



SCHOOL OF

BIOLOGICAL SCIENCES

NEWS

SUMMER 2023

New faculty bring new research areas to the school

We were thrilled to hire three exceptional new faculty members in 2019 and 2020, Dr. Pirmin Nietlisbach, Dr. Martin Engelke, and Dr. Lise Comte, and we invited them to introduce themselves.

Evolutionary Biologist Dr. Pirmin Nietlisbach studies the genetics of small populations



I am Pirmin Nietlisbach, a new assistant professor of evolutionary biology. I obtained my Ph.D. in 2015 from the University of Zurich, Switzerland, and then worked as a postdoctoral researcher at the University of Zurich and the University of British Columbia in Vancouver, Canada.

I am an evolutionary geneticist with a research focus on the causes and consequences of inbreeding (i.e., reproduction among related individuals). In my lab, we use a combination of genetic and genomic data from wild populations and theory to study the genetic reasons for the reduced survival and reproductive success of inbred individuals. Students in my lab will gain experience in fieldwork, lab work, and genetic and statistical analysis.

Since 2010, I have been part of a collaborative team studying a population of song sparrows on Mandarte Island, a small island on the west coast of Canada. All individuals in this population have been marked with unique combinations of colored leg bands, and a large amount of genetic and ecological data are now available. Despite regular immigration of song sparrows from other islands, we have found that offspring of related individuals in this population are less likely to survive and less successful at reproduction, and thus suffer from inbreeding depression. In the future, we aim to figure out what genes are responsible for these effects.

Mandarte Island is also inhabited by a population of approximately 100-300 North American deer mice that my lab started studying in 2020. The deer mouse populations on Mandarte Island and surrounding islands are likely strongly isolated from each other due to the ocean in between them preventing the exchange of individuals. This isolation makes them an ideal system to study the genetic consequences of life in small populations and, thus, a good model system for endangered populations.

Last but not least, my lab will study evolutionary processes in a house wren population at the Parklands Merwin preserve along the Mackinaw River north of Normal. This bird population has a long history of research at Illinois State University. I am excited to collaborate with the founder of this study system, Charles Thompson, and his long-term collaborator, Scott Sakaluk.

I am a passionate field ornithologist, and I, often accompanied by two dogs, may be seen exploring the local parks and natural areas looking for birds. I am excited to pass on my love for these living feathered dinosaurs to students in Avian Biology and to teach about their evolution and the processes that gave rise to the astounding biological diversity we see around us in courses of Evolutionary Biology and Population Genetics.

Director's message

After a pandemic delay, here we present School of Biological Sciences highlights from 2019-21. It's a period that saw



Director Rachel M. Bowden, Ph.D.

upheavals across society and here at Illinois State, as we worked collectively to weather a terrible pandemic that forced us to distance ourselves from our students and each

other. As biologists, we thrive on those interactions, and so it is a huge relief that we are finally returning to in-person teaching and training. We recognize the tremendous efforts of our faculty and students in successfully making the unplanned transition to remote work in 2020. We are proud to remain a highly desirable destination for undergraduate and graduate students and continue to be a top choice for Illinois students.

This period had some notable transitions. After 10 years of dedicated service, Dr. Craig Gatto stepped out of the role of director, and I took over on July 1, 2020. We are grateful to Craig for his leadership and advocacy on behalf of the school. In 2019-20 we welcomed three new colleagues, Dr. Martin Engelke (cell physiology), Dr. Pirmin Nietlisbach (evolutionary biology) and Dr. Lise Comte (conservation biology), who join us as assistant professors; they introduce themselves in our lead article. For their decades of service, we thanked Associate Professor Dr. Cynthia

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

Check out our Facebook page:
[Facebook.com/ISUBiology](https://www.facebook.com/ISUBiology)

Visit our homepage:
[Biology.IllinoisState.edu](https://www.Biology.IllinoisState.edu)

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

Moore, our biology teacher education coordinator, who retired May 2020, and Distinguished Professor Dr. Scott Sakaluk who retired May 2021.

Our research efforts remain strong: The school secured \$3,815,857 in external funding in FY21. In 2020 we published 47 papers in peer-reviewed journals, and 39 of those publications include one or more student co-authors. We take great pride in our individualized training of students and particularly when that results in student co-authorships.

