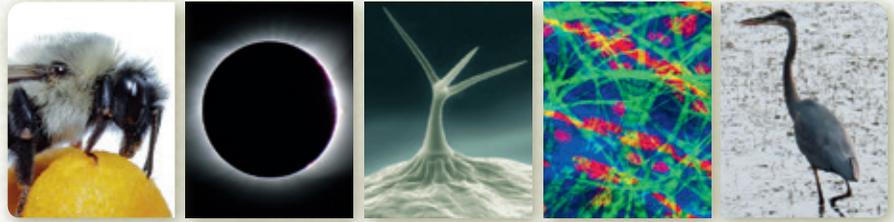




ILLINOIS STATE UNIVERSITY
Illinois' first public university



SCHOOL OF

BIOLOGICAL SCIENCES

NEWS SPRING 2018



International collaborations of the ISU faculty.

Science is collaborative and international

Scientific research has always required inquisitiveness, analytical thinking, and attention to detail. But just as our lives have been changed by modern technology, the internet, and social media, the way we conduct research has been recently transformed by the same driving forces. We are all aware how technological advances revolutionized research in biology. The development of highly sensitive and conceptually new instruments has allowed researchers to ask deeper questions about mechanisms of biological processes. New experimental tools and laboratory techniques help us to expedite experiments and open new possibilities to tackle our favorite research problems. Widespread usage of internet and social media removed time and distance barriers from scientific communications, facilitating international collaborations. While in the 20th century research was mostly coordinated and managed at a national level, science in the 21st century became global.

Between 2000 and 2013, the percentage of publications with coauthors from more than one country rose from 13 percent to 19 percent, according to research statistics published by the U.S. National Science Foundation (NSF). The trend is growing fast with about 25 percent of international publications reported in 2015 by the *UNESCO Science Report: towards 2030*.

Several forces drive the globalization trend in science. As the world becomes more interconnected, the problems we are facing are becoming increasingly international as well. HIV/AIDS, Zika, Ebola, early flu outbreaks require coordinated efforts of scientists from around the world to efficiently combat these threats. International collaborations

Director's message

ISU Biology's enrollment has grown once again, bringing the number of undergraduate students in our school to nearly 800.



Director Craig Gatto

Some of the most successful interdisciplinary programs are the molecular and cellular biology major, which just turned four years old, and the zoology and physiology, neuroscience, and behavior sequences.

The majority of students adopt the general biology track, which provides them the most degrees of freedom. The popularity of biology continues to keep us as the second most populated major in the college.

We were excited to see the state of Illinois pass a budget in 2017, which enabled us to embark on two national faculty searches in the areas of microbiology and ecology. Six candidates were brought to ISU for seminars and interviews in spring 2018, and we were able to recruit two new colleagues to join the faculty for the 2018-19 school year. Maintaining our faculty numbers is crucial given several retirements in the recent past coupled with the student population growth.

The research productivity of the school remains strong. We once again brought in over \$2 million in extramural support, which enabled faculty to mentor

Continued on Page 2

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HERE ARE TWO GREAT WAYS TO KEEP UP WITH LATEST EVENTS:

Check out our Facebook page:
www.facebook.com/ISUBiology
 Visit our homepage:
biology.IllinoisState.edu

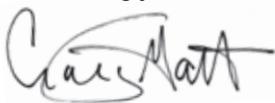
Write to Kevin at kaedwar@IllinoisState.edu if you have any news to contribute for next year!

over 100 undergraduate and 60 graduate students in their laboratories. These efforts resulted in over 60 peer-reviewed publications with the majority of these including student co-authors. Additionally, our faculty and students combined to give nearly 100 presentations at national and international scientific conferences last year. Regularly attending scientific conferences is necessary to stay current in one's field as information that comes out in publication is usually one to two years old the day it is published. I would also like to congratulate Assistant Professor Benjamin Sadd for winning the University Outstanding Research Initiative Award, which is given to the most successful scholars among pre-tenured faculty. In addition, I also congratulate Professor Laura Vogel for being named the College of Arts and Sciences Distinguished Lecturer.

I would like to thank all the folks who donated to the school on Giving Tuesday 2017. We are in the middle of a comprehensive campaign at Illinois State University, and these gifts critically contribute to our ability to provide scholarships, as well as support student research and travel.

We love to hear from our alumni, so please drop me (or any of us) an email, or like us on Facebook, and let us know what you're up to.

Wishing you much success,



Craig Gatto, Ph.D.
Director, School of Biological Sciences

School of Biological Sciences News

Issue 4

Editors: Martha Cook, Kevin Edwards

Associate editors: Diane Byers, Barbara Cox, Kristin Duffield, Amy Gilliland, Viktor Kirik

Thanks to all members of Biological Sciences who submitted photos and stories.

Bio.IllinoisState.edu

allow researchers to share very expensive equipment. Astronomers from all over the world are probing outer space with the Very Large Telescope (VLT) in Chile. Cell biologists are working together on microscopes that can approach \$1 billion U.S. dollars in purchase costs. Lastly, the diversity of thought brought about by different cultural approaches facilitates problem solving, stimulates creativity, and leads ultimately to better, more engaging science.



A lake in Finland was one of the collaborative travel destinations visited by Bill Perry.

Does our School of Biological Sciences benefit from the powerful advantages of global science? Certainly yes! International diversity and collaborations across the globe are an organic part of the research at our school. Members of our faculty foster collaborations with scientists from four continents. Five of our professors got their Ph.D. or bachelor's degrees outside the United States. The biology graduate school has a long tradition of educating international students from all over the world including Azerbaijan, China, Germany, India, Iran, and Philippines.

The collaborative research of Scott Sakaluk, Ben Sadd, and scientists from Western Sydney University in Australia has been funded by NSF in 2017. Together they study the evolution of insect-mating behavior. Sakaluk also maintains collaborative ties with his former graduate student Sandra Steiger from the University of Gießen in Germany.

A coordinated continent-wide study (Canada, Mexico, and USA) of bird-window collisions involves a collaboration between 40 university campuses, with the School of Biological Sciences represented by Angelo Capparella and his undergraduate research assistants.

To learn the techniques of isolation and molecular characterization of the crayfish plague oomycete *Aphanomyces astaci*, Bill Perry traveled to Kuopio in Finland and to Landau in Germany in the summer of 2017. There he learned firsthand from leading world experts on this organism and discussed future collaborations. Jumping between continents, Perry traveled to Tanzania to help his colleagues with modelling Lake Tanganyika physics, and to New Zealand for studies on crayfish and eel.

The lab of Andres Vidal-Gadea joined efforts with the Gustavo Salinas group at the Pasteur Institute of Montevideo, Uruguay to identify genes that can be targeted to impair parasitic nematodes from infecting livestock and crops.

Viktor Kirik visited the Center for Plant Molecular Biology in Tuebingen in the summer 2017. There he discussed a collaborative paper on plant cell division and learned about a new generation of confocal microscopes with improved signal-to-noise ratio and superresolution.

Diane Byers has been collaborating with Thomas Meagher of St. Andrews University in Scotland. Ongoing work focuses on modelling the dynamics of inbreeding of native prairie species in small populations. This fall she will be returning to Scotland to continue her collaboration but focusing on historical datasets at Kew Gardens to assess potential impacts of climate change on the timing of flowering.

Wolfgang Stein's and Vidal-Gadea's labs together with Frank Lyko's research group from the German Cancer Research Center have recently sequenced the first genome of a crayfish. Their work was published in *Nature Ecology & Evolution* in February 2018.

Vibrant diversity of research approaches and ideas come to life in international conferences, where graduate students and faculty members have the opportunity to discuss and gain an outside perspective on their projects and to forge mutually beneficial collaborations. Graduate students Margaret DeMaegd from the Stein lab and Christy Fornero from the Kirik lab attended international meetings in 2017.

Science makes the world flatter, and our school both benefits from and contributes to the global trend. The excellent research of our students and faculty puts the School of Biological Sciences on the map, and we expect to see more international collaborations in the future.

Welcome Back! Alumni Day 2017



Molly Schumacher with her M.S. mentor, Professor Steven Juliano.



Amanda (Hoerr) Seeber with her undergraduate research mentor, Professor John Sedbrook.

For Alumni Day each year we invite two to three alumni back to give a presentation on their ISU experiences and their current career. They are also recognized at an alumni lunch held by the University. This takes place the Thursday and Friday before Homecoming Saturday every fall. If you would like to be considered for this or would like to suggest someone, please send Kevin Edwards an email (kaedwar@IllinoisState.edu) with the name of the nominee, year and degree(s), current position, and their email address.

Our 2017 invitees **Amanda (Hoerr) Seeber** and **Molly Schumacher** gave inspiring presentations to a packed house of students and faculty, linking their experiences at ISU to their current careers. Seeber received her B.S. in 2009 in biological sciences and a master of medical science from Nova Southeastern University in Florida. While at ISU, she developed a passion for science and how it improves people's lives through evidence-based medicine. She is currently a physician's assistant in the emergency department at Centegra Health System in McHenry. Schumacher received her B.S. in 2011 and an M.S. in 2015 in biological sciences under the direction of Professor Steven Juliano. She is currently a research associate in the Crop Bioprotection Unit, NCAUR, USDA, Peoria, where she continues to work with mosquitoes.

