



ILLINOIS STATE UNIVERSITY
Illinois' first public university



SCHOOL OF

BIOLOGICAL SCIENCES

SUMMER 2019

NEWS

Biological Sciences awarded over \$1.8 million in NSF support

The National Science Foundation (NSF) is the part of government charged with promoting scientific progress in the U.S. across all fields of science. NSF is smaller than the National Institutes of Health (NIH), with a budget of \$7.8 billion vs. \$39 billion. Thus NSF tends to exclude research that is directly targeted to human disease, but it does support all other areas of biology. NSF and NIH can overlap in their areas of support, especially in the fields of molecular/cellular biology and physiology and good basic research that ultimately informs medicine may be supported by either agency.



A major part of NSF's mission is to "ensure that research is fully integrated with education" (nsf.gov/about), a goal that is well aligned with our mission at the School of Biological Sciences. We encourage all of our undergraduate students to pursue mentored original research in a faculty lab, and conversely our research is closely integrated with our courses, in the form of lectures, activities, and lab or field work. This shared value has been increasingly

recognized at NSF, as our NSF funding has significantly increased in recent years, peaking in 2018 with \$1,879,369 for the school's research, as well as participation in a \$1,771,556 collaborative educational project.

A key feature of successful NSF proposals, beyond their intellectual merit, is their set of "broader impacts" for the benefit of society. (nsf.gov/od/oia/special/broaderimpacts). These impacts include training the future scientific workforce, a major function of the school, but they can also include outreach to the public, generating online resources, enhancing participation in science by underrepresented groups, and other important practical outcomes. These types of broader impacts are usually an inherent part of our research lab activities, and so the fact that NSF recognizes their importance makes us all the more competitive for support. The combined impact of these grants is to strengthen the entire research infrastructure of the school, allowing us to offer the best possible training opportunities to our students.

We asked our 2018 NSF grantees to discuss their projects.

Director's message

Enrollment in Biological Sciences has grown once again; our total student population exceeds 800, making us



Director Craig Gatto

the second largest unit in the College of Arts and Sciences (CAS). 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.

We were excited to see the state of Illinois pass a budget in 2017; this enabled us to embark on two national faculty searches, in the areas of microbiology and ecology. Six candidates were brought to campus for seminars and interviews in spring 2018, and we recruited two new colleagues to join the faculty for the 2018-19 school year. Maintaining faculty numbers is crucial, especially given enrollment growth and several retirements in the recent past.

The research productivity of the school remains strong. We once again brought in over \$2 million in extramural support, which enabled faculty to mentor over 100 undergraduate and 60 graduate students in their laboratories. These efforts have 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

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!

Wolfgang Stein, "Extrinsic neuromodulation is a general mechanism to stabilize neural network function during temperature changes" (\$495,000). How nerve cells in the brain deal with temperature changes is not well understood. The electrical activity that nerve cells produce relies on a well-balanced flow of ions across the cell membrane. It is this balance that is critically altered by tem-

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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 like to congratulate Dr. Benjamin Sadd for winning the University Outstanding Research Initiative Award, which is given to the most successful scholars among ISU pre-tenured faculty. In addition, I also congratulate Dr. Laura Vogel for being named the CAS Distinguished Lecturer, the highest honor CAS can bestow on a faculty member.

I would like to thank all the folks who donated to the school in 2018. We are in the middle of a comprehensive campaign at ISU, and these gifts critically contribute to our ability to provide scholarships, as well as support student research and travel. The fact of the matter is that many of the opportunities afforded our students are only possible from the generosity of our alumni. Whether students realize it, most of them have benefited greatly from similar alumni support while they attend ISU.

Please remember, 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 5

Editor: Kevin Edwards

Associate editors: Kara Baldwin, Diane Byers, Martha Cook, Barbara Cox, Amy Gilliland, Viktor Kirik

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

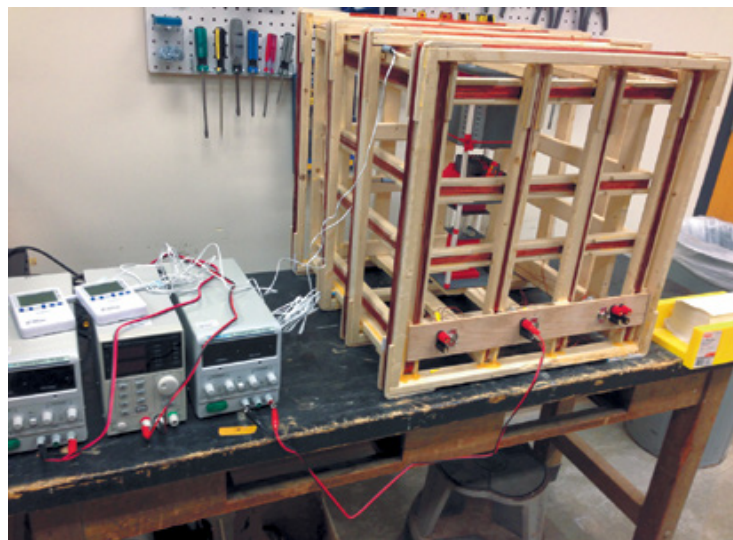
Bio.IllinoisState.edu



The Stein lab attends Phi Sigma Research Symposium.

perature, leading to failures in neural activity and accordingly severe consequences for vitality. Many animals have evolved compensatory mechanisms allowing their brains to function over a wider temperature range. Stein's grant studies whether species have evolved conserved mechanisms to battle temperature effects using several species of crustaceans. Crustaceans are ideal for this because their large and identified nerve cells can even be tracked from one species to the next. This is particularly interesting since crustaceans live at a variety of different temperatures, which will allow identification of evolutionary conserved mechanisms. The grant will also provide comprehensive training in identifying temperature effects on nerve cell physiology and in cutting-edge electrophysiology for all levels of students. Studying how temperature compensation works is not only crucial for our understanding of how animals battle climate change and survive in continuously changing environments—ultimately this research is also a prerequisite for the investigation and treatment of hyper- and hypothermia in humans. See also: <https://bit.ly/2SgCDkY>.

Andres Vidal-Gadea, “Neuronal and molecular basis for magnetic transduction in the nematode *C. elegans*” (\$638,606). Many organisms, spanning bacteria to mammals, are able to use the magnetic field of the earth to navigate their environment. While the list of ‘magnetotactic’ species continually grows, we know little about how this sensory feat is accomplished. A leading hypothesis proposes the existence of intracellular compasses. Animals might assemble magnetic particles in their tissues into intracellular compass needles. Tethering these magnetic needles to a stretch sensor might produce a cellular response as they are continually pulled by the Earth's magnetic field. Two big obstacles have hindered the search for these structures. First, magnetic orientation can be a truly planetary behavior (e.g. many migratory birds and fish). This makes studying magnetic orientation in the lab a consider-



Vidal-Gadea's triple magnetic coil system used to test the ability of worms to detect and orient to magnetic fields.

able challenge. The second obstacle is that while animals often possess millions (and even billions) of neurons, they might only need a single cell to achieve magnetic field detection. This makes the task of looking for a magnetic detector a proverbial needle in a haystack challenge. The Vidal-Gadea lab recently used a tiny soil nematode, *C. elegans*, and its economic 302-neuron nervous system to overcome these challenges, identifying the first set of magneto-sensory neurons ever described in any animal. Last summer the National Science Foundation awarded the Vidal-Gadea lab a grant to investigate the molecular and cellular basis of magnetic field detection in *C. elegans*. The funds will allow two graduate students, plus several high school and undergraduate researchers to investigate this enigmatic sensory modality. By investigating how the Earth's magnetic field interacts with the proteins and cells of *C. elegans*, ISU students will help us understand how migratory animals perform this remarkable behavior. Their work will also help us grasp how all living cells interact with this invisible force field continuously generated by our planet.

