria in soil that are producing antibiotics, participating first hand in this critically important step in the process of antibiotic development — a serious global need.

Wildschutte’s students already have identified a gene cluster whose products may inhibit the growth of bacterial human pathogens, and they were the first team from 150 universities in 12 countries to submit a research manuscript on their findings, which was authored by all the students in the lab class.

Dr. Hans Wildschutte



Moira van Staaden earns Olscamp Research Award

Dr. Moira van Staaden



Dr. Moira van Staaden’s research productivity and impact have been significant over the past three years, which earned her BGSU’s 2017 Olscamp Research Award for outstanding scholarly or creative accomplishments.

Among her achievements are a \$1.5 million grant for STEM education, and a \$3.1 million

award from the National Science Foundation (NSF) to improve quantitative literacy. Van Staaden’s research productivity and impact have been significant over the past three years. She has served on six NSF review panels during that span and was a 2015-16 visiting scholar in education at Harvard University.

The most recent NSF grant—the five-year SEA Change grant—is focused on introducing new ways of thinking about STEM pedagogy — an area of high need in the United States today. The aim is to get undergraduates off on the right foot, encouraging them to persist, and enhance retention. It builds on some of the best practices that arose from the earlier SETGO five-year NSF grant administered by van Staaden, which also included Owens Community College.

In addition to evidence-based teaching practices, SEA Change also includes a biweekly meeting for faculty to share and network with one another. “We want to broaden the conversation and bring more people in, and develop faculty leadership,” van Staaden said. “You can combine teaching and research very successfully but you need people around you to provide support.”

Fruitful research on cause of 'food coma'



Dr. Robert Huber's research expands knowledge about neurobiological connections between eating and sleep.

The humble fruit fly has proved to be a fruitful research subject for BGSU neuroscientist Dr. Robert Huber and colleagues from Scripps Research Institute in Florida and elsewhere. The collaborators' research into their behavior has helped expand our understanding of some important neurobiological connections between eating and sleep — including the infamous “food coma” felt after a big meal.

The cause of the food coma turned out to be protein and salt, along with the time of day the food was consumed. Surprisingly, sugar did not seem to play a role, according to the study. The results of the experiments Huber conducted with lead researcher Dr. William Ja of Scripps and his team were reported in more than 200 newspapers around the world.

The scientists will now look more deeply at the brain structures that induce the insects to sleep after consuming protein and salt, and test theories

about why sleep then would be beneficial.

“Clearly, protein is a very expensive commodity,” Huber said. “If sleep increases your ability to resorb it, that would be a possible reason. And the same thing with salt.” Carbohydrates, on the other hand, are much easier to come by in nature, he said, so might not call for such dedicated digestion.

The fruit flies' preference for protein does explain their attraction to overripe fruit, where they can lay their eggs.

“The flies have very good sensory receptors to detect all kinds of volatile compounds that indicate ripe fruit and yeast,” Huber said.

Huber's expertise with video tracking and applying computer vision to monitor and measure the tiny flies' behavior allowed the researchers to collect much more reliable data “than having an observer there with a clipboard, writing a summary of what happens,” he said. “Instead, we apply computer technology with strict rules to objectively remove observer bias. Behavior is a

very complex type of trait or phenotype, so it's not as simple as measuring the height of something. We use computer technology with video tracking, integrating it with sensors and robotic interfaces. We can create automated learning paradigms in real time.”

Thus, a system devised by Huber senses when a fruit fly alights on a tiny platform and reaches up to eat from a tube. The computer measures exactly the number and duration of instances of feeding along with a record of the fly's activity levels, including those that denote sleep.

“We can really improve our characterization of food consumption and activity,” Huber said. “In one second, we can get a thousand data points, very accurately, showing when, how much, how often they feed. That's not something you are able to do by hand.” During the food coma, the flies remain still for a certain amount of time and they are much less responsive to any kind of other cues than they would normally be, he said.

“There's clearly something very potent about sleep itself,” Huber said. Using genetic manipulation techniques, the team will look at whether a neuron with a receptor for a neuropeptide called leucokinin is actually playing a role in causing the flies to fall asleep specifically after consuming protein and salt.