Students visit ISU from China

By *Rebekka Darner*

Twenty students from Southwest University in China visited the School of Biological Sciences for 10 days in January 2018. This visit was initiated by the University's ongoing effort to build a collaborative partnership with several institutions in China. These 20 students are in their third year of a degree program at their home institution that is comparable to our general biology major. Thus, the visit served as an opportunity to explore ISU's graduate programs, as well as American culture. The students sat in on lower- and upper-division courses, as well as the general education biology course. Additionally, Assistant Professor Andrés Vidal-Gadea provided a supplemental workshop entitled Neural and Molecular Bases of Disease and Behavior, and Associate Professor Wade Nichols delivered a supplemental lecture entitled Pathogenic Microbes: Evolution of Symptoms and Transmission. Students met with the School of Biological Sciences' graduate coordinator, Professor Steve Juliano and had the opportunity to see Illinois sights. During their visit, they visited Chicago, St. Louis, and Springfield. They participated in a cultural roundtable discussion where they had the opportunity to discuss social cultural issues with ISU students. As a result of this visit, there is now consideration of a possible exchange program being established between ISU and Southwest University.



Rebekka Darner hosts visiting undergraduate students from China's Southwest University in spring of 2018.

2017 Awards

School of Biological Sciences Awards

Charlena Wallen Memorial Scholarship
Kara Hodges

Jack Ward Service Award
Mary Fischer

Dr. Robert H. Gray Biology/Ecology Scholarship
Logan Sauers

H. Tak Cheung, Lauren Brown, Phi Sigma Student Publication Award
Lisa Treidel, Kevin Stanley

Outstanding Biology Teaching Assistants (In memory of Robert and Marion Finn)
Taylor Joray, Kristina McIntire

Drs. H. Tak Cheung/Joni St. John Endowment for General Education Teaching Assistant Awards
Brice Jarvis, Cody Scholtens, Rachel Sparks, Morgan Walder

Phi Sigma Awards

Outstanding M.S.: Nick Rhoades
Outstanding Ph.D.: Kevin Stanley

Undergraduate Awards

Undergraduate Researcher
Casey Gahrs

Undergraduate Service Award
Andrew Schuler

Undergraduate Teaching Assistant
Micheal Muneses

Dr. David W. Borst, Jr., Memorial Endowed Scholarship Fund
Robert Baker

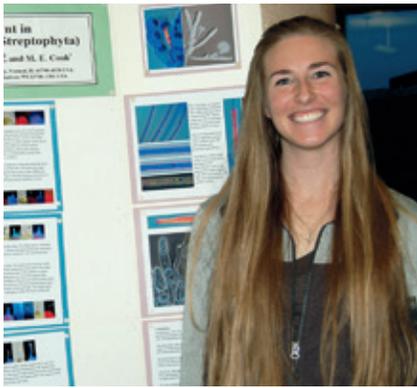
Barbara Bathe Biology Teacher-education Award
Charity Mannix

Bohn/Nielsen Healthcare Pre-professional Scholarship
Mary Fischer

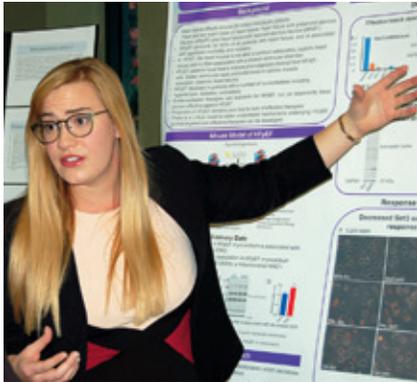
Dr. John B. Colwell Scholarship
Loren Roustio

Rilett Scholarship Awards

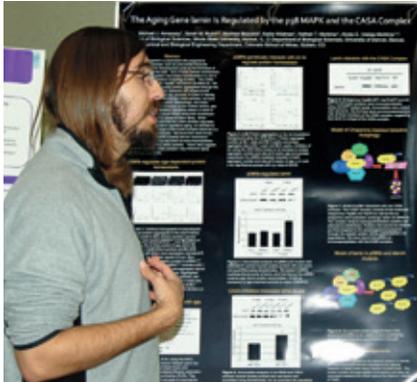
Michael Almassey, Gloria Alvarado, Marc Ashford, Chance Bainbridge, Marissa Cruz, Margaret DeMaegd, Rachael Discuillo, Kristin Duffield, Malihe Esfahanian, Joshua Hill, Pooja Kadaba Ranganath, Christy Moore, Nick Rhoades, Anjelica Rodriguez, Ashley Waring



Rachel Offenheiser presents at the BSSA Research Symposium.



Mary Fischer presents at the BSSA Research Symposium.



Michael Almassey presents at the BSSA Research Symposium.



Phi Sigma officers (2017-2018) standing from left: Logan Sauers, Kerrigan Tobin, Kara Hodges, Marc Ashford, Ashley Waring, and Rachel Sparks in front.

Biological Sciences Student Association

By Meghan Freund and Sarahi Ramirez

The Biological Sciences Student Association (BSSA) is a student-led organization that focuses on exposing undergraduate students to opportunities within the science community. Our goal is to create connections between our members, faculty and community. We are open



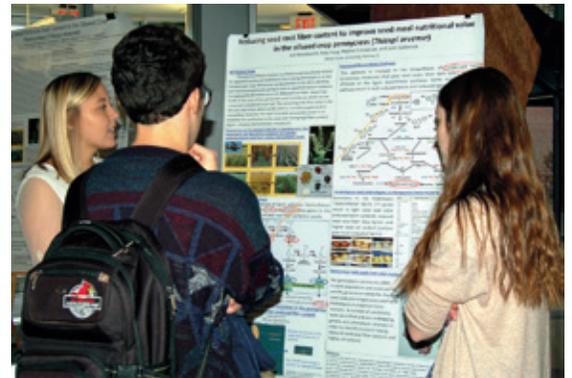
Terrarium Night.

to all students with a passion for biology who are interested in helping the community. BSSA provides students with volunteer opportunities, exposure to research labs, and a chance to interact with their peers in order to build connections that will last a lifetime. Our meetings typically consist of lab tours. One of ISU's great opportunities is the chance to participate in undergrad research. This is a unique chance to get involved in a way that will provide students with many useful skills for later in their careers. It is our goal to make students aware of this opportunity and push them in the right direction by connecting them with professors. To do this we tour various research labs and learn what is going on in each. Even for students already involved in research, these tours can provide a chance to learn about what is going on in other laboratories.

We also pride ourselves on helping our community and giving back. One way we work to do this is volunteering around Bloomington-Normal. Our members are involved with Habitat for Humanity, Salvation Army, and the Miller Park Zoo.

Throughout the semester our members have the chance to build many connections. We encourage study sessions outside the classroom and have hosted a few meetings that focus on allowing students to help each other. This allows students with academic strengths in a particular subject to assist those students that may need the extra help.

This semester we hosted a terrarium night, which allowed students to take a break from the stress of school and create their own terrariums. We also hosted the second annual BSSA Research Symposium in November. This was a great success with many students and faculty coming out to show their support. There were many great posters that displayed the efforts put into undergrad research. The participants' passion for each project was clear and demonstrated the knowledge they have gained from their experience in lab. Our mission is to enhance the experience of biological sciences students here at ISU and to provide them with the lifelong skills they will need to succeed.



2nd annual BSSA Research Symposium.

Phi Sigma Biological Sciences Honors Society

By Logan Sauers and Kristin Duffield

The Phi Sigma Biological Honor Society is a national student organization originally founded at The Ohio State University with the purpose of promoting scholarship and research. The

Beta Lambda Chapter at Illinois State University has many organized events and programs created with the organization's goals in mind. The chapter holds various events which provide funding for science and scholarship to local low-income elementary schools, to individuals performing biological research at Illinois State, and to individuals planning to travel and present their research at national conferences. These programs support the organization's goals at a local, university, and national level.

This year the Beta Lambda Chapter added a new event to its calendar with the goal of expanding the organization's impact beyond Illinois State University to the local community. This event, a Halloween trivia night, raised \$800 to supply scholarship material to a local elementary school. This money was used to supply subscriptions to *Science Spin Magazine* and *Scholastic News* for each student in kindergarten through second grade and to help fund collaboration between graduate students and the local school district. This is the first time in recent years Phi Sigma has organized an event directed at aiding funding for science education in the local community.