“Acquisition of a laser scanning confocal microscope within a core facility for research and training at Illinois State University” (\$661,326). Principal investigator: Kevin

Edwards; co-principal investigators: John Sedbrook, Wolfgang Stein, Thomas Hammond, Alysia Mortimer. Additional major users: Andres Vidal-Gadea, Marjorie Jones (CHE). One of our largest-ever research awards, this grant allows ISU to establish a state-of-the-art bioimaging facility for use by labs across ISU and Central Illinois. The proposal involved bringing together research plans from a total of 24 researchers, including labs in Biological Sciences, Chemistry, and Physics at ISU, and external users from the Millennium Pain Center, Knox College, Illinois Wesleyan, and the USDA National Center for Agricultural Utilization Research. The facility is centered around a new laser scanning confocal microscope, which allows for the precise visualization of multiple different biomolecules within a complex cell, tissue, or organism. Each biomolecule is fluorescently labeled with an antibody, dye, fluorescent protein tag, etc. The labels are then visualized in the tissue by scanning a laser across the sample at rates up to 16,000 times per second. The system is designed to be gentle on live cells, allowing for extended time lapse imaging of dynamic processes such as cell movements during development or cell-cell communication events. Special software can remove the inherent blurring of sub-micron structures, revealing very clear, sharp images of cell structures that could not be seen by standard microscopy. The microscope will promote research in the developmental biology and physiology of microbes, fungi, plants, and animals. Students at all levels will train in advanced imaging methods, and the school will also use the system for science outreach to school groups and the public. Details of the system will be available to potential users by visiting IllinoisState.edu/Confocal.



ISU Confocal microscope captures a 5-color image of fruit fly egg chambers.

“Dimensions of Biodiversity US-China: Collaborative Research: Microbe eco-evolutionary feedbacks as drivers of plant coexistence and diversity gradients” (\$84,437).

Diane Byers, co-principal. Byers works along with collaborators at the Universities of Kansas and Minnesota, and The Land Institute in Kansas. Another group of collaborators is testing similar hypotheses in China. The overall hypothesis they are testing is whether the interactions between plants' roots and the soil microbial communities increase the diversity of both. Observation indicates both the plant diversity and the soil microbial diversity in our tallgrass prairies in Illinois are significantly higher than in Kansas. They propose the greater moisture of the Illinois prairies enables a greater diversity of soil microbes to become established in the prairie soil, with interactions with the plants leading to increased specialization of the microbial pathogens and greater diversity of the plant community. To formally test this hypothesis, they are establishing experimental gardens in Illinois and Kansas where the plants are from prairies in Illinois and Kansas, and the microbial community is from local prairies. Byers is growing four species of prairie plants in experimental plots at the ISU

2018 Awards

School of Biological Sciences Awards

Charlena Wallen Memorial Scholarship
Kylie Hampton

Jack Ward Service Award
Marc Ashford

Dr. Robert H. Gray Biology/Ecology Scholarship
Kristina McIntire

H. Tak Cheung, Lauren Brown, Phi Sigma Student Publication Award
Darren Will, Amanda Wilson Carter

Outstanding Biology Teaching Assistants (In memory of Robert and Marion Finn)
Abigail Benson, M.S.
Chris Goldsmith, Ph.D.

Drs. H. Tak Cheung/Joni St. John Endowment for General Education Teaching Assistant Awards
Kylie Hampton, Chris Lark, Rachel Sparks, and Ashley Waring

E.L. Mockford and C.F. Thompson Summer Research Fellowship Awards
Austin Calhoun, and Kerrigan Tobin, M.S.
Rosario Marroquin-Flores, Ph.D.

Phi Sigma Awards

Chance Bainbridge, Ph.D.
Dylan Poorboy, M.S.

Undergraduate Awards

Undergraduate Researcher
Kaitie Wildman

Undergraduate Service Award
Rachel Angles

Undergraduate Teaching Assistant
Julia Martin

Dr. David W. Borst, Jr., Memorial Endowed Scholarship Fund
Amanda Klingler

Barbara Bathe Biology Teacher-education Award
Abby Primo

Rilett Scholarship Awards

Micheal Almassey, Mina Amini-Moghaddam, Chance Bainbridge, Abigail Benson, Margaret DeMaegd, Rachael DiSciullo, Kristin Duffield, Malihe Esfahanian, Casey Gahrs, Kara Hodges, Kiley Hughes, Pooja Kadaba Ranganatha, Rosario Marroquin-Flores, Dylan Poorboy, Logan Sauers, Rachel Sparks, Kerrigan Tobin, and Ashley Waring

In other news

New student organization provides venue for exchange of ideas

The **Scientific Community** is a student-run organization dedicated to “preserving science as the forefront of knowledge.” It hosts faculty, students, and guest speakers to engage with audience members from diverse scientific backgrounds. The group’s first semester featured a presentation from the ISU solar car team, a CRISPR forum, and a discussion of science funding with Kevin Edwards from Biological Sciences. Organizer Cameron De La Mora (molecular and cellular biology major) says the group plans to hold an interdisciplinary ethics forum on topics including human gene editing, the economics of space travel, and nuclear waste disposal. The group is also looking forward to touring a solar farm in Bloomington run by an ISU professor.



The Spring 2018 Alumni Seminar Series in Genetics featured

Dr. Peggy Redshaw

(Ph.D., '74) of Austin College, presenting an overview of

her career as a science educator, “Four Decades of Liberal Arts Teaching.” The series is supported by the Herman E. Brockman Fund, ISU Foundation.

Rosangela Follmann , Christopher Goldsmith , and Wolfgang Stein

published “Multimodal sensory information is represented by a combinatorial code in a sensorimotor system” in *PLoS Biology* (doi.org/10.1371/journal.pbio.2004527)

Biological Sciences awarded, continued from Page 3



Byers and team look at what’s under the surface of an Illinois prairie.

Horticulture Center. Soil will be sampled after a year to assess the changes in the microbial community from interacting with the plant roots. Information from this research will aid restoration managers as to how to manage their prairies for maintaining or increasing diversity.

“Collaborative Research: Environmental Data-Driven Inquiry and Exploration (EDDIE): Using Large Datasets to Build Quantitative Reasoning” (\$1,771,556.00). Principal investigator: Catherine O’Reilly; Co-principal investigators: Thomas Meixner [U. Arizona], William Hunter, Rebekka Darner, Cailin Orr [Carleton College]. (CeMast.IllinoisState.edu/Downloads/Data-for-students/brochure.pdf).

This national collaboration is designed to help students and faculty work with large data sets. Darner explains that Project EDDIE has built several curricular modules around open-source datasets available online through organizations such as the U.S. Geological Survey, the Environmental Protection Agency, and the National Ecological Observatory Network. Funded by NSF in 2013, the initial phase of EDDIE involved about 10 faculty members from across the country who met each summer to write curricular modules and pilot them in their classrooms. Students’ quantitative literacy resulting from EDDIE modules was not surprising; students who engaged in the modules learned statistical concepts, such as differentiating r-squared from slope, better than students who did not engage in the modules. Surprisingly, however, participants noticed that teaching with EDDIE modules seemed to have provided an “on-ramp” for faculty who were otherwise resistant to trying innovative teaching methods. Thus, the team sought funding for the second phase of EDDIE, in collaboration with the Science Education Resource Center at Carleton College, to test this hypothesis. The second phase of EDDIE will provide professional development workshops for faculty to learn how to implement EDDIE modules in their classrooms as well as build new modules, starting in 2020. In 2019, in collaboration with a post-doctoral researcher, Darner will be developing an instrument to measure faculty’s pedagogical orientation toward inquiry-based teaching and active learning methods, which will be used to gauge the influence of EDDIE involvement through workshop attendance and module implementation. Through dissemination of EDDIE modules across post-secondary science major and nonscience major science courses, as well as facilitation of pedagogical orientations that favor active learning and inquiry among faculty, the team seeks to achieve quantitative literacy among both future scientists as well as nonscientists. The specific areas of quantitative literacy that are fostered by EDDIE modules are graph creation and interpretation, development of statistical ideas such as r-squared, slope, variation, and randomness, and appreciation for big data and the robustness of analyses that are made possible by it.