“You can turn those receptors on and off with molecular genetics and piece together how the whole network that controls sleep is put together,” Huber said.

This should help reveal more about the mechanics of sleeping and eating. Using a tiny but extremely powerful LED light, he is able to trigger responses in the genetically modified flies. When the light is not activated, the insects behave just like any other normal fruit fly.

Water crisis may be linked to virus infection

In August 2014, toxins from algal blooms in Lake Erie shut down the city of Toledo, Ohio's water supply, leaving half a million residents without drinkable water for more than two days. A new study co-authored by Bowling Green State University researchers shows that a virus may have been involved in the crisis and suggests methods for more stringent monitoring of water supplies.

Drs. Michael McKay, the Patrick L. and Debra Scheetz Ryan Professor of Biology, and George Bullerjahn, Professor of Research Excellence at BGSU, worked with a team of 25 researchers to examine the physiological traits of *Microcystis*, the cyanobacterial organism responsible for scum-like algal blooms in Lake Erie. They found that it was consistent with algal blooms from 2012 and 2013 except for one thing — the 2014 *Microcystis* cells had a viral infection. Typically, toxins from algal blooms are trapped within the cell until the cell dies. But virus infections can cause cells to break open, leaking the toxin into the water and subsequently into water facility intake pipes and treatment centers.

The viruses analyzed in this study infect only bacteria and do not infect humans.

"The study changes the way we think about how the toxin moves around aquatic systems and gets into water supplies," said Dr. Steven Wilhelm, Mossman Professor of Microbiology at the University of Tennessee, Knoxville, who led the study. "It may help us understand how these organisms persist in nature."

The study was published recently in the journal *Environmental Science and Technology*.

Co-authors included Wilhelm and his team from the University of Tennessee; Dr. Tim Davis, a molecular harmful algal bloom ecologist formerly with the National Oceanic and Atmospheric Administration Great Lakes Environmental Research Laboratory and now a BGSU faculty member; and Dr. Gregory Dick, an associate professor of earth and environmental sciences at the University of Michigan.

The scientists documented the viral infection by sequencing RNA from the Toledo water



Drs. Mike McKay and George Bullerjahn are actively involved in algal research.

samples. They also used computer mathematical models to simulate how the algal blooms moved through water: satellite images were used to pinpoint where the blooms were on certain days, and computer models filled gaps in between.

"The biggest thing we're learning is that there are dissolved and particulate sources of the toxin," Wilhelm said. "We historically think of toxin as being stuck in the cell. In this study, we have identified a way for the toxin to move from particulate to the dissolved phase."

"It's making us re-evaluate how nutrients may shape the microbial communities," Wilhelm said.

Researchers are still trying to understand why algal blooms have exploded in growth since the 1990s in bodies of water around the country and the world.

While the BGSU team had been studying algal blooms in Lake Erie prior to the Toledo water crisis, "This event was a game-changer," noted McKay. "Since the water crisis, we have become more involved in helping to shape policy through our interactions with Congressman Bob Latta's office, and through our scientific contributions and outreach efforts BGSU is being recognized as a leader in freshwater harmful algal bloom research."

"Algal blooms are growing in intensity, severity and frequency and we're trying to understand why," Wilhelm said. "This study is another piece of the puzzle."

BGSU faculty learn lessons from Lake Erie



BGSU and Owens faculty and administrators take to the lake for STEM education.

An intrepid group of Bowling Green State University and Owens Community College faculty and administrators set sail this past summer to learn more about hands-on STEM education and undergraduate research. Assuming the role of students, they learned from biologist Dr. George Bullerjahn, Professor of Research Excellence, how to collect samples for water quality testing and about BGSU research into the toxic algae that often invades Lake Erie and Sandusky Bay.

The June 21 shipboard experience was part of Project SEA Change, a five-year, \$3 million National Science Foundation grant received by Dr. Moira van Staaden. Spending the day on the water together aboard the Ohio State University research vessel Gibraltar III gave the participants the opportunity to get out of their respective disciplinary silos, and to increase their understanding of science and the process of science while learning about an environmentally relevant issue.