The Beta Lambda Chapter also holds an annual competition offering students the chance to experience and practice grant-writing skills while competing for internal funding. During the 2017 calendar year, this grant program known internally as the Weigel Grant, awarded over \$10,000 in funding to 20 graduate and undergraduate student-researchers. Another core program sponsored by the Phi Sigma Honor Society is the E. L. Mockford and C. F. Thompson Summer Research Fellowship. This fellowship is awarded on a competitive basis to one Ph.D. and two M.S. students, supplying them with a full summer salary. The hope is that these summer salaries will allow the students the financial stability to focus solely on their research, resulting in quality work with the future possibility of publication.

This past year Phi Sigma held its 18th Annual Phi Sigma Research Symposium. This symposium allows students at Illinois State to showcase their research to their peers while developing professional skills for national conferences. At the 2017 symposium, eight students from Illinois State presented their research in an oral format, while 35 created poster presentations. This event also features a large number of attending undergraduate students as faculty collaborate with coordinators bringing students from biology courses to the event. Many of the presenters elect to participate in the Phi Sigma Presentation Competition. In this competition, faculty members judge the oral and poster presentations with the highest ranking presentations receiving travel awards. These travel awards aim to help fund student presentations at regional and national conferences. The 2017 symposium featured Marcella J. Kelly, associate professor in the Department of Fish and Wildlife Conservation at Virginia Tech, as the keynote speaker. Kelly's research focuses on carnivore co-existence and community structure in forested ecosystems. Kelly uses a wide range of techniques including: mark-recapture, non-invasive genetic sampling, and remote camera trapping introducing the attending students to many methods for collecting field data. The planned 19th Annual Phi Sigma Research Symposium is being held at the Marriott in Normal. The move will provide a more professional feel to the event while allowing for a significant increase in overall space. Ross Nehm, associate professor in the Department of Ecology & Evolution at Stony Brook University in New York, has agreed to give the keynote speech at the event. Nehm and his team study science education with a focus on evolution and natural selection and how teachers' beliefs can shape student misconceptions about these topics.

The Phi Sigma Honor Society plans to end the year as impactfully as it started, by hosting the annual Spring Awards Banquet. During the banquet Phi Sigma and the Illinois State University School of Biological Sciences will highlight faculty and students who have excelled in a variety of areas including: research, scholarship, and education. It is during this event that the recipients of the Weigel Grant and Mockford-Thompson Fellowship will be recognized, outstanding teaching assistants will receive awards, and individuals performing outstanding service to the University community will be honored. The Beta Lambda Chapter extends its gratitude to the current and future members who have made this organization a great success and thanks the department, staff, faculty, and students for their continued support and involvement. Most importantly, we thank all the alumni who support our organization, allowing us to contribute to science and scholarship through our programs. We wish all our current and future alumni continued success and a year that is as fulfilling for them as it has been for our organization.

Brockman Alumni Seminars

The Alumni Series in Genetics, which is supported by the Herman E. Brockman Fund, ISU Foundation, continued in spring of 2017 with Vineet Singh, who was a



Jayaswal, Singh, Brockman, and Wilkinson.

postdoctoral fellow with Brian Wilkinson from 1997–2002. Currently, he is at A.T. Still University of Health Sciences in Missouri. He spoke on "Significance of Methionine Sulfoxide Reductases in *Staphylococcus aureus*." In fall of 2017, Sandra Steiger returned to give a presentation on "New insights into family life-why fathers stay, mothers are so caring and offspring get spoiled." She was



Craig Gatto and Sandra Steiger.

a postdoctoral fellow with Scott Sakaluk and now is at University of Gießen in Germany. This spring Peggy Redshaw, now at Austin College in Texas, will give a presentation.

Robert Baker, a senior in Alysia Mortimer's lab, was the 2017 recipient of the David W. Borst Scholarship. Baker's project, which he started as a sophomore, is to identify mechanisms that protect the brain against neurodegeneration. He is testing if expressing an antioxidant gene in dopaminergic neurons, which are targeted in Parkinson's disease, prevents or delays the death of these neurons.

Assistant Professor Nate Mortimer was named a project leader by the Genomics Education Partnership. In this role, Mortimer is currently leading a course-based Undergraduate Research Experience that is based on research being conducted in his lab. This project began at ISU in the Genomics and Bioinformatics course in fall 2017 and will be implemented at an additional 11 universities across the country over the next year. Mortimer is very excited to be partnering with faculty at Bucknell University, New Jersey City University, University of Puerto Rico at Cayey, and others to bring this research opportunity to a diverse group of students.

Dilini Ralalage Samarajeewa had a big year. She earned her Ph.D. with Tom Hammond and published part of her thesis in the journal *G3: Genes, Genomes,*



Genetics. She is now beginning work at EPL Bio Analytical Services located in Niantic, near Decatur.

Nick Rhoades, Mockford-Thompson Summer Research Fellowship awardee, investigates a genetic mystery in bread mold

By Nick Rhoades

The purpose of my research in Tom Hammond's lab is to study the molecular parameters of homologous chromosome searching during meiosis in *Neurospora crassa*. During meiosis, homologous chromosomes must find and pair with each other in order to undergo meiotic



recombination. This recombination event maintains genetic variability within a population, however the process by which homologous chromosomes find and pair with each other is difficult to study. Our lab studies homology searching in the context of a fungal genome defense mechanism, Meiotic Silencing by Unpaired DNA (MSUD). In this mechanism, any gene that is spatially unpaired on homologous chromosomes (i.e., one chromosome from each parent) during meiosis will be identified and silenced for duration of meiosis via an RNA interference-like mechanism. For example, the roundspore gene (*rsp*) is responsible for the American football-shaped ascospores that are produced from *Neurospora* sexual reproduction. When unpaired during meiosis, either by an ectopic insertion or a native locus deletion, *rsp* expression is silenced and round-shaped spores are produced. We have recently been investigating the mechanism by which unpaired DNA is detected at a sequence level by inserting a partially homologous sequence in Parent A at the same genetic loci as an ectopically inserted *rsp* gene in Parent B. For example, a partially homologous fragment of *rsp* is placed at a locus on chromosome I of Parent A and the ectopically inserted *rsp* gene is placed at the same locus on chromosome I of Parent B. We have found that certain patterns of homology (e.g., two homologous bases succeeded by one non-homologous base repeated in an 11bp periodicity) are detected as unpaired more efficiently than others (e.g., seven homologous bases succeeded by four non-homologous bases repeated in an 11bp periodicity). These results have suggested that sequence-level homology may play a role in the detection of non-homologous DNA detection. Furthermore, we have begun to investigate the possibility that the homology search mechanism used in MSUD functions independently of double-strand break events. In this model, we have proposed that the chromatin loops of homologous chromosomes may interact with each other during meiosis in a spatially constrained manner. We are currently performing experiments to allow us to visualize these chromatin loops in meiotic cells. We are also performing experiments to knock out Spo11, a protein responsible for the creation of double strand breaks during meiosis, to further elucidate whether double strand breaks are required by MSUD in the homology search process.

Ashley Waring, Mockford-Thompson Summer Research Fellowship awardee, probes *Drosophila* immune responses to wasp eggs

By Ashley Waring

A well-functioning immune response is essential for the survival of all animals. Immune responses act as a defense mechanism that protects a host against harmful substances and pathogens. The immune response that gets elicited in response to an infection is energetically costly and requires an increased availability of energy from the host. The purpose of my



Ashley Waring presents at the 2017 Midwest *Drosophila* Conference.

research in Nathan Mortimer's lab is to investigate the mechanisms that regulate the energy shift that occurs from development to immunity in response to an infection. To do so, I utilize the host-parasite interaction of the fruit fly *Drosophila melanogaster* and parasitoid wasps. In nature, parasitoid wasps will infect a fruit fly by inserting an egg and venom into the larva. In response to the insertion of the egg, fruit fly larvae will mount an immune response on the wasp egg by forming a capsule around the egg, eventually suffocating and killing the invader. The capsule requires the activation of immune cells known as hemocytes. These hemocytes require substantial amounts of energy in order to mount an effective immune response. The hemocytes obtain energy by releasing extracellular adenosine (e-Ado). This e-Ado then signals to the fat body, the place where energy is stored, to release energy. The energy

that is released is selfishly taken up by immune cells during an immune response, creating a shift from energy being used for development to energy being used for an immune response. We know that this shift occurs due to an increase of e-Ado, but what is not known is what is signaling that e-Ado to be released from the hemocytes during an infection. My project focuses on investigating PVR, a cell-surface receptor tyrosine kinase, and its role in the releasing of e-Ado from the hemocytes during an infection. PVR and its associated ligand, PVF1, have previously been shown to be involved in e-Ado release during hemocyte production in the lymph gland of the fly. Current findings show that lack of PVF1 and PVR function in the hemocytes decreases the ability of the larvae to mount immune responses as well as slows down developmental rate and size. I have proposed a model in which PVF1 binding to PVR on the hemocytes initiates the release of e-Ado, ultimately creating the shift in energy from development to immune response. Currently I am performing experiments that will allow me to quantify the stored energy during an infection and development as well as experiments that allow me to determine if there is an epistatic relationship between PVR and e-Ado during an immune response.