New faculty

My name is **Jan-Ulrik Dahl**, and I am the new assistant professor of microbiology in the School of Biological Sciences. I am a bacterial physiologist with a particular focus on the molecular mechanisms of how pathogenic bacteria respond to oxidative stress as it is produced (e.g. during host defense or inflammation).

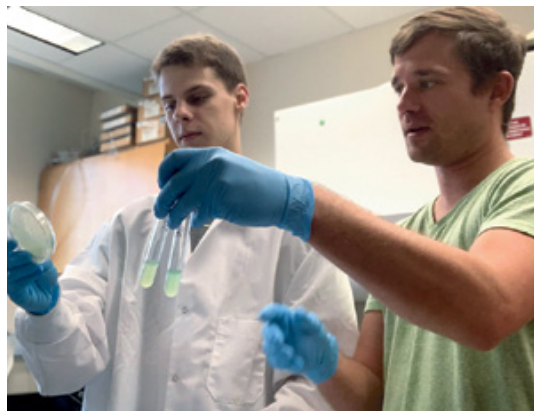
I received my B.Sc. in 2008 and graduated with honors and distinction for my M.Sc. in 2010 from University of Potsdam (Germany). During my graduate career, I was trained as a protein biochemist at Potsdam, studying how sulfur is distributed toward biosynthesis pathways of sulfur-containing cofactors in bacteria. In addition, I spent a significant amount of my Ph.D. as a research assistant at the CNRS—Laboratoire de Chimie Bacterienne in Marseille (France)

where I was trained in transcriptomics. Supported by a fellowship of the German Research Foundation, I then joined Ursula Jakob's lab at the University of Michigan as postdoctoral research fellow to train in redox biology and microbiology. My studies there identified and mechanistically characterized strategies that pathogenic bacteria employ to survive low pH and oxidative stress situations. Further, my research identified an FDA-approved drug that efficiently inhibits one of the most effective posttranslational stress response systems in bacteria during oxidative stress. My research has been published in numerous journals, including *Nature Microbiology*, *Molecular Microbiology*, *Journal of Biological Chemistry*, *Protein Science*, and *Journal of Molecular Biology*.

In my own lab here at ISU, I will now use a combination of genetic, biochemical, and microbiological methods to expand this research to studies of how redox-regulated processes regulate biofilm formation in pathogenic species with the goal of determining the role of these processes in host defense. This will help to identify potential novel drug targets that could lead to alternative treatment strategies to combat bacterial infections. I feel that this research program is ideally suited for ISU students in every training stage to become effective scientists.

As an alumnus of the ASM Science Teaching Fellow Program, my goal is to provide students with the best possible education, both in class and the lab. I teach microbiology in spring 2019.

I am **Matt Dugas**, a new assistant professor of ecology. After completing my Ph.D. with Doug Mock at the University of Oklahoma, I held a visiting position at Hendrix College and then went on to post-doctoral research positions at Tulane University, Case Western Reserve University, and Murray State University. I am excited to join such a vibrant, productive, and



Undergrad Greg Anderson (L) and his research mentor Jan-Ulrik Dahl (R)

collegial department, and I sincerely hope this is my last move (and I never have to load a U-Haul again).

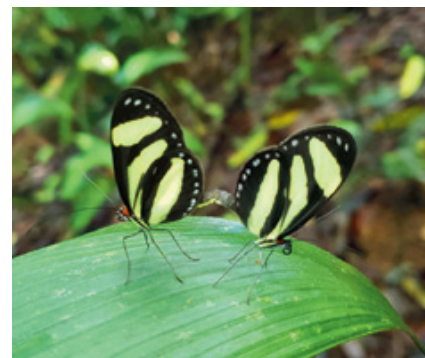
My research spans taxonomic groups and has included work in songbirds, tropical dart frogs, desert toads, and freshwater minnows. My primary interests lie in addressing questions about how and why offspring communicate with their parents, and why parents do or do not respond to these pleas for attention. The mouths of nestling birds are often colorful, and these colors fade as they reach independence, suggesting that these colors play a special function in early life. My research has shown that, much



Matt Dugas

At the 2018 Annual Drosophila Research Conference, in Philadelphia, a trio of Alysia Mortimer's students presented their research. **Michael Almassey** (Biotech M.S.), presented a poster on his thesis research on the role of lamin in aging. **Kaitie Wildman** (Molecular and Cellular Biology '18) presented a poster on her research on the evolution of stress response genes in *Drosophila*, and **Basheer Becerra** (senior, computer science and mathematics–statistics double major, biology minor) presented a poster on his research on developing bioinformatics tool for studying large proteomic data sets.

Our Rain Forest Ecology course once again made the journey to LaSelva Biological Station in Costa Rica. Students



developed, conducted, and presented their own individual research projects in tropical ecosystem structure, function, and conservation.

Do you know a student at ISU or an IL community college who is interested in science, technology, engineering, and mathematics (STEM) teaching? The ISU Noyce Scholarship Program seeks to encourage talented STEM majors and professionals to become K-12 STEM teachers. Read about our program, with awards worth up to \$20,000, at isunoyce.org.

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Bill Perry travelled to Tanzania to work on a Danish-funded collaborative project with Catherine O'Reilly (Department of Geography, Geology, and the Environment) at TAFIRI, a Tanzania government research laboratory from November 11 to November 23. They have put a monitoring buoy on Lake Tanganyika, a lake which contains 20 percent of the Earth's surface water and is 1,500 meters deep.

Alums **Laura Kuczek** and **Carter Siegfried** returned to ISU in fall 2018 to inform



students about industry careers, focusing on their experience in the biotech supply company Thermo Fisher Scientific. Kuczek is currently a scientist in Antibody Production and Custom Services and Siegfried is supervisor for Antibody



Production, both working at the Rockford branch of the company.

New Faculty, continued from Page 5

like the colorful plumage of adult male birds advertises their high quality, colorful nestlings are in better condition than their paler siblings. Parents turn out to favor their most colorful offspring. I have been lucky enough to already attract excellent ISU undergraduates who are busy re-analyzing recordings and helping me expand this research to include questions about how nestling coloration influences parents' ability to see their chicks in dark nests.

I also study parental care in the strawberry poison frog, a native of Central America. This frog lays its eggs in the leaf litter, and once they hatch, a mother transports each tadpole to a rearing site (usually a water-filled leaf axil), and then returns regularly for about a month and a half to feed tadpoles with unfertilized eggs. Even more surprising is that, when mothers visit, tadpoles perform a specialized display, stiffening their bodies and vibrating rapidly. My work in this frog has helped us understand the constraints that parents are under (in big families, for example, tadpoles are fed less), and shown that these vibrational displays are performed best by high-condition tadpoles and rewarded by mothers with bigger meals. I am establishing a captive breeding colony of these (and related) frogs here at ISU and am off to Panama this summer to study how parental care and tadpole begging differ among populations that experience very different predation risks.