"STEM teaching can be very powerful when it's embedded in a robust research environment," van Staaden said. With a varied group, many of whom are not in STEM disciplines, the boat experience elicited varied reactions and much enthusiasm.

"I was happy to be invited to come along. Lake Erie is our backyard and I am eager to understand what it looks like from the science point of view,"

said Lynn Whitney, associate professor and head of the photography division in the School of Art. "I've been photographing the Lake Erie shores for a long time, and I would like to inject some of the science of it into my pictures, to make the invisible visible. George was terrific at explaining his research methodologies, and engaging us physically with testing the waters, and making his passion accessible to all of us."

For microbiologist Dr. Zhaohui Xu, being able to get outdoors was a "special treat" and gave her a new appreciation of the challenges of fieldwork and a better understanding of where the materials she and her students study come from.

"The majority of the time, we stay in the lab," she said. "The samples we study are already purified and somebody else has gotten them. We lack the experience of doing fieldwork. But I still remember the one time in college when our professor took us to a fermentation station to see what was happening. After all this time, I still remember that very clearly."

The group also saw how data is gathered from the sensors BGSU has on buoys in the bay and how they are transmitted wirelessly to the researchers' computers and cell phones.

Karen Root takes on leadership role in conservation biology society

Dr. Karen Root

Dr. Karen Root, an associate professor of conservation biology, will have the opportunity over the next six years to greatly expand her contribution to conservation and to the community of professionals who share her values. Root was recently elected to the leadership of the Society for Conservation Biology North America. She will serve as president-elect for two years, then president for two years and finally past-president for another two years.

Her deeply felt commitment to both the cause and her peers led her to take on the role with the society.

"This is an organization I believe in," she said. "They're highly motivated, very passionate people giving so much of themselves and doing the thing they care most about, all on a volunteer basis. It's my professional home where I feel most comfortable."

With members from academia, the private sector and governmental agencies, the society is a strong and united voice for the role of science in policy and management decision making. As its vision statement says, "The Society for Conservation Biology (SCB) envisions a world where people understand, value, and conserve the diversity of life on Earth. We envision SCB, a global community of conservation professionals, as a leading scientific voice for the study and conservation of Earth's biological diversity."

Root's research over the last 24 years has focused on the conservation of native biodiversity, including ecological surveys, habitat and



population modeling, and conservation planning and management.

"Conservation is an extremely complex topic," Root said, "and one that must consider multiple factors beyond the strictly biological, including political and cultural differences, competing interests, different landscapes and a variety of scientific disciplines. There are many hard choices that have to be made, and many viewpoints are needed. Part of the society's mission is to identify and support the scientific research needed to understand and conserve biological diversity."

She is already setting goals for what she hopes to accomplish in her six years in leadership, including increasing professional development opportunities, and focusing on diversity and equity within the organization.

Root, who has been a member of the organization since she was a graduate student at the Florida Institute of Technology, is also chair of the conference committee planning the sectional meeting in Toronto next year, which will be attended by about 1,200 people.

BUCHANAN LECTURE CONTINUES LEGACY OF EXCELLENCE

The field of ecological developmental biology seeks to look at development in the real world of predators, competitors and changing seasons. Dr. Scott Gilbert, professor of biology at Swarthmore College, discussed his research about ecological developmental biology during the 2017 Jean Pasakarnis-Buchanan Lecture in April.

Ecological developmental biology brings together aspects of embryology, medical physiology, ecology and evolution. He presented "Eco-Evo-Devo: The Synthesis of Epigenetics, Medicine and Evolution" during the public presentation and "How the Turtle Got Its Shell" at the scientific lecture. Gilbert, the Howard A. Schneiderman Professor of Biology, is known for his work in developmental genetics, embryology and the history and critiques of biology.