Kiran Tiwari, Mockford-Thompson Summer Research Fellowship awardee, analyzes bacterial adaptations to human skin

By Kiran Tiwari

Human and animals have various bacteria on skin, nose, ear, mouth, upper respiratory tract, lower intestine, and genitourinary tract. Most of these bacteria are normal flora and protect us from pathogens, boost immunity, and provide some vitamins. However, they can sometimes cause diseases when they escape from their natural niches or in immunocompromised individuals, and are often called opportunistic pathogens. Staphylococci comprise the largest population of normal flora and thrive on skin. Based on their ability to produce coagulase (a virulence factor), the cocci are grouped into coagulase-positive and negative cocci. Conventionally, the coagulase-negative staphylococci (CONS) are considered lesser or non-pathogenic and their clinical relevance has been underappreciated. Many CONS harbor at least some important virulence factors and/or antibiotic resistance genes and are increasingly being recognized as major pathogens worldwide. Additionally, most of the CONS form strong biofilms in tissue implants that are difficult to treat.

Staphylococci have saturated branched-chain fatty acids (BCFAs) and straight-chain fatty acids (SCFAs) in the cell membrane. Bacteria modify membrane composition in response to environmental changes. The membrane biophysics of the well-known coagulase-positive member, *Staphylococcus aureus*, has been studied previously. However, how various CONS species adapt in their natural environments with a variety of fatty acid compositions has not been explored yet. In our project, various CONS were grown in diverse media and analyzed

Kara Hodges has been awarded a \$2,180 research grant from the American Ornithological Society (AOS). Hodges, a first-year M.S. student in the Sakaluk-Thompson Avian Ecology Laboratory, was awarded the grant in support of her first field season of research on how house wren eggshell pigmentation influences paternal investment in offspring. AOS grants support research in all areas of avian biology. This year 141 applicants from around the world competed for 32 awards.



Assistant Professor Alysia Mortimer was selected to give a talk at the 3rd Proteostasis and Disease Symposium in Wollongong, Australia. Her talk was entitled "Proteomic analysis of p38 MAPK longevity reveals regulation of age-dependent disease proteins."



Awardees Kerrigan Tobin and Kristin Duffield.

ISU grad students were awarded five National Grants-in-Aid of Research from Sigma Xi Scientific Research Honors Society in 2017. This

program is highly competitive, with only 17 percent of applicants chosen for funding. Congrats to the awardees: Kara Hodges, Anthony Breitenbach, Joseph Neale, Kerrigan Tobin, and Kristin Duffield.

Basheer Becerra, a junior in the biology and computer science programs, gave an oral presentation of his research at the International Symposium on Biomathematics and Ecology Education and Research in October. Becerra's presentation was entitled "*CAGE: a tool for identifying genes with correlated spatiotemporal expression*" and was based on his honors research project being conducted in Nate Mortimer's lab.

Ashley M. Hembrough (M.S., 2015), a Rilett Scholarship awardee, recently published her thesis research in the journal *Botany* (Hembrough, AM and



VA Borowicz. 2017. Pre-dispersal seed predation by the weevils *Trichapion rostrum* and *Tychius sordidus* limits reproductive output of *Baptisia alba* (Fabaceae). *Botany* 95: 809-817 dx.doi.org/10.1139/cjb-2016-0329). Hembrough demonstrated that seed predation by two small weevil species has a greater impact on a native prairie legume's reproduction than does pollen limitation or soil fertility. This work has implications for how prairie managers collect seed for prairie restoration. Hembrough currently works on a Monsanto research team studying crop physiology.

Tiwari, continued from Page 7



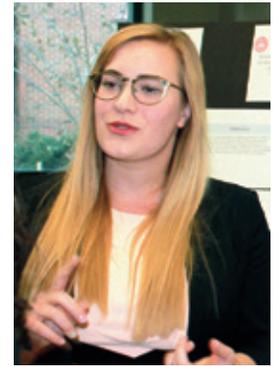
Kiran Tiwari, right, with his mentor Professor Brian J. Wilkinson.

To understand the effect of UFAs, CONS were grown in human serum that contains a large pool of UFAs, and separately tested for their response to some known host-derived antimicrobial UFAs. Interestingly, they acquired a significant proportion of UFAs (mainly, linoleic and oleic acids) in the membrane when grown in human serum. Irrespective of their fatty acid compositions, the CONS responded similarly to sapienic (human skin specific antibacterial UFA) and palmitoleic acids and were either very sensitive or highly resistant to linoleic acid. Our work leads to the concept that medically important skin flora can alter their fatty acid composition and membrane biophysics to suit their specific ecological niches.

for growth, membrane fatty acid composition, and response to host-derived antimicrobial fatty acids. We found the type of growth media had significant impacts on the proportion of BCFAs to SCFAs. Staphylococci do not possess unsaturated fatty acids (UFAs) and, thus, the BCFAs play similar roles in maintaining membrane fluidity in the bacterial membrane as UFAs do in other organisms. Animal skin contains various antibacterial UFAs, and the cocci should be able to thrive under the challenges in their ecological niches.

Bone Scholar Mary Fischer studies host-parasite interactions

By Mary Fischer



The School of Biological Sciences has been my home for the past three years and has been influential in making me the individual that I am today. So many stellar teachers and mentors at ISU have encouraged me to test the limits of learning and pursue research. Beginning my sophomore year I was privileged to join Nathan Mortimer's research lab, and I have enjoyed becoming part of his lab and conducting research in genetics and cell biology. We study host-parasite interactions between parasitoid wasps and the fly *Drosophila*. Flies provide good model organisms to better understand human systems. My first project was to identify the gene responsible for an autoimmune response in *tuSz* mutant flies. Originally, there were seven candidate genes under investigation, and after my research using molecular biology techniques, a single candidate gene was isolated. Under Mortimer's mentorship, I was able to identify the gene responsible and verify its effect on autoimmunity. This gave our lab team insight into the development of autoimmunity in our model organism. My work will be part of an upcoming paper from the lab.

My next independent project involved parasitic wasps, mutant flies, and a potential cure for a specific type of cancer. The mutant *hop[Tum]* flies have a mutation in the Jak-Stat pathway that is very similar to the mutation responsible for a large percentage of leukemia in humans, and leads to a similar phenotype in flies. However, the effect of this mutation is not seen when the mutant flies are infected with the parasitoid wasps. This posed the question, how does the wasp prevent the development of this leukemia-like phenotype? Parasitic wasps inject venom into flies during infection, and we want to understand which protein or set of proteins in the wasp venom is responsible for altering the mutant to make it appear normal. For my undergraduate thesis on this project I developed a new in vitro assay to study Jak-Stat activity in *Drosophila*. This method will be used in further studies to identify the target protein in the venom. The ultimate goal of the project is to determine the structure of this protein and develop a mechanism to better understand how this protein affects the Jak-Stat pathway in flies. Understanding this pathway in our fly model will help us to develop a version targeted to the human Jak-Stat pathway. My hope is that this could eventually be developed as a specific therapeutic for leukemia caused by Jak-Stat mutations.

Research and ISU have provided me and so many other students an opportunity to apply what is learned in the classroom to the world of science. Also through Mortimer's mentorship, I applied for and received a summer research fellowship at U. Texas Southwestern where I further explored the field of cardiology research. I am finishing my undergraduate education abroad in Mexico while completing a medical internship at a local clinic.

National Science Foundation award brings new cell sorter

Faculty in Biological Sciences received a \$316,778 Major Research Instrumentation (MRI) grant from the National Science Foundation. The highly competitive MRI grant program received hundreds of grant proposals from across the country and only funded the top 16 percent of the applications. Led by Laura Vogel and co-PIs Rachel Bowden, Nathan Mortimer, and Ben Sadd, the project brings a new BD FACSMelody flow cytometer/cell sorter to ISU, housed in the Science Lab Building. This instrument is a powerful discovery tool that will enable research not previously possible at ISU. In flow cytometry, a suspension of cells or particles flows in "single file" past a laser array. Depending on the interaction of the light with the cell, the cell can be measured, counted, or collected for further analyses such as RNA sequencing. The instrument can examine such parameters as cell morphology, cell cycle stage, surface and intracellular protein expression, gene expression, and cellular physiology. Numerous faculty and students will use the instrument for their research. From the School of Biological Sciences: Vogel and Bowden will study reptile immunity and isolate B lymphocytes from turtles; Mortimer will study immune cell signaling using the fruit fly as a model system; Sadd will study bumblebee disease and immunity by high speed sorting trypanosome parasites in bumblebees; Diane Byers will quantify and purify pollen grains; Steve Juliano will analyze and separate insect cell populations; Alysia Mortimer will sort and purify specific populations of neurons from the *Drosophila* brain; Scott Sakaluk and Charles Thompson will sort avian blood cell populations. From the Department of Chemistry, Marge Jones will sort and analyze *Leishmania* parasites and Chris Weitzel will perform cell cycle analysis of the microbe *Sulfolobus*. In addition, students in several courses will learn how to use the cell sorter, including health sciences students led by Professor Beverly Barham. For many health sciences professions, this is a commonly used clinical instrument, important for diagnosis of disease. Barham says there will be a definite advantage for health sciences students to observe a working flow cytometer and understand the various applications before they leave campus.