I feel very fortunate to have landed here at ISU and am excited to continue my work, collaborate with my great colleagues, and be an effective teacher and mentor. I thank everyone for welcoming me.

Phi Sigma's 2018 Year in Review

2018 was an exceptional year for the Beta Lambda Chapter of Phi Sigma Biological Sciences Honor Society. The beginning of the year was devoted to planning and executing the 19th Annual Research Symposium, which was held at the Bloomington-Normal Marriott Hotel and Conference Center for the first time since the symposium began. The goal of this venue



Research Symposium travel award winners, from left, Maggie DeMaegd, Dylan Poorboy, Kristin Duffield, Nicole Campbell, Tony Breitenbach, and Pooja Kadaba Ranganatha.

change was to promote a more professional atmosphere while also providing more space for increased student participation. This event was a resounding success, with six oral presentations and 43 poster presentations from graduate, undergraduate, and high school students. At the symposium, presenters have the option to compete for travel funding with the top three oral, poster, and undergraduate presentations receiving awards. In 2018, we awarded over

\$1,500 in travel grants through this competition. We are very grateful to the faculty members who volunteered to judge this competition and to our students for participating.

The highlight of the Research Symposium is always the keynote speaker; in 2018, we were fortunate to host Dr. Ross Nehm from Stony Brook University in New York. Nehm is an associate professor of Ecology and Evolution and associate director of the Ph.D. program in Science Education at Stony Brook University in New York. His work focuses on the measurement and assessment of student learning with an emphasis on the learning of natural selection and evolution. His keynote talk was entitled "Thinking About Evolutionary Change: Concepts, Contexts, and Cognitive Coherence." Everyone in attendance benefited greatly from learning about how recent studies of evolutionary reasoning across age groups, nations, and expertise levels can inform evolution education at all levels.

At the same time that the Research Symposium was being planned, the Beta Lambda Chapter awarded over \$10,000 in research funding to 21 students through the R.D. Weigel



Phi Sigma's 2018-2019 Executive Board at the 2018 Spring Banquet. From left: Rosario Marroquín-Flores, Kylie Hampton, Ashley Waring (holding Kate Evans' image on a popsicle stick), Rachel Sparks, and Julia Martin.

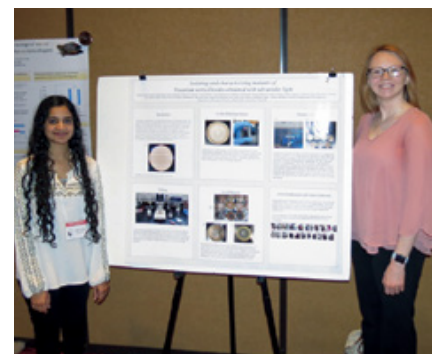
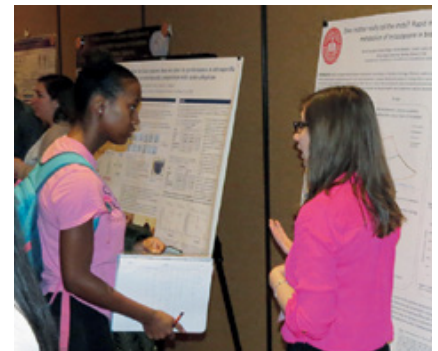
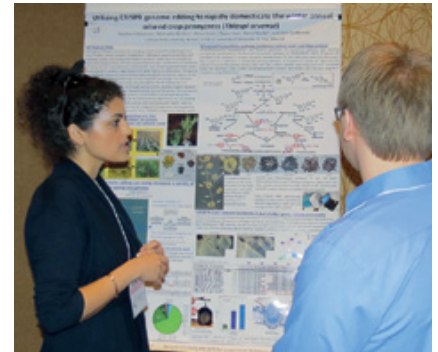
member who made an exemplary effort to provide constructive and valuable feedback to applicants. In 2018, Rebekka Darner served as the chair of the review committee, and Nate Mortimer received the Mockford-Thompson Outstanding Reviewer Award. We wrapped up our spring semester with the annual Spring Banquet, which took place at Reality on Monroe in Bloomington. This provided an excellent venue where numerous faculty members, graduate students, and undergraduate students received awards highlighting excellence in research, teaching, and scholarship. At the banquet, we also inducted 13 new members into our chapter and installed the 2018-2019 Executive Board.

Following a busy summer of research and teaching productivity, 2018-2019 jumped right back into action in August, holding a week of social events during Teaching Assistant Training, including a pizza night at Firehouse, miniature golf at Pheasant Lanes, and an outing to the local Corn Crib stadium. This allowed new graduate students to get to know returning graduate students and provided a relaxed environment prior to the start of the semester. The social events continued with our annual Fall Picnic in September, hosted by Charlie and Karen Thompson. This event celebrated the start of another successful academic year with burgers, veggie burgers, and brats provided by the Executive Board, with members bringing a fabulous array of side dishes. Our final social event for 2018 was the annual Winter Potluck at Ironwood Golf Course, a tradition devoted to ugly sweaters, a white elephant gift exchange, and the induction of the 11 members of our fall new member class. Rachel DiPietro won the ugly sweater competition with her homemade sweater including (fake) birds, nests, and authentic birdfeed. These events were wonderful opportunities for our members and faculty to spend time together outside of the academic setting and create great memories!

The fall semester also included the introduction of two new programs that the 2018-2019 Executive Board is particularly proud of, the External Grant Award and the Weigel Seminar Series. Inspired by our outreach with Bent Elementary last year, we started this program to formally award a grant of up to \$1,000 to a teacher, school, or community organization promoting K-12 students' interest and engagement in biology. A number of applications were received, and after a double-blind review process, our reviewers unanimously selected the STEM Club at Normal West High School as the recipient of this grant. Funds were used to purchase a do-it-yourself, open source Polymerase Chain Reaction (PCR) thermocycler kit produced by OpenPCR. The Bio-Rad PCR Bioinformatics kit allowed STEM Club students experience constructing the kit, testing and calibrating the PCR thermocycler, and developing a protocol for future use by students. To fund this grant, Phi Sigma held a Halloween-themed trivia night answering questions about spooky topics like horror movies, serial killers, and ghosts along with our favorite classic categories of pop culture, trivia snake, and Harry Potter. This event also boasted a very competitive costume contest, with entries including but not limited to notorious candy aficionado Draco Malfoy, *Aedes* (pronounced 80s) *aegypti*, Austin Powers, and a GFP-tagged *Drosophila melanogaster*. This event and the External Grant Award were a resounding success, and we're excited to continue giving back to the McLean

Research Grant Program. Aside from the financial research benefits, this grant competition gives students the opportunity to practice their skills in grant writing and reviewing. Graduate students are also able to earn summer funding through the E.L. Mockford and C.F. Thompson Summer Research Fellowship, which is awarded on a competitive basis to one Ph.D. and two M.S. students. This fellowship provides students with a full summer salary to allow them to focus on making substantial research progress to contribute to future publications. Following the 2018 Mockford-Thompson Fellowship review process, the 2017-18 Executive Board decided to formally recognize the chair of the review committee and one faculty

Students present their science at the 19th Annual Phi Sigma Research Symposium.



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Louis Stokes Alliances for Minority Participation (LS-AMP) scholars: **Crystal Jones** (senior, general biology major) in Alysia Mortimer's lab was the recipient of the LS-AMP 2018 Academic Excellence Award, Community Scholar Award, and the Research and Mentorship Award. Jones' research project is to clone stress response genes for making transgenic fly models of muscular dystrophy. **Victoria Linton** (junior, general biology major) was the recipient of the LS-AMP 2018 Community Scholar Award, and the Research and Mentorship Award. Linton's research project is to test how stress response genes protect the brain from Parkinson's disease, also in Mortimer's lab.