Assistant Professor Dr. Ryan Paitz was a recipient of the University Research Initiative Award, which is given to pre-tenure faculty who have displayed excellence in their scholarly pursuits. Professor Dr. Wolfgang Stein was named an Outstanding College Researcher, and he received a prestigious Krupp Fellowship which allowed him to spend the 2021-2022 academic year in Greifswald, Germany, at the Alfried Krupp Institute for Advanced Study.

Finally, I'd like to take a moment to thank everyone who has donated to the school over this period, including those who donated during Birds Give Back. Your generosity helps us provide scholarships to students and supports student research and travel.

You can follow us on social media, and, as always, we love to hear what our alumni are doing, so please reach out to us!



Rachel M. Bowden, Ph.D.
Director, School of Biological Sciences

School of Biological Sciences News

Issue 6

Editor: Kevin Edwards

Associate editors: Barbara Cox, Martin Engelke, William Perry, Viktor Kirik, and Diane Byers.

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

Bio.IllinoisState.edu

Dr. Martin Engelke examines the primary cilium, a signal processor for the cell



My name is Martin Engelke, and I joined the faculty of the School of Biological Sciences in the summer of 2019 as an assistant professor of cell physiology. For as long as I can remember, my interests have revolved around the question of how life functions. My passion is to decipher essential and dynamic cellular processes in molecular detail. To prepare myself for this, I obtained a master's in biochemistry at the University of Leipzig, Germany, and then pursued a Ph.D. in virology/cell biology at the University of Zurich, Switzerland.

For my Ph.D., I joined a team of researchers studying the motions of fluorescently-labeled viruses in the cytoplasm of infected human cell cultures. In order to reach the nucleus for replication, the virus hijacks the transport machinery of the cell, which comprises motor proteins that move along proteinaceous pathways called microtubules. I was fascinated by the complex motions of the fluorescent virus particles that I could observe under the microscope, which motivated me to investigate the motor proteins that give rise to this motility.

To learn more about motor proteins, I joined the laboratory of Dr. Kristen Verhey at the University of Michigan as a postdoctoral fellow. During my Ph.D. work, I had realized that, like virus transport, many cellular processes are driven by multiple kinds of motor proteins at the same time. This makes it difficult to decipher the specific contribution of a motor protein to a certain cellular pathway. The gold standard to address this question is to abruptly interfere with the function of a motor protein and observe the resulting change in the cellular pathway. The barrier that I faced was, however, that there were no methods available to acutely inhibit the kinesin motors that I was interested in.

During my postdoctoral research, we were able to overcome this barrier by developing genetically engineered kinesin motors that function like the wild-type motor but are engineered to specifically bind a drug that inhibits the motor abruptly (Engelke et al., *Nature Communications*, 2016). I was then able to define the specific function of kinesin-2 in a specialized transport process (intraflagellar transport) that occurs in the primary cilium (Engelke et al., *Current Biology*, 2019). Primary cilia are essential for mammalian life, and mutations affecting ciliary proteins are associated with a plethora of diseases, ranging from developmental defects and kidney disease to obesity, blindness, and cancer.

I feel extremely fortunate to have been given the opportunity to start my own lab at Illinois State University, which provides me with a great environment in which to thrive. Here I am supported by collegial faculty and great students and have access to all the equipment that I need for my research. Employing genetic protein engineering, cell culture techniques, and state-of-the-art light microscopy, my team will continue to study the function of kinesin-2 motors in primary cilia. If you share my passion for deciphering dynamic processes that are fundamental to life but also want to do research that is clinically relevant, come join my lab.

Dr. Lise Comte investigates the consequences of climate change on species distributions



I am Lise Comte, a new assistant professor of conservation biology in the School of Biological Sciences. I obtained my Ph.D. in 2013 from the University of Toulouse in France and then had the opportunity to work as a postdoctoral researcher at the University of Washington, the University of California Berkeley, and the University of Tennessee, Knoxville, before starting at Illinois State University in 2021.