BGSU's annual lecture series was created in 1998 by Jean Pasakarnis-Buchanan, who graduated from the University in 1952 and went on to a

33-year career as a cytologist with Massachusetts General Hospital. She also taught cytology, the study of human cells, at Northeastern University. Buchanan received the Alumni Community Award from BGSU in 1972, and in 1987, set up a scholarship for biology majors. Her lectureship endowment allows the University to bring some of the leading scientific figures to campus each year.

The 2018 Pasakarnis-Buchanan Lecture is scheduled in April, featuring Dr. Hopi Hoekstra, the Alexander Agassiz Professor of Zoology in Harvard University's Departments of Organismic and Evolutionary Biology and Molecular and Cellular Biology. Her research interest is in the genetic basis of adaptation from morphology to behavior in vertebrates, primarily wild mice. She will present a public lecture at 7 p.m. April 3 in the Bowen-Thompson Student Union Theatre (Room 206).

BGSU teams with county to monitor mosquitoes

Dr. Dan Pavuk prepares locally caught mosquitoes for analysis.



An uptick in mosquitoes in northwest Ohio was the focus of a collaborative project between BGSU and Wood County (Ohio).

Dr. Dan Pavuk, an insect biologist and lecturer, led a local monitoring project in conjunction with the Wood County Health District. The health district, which received a \$17,696 grant from the Ohio Environmental Protection Agency to study the local mosquito population, contracted with BGSU to assist with the project.

Pavuk and two undergraduate biology students, Erica Eskins of Bellevue, Ohio, and Hannah Alanis of Oregon, Ohio, worked on the project all summer. They set the traps throughout Wood County, including three sites in Bowling Green and one each in Pemberville, Grand Rapids, Perrysburg, Rossford, North Baltimore and Walbridge.

Among the mosquito species sampled for was the Asian tiger mosquito, *Aedes albopictus*, which occurs over a large part of Ohio but not usually northwest Ohio except for Lucas County, Pavuk said. "Asian tiger mosquitoes vector Zika virus, but we don't have a vector of Zika virus that normally occurs in this area. Even if Asian tiger mosquitoes show up, it doesn't mean people are suddenly going to come down with a Zika infection."

Pavuk also said that the yellow fever mosquito, *Aedes aegypti*, a major vector of Zika virus and several other viruses such as yellow fever virus, dengue virus and chikungunya virus, does occur as far north as Cincinnati.

Pavuk and his students were primarily concerned about surveying

mosquitoes, *Culex pipiens* and other *Culex* species, that vector the West Nile virus. He said there were a number of counties in Ohio this summer that captured mosquitoes that have tested positive for the virus.

After capturing the mosquitoes in their traps, Pavuk and the students put them in a freezer, then shipped them overnight to the Ohio Department of Health's vector disease unit that tests the vectors of West Nile virus.

Pavuk said the Ohio Department of Health tested more than 200,000 individual mosquitoes this summer using molecular techniques to identify DNA from the virus.

"We've had several individual mosquitoes in Wood County that tested positive for West Nile virus," he said. "Franklin and Lucas counties have had a number of cases, as well as the Cincinnati and Cleveland areas and other big urban counties. That's really a function of how large their mosquito surveillance programs are in those large urban areas. The more mosquitoes you catch, the more likely you'll find some that are infected."

Eventually, the Centers for Disease Control and Prevention in Atlanta, which tracks mosquito-borne diseases across the country, collects the data if there are any West Nile disease-positive mosquitoes.

In that way, the primary purpose of the Wood County surveillance project, Pavuk said, was to provide public health officials in the Wood County Health District and the Ohio Department of Health with an early warning system.

Canine genome opens long line of research options

Dr. Julia Halo Wildschutte researches the canine genome.



Dr. Julia Halo Wildschutte, an assistant professor, is taking a new look at the canine genome, and her research is beginning to reveal that some long-held beliefs about what it contains may not be entirely accurate.

A specialist in virus-host interactions, Halo Wildschutte has a \$300,000, three-year Academic Research Enhancement Award from the National Institutes of Health to study “The Properties and Impact of Endogenous Retroviral Elements to the Canine.”