The Research to Establish a Scientifically Informed Society lab, led by **Rebekka Darner**, associate professor of biology education in the School of Biological



From left: Rachel Sparks, Kara Baldwin, Rebekka Darner, and Julia Martin.

Sciences, attended the annual meeting for the Society for the Advancement of Biology Education Research in Minneapolis this summer. Across the lab members, six posters were presented on topics such as student learning of evolutionary biology in a specially designed version of BSC 101, interest in STEM careers among middle school girls resulting from a STEM camp funded by ISU's Noyce program, and how future STEM teachers learning about the authentic practices of their disciplines during research internships.

Phi Sigma, continued from Page 7



Phi Sigma's Halloween trivia night at Ironwood Golf Course.

speaker in order to foster the growth of our graduate students as researchers and educators. For our inaugural year, we were fortunate to host Dr. George Uetz from the University of Cincinnati, who studies multi-modal communication and sexual selection in wolf spiders as well as social behavior in colonial web-building spiders. His seminar, "Multimodal communication in wolf spiders: content, context and consequences," focused on studies of courtship and mating to elucidate the information contained in spider signals, the importance of context in mate choice, and the potential fitness consequences of these communication methods.

With a busy and enormously successful year behind us, we are looking forward to continued success throughout 2019. With the 20th annual Research Symposium quickly approaching, we eagerly anticipate learning from our keynote speaker, Dr. Hollis Woodard from the University of California Riverside, who studies behavior and physiology of bees in extreme and changing climates. We are also currently in the process of reviewing 36 applications for the R.D. Weigel Research Grant and 25 applications for the E.L. Mockford and C.F. Thompson Summer Research Fellowship and are delighted to be in a position to continue to support students' research efforts. As always, Phi Sigma is deeply thankful for the support of all current and former members involved in the process of promoting research and academic success. We extend our gratitude to all alumni who have been involved in our traditions and actively support our endeavors, and we are inspired by your continued success and look forward to your many future accomplishments. —*Rachel Sparks, 2018-2019 president*

County STEM community.

Our second new program, the Weigel Seminar series, was developed to emphasize graduate student professional development through interacting with a prominent researcher in the biological sciences. The Weigel Seminar is distinct from our other weekly seminars in that in addition to hosting an outstanding researcher, this seminar gives graduate students who are members of Phi Sigma priority in scheduling meetings with the

2018 alumni career seminars focus on career paths

The school hosted two different career seminars in conjunction with Alumni Weekend events, October 11-12, 2018. First, Kiley McGlauchen, M.S., CCRP, gave a seminar on opportunities in clinical research. In 2004, McGlauchen graduated from ISU with a M.S. in biological sciences/biotechnology, then joined Washington University School of Medicine as a research patient coordinator. In 2007, she started the Clinical Research Department at Quincy Medical Group, where she has been solely responsible for the direction of the department, engaging with physicians to bring clinical trials to serve unmet medical needs, and collaborating with pharmaceutical companies. She is pictured at the Alumni Luncheon with her M.S. advisor, Laura Vogel.

Next we learned the practical side of genetic counseling with Jeannine Oldzej (née St. John), M.S., LCGC. Oldzej graduated from ISU in



Kiley McGlauchen with her M.S. mentor, Dr. Laura Vogel

2008 with a B.S. in biological sciences. In 2010, she received her M.S. in genetic counseling from the University of California, Irvine. Since graduating, Oldzej has worked for multiple molecular genetic testing laboratories where she has been involved with test utilization management, analyzing/interpreting genomic data, and patient/provider education. She currently works for Kaiser Permanente in California as a clinical testing coordinator. She is pictured at her talk with her undergraduate research advisor, Scott Sakaluk.



Jeannine Oldzej with her undergraduate research mentor, Dr. Scott Sakaluk.

Both of these exciting talks drew large crowds of students eager to learn how to capitalize on their ISU training and use it to help solve pressing health care needs. These kinds of talks are highly valuable for our students, allowing them to picture themselves in new career paths that they had not previously appreciated. The school thanks McGlauchlen and Oldzej for taking the time to visit, give talks, and meet with interested students.

If you are an alum who would like to make an impact by telling students about your career path, please contact Kevin Edwards at kaedwar@IllinoisState.edu.

Rosario Marroquín-Flores, Mockford-Thompson Summer Research Fellowship awardee

My research in the Bowden Lab and Paitz Lab involves the study of the mechanistic drivers of temperature-dependent sex determination (TSD) in turtles. Reptiles of many species exhibit TSD, where thermal cues trigger gonadal differentiation during the middle third of development.

The red-eared slider turtle (*Trachemys scripta elegans*) exhibits TSD and is sensitive to female-producing temperatures of 31°C and male-producing temperatures of 26°C, but we do not fully understand how temperature affects the molecular mechanisms underlying sex determination. While TSD has been studied for upwards of 50 years, the majority of genetic research has focused on describing drivers of sex determination based on measuring transcripts that are up- and down-regulated in response to temperature shifts. Few studies have taken a functional genomics approach to these questions, largely due to the lack of genomic resources and well-developed protocols, nor have they used biologically relevant thermal conditions.

Accessibility to and advances in genomic resources for non-model organisms have increased our ability to pursue questions that target gene function. Additionally, previous research in the Bowden Lab has determined appropriate incubation treatments that are representative of soil temperatures that *T. s. elegans* experience in the nest. In our most recent work, we are targeting a candidate protein for driving sex determination in species with TSD, cold-inducible RNA-binding protein (Cirp). Cirp is a thermally sensitive nuclear RNA-binding protein present in the gonadal tissues of many vertebrates, and it exhibits temperature-dependent expression in TSD species. RNA-binding proteins have the capacity to regulate the expression of genes by coordinating the splicing of introns from pre-mRNA transcripts whereby introns are either retained or excised to produce a mature mRNA. Intron retention has been proposed as a regulatory mechanism for male development in *T. s. elegans*, and we propose that a similar mechanism exists for the female pathway whereby RNA-binding



Rosario Marroquín-Flores

Kirik Lab graduate students **Christy Fornero** and **Trevor Rickerd** published their work in *Planta*: “Papillae formation on Arabidopsis leaf trichomes requires the function of Mediator tail subunits 2, 14, 15a, 16, and 25” (doi.org/10.1007/s00425-018-3063-y). The paper details the role of the transcriptional mediator complex in generating specialized cell wall structures in plants.

Several students in Alysia Mortimer’s lab co-authored the article “Rare Disease Mechanisms Identified by Genealogical Proteomics of Copper Homeostasis Mutant Pedigrees,” published in *Cell Systems* [doi: 10.1016/j.cels.2018.01.008]. Among the authors, **Lucas Carey** ’16 will be starting the Doctor of Physical Therapy degree program at A.T. Still University in Mesa, Arizona, fall 2019.

Morgan McCall ’14 was a post-bac student mentored by Alysia and Nathan Mortimer and is currently in the dental program at Midwestern University. **Liz Scott** ’16 is currently working as an andrology lab technician at the Fertility Centers of Illinois and is applying for physician assistant programs.

The Proceedings of the 24th North American Prairie Conference, held at ISU, are available at the digital repository *ISU ReD: Research and eData*. Go to IR.Library.IllinoisState.edu/NAPC for downloads of the submitted papers and information about the conference, chaired by Roger Anderson.