I am a conservation biologist studying the effects of human activities on biodiversity. My interests lie at the interface of the field of biogeography, trying to understand why species occur where they do and the field of conservation biology, trying to understand the mechanisms by which human-induced environmental changes affect biodiversity, which is a sub-discipline of conservation biology called conservation biogeography.

A central theme of my research projects is to understand the vulnerability of freshwater fishes to ongoing climate change in order to better anticipate and mitigate those impacts. Essentially, species faced with changes in climate may either stay put and adapt, move to track shifting climates or die. Freshwater fishes are thought to be particularly vulnerable to climate change because of their ectothermic physiology (the fact that their body temperature changes with the temperature of the environment) and constrained distribution within hydrographic

networks that are further fragmented by numerous human-made obstacles such as dams or road crossings. Yet, we still know little about which species or area will be the most vulnerable.

To answer these questions, the research in the lab combines analyses of long-term biodiversity databases with innovative modeling approaches to improve our ability to detect and predict the consequences of climate change. We are also very interested in the effects of biological invasions on biological communities and the interplay of these two major threats on freshwater biodiversity.

As a conservation biologist, my goal is to advance knowledge through innovative research while also playing a strong role in the training of the next generations of scientists and citizens through thoughtful mentoring. As our environmental and societal challenges expand, a diversity of perspectives and values will be needed to identify and pursue solutions to increasingly complex problems. I am therefore committed to inspiring and encouraging more women and young people from minority ethnic or sexual backgrounds and other discriminated groups to pursue careers in science!

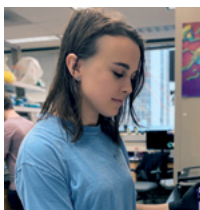
Research profiles of Mockford-Thompson Summer Research Fellowship awardees

Kiley Hughes: Muscle plasticity in *C. elegans* (roundworm)

To thrive, animals must adapt to the physical demands posed by ever changing natural environments. Muscles are responsible for generating force necessary for locomotion in animals and must respond to significant changes in requirements imposed by an organism's environment. The adaptability of muscles ensures that animals only use the resources necessary for locomotion, while also maintaining the flexibility to alter this output should the need arise. Muscle cells drive locomotion through the controlled shortening of sarcomeres caused by the ATP-powered sliding of actin and myosin filaments. The large forces necessary for locomotion can cause damage to the actin and myosin proteins in muscles, but the cell quickly responds by synthesizing new actin and myosin proteins. When this equilibrium favors protein synthesis rather than breakdown, the muscles grow in size, termed hypertrophy. Muscle growth is associated with benefits in overall health, including lifespan, and allows the muscles to exert more force. Appropriate force transfer through the dystrophin glycoprotein complex (DGC) is crucial for muscle function, and to maintain sarcomere integrity during contraction. Discerning how the DGC adapts to changing external demands will help us understand the molecular changes that help make muscle cells malleable.

Previously, we have shown that *C. elegans* that undergo burrowing, a behavior that requires high muscular output, become hypertrophic. We have found through confocal imaging that following intermittent exposure to environments that demand burrowing, muscle fibers grow in both diameter and volume which is supported by an increase in expression of the muscle contractile genes actin and myosin. I plan to test whether expression of DGC genes is also affected. I am now generating animals with fluorescently-labelled dystrophin isoforms, so that I can determine *in situ* if changes in gene expression result in altered dystrophin protein expression in hypertrophic muscles. This approach is providing information on gene expression, but also on possible changes in dystrophin composition and organization. This work will increase our understanding of muscle function by elucidating the interplay between its force generation and force transfer machinery.

Casey Gahrs: Crustacean models to understand neuromodulation



All nervous system functions, from simple reflexes to higher cognitive tasks, ultimately result from the activity of neural circuits. Almost all substances released by neurons, including neuroactive peptides and small-molecule transmitters, can act as neuromodulators to modify circuit output and provide extensive flexibility in circuit function. Neuromodulators not only play an important role in the control of information flow in the brain, but are also deemed essential for normal brain function. The major determinant of a neuromodulator's action is the receptor mediating the target's response. Due to receptor diversity and distribution, a single neuromodulator can exert different responses within the same circuit