ISU graduates first full class of MCB majors

The B.S. in molecular and cellular biology (MCB) became our school's first subject-specific major in 2013, and this past year the first full four-year MCB class got their degrees. The MCB B.S. enrolls over 120 majors and has graduated 30 majors in each of the last two years, 2016 and 2017. Job prospects are looking strong for these majors, as the MCB field moves to a central position in our tech economy due to the dramatic rise of next-gen sequencing, genome editing, and associated applications. Genome and transcriptome sequencing have transformed basic research and are well on the way to becoming standard tools for diagnosing (and hopefully preventing) illness. In response, the MCB program is increasing its emphasis on genomic technologies to better prepare our students for future careers across biology and medicine. The MCB curriculum is designed with two notable features to promote student success. The flexibility of 300-level course requirements allows the student to specialize in an area of interest or try an advanced subject they are curious about, from cell signaling to infectious disease to neuroscience. Second, we have designed the program to leave plenty of time for mentored undergraduate research, which has become essential for getting into competitive higher degree programs. If you know of any students interested in the MCB major, please refer them to MCB Coordinator Kevin Edwards (kaedwar@IllinoisState.edu). Congratulations to all our 2017 MCB graduates: Casey Amundson, Katelyn Anderson, Nicholas Bretz, Kayla Campbell, Cara Custer, Brian Deng, Alaina Dodge, Kirk Eichenberg, Mark Ferguson, Cooper Fields, Ratasha Garbes, David Greiner, Ken Hart, Chaz Im, Jaylene Jennings,

Danny Vetter (B.S., 2017) has started in the Animal Science Ph.D. program at the University of Illinois at Urbana-Champaign. While an undergraduate at Illinois State, Vetter worked on a research project in Nate Mortimer's cellular immunology lab. Vetter will continue in this field for his Ph.D. working with the Integrative Immunology and Behavior group in the lab of Gregory Freund.

Robert Philips (M.S. student in the Byers Lab) presented his research "Does habitat specific seed sources result in differential success of *Chamaecrista fasciculata* in a restored tallgrass prairie?" at the Evolution 2017 meeting in Portland, Oregon.

Taylor Suo (B.S., 2017), **John Sussman** (B.S., 2016), and **Taylor Zarifis** (B.S. 2015) published their undergraduate research

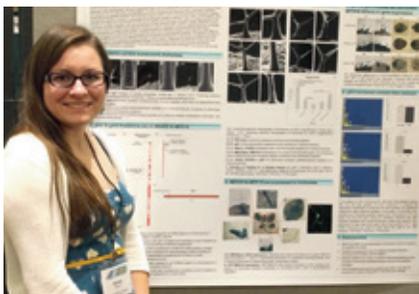


in the *Journal of the Torrey Botanical Society* (Suo, T.J., J. Sussman, T. Zarifis, J. E. Armstrong, and V. A. Borowicz. 2017. *Dasistoma macrophylla*: Hemiparasite growth and impact on *Acer saccharum* and *Quercus macrocarpa*. *J. Torrey Bot. Soc.* 144). Plant parasites that attach to roots of temperate trees are poorly studied. Their greenhouse experiment resulted in a new host record and showed that sugar maple and bur oak are neither equally valuable to, nor equally affected by, mullein foxglove, a parasitic plant native to Illinois.

Continued on Page 10

Kaitie Wildman, a senior MCB major in Alysia Mortimer's lab, was selected to give a talk at the 2017 Midwest Drosophila Conference in Monticello (see photo on page 19). She presented her project "The Evolution of p38 MAP Kinases," which she has been working on since her sophomore year. Wildman was the only undergraduate student selected to give a talk. She also won a \$200 gift certificate to the 59th Annual Drosophila Research Conference, which she will be attending in April. Wildman was the 2016 David W. Borst Scholarship recipient.

With the help of a Phi Sigma Travel Award, a Symposium Presentation Assistance Grant, and a Rilett Award, **Christy Fornero** was able to attend and present a poster at the 28th International



Conference on Arabidopsis Research in St. Louis. She was the first author on a recently published paper from the Kirik lab: Fornero, C., Suo, B., Zahde, M., Juveland, K., and Kirik, V. (2017). Papillae formation on trichome cell walls requires the function of the mediator complex subunit Med25. *Plant Molecular Biology*, 95:389-398.



Jessica Fowler (M.S. student) presenting her poster on the invasive species *Lespedeza cuneata* at the fifth annual Integrative Plant Biology and Bioenergy Spring Poster Session.

MCB majors, continued from Page 9

Parker Johnson, Andrew Labroo, Megan Legge, Ryan Marlett, Micah Nicolay, Dipak Patel, Tejas Patel, Turner Reid, Loren Roustio, Alec Sikarin, Javaka Thompson, Miranda Villarreal, Jack Weisbond, Jessica Wickline, Dalton Williams.

Q & A with MCB graduate Tejas Patel

By Van Miller

Why did you decide to study biology?

I chose biology because I had a friend who fought a losing battle against leukemia and instead of blaming physicians I chose to pursue medical education in the U.S.



What did you like most about your major?

There are so many opportunities available to undergraduates at ISU. For example, right off the bat I was able to translate textbook knowledge and apply it to solve real-world problems by working in Dr. Hammond's laboratory. Learning should not be restricted or confined to a traditional classroom. Conducting basic research is that gateway to higher learning. I loved having the one-on-one interactions with Dr. Hammond on a daily basis regarding the research, an opportunity very rare in a setting such as this.

What have you been up to since you left ISU?

After graduating in 2017, I moved to Durham, North Carolina, and am working on a post-baccalaureate at the National Institute of Health. My research focuses on how environmental factors are affecting our health, with a specific focus on breast cancer research.

What's in your future?

I'm enjoying research now and am in the process of applying to medical school.

What was your favorite experience outside the classroom?

Being a resident assistant (RA) in Manchester. My first year RA took an interest in me and really helped me adjust to college life. He taught me that you get the best experience at ISU when you know what resources the University has to offer. I was happy to have the opportunity to play that same role for residents on my floor. My residents would come to me for help at all hours of the night, and because of the highly unpredictable nature of this position I learned to become more proactive and organized. Looking back, I know that I helped many residents find their passion at ISU, and that's rewarding.

Have you benefited from alumni and donor support?

Yes, my scholarships made it possible for me to afford college here. My parents live in India, and I immigrated to the U.S. alone. Receiving scholarships helped me realize there are alumni who want to support students like me, even though they don't know me. It's a great feeling to know that people believe in you.

How did your scholarship affect your experience at ISU?

Receiving the scholarship meant I didn't have to work as many hours, which allowed me to do my research and concentrate on my studies, helping me get where I am today. I look forward to the opportunity to support the next generation of Redbirds when my time comes.

New faculty member joins School of Biological Sciences

By Ryan Paitz, Ph.D. '10

In the fall of 2004, I moved to Bloomington-Normal to start in the Ph.D. program at ISU. Now, 13 years later, I am starting as an assistant professor in the School of Biological Sciences. Although I have never moved away from Bloomington-Normal during that time, it

has been quite a journey nonetheless. My time at ISU has involved meeting my wife (Kendra), the birth of our daughter (Mia), the birth of our son (Henry), several post-doc positions, several study systems, and now a research program of my own. As an alumnus of the school, I take a lot of pride in ISU and what it has to offer and plan to instill that pride in my students through the years.

My research program investigates how developing embryos regulate their exposure to maternal steroids and environmental chemicals. For amniotes (mammals, birds, and reptiles), embryos produce extraembryonic membranes early in development that are responsible for absorbing nutrients, obtaining oxygen, and removing metabolic waste products. Perhaps the most specialized form of these membranes is the human placenta. Another function of these membranes is the metabolism of steroids and environmental chemicals as they move from the maternal environment to the embryonic environment. Research in my lab utilizes developing chicken embryos to investigate how extraembryonic membranes regulate the amount of steroids and environmental chemicals that reach the embryo. In this system, the steroids and chemicals are present in the yolk at the time the egg is laid, and many of these compounds can have detrimental effects on the embryo. We tend to view the metabolism of compounds by the extraembryonic membranes as a buffer that protects the embryo. Initial studies are focusing on finding mechanisms responsible for maintaining this buffer at a high capacity. Even though I've been working in the Science Laboratory Building for 13 years, this still feels like an exciting first step on a journey I'm thrilled to be taking. Hopefully I can bring some more pride to all fellow alumni through the years.