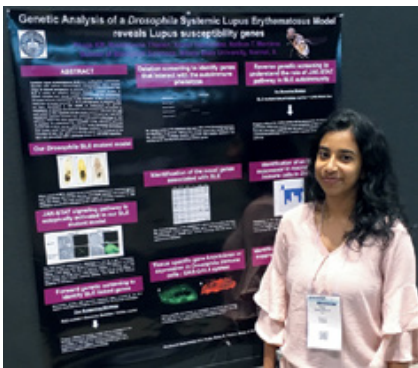
Emma Hartness, left, presents her work from the Nathan Mortimer lab at the 2018 Biological Sciences Student Association poster session in Science Laboratory Building.

Continued on Page 10



Kristina McIntire (pictured here in Costa Rica) and Steven Juliano published “How can mortality increase population size? A test of two mechanistic hypotheses” in the journal *Ecology* (doi.org/10.1002/ecy.2375).

Pooja KR, a Ph.D. student working in Nathan Mortimer’s lab presented her research at the American College of



Rheumatology (ACR) Annual Meeting in Chicago. Pooja’s research is focused on understanding the genetic basis of autoimmune disease, and she was awarded a free student membership to ACR.

Rosario Maroquinn-Flores, continued from Page 9

proteins regulate the expression of sex-determining genes by impacting intron retention. We are taking a functional genomics approach to answer these questions by adapting molecular protocols common in model systems for use in *T. s. elegans*.

Kerrigan Tobin, Mockford-Thompson Summer Research Fellowship awardee

The effects of climate change manifest in a variety of ways, including consecutive days where temperatures are hotter than average, also known as heatwaves. Native pollinators are important in natural ecosystems, but bumble bees are also economically important since their pollination services have been linked to higher quality and larger fruit yields. The goals of my research are to understand if heatwaves reduce bumble bee survival, whether heatwave-exposed bees have compromised immunity, and if current or future infection outcomes are influenced by heatwaves.

Using incubators to apply heatwaves, age-controlled adult bees were exposed to a realistic five-day heatwave (modeled after climate data from the last 20 years in Central Illinois), then I subsequently monitored survival. Heatwave-exposed bees showed decreased longevity compared to bees that were given a control temperature regime. Bees that underwent the heatwave treatment also showed a decrease in inducible immunity as measured by their anti-bacterial response, although I didn’t see differences in some metrics of baseline immunity. When bees had a live parasite exposure prior to undergoing a heatwave, there was not a significant difference in infection. However, after bees had already been exposed to a heatwave and were subsequently infected with a parasite, they had higher infection loads compared to bees that were exposed to control conditions before infection.



Kerrigan Tobin and friend.

My results showing decreased survival and decreased antibacterial activity led me to ask if costs of immunity interact with heatwave exposure to amplify effects on survival so I gave a simulated immune challenge and exposed bees to either control or heatwave temperature conditions. Control bees showed a cost of immune stimulation (decreased survival), however bees that underwent a heatwave didn’t have decreased survival. This result was surprising, and the interaction between immunity and thermal stress will continue to be investigated by our lab.

My work illustrates how climate change influences a host-parasite system. I gave a talk on my preliminary findings from these experiments at the Spring 2018 Phi Sigma Research Symposium and then in August, I traveled to New Orleans to present my research at the Ecological Society of America Annual Meeting. I am incredibly grateful to the application review committee that selected my project to receive funding in the summer of 2018 and to everyone who has contributed to the Edward L. Mockford and Charles F. Thompson Summer Fellowship Endowment, which continues to fund a variety of scientific endeavors.

Austin Calhoun, M.S. student in the Sadd Laboratory

Pollinator populations are experiencing rapid and devastating declines across the globe, with many of the sources of decline thought to be human-induced. Such causes include climate change, habitat loss and land intensification, pathogenic exposure, and pesticide exposure. I work in the infectious disease ecology lab of Dr. Ben Sadd, where we address the outcomes of infectious diseases in bumble bee species under an evolutionary ecology framework. My



Austin Calhoun

research specifically investigates how pesticide exposure may directly or indirectly hinder host tolerance and resistance to parasitic infection. The work that I proposed originated from a recent landscape analysis which found that a fungicide called chlorothalonil was the best predictor of the microsporidian parasite, *Nosema bombi*, in declining bumble bee species. This analysis is suggestive of a correlative link between pesticide exposure and high levels of a microsporidian infection, but I aim to experimentally assess the existence of a causative relationship between these two stressors.

As our study system, we use the common eastern bumble bee, *Bombus impatiens*, which is an economically and ecologically important pollinator in North America. These bumble bees can be found locally around Normal, which provides us with an excellent opportunity to ask questions about their ecology and relate our findings to the declines seen in nature. My research uses an experi-

mental approach to investigate the “multiple stressor hypothesis,” which states that the combination of stressors likely exacerbates the detrimental effects of either stressor individually on the host. Because chlorothalonil may directly or indirectly influence immunity, sublethal exposure to this pesticide will have detrimental consequences toward bumble bees’ ability to tolerate and resist infection. To investigate this, I use a microcolony approach, where we establish microcolonies from wild, field-caught *B. impatiens* queens, and then apply the appropriate treatments of chlorothalonil and/or *N. bombi* to bumble bees during their larval development. Subsequently, various measures of fitness will be recorded in bumble bees upon adult eclosion, with the prediction being that concurrent exposure to the parasite and pesticide will yield higher infection intensities and have greater consequences to overall health than either stressor alone. Testing the hypothesis that these multiple stressors are detrimental to health requires a multi-disciplinary approach, which will assess toxicological effects on bumble bee immunity and condition and how these influence host tolerance and resistance to a microsporidian infection. By assessing the harmful effects that pesticides and pathogens have on native pollinators, we can predict the outcomes that continued exposure to new, harmful pesticides have on pollinator health.

New grant for reptile immune system study

Professor of Immunology Laura Vogel and Distinguished Professor of Ecological Physiology Rachel Bowden received an award of more than \$430,000 from the National Institutes of Health for their project, “Nature of systemic and mucosal B cell function in reptiles”

“The immune system is critical for protection from infection, yet its function declines in elderly individuals,” said Vogel, who has dedicated her career to studying B cells, a type of white blood cell that contributes to the immune system. “Other animals, such as reptiles, have very similar immune system components but are able to maintain their immune function in old age.” Bowden’s lab studies red-eared slider turtles and the connection between the reptile systems and humans. “Turtles are long-lived reptiles that encounter many microbes while feeding, yet scientists know very little about their gut immunity,” said Bowden. The immune system plays an essential role in con-



Rachel Bowden and Laura Vogel. Photo by Claire Wagner of *The Vidette*

Morgan Walder (M.S. '17) published her thesis research in *Biological Invasions* (Walder M., J.E. Armstrong, and V.A. Borowicz. 2018. “Limiting similarity, biotic resistance, nutrient supply, or enemies?



What accounts for the invasion success of an exotic legume?” *Biol Invasions* doi.org/10.1007/s10530-018-1835-8). Walder showed an exotic bush clover was less likely to invade and grow where similar species were abundant, supporting Darwin’s hypothesis of limiting similarity. Walder is currently with The Nature Conservancy, Michigan.

Assistant Professor **Alysia Mortimer** received a RO1 subaward for her collaborative project “Neuronal Mechanisms of Copper Transport and Toxicity” with **Dr. Victor Faundez** at Emory University. Drs. Mortimer and Faundez’s long-term collaboration has revealed that mutations in a gene that plays a role in the body’s ability to handle copper also affect other genes in seemingly unrelated neurodevelopmental and neurodegenerative disease. Their grant aims to understand this relationship between copper toxicity genes and neurological disorders.

Continued on Page 12



Laura Vogel was selected to give the Spring 2018 Distinguished Lecture for the College of Arts and Sciences. The lectureship honors Arts and Sciences faculty members who have made outstanding scholarly contributions to the University and to their disciplines. Vogel is pictured with Director Craig Gatto, left, and Dean Greg Simpson.