“When a retrovirus infects a cell, it integrates a DNA ‘copy’ of its genome, or ‘provirus,’ into the nuclear genome of that cell. This means that if a retrovirus is able to infect a germ cell, the provirus may inadvertently be passed onto offspring. And this unlikely scenario has happened a lot in mammalian evolution. Fully 8 percent of the human genome is derived from retroviruses. In mice, it’s about the same. But dogs are interesting,” she said. “In dogs, it’s only .15 percent. How did it happen that dogs have missed such a rich history of retroviruses infecting their germ line?” she said.

“It’s such an unexpected finding, and there’s so much that I expect will come out of this work from both a scientific view and from a biomedical view.”

Halo Wildschutte became interested in these elements, termed ‘endogenous retroviruses,’ during her doctoral work at Tufts University, and

continued in the field as a postdoctoral fellow at the University of Michigan.

Endogenous retroviruses have been part of the human genome for millennia. Once a retrovirus has inserted itself into a cell’s genes, “if it survives, a copy of it can be passed down forever in every single cell of an offspring,” Halo Wildschutte said.

Endogenous retroviruses that have entered the germ line at some point in evolution also contribute to genetic diversity, she said.

She has expanded her interest in host-virus interaction and retroviruses to a different model system — the canine — and has applied the sophisticated techniques and analysis that her former team performed on human virus genomes to the canine and other species in the canidae line, which includes wolves, jackals, coyotes and other related groups. What she found has only deepened the mystery and further intrigued her.

While humans have circulating retroviruses such as HIV and HTLV, dogs don’t have any retroviruses that are known at this time.

“This raises the possibility that canines, and their ancestors, are somehow able to evade such retroviruses, and we don’t know why,” Halo Wildschutte said. Not a lot of research has gone into that yet. That’s something that is really interesting to me. I foresee some of research going in that direction.”

Nonetheless, evidence that retroviruses did indeed exist in canine ancestors can be inferred by examining the genomes of contemporary canids for the presence of endogenous retroviruses. She and her team searched through roughly 350 canid genomes, including DNA from breed dogs (pets), “village dogs” (scavengers), wolves, coyotes, jackals and other outgroups.

They found an unexpectedly high amount of genetic variability and insertions of endogenous retroviruses in those samples. In addition, “these insertions were obviously from an evolutionarily recent circulating virus, within the last several hundred thousand years,” she said. “It was a very similar analysis to our HERV-K that previously infected human genomes.”

She is preparing to publish the findings from this first round of discovery.

“This was something in the field that was unexpected, and people really didn’t expect to find this high variability of these endogenous retroviral insertions in dog genomes,” Halo Wildschutte said. “Plus, they had the signature of being fairly new. It’s sort of like a new lineage and it seems to be specific to the canidae lineage.”

“This dog group is very new, and while I wasn’t expecting to find so much variability of insertions in dogs, it’s there. What I’m interested in now is to investigate the prevalence and patterns of these elements and their expression in canine tissues.”

Halo Wildschutte is working in her lab with graduate student, Abigail Jarosz, who will also be staying at BGSU for her Ph.D. Jarosz’s master’s degree project is looking at canine tumor tissue, extracting RNA and genomic DNA from the cell lines, genotyping the cell lines and cloning RNAs expressed from the new group of endogenous retroviruses, and starting to build phylogenies based on the genes that she’s cloning from these viruses. This will help identify and group similar gene sequences and help reveal which endogenous retroviruses are being expressed in which different types of tumors and in nonrelated tissues.

Also on the project is undergraduate researcher Malika Day, who performed much of the sequencing and validation of results.

Halo Wildschutte sees this as the beginning of a long line of research possibilities.

Bio:Life

Biological Sciences Scholarship and Award Recipients

Following is the list of scholarship recipients for 2017-18. This list includes awards for graduating seniors. Congratulations to these outstanding students and special thanks to our donors!

To view scholarship criteria, please visit: www.bgsu.edu/biologyscholarships.