Graduate student **Marc Ashford** has received several awards for his research presentations in the past few months. Ashford, co-supervised by Professors Rachel Bowden and Laura Vogel, is



studying the reptile immune system. Ashford presented his research at the Autumn Immunology Conference this November in Chicago where he received the John Wallace Diversity Award and also at the Society for Integrative and Comparative Biology this January in San Francisco where he received the Broadening Participations Travel Award. The title of his research was "Formation of ILF-like Structures in Hatchling *T. scripta*."

Rosario Marroquin-Flores (Ph.D. student in the Bowden lab) was accepted as one of 40 fellows in the Yale Ciencia Academy for 2018. This national program is geared toward providing mentoring and

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Wilkinson Alumni Symposium brings generations of alums together

Last fall, alumni gathered from across the U.S. and overseas to pay tribute to their mentor and colleague Brian Wilkinson. Wilkinson retired after 38-plus years at Illinois State. Former undergraduate, master's, doctoral, and postdoctoral students from all generations of the lab returned for the Wilkinson Laboratory Alumni Symposium at ISU on October 14, 2017. This was followed by a retirement party and roast at Lakeside Country Club. Twenty-three alums presented a day-long symposium in Moulton Hall, featuring speakers from industry, academia, and government service. These engaging talks included current science, but the speakers also presented their path from studying microbiology at ISU to their current positions. Two of Wilkinson's earliest M.S. students in attendance were Dr. Brian King, now "Radiologist to the Stars" in Los Angeles, and Dave Smiley now enjoying a second career as a certified financial planner, after a career in the biotech industry. From these diverse stories, a clear theme emerged: a solid foundation in experimental science coupled with a supportive training environment equips our alums to chart their own course in science.

Lance Bigelow (M.S., 2004) went on to work as a protein crystallographer from 2004-15 at Argonne National Laboratory, where he co-authored publications in numerous journals including *PNAS*. He gave us some perspective and tips for protein 3D structure determination: since only 15 percent of native proteins will crystallize, chemical tricks are needed to improve protein packing. Bigelow is now a scientist at Abbvie.



Sarah (Scybert) Shaw (M.S., 2003) told us that her training with Professors Jayaswal and Wilkinson "put me in a position to find my strengths," a sentiment echoed throughout the symposium. Shaw was unsure of her path heading into grad school. After obtaining her M.S. at ISU, she joined Eli Lilly and was a successful sales representative, specializing in osteoporosis, for over five years. Her scientific training gave her insights into drug mechanism of action, and she could pass this on to her colleagues with business and sales backgrounds. She left big pharma to raise kids and work on the family business for several years. Moving back into the healthcare field, she is now director of sales for a five-state region with Compassus, a network of community-based hospice, palliative, and



Continued on Page 12



networking opportunities for Hispanic/Latinx scientists. As part of this program, Marroquin-Flores attended the American Association for the Advancement of Science meeting in Austin, Texas. Marroquin-Flores presented at the Society for Advancing Chicanos/Hispanics and Native Americans in Science (SACNAS) conference in Salt Lake City. She received both a Travel Award and Graduate Oral Presentation Award for her presentation of a project she conducted under the guidance of Associate Professor Christopher Witt (University of New Mexico) that she completed prior to starting in the Ph.D. program in fall 2017.

Michael Almassey, a M.S. student in Alysia Mortimer's lab and a recipient of the Rilett travel award, was selected to give a talk at the 23rd Annual Midwest Stress Response and Molecular Chaperone Meeting in Chicago. He presented on his project "The Aging Gene *lamin I* Is Regulated by the p38 MAPK and the CASA Complex."

Kate Evans (MS student with Steve Juliano) and **Logan Sauers** (MS student with Ben Sadd, who has been working on a side project in Steve Juliano's lab) presented talks at the annual Illinois



home health care services. This career is especially rewarding, as she gets to help and empower patients at their most vulnerable.

Dave Townsend (Idexx Laboratories), M. Walid Qoronfleh (Qatar Foundation), Rich Pfeltz (Becton Dickinson), and Atul Singh (JemPakGK) relayed their journeys from the bench to top positions in industry. Jim Graham (University of Louisville), John Gustafson (Oklahoma State University) and Jen Schmidt (St. Vincent University), among others, represented academia. Siqing Liu (USDA Peoria) and Yang Song (University of Maryland Genome Institute) gave talks on butanol tolerance and bioinformatics analysis respectively. Speakers were grouped according to which major theme involving *Staphylococcus aureus* or *Listeria monocytogenes* they worked on during their time in the lab.

At the post-seminar gala, Wilkinson's longtime friend, colleague, and co-retiree Alan Katz "roasted him so hard that all that was left was a cinder," according to accounts from the evening.

Darner appointed assistant director for under-represented groups at CeMaST

Beginning in August 2017, Rebekka Darner, assistant professor of biology education, began a partial appointment at ISU's Center for Mathematics, Science, and Technology (CeMaST) as assistant director for under-represented groups. In this role, Darner pursues projects that encourage and support students who belong to under-represented groups as they pursue careers and achieve excellence in science, technology, engineering, and mathematics (STEM) fields.

One such project is the Louis Stokes Alliance for Minority Participation (LSAMP), which is a supportive community made of STEM undergraduates, mentors, faculty, and staff. LSAMP provides research and career mentorship, financial assistance, and professional development workshops to African-American, Latinx, Alaskan Native, American Indian, and/or Native Pacific Islander students who are majoring in a STEM field at ISU. Darner assumed directorship of ISU's LSAMP program upon her appointment at CeMaST, so she attended the national LSAMP conference in October to recruit for ISU's STEM graduate programs.

Darner has also been busy forging relationships with several diverse high schools and community colleges in Illinois, working toward the goal of increasing under-represented minority participation in ISU's STEM majors. During the fall semester, she visited Olive-Harvey College's STEM Center and Chicago Vocational Career Academy, both on the South Side of Chicago, to talk about the numerous options at ISU for pursuing a career in the health sciences. Similar visits will be made to Valley View School District high schools in Romeoville and Bolingbrook in the spring 2018 semester, and conversations have just begun with Peoria Public Schools. Darner's goal is to form relationships with community colleges and school districts around the state that result in more applications and more students coming to ISU to major in a STEM field. Her goal is that when students from those colleges and districts attend ISU as a major in a STEM field, they feel like supported and valued members of the ISU community.

In addition to her CeMaST responsibilities, Darner is continuing as the director of the school's Fundamental Concepts of Biology (BSC 101) course, as well as maintaining a lab of undergraduate and graduate students who conduct science education research.



Rebekka Darner attends the LSAMP National Meeting in Indianapolis to recruit for ISU STEM graduate programs.

Harnessing our research programs to improve scientific literacy in our community

By Andrés Vidal-Gadea

In addition to its scientific research mission, the Vidal-Gadea lab works to develop and advance an educational mission. We aim to harness our research to create and support a scientific literacy program serving youth in our community regardless of their educational level.

Our program started by training a few undergraduate researchers in our lab, integrating them into every aspect of our research. Over time, we began collaborating with College Mentors for Kids to provide science outreach to local first- through sixth-graders. We then started to train local high school volunteers to work with us over the summer. Since 2016, we have participated in the Illinois State Summer Research Academy Program (ISRA, sponsored by the Center for Mathematics, Science, and Technology).

Through the ISRA program, 12-15 high school students from across the state join our lab each summer for an immersive scientific “boot camp” participating in several of the projects under study by our lab. Students learn every aspect of our research, from animal husbandry and handling, to microscopy, behavioral assays, immunohistochemistry, data acquisition and statistical analysis, and result presentation. After the summer, many of these driven young students opt to become permanent research scientists in our lab. They volunteer after school each week. Three of our seven high school students are from out of town, and they log onto our computers remotely from Chicago in order to analyze data, participate in lab meetings, and remain active lab members.



ISU undergrad Andrew Schuler teaches microscope techniques to several high school students in the Vidal-Gadea laboratory. Schuler also was instrumental in organizing the first BSSA Symposium. He has two publications and has been accepted to medical school.

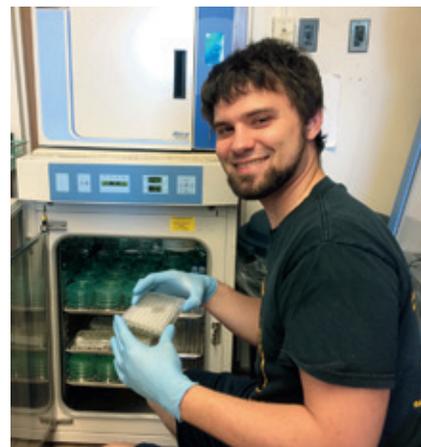
Over its first three years, our lab mentored 47 undergraduate students and over 30 high school students. During this time, we learned a couple of valuable things. First, our youth possess great potential as well as a thirst for knowledge and opportunities. Second, we learned that for every student we reach and introduce to scientific research, many more remain that lack either the opportunity or the awareness of its existence. To address this, our lab recently partnered with several colleagues in the College of Arts and Science to see what we may be able to do to reach as many youths as possible. This interaction resulted in the recent award of the College of Arts and Sciences Interdisciplinary Initiative Grant to the Stein (Biology), Epaminondas (Physics), Darner (Biology), and Vidal-Gadea (Biology) labs. Through this initiative, Rebekka Darner’s Noyce Scholars (future biology teachers) will join the Epaminondas, Stein, and Vidal-Gadea labs to participate in their research programs. Over the summer, they will develop science teaching modules using our research programs to address identified gaps in science education in local schools. These modules will then be piloted in these schools, allowing the research conducted in the College of Arts and Science to have a positive impact on the education of the next generation of high school and ISU students.