In other news

Congratulations and thanks to Kim Garris for her role as SHIELD Illinois testing lab manager and Dr. Paul Garris for serving as ISU COVID-19 testing coordinator. They ran ISU's in-house coronavirus testing facility, located in the Science Lab Building, during the past two years. The facility could test over 50,000 samples in a week and provided clinical lab experiences for dozens of ISU students. See the story here: [News.IllinoisState.edu/2022/03/students-faculty-and-staff-contribute-to-massive-covid-19-testing-effort](https://news.illinoisstate.edu/2022/03/students-faculty-and-staff-contribute-to-massive-covid-19-testing-effort)



Madi Rittinger, as a master's student in the Thompson-Sakaluk labs, received \$4,300 in external funding in awards in 2020, from the American Ornithological Society Hesse Award, Animal Behavior Society Student Research Grant, Society of Integrative and Comparative Biology, and Sigma Xi. This funding was in support of Rittinger's research on the role of the avian metabolic hormone, corticosterone, in mediating sex-specific maternal effects on offspring phenotype.



Marc Ashford, who earned his M.S. in the Bowden/Vogel labs, authored the article "Intestinal B cells in the red-eared slider turtle, *Trachemys scripta*: Anatomical distribution and implications for ecological interactions with pathogenic microbes" [DOI: 10.1002/jez.2307]. Ashford has moved on to California where he is now a technical service engineer with Thermo Fisher Scientific.



Members of Dr. Nathan Mortimer's lab presented their research on innate immunity at the Autumn Immunology Conference in Chicago. Ph.D. students Ashley Waring and Pooja KR gave talks and M.S. student Eva Gunawan and undergraduate researchers Emma Hartness and Bryce Whitehead (joint with Dr. Jan Dahl's lab) all presented posters.



Research profiles, continued from Page 3

and lead to substantial functional diversity. Thus, as a prerequisite to understand the actions and functions of neuromodulators, we must first identify the location of their receptors and characterize which receptor subtypes are expressed.

We study the functional consequences of neuromodulators on circuit function in the stomatogastric nervous system (STNS) of decapod crustaceans (e.g. crabs, lobsters, and crayfish). In this system, the motor circuits in the stomatogastric ganglion (STG) provide many advantages for studies of neuromodulator actions. These advantages include a small number (<30) of large neurons that are unambiguously identifiable across individuals, allowing dissection of individual neurons for molecular characterization. Additionally, the connectivity between neurons is well established, allowing detailed studies of modulation of individual neurons and synapses. The STG is modulated by upwards of 70 local and long-range neuromodulators, providing a unique opportunity to determine the influences of many different modulator types on circuit output.

One of these is serotonin (5-HT), which is co-released from sensory neurons and descending projection neurons that innervate the STG and leads to a general excitation of the STG motor circuits. In the pyloric circuit, however, 5-HT causes multiple distinct physiological responses, including excitation of two pyloric neurons and inhibition of two other pyloric neurons. Given their opposite actions, these responses are likely mediated through at least two different 5-HT receptors (5-HTRs). I am characterizing the 5-HTRs of the pyloric circuit of the STG, including their subtypes and expression patterns, using the marbled crayfish, *Procambarus virginalis*, which is the first decapod crustacean to have its genome and transcriptome publicly accessible. I identified four orthologs of 5-HTRs (5-HTR 1A, 5-HTR 1B, 5-HTR 2A, and 5-HTR 7) in the marbled crayfish transcriptome, which are upwards of 80% homologous to other crustaceans' 5-HTRs. To determine which 5-HTRs are expressed in the pyloric circuit of the STG, I am performing single-cell RT-PCR to generate a gene expression profile. This research will expand our understanding of the molecular underpinnings of the physiological actions of 5-HT on cellular and circuit dynamics. Characterization of the spatial patterns of 5-HTR expression in the physiologically well-characterized pyloric circuit of the STG is a first step toward understanding how individual 5-HTR subtypes impart flexibility in this neural network.

Kylie Hampton: Immune system joins the battle of the sexes



Reproduction and immune defense against disease are critical for an organism, but how resources are allocated to each profoundly influences an individual's evolutionary fitness. Mating has even been shown to affect different aspects of the female immune system of females in various insect taxa, both positively and negatively. This can be the result of hormones released on mating, female responses to sexually transmitted microbes