Beta Beta Beta Award

Catherine Freed (Wooster, OH)

Edward J. Karlin Memorial Scholarship

Rachel Crowl (Akron, OH)

Biological Sciences Alumni Scholarship

Annaliese Keiser (Fostoria, OH)

Jean Pasakarnis Buchanan Junior/Senior Scholarship in Biology

Emily Breech (Commercial Point, OH)
Kelsey Buettner (Grandville, MI)
Kelsey Dietrich (Port Clinton, OH)
Emma Harkness (Bowling Green, OH)
Haley Kilgore (Amelia, OH)
Katelyn Lang (Bowling Green, OH)
Megan Semler (Toledo, OH)

T. Richard Fisher Biology Scholarship

Erica Cech (Westlake, OH)
Susanna Thibault (Bloomington, OH)

James D. Graham Scholarship

Sara Bodnar (Imperial, PA)
Rebecca Lang (Bowling Green, OH)

Ralph V. McKinney, Jr. – Eloise Whitwer Scholarship

Cameron Friedman (Pickerington, OH)
Paige Lepowsky (Austintown, OH)

Dr. Suzanne K. Miller-Kobalka Undergraduate Assistantships in Biological Science

Andrea Fisher (Springboro, OH)
Katherine Marita (North Olmsted, OH)
Nicholas Mendenhall (Strongsville, OH)
Shannon Turner (North Ridgeville, OH)

Barry R. Morstain Biology Scholarship

Stefanie Salazar (North Olmsted, OH)
Katrice Williams (Cincinnati, OH)

Multicultural Student Scholarship in Biological Sciences

Brittany Carter-Stewart (Columbus, OH)

Linda and Larry Oman Scholarship (graduate students)

Ana Jurcak (Bethlehem, PA)
Rachel Kappler (St. Johns, MI)

Myra L. Patchen Biology Scholarship

Ashley Fortunato (Lyndhurst, OH)

Dawson S. and Sylvia A. Patterson Scholarship

Rachel Fenton (North Bloomfield, OH)
Caitlin Gold (Medina, OH)
Hugh McQuillen (Port Clinton, OH)
Nadia Mustafa (Euclid, OH)

Robert C. Romans Biological Science Scholarship (incoming freshmen)

Samantha Lehker (Fairfield, OH)

Joseph J. and Marie P. Schedel Scholarship

Kaitlyn Busch (Westerville, OH)
Jamie Hawkins (Fletcher, OH)
Eric Huber (Lancaster, OH)
Karen Potter (Strongsville, OH)

Stephen S. Steel Scholarship

Haley Jacobs (Littleton, CO)

Waldo and Evelyn Steidtmann Scholarship

Katherine Herzog (Rockwood, MI)
Samantha Newhouse (Toledo, OH)
Bonnie Plickert (Jacksonville, FL)
Mary Walther (Whitehouse, OH)

Cynthia Collin Stong Marine Biology Scholarship

Madeline Dominique (Swanton, OH)
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Krystyn Files (Swanton, OH)
Jocelyn Walborn (Mainville, OH)

Dennis R. Whitmore Memorial Scholarship

Erica Eskins (Bellevue, OH)
Mahnur Khan (Perrysburg, OH)

Biological Sciences Scholarships

Visit www.bgsu.edu/biologyscholarships for a list of funded scholarships that are available to our undergraduate and graduate students thanks to the generous contributions of alumni, friends and other donors. We thankfully accept donations to any of these scholarships for assistance of our students.

October 2016 – October 2017 Alumni/Retired and Current Faculty/Staff/Friends Contributions (\$32,750)

Again this year we want to recognize and thank our donors for their generous contributions. If you have provided a monetary gift to the Department of Biological Sciences and are not listed below, please let us know and we will include it in the next newsletter.

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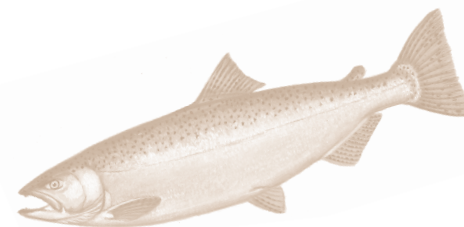
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