Fighting for the future of higher education

By Geoff Ower, Ph.D. student

I was arrested in Washington, D.C., with seven other graduate assistants from around the country on December 5, 2017, for committing non-violent, civil disobedience outside of U.S. House Speaker Paul Ryan’s office. We were trying to meet with Speaker Ryan to discuss how devastating the Republican tax bill would be for undergraduates, graduate assistants,

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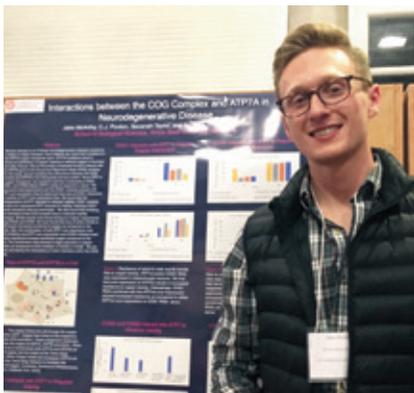
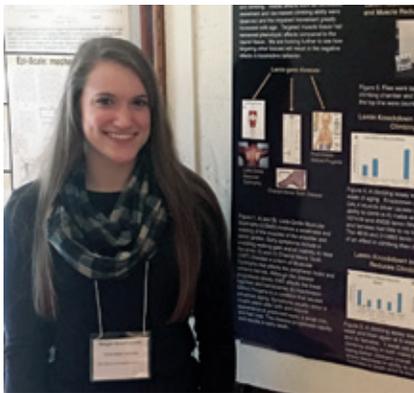


Mosquito and Vector Control Meeting in November 2017. Evans won the award for best student talk for her talk entitled: “Survival of container-breeding mosquito larvae: Density in the field;” and Sauer was one of two runners-up for his talk entitled: “Two is company, three hundred is a crowd: Larval density effects on mosquito populations.”

Ben Sadd, assistant professor, won ISU’s Research Initiative Award, presented at the annual Founders Day convocation. This award recognizes faculty members who have initiated a promising research agenda early in their academic careers. Since joining the school in fall 2013, Sadd has published 19 journal articles, given 14 invited national and international presentations, and been PI/co-PI on National Science Foundation (NSF) and United States Department Agriculture grants worth over \$1.4 million. In addition, he has served on 16 graduate committees, reviewed for several of the top journals in his field, and has been a funding referee for the NSF. Together with his group and collaborators, he continues to work on the evolution and ecology of interactions between organisms and their infectious diseases, focusing particularly on bumble bees and crickets.



Katelyn Anderson, Megan Knoernschild, and Jake McCarthy, seniors in Alysia Mortimer's lab, presented posters at the 2017 Midwest Drosophila Conference in Monticello. Anderson presented "Cloning of Muscular Dystrophy Genes in *Drosophila*." Knoernschild presented "*Drosophila lamin acts in both motor neurons and muscle to regulate locomotor functions*." McCarthy presented "Interactions Between the COG Complex and ATP7A in Neurodegenerative Disease." McCarthy also presented at the 23rd Annual Midwest Stress Response and Molecular Chaperone Meeting in Chicago in January 2018.



Future of higher education continued from Page 13



Geoff Ower, second from left seated on floor.

financial hardship. The bill also would have made higher education less affordable for our undergraduate students by taking away tax credits that are essential for working-class families. In the House version of the bill, our alumni would have lost the \$2,500 student loan payment deduction.

I strongly believe that education and advanced graduate degrees should be affordable to anyone committed enough to do the hard work of earning their degrees. The Republican tax bill would have made it so that only wealthy people could afford to advance their education. This likely would have reduced participation in the sciences by women, people of color, and other underrepresented groups that have fewer economic opportunities and are statistically paid lower wages. In order to advance science we need a broad diversity of people involved that bring valuable new ideas and talents to the sciences, which is why I thought it was worthwhile risking arrest to stop the Republican tax bill.

I want to thank my colleagues and our community for the thousands of phone calls, faxes, and letters you sent to Congress and for rallying and marching with us at the Science March, the Climate March, and against the Republican tax bill. We could not have defeated the tuition waiver tax and saved student loan deductions without your help! More attacks on higher education are coming as Congress works to reauthorize the Higher Education Act. Congress is planning on limiting the amount of loans that graduate assistants can take out, eliminating income-based loan repayment plans and student debt forgiveness options. Under the new bill, higher education would be market-driven, which would likely eliminate loans for students in the arts and humanities.

Due to the power that unionized grad assistants have built nationally I was able to travel to Washington, D.C., alongside grads from across the country, have great legal representation, and feel supported at every step of participating in civil disobedience to stop the grad stipend provisions of the tax bill. Unions have a long history of helping the powerless gain a strong voice, and given the troubling abuses of power we see in Washington, it is important to empower people by building a strong labor movement.

alumni, and higher education. After Speaker Ryan's office refused to meet with us we sat down on the floor to block the entrance. Our arrests made the national news, which helped raise public awareness and increase pressure on Congress.

The House version of the tax bill included a provision that would have taxed graduate assistants' tuition waivers as if they were a part of our monthly stipends. That would have doubled income taxes for graduate assistants at ISU, making grad school even less affordable for many of my colleagues who are already struggling under

Students and faculty join with the B-N community and Chicago to March for Science

Many students and faculty from the school joined hundreds in the March for Science in Normal. Others united with more than 40,000 people in downtown Chicago. The March for Science event (held on April 22, Earth Day) was a series of marches and rallies across the globe to call for "science that upholds the common good, and for political leaders and policymakers to enact evidence-based policies in the public interest." Marchers also protested large cuts to funds for science, education, and the arts proposed in President Donald Trump's budget. Estimated global attendance was 1.07 million. While non-partisan, the event was largely a response to policies and ideals put forth by the Trump administration, which have been widely viewed as hostile toward scientific research and evidence-based policymaking.

Read more about the March in Normal at news.IllinoisState.edu/2017/04/redbird-scholars-march-science.



Ben Sadd and students at the Chicago March for Science.



Steven Juliano at the March for Science in Uptown Normal.



Wolfgang Stein informs the March for Science crowd in Uptown Normal of the importance of public funding of science.



March for Science in Uptown Normal includes school faculty and students.



Diane Byers at the Chicago March for Science.

Anthony Breitenbach (Ph.D. candidate in the Bowden lab) received a 2018 Illinois Lake Management Association Grant to support his research on the effects of thermal fluctuations on sex determination in the red-eared slider turtle. Through his research, Breitenbach hopes to better understand how thermally sensitive species will respond to climate change.



Three Minute Thesis Competition (3MT)

As part of the international Three Minute Thesis Competition (3MT), sponsored by the ISU Graduate School, biological sciences students took up the challenge of describing their research verbally to a non-specialist audience in only three minutes with help from a single (non-animated) image slide. Kristin Duffield and Dylan Poorboy won the school competition at the Ph.D. and M.S. levels respectively and moved on to represent the school at the college level. Duffield, who works with faculty members Ben Sadd and Scott Sakaluk, advanced to the university level where she competed with nine other students from across campus at the Normal Theater, presenting her talk "When Resistance is Futile: Exploring Terminal Investment in Crickets." At the campus level Duffield won not only

Continued on Page 16

first-place but also people's choice. Duffield reports that the competition has helped her think about how to present the relevance of her work in a broader



context. Each word was carefully chosen, and she has refined her presentation each time she presented it. Duffield will next compete regionally at an event in Grand Rapids, Michigan, sponsored by the Midwest Association of Graduate Schools.

You can see her slide and watch a video interview with Duffield in a longer story here: news.illinoisstate.edu/2018/02/cricket-researcher-sweeps-top-awards-3-minute-thesis-competition/.



Joy Hall (M.S. student) discussing the potential for wetland plants to restore water quality with Roger Anderson at the fifth annual Integrative Plant Biology and Bioenergy Spring Poster Session.

A take on rain forest ecology—Costa Rica

By Austin Calhoun and Kerrigan Tobin

After two months of intense research and careful planning, 15 students embarked on a tropical adventure to La Selva Biological Station in Costa Rica, led by faculty members Rachel Bowden and Ben Sadd. From first passing through Costa Rican customs, to setting foot back on U.S. soil 12 days later, adventure followed every step. Living in such tight quarters, students developed close relationships with their peers and became deeply invested in one another's research. Those studying millipede mate-guarding assisted those working with various leaf cutter ant projects, while those investigating *Cecropia* physiology assisted those studying properties influencing communities within bromeliads, and so on. It was hard not to take interest and become involved in work other than one's own, as that involvement was often reciprocated.