Hammond lab graduate student **Nick Rhoades** presented "Identification of a genetic element required for spore killing in *Neurospora*" at the conference *Neurospora 2018* in Pacific Grove, California.

Jake McArthy '18 began the M.S. in physiology at Georgetown University, in Washington, D.C., in fall 2018. McArthy worked in Alysia Mortimer's lab for two years on the role of the ATP7a gene in Menkes disease. He was second author on "The interactome of the copper transporter ATP7A belongs to a network of neurodevelopmental and neurodegeneration factors" in the journal *eLife* (doi: 10.7554/eLife.24722).

The school's prestigious R. Omar & Evelyn Rilett Family Life Sciences Lectures Series continued in spring 2018, featuring a fascinating talk on the molecular biology of the octopus. **Joshua Rosenthal** of the Marine Biological Laboratory presented "Rewriting the blueprint for the cephalopod nervous system in RNA."

New grant, continued from Page 11

trolling what are known as "good gut microbes" and keeping out disease-causing microbes, noted Vogel. "Our labs are interested in how the immune system in the intestine helps keep you healthy. Our work focuses on a population of white blood cells called B lymphocytes that make antibodies that coat the intestinal walls and bind to microbes."

Working together, Bowden and Vogel will investigate how the reptile immune system is different from that of humans, focusing on the function and distribution of B cells in the intestine. This basic research could ultimately provide new targets for interventional therapies to improve health span in the elderly. "Our research on the turtle immune system represents a true collaboration where each of us has brought our strengths to a project that would have been quite difficult to do independently," Bowden said. The grant will support the work of student researchers in the Bowden and Vogel labs. "We are excited to be able to involve a number of ISU graduate and undergraduate students in this three-year project," Vogel said.

Thompson gift keeps *Redbirds Rising*

When Professor Emeritus Charles "Charlie" Thompson joined the Department of Biological Sciences in 1978, he wanted to have a lasting impact. Considering Thompson's 40-year commitment to his work, combined with a generous gift commitment through *Redbirds Rising: The Campaign for Illinois State*, he has left an indelible mark on ISU. Throughout his tenure and following his retirement in 2007, Thompson has worked diligently to advance students' capacity to perform research in the field of avian ecology. Inspired by the Wytham Woods research study conducted at Oxford since 1947, Thompson initially worked to set up hundreds of bird boxes in Mackinaw. The boxes provide Thompson, doctoral researchers, and student researchers the opportunity to conduct an array of studies regarding house wrens, many revolving around questions of immunology and endocrinology. To this day, Thompson continues to work alongside graduate students engaging in field research.

As a result of Thompson's years of commitment to establishing and conducting biological research, he knows firsthand the impact philanthropy has on the development and sustenance of research. Thompson noted that field work is heavily reliant upon obtaining grants, as it is for most all scientific research. "Biological research is not cheap," Thompson said. "In the funding business it tends to be feast or famine, and if you don't have grants you're in a difficult situation. Philanthropy can help keep a research program going."

When writing their wills, Charlie and his wife Karen Thompson determined to continue to support research at ISU for years to come. The couple included a generous bequest to the Mockford-Thompson Summer Fellowship Endowment, which provides a stipend to support graduate students so they can continue to do research over the summer, like

2018 winners Rosario Marroquin-Flores (Ph.D.), Kerrigan Tobin (M.S.), and Austin Calhoun (M.S.). School of Biological Sciences graduate Christine Hodges, M.S. '14, was a former student of Charlie Thompson's and a recipient of the Mockford-Thompson Summer Fellowship. With her fellowship, Hodges was able to conduct her summer research on the life-history trade-offs of increasing reproductive efforts in house wrens without relying on financial support from her professors' grants or laboratory funding. "I appreciated being awarded the stipend because I knew that our laboratory was saving money by not having to fund my salary," Hodges said. "My research lab could buy more supplies and hire more summer workers as a result. I was very grateful to be awarded the fellowship. It was a great honor."



Donations like the Thompsons' to Redbirds Rising uplift students by giving them the means to participate in innovative research. By including ISU in their wills, the Thompsons will ensure that students continue to have access to the unique research opportunities the University offers. "I wanted to set up a research program that would be here long term," Charlie Thompson said. "I have a philosophy in life that wherever I go, I try to make it a better place when I leave."

Interested in learning more about how you can include Illinois State in your estate plans? Contact CAS director of development Kate Childs at kachild1@IllinoisState.edu or (309) 438-7682.

Meet our 2018-2019 Bone Scholar, Rachel Angles

My name is Rachel Angles, and I am an undergraduate biological sciences (zoology) and biochemistry major at Illinois State University. I will graduate in May 2019 as a dual degree student. As someone who has a foot in two different science departments within the University, I have gotten pretty involved with research. It has been a great opportunity for professional development, and I have managed to improve on several skills such as critical thinking, communication, and academic writing.



I first started working in the lab of Dr. Rachel Bowden in the spring semester of 2017, where my focus was on the metabolism of testosterone in red-eared slider turtle hatchlings and in starling eggs. I also was given the opportunity to do some field work, going out to Banner Marsh to trap turtles and collect eggs. I co-authored a poster that was presented at the Society for Integrative and Comparative Biology meeting in January 2018. Additionally, I was able to design my own poster and present some of my research at the Phi Sigma Symposium in April of 2018. During the spring semester of 2018 I also had the wonderful experience of joining a biochemistry lab, the lab of Dr. Marjorie Jones. There I did DNA recombination studies to insert a gene

from *T. cruzi* into the *E. coli* genome for inhibition studies. Since then, I have transitioned over to the lab of Dr. Ryan Paitz, where the majority of my work has been focused on the metabolism of progesterone in chicken eggs. I am currently writing a thesis based on this work and plan to present at the University Research Symposium and the Phi Sigma Symposium this spring.

Ultimately, my goal is to become a veterinarian and possibly specialize in wildlife/exotic animal medicine. So far, I have been offered interviews at three different vet schools and have already been accepted into the veterinary program at the University of Missouri. I plan to continue doing research through vet school and beyond, and I believe that my previous research experience will give me a significant advantage and jumpstart my career. I am beyond grateful for all the wonderful experiences that I have had since coming to ISU and all the fantastic opportunities I have been presented. Even as I begin the next chapter of my life, I will never forget everything that I've done and all the amazing people that I have met! Thanks for everything, and go Redbirds!

Ben Sadd receives 2018 University Research Initiative Award

At ISU's Founder's Day in February 2018, Dr. Ben Sadd was honored with the University Research Initiative Award. This highly competitive award recognizes the quality of accomplished research of junior faculty and their potential for future accomplishments.

Sadd has been an assistant professor in the School of Biological Sciences since fall 2013, when he moved from a position as a senior research scientist at the Swiss Federal Institute of Technology in Zurich, Switzerland. He has established a successful research group that uses a diversity of approaches to study the evolution and ecology of host-disease interactions. Us-

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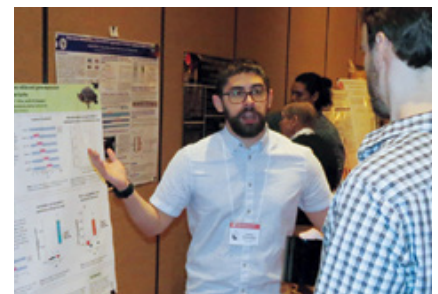
Congratulations to **Anjelica Rodriguez** (Vidal-Gadea Lab), who defended her M.S. thesis, "Using *Caenorhabditis elegans* to model the muscular and neurological impairments of Duchenne muscular dystrophy" in spring 2018; she moved on to a position at the University of Wisconsin.