While experiments were not running, students had numerous opportunities to hike the rain forest trails, engage with other scientists at the station, take photos, and make memories. In that time, a number of venomous snakes were spotted, along with mammals unlike any



The 2017 Rainforest Ecology class.

seen in North America, and a close encounter between one instructor and a full-sized puma occurred. The rain forest, in all its magnificence, masked life-threatening dangers behind every leaf. But it was the feeling of being forced beyond one's comfort zone that led students to excel.

Expanding beyond one's wealth of knowledge allowed students to truly discover if scientific research is a practical future aspiration. By performing experiments in such an exotic environment, students learned not only to



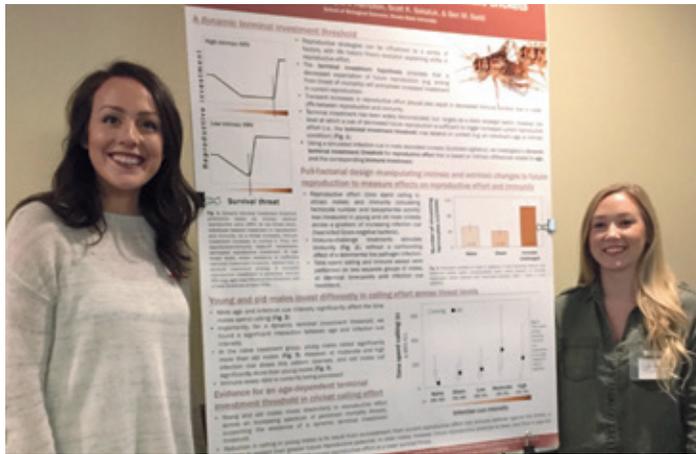
Ben Sadd captures an image of developing tree frog embryos on a nighttime hike in Costa Rica.

be self-reliant, but also the importance of collaboration. However, these collaborations were not met without difficulty. A second lesson learned, and possibly the most important, was the ability to respond to failure. While projects did not always go as planned, the lessons learned from failure proved far more valuable than those learned from success, and the memories made from hard work and adventure in the tropics will stay with us.

Graduate student Kristin Duffield publishes on the strategy of organisms when the end is nigh

Kristin Duffield, a Ph.D. student co-advised by Ben Sadd and Scott Sakaluk, is interested in the strategic decisions organisms make when their survival is under threat. These evolved strategies dictate how an individual will invest the limited resources they have into growth, survival, and reproduction. Classically, the idea is that when faced with a life-threatening event, such as injury or disease, an organism will invest in defense and survival to overcome the threat. However, evidence exists that when the situation gets too bad, an individual should invest fully in reproduction in a last-ditch attempt to pass on its genes before death. This strategy is known as terminal investment. Duffield recently published a review and perspective on terminal investment in the journal *Behavioral Ecology and Sociobiology*. This widely encompassing synthesis looks at terminal investment in a variety of organisms, from mammals to microbes. Further, Duffield and her co-authors propose a novel framework in which to understand terminal investment, called the dynamic threshold model. They argue that whether an organism switches to a strategy of terminal investment will depend on its condition, aside from the threat being faced.

In support of this idea, Duffield has also had a paper accepted in which she experimentally demonstrated that the strategy of terminal investment in male crickets is dependent on their age. When faced with a simulated threat to



Kristin Duffield (left) and Kylie Hampton.

their survival, older males essentially throw in the towel with regards to their survival and increase their reproductive effort in a last attempt to secure mating. Young males do not do this. This study by Duffield and co-authors appears in the prestigious journal, *Evolution*. In addition to Duffield, Kylie Hampton, currently an M.S. student with Sadd and Sakaluk is a co-author, having assisted with this study during her time as an undergraduate volunteer. Duffield also presented her studies on terminal investment at an international conference on “Open questions in disease ecology and evolution” in Roscoff, France. The work adds to our understanding of evolved strategies of investment by organisms but has further implications for predicting and managing reproduction in pest species and those of conservation concern.

Duffield’s work has also earned her a competitive international research award, a 2017 Godfrey Hewitt Mobility Award from the European Society of Evolutionary Biology. The funds will facilitate a research trip to the lab of collaborator Professor John Hunt at Western Sydney University, Australia. Working with Hunt, Duffield will learn and develop new techniques for her project.

Duffield, KR, Hampton, KJ, Houslay, TM, Hunt, J, Rapkin, J, Sakaluk, SK and Sadd, BM (accepted) Age-dependent variation in the terminal investment threshold in male crickets. *Evolution*.

Duffield, KR, Bowers, EK, Sakaluk, S and Sadd, BM (2017) A dynamic threshold model for terminal investment. *Behavioral Ecology and Sociobiology*, 71, 185.



Undergraduate research of Mitchell Czerwinski on pesticides and bumble bee immunity published

Research carried out by Mitchell Czerwinski during his time as an undergraduate researcher in the group of Ben Sadd has been published in the *Journal of Experimental Zoology A*. The work, published together with Sadd, was part of Czerwinski’s senior honors thesis, which he completed prior to graduating in 2016. Using native North American bumble bees, Czerwinski carried out lab experiments to study the interaction between exposure to a commonly used agricultural neonicotinoid pesticide and bee immunity. In agro-ecosystems, bees will commonly co-encounter the pesticide and infectious diseases that they must defend themselves against. Czerwinski demonstrated that up-regulation of immunity together with pesticide exposure reduces bee survival and that bees exposed to naturally realistic doses of the pesticide have reduced immune function. This work is a vital step in understanding how multiple stresses in the environment, such as agricultural pesticides and disease, can negatively affect the health of wild pollinators. Czerwinski, MA and Sadd, BM (2017) Detrimental interactions of neonicotinoid pesticide exposure and bumblebee immunity. *Journal of Experimental Zoology A*, 327, 273-283.

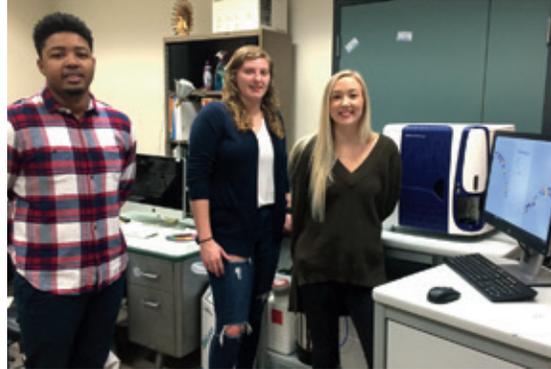


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Congratulations to faculty awarded major research grants in 2017

The following faculty received external funding during the last year: Brian Wilkinson with Craig Gatto (NIH, for Impact of Unsaturated Fatty Acids on *S. Aureus* Membrane Properties), Laura Vogel with Rachel Bowden, Nate Mortimer, Ben Sadd (NSF, for Acquisition of a



Newly acquired cell sorter, with students Marc Ashford, Ashley Waring, and Kylie Hampton.

high speed cell sorter for interdisciplinary student research and training in Biological Sciences), John Sedbrook (USDA, DOE and Arvegenix for his projects that advance field pennycress as a new oilseed biofuel), Diane Byers with Jim Bever (as P-I) and others from University of Kansas and University of MN (NSF, for Collaborative Research: Dimensions US/China: Microbe Feedbacks), Rebekka Gougis with James Wolf from the School of Information Technology (NSF, for Collaborative Research: Asynchronous Discussions to Engage Students in Scientific Ar-

gumentation), Scott Sakaluk with Charles Thompson (NSF, for Induced Immunity/Maternal Effects on Offspring Phenotype), Ben Sadd (U of I/USDA, for Interactive effects of Nosema infection and the neonicotinoid imidacloprid on bumble bee decline in the U.S.), and Scott Sakaluk with Ben Sadd (NSF, for Experimental evolution of insect nuptial food gifts and female responses).



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School of Biology Picture Day, fall 2017.



Faculty and students conducting research in the plant sciences gather for the fifth annual Integrative Plant Biology and Bioenergy Symposium. Talks by students from five labs and by Fell Arboretum Curator Patrick Murphy and emeritus faculty member Roger Anderson ranged in subject from cell wall structure to prairie ecology and development of bioenergy crops.



In November, students from the A. Mortimer and N. Mortimer labs (C. Lark, P. Kadaba Ranganath, A. Waring, K. Wildman) presented their science at the 2017 Midwest Drosophila Conference in beautiful Allerton Park near Champaign.



ISU's Laboratory for Environmental Analysis (LEA), in the Felmley Science Annex, holds its ribbon-cutting ceremony with CAS Dean Simpson, LEA Director Bill Perry, and GEO Chair Dagmar Budikova. "The goal is to maintain or improve clean drinking water for local communities," Perry said. Current projects include monitoring the water quality in streams entering Lakes Bloomington and Evergreen.