Students **Emma Hartness, Brie Ocegueda Perez, Eva Gunawan, and Pooja KR**



attend the 2018 Midwest Drosophila Conference in Allerton.

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



Awardee Anthony Breitenbach presents at the Phi Sigma Research Symposium

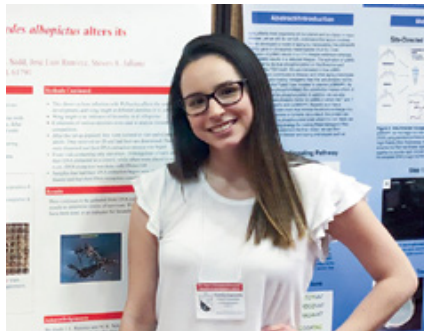
2018. This program is highly competitive, with only 18 percent of applicants chosen for funding. Congrats to the awardees:

Anthony Breitenbach, Austin Calhoun,

Continued on Page 14

Cecilia Canizela, Daniel Goldberg, and Jayde Reid.

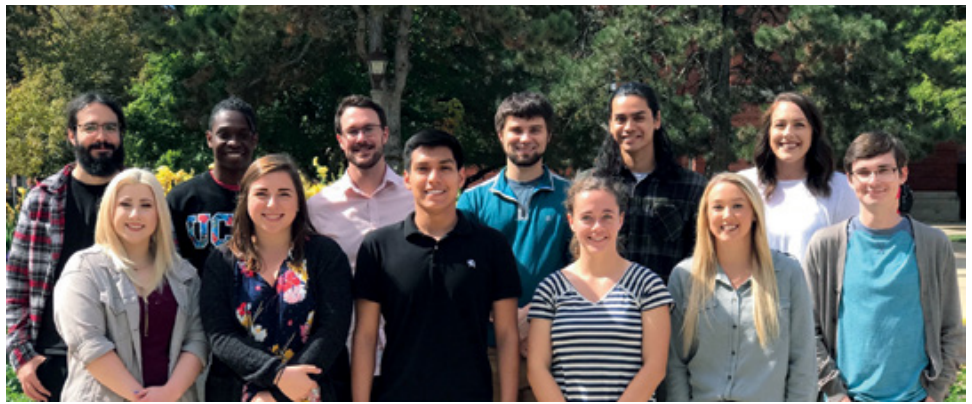
Cecilia Canizela's Sigma Xi funded project is "Intraspecific Competition of Wolbachia-infected *Culex pipiens*." Canizela is an undergraduate student conducting honors research in the Juliano



Awardee Cecilia Canizela presents at the Phi Sigma Research Symposium.

Ecology Laboratory. She investigates how the intracellular parasite *Wolbachia* affects intraspecific competitive ability in mosquito larvae. This research is important for understanding how *Wolbachia* may be used to control mosquitoes that are vectors of pathogens.

In addition to his Sigma Xi award, **Daniel Goldberg** (Capparella Lab) received the Kendeigh Grant for Ornithology Research (Champaign County Audubon Society) and an Illinois Ornithological Society Grant. His funds went toward the purchase of acoustic equipment to conduct an exploratory project recording the nocturnal and crepuscular vocalizations of Illinois wetland birds called rails.



Research group of Dr. Ben Sadd. From left: Dr. Ruben Blazquez (co-advised post doc), Shannon Barbarek, Earon Grinage (undergraduate), Kerrigan Tobin (M.S.), Dr. Ben Sadd, Abraham Martinez (undergraduate), Logan Sauer (Ph.D.), Audrey Harrod (undergraduate), Austin Calhoun (M.S.), Kylie Hampton (co-advised M.S.), Kristin Duffield (co-advised post doc), and Ian Rines (co-advised Ph.D.).

Ben Sadd, continued from Page 13

ing insects, particularly bumble bees and crickets, the latter in collaboration with Dr. Scott Sakaluk, Sadd addresses questions that are of basic conceptual importance and frequently of applied relevance. These include, what are the consequences of infection for hosts, how do organisms defend themselves against disease, and what are the causes and consequences of variability in disease outcomes between individuals, populations, and communities of organisms?

Since arriving at ISU, Sadd has published 22 peer-reviewed articles. Many of these publications have included ISU undergraduate and graduate students, to whom Sadd attributes the success of his research program. The published studies, in internationally renowned journals, have made important contributions to the fields of Disease Ecology, Evolutionary Ecology, Ecological Immunology, and Conservation Biology. Research highlights include: co-leading an international consortium in the first sequencing and analysis of the genomes of two bumble bee species; the development and testing of a conceptual model on the strategies of investment into immunity and reproduction together with previous graduate student Dr. Kristin Duffield; and an analysis of how exposure of bumble bees to pesticides may negatively affect their ability to fight diseases.

Continuing research for Sadd's group is currently funded by the National Science Foundation, the National Institutes of Health, and the U.S. Department of Agriculture. It includes further investigations into threats to bumble bee pollinator health, reproductive strategies and immunity in crickets, and the interactions between hosts and their microbes. The latter now includes an investigation of the beneficial bacteria that are found in the guts of bumble bees, which represent a model system for understanding the development and maintenance of these important beneficial interactions in other organisms. Sadd is excited to continue the further development of his research program, while fostering an interactive environment that sees the integration of students at all levels into the process of scientific discovery.



For more information, visit
Homecoming.IllinoisState.edu



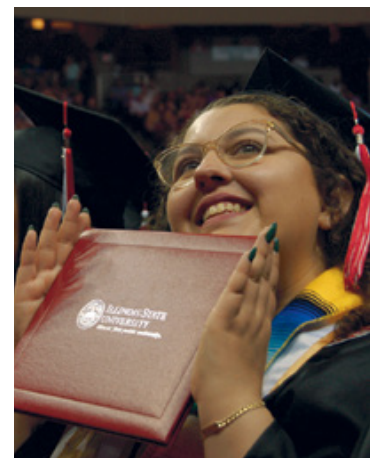
School Picture Day, fall 2018



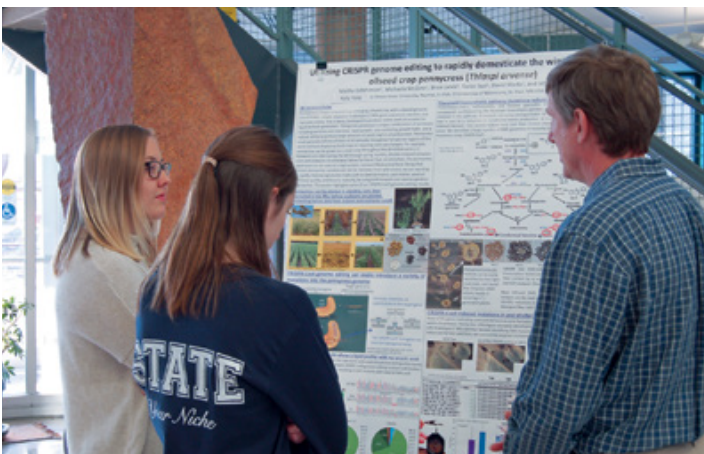
Kerrigan Tobin and Karly Cazzato perform research at La Selva Biological Station in Costa Rica for the Rainforest Ecology course.



Phi Sigma members volunteered at Millennium Girls in fall 2018, an event for fifth through eighth grade girls to explore their potential in STEM careers through hands-on labs and activities.



Maritza Arevalo at Graduation. Congratulations to all our 2018 grads!



Students and faculty gather at the 2018 Biological Sciences Student Association poster session in Science Laboratory Building.



Students in the physiology and neuroscience program celebrate the holidays.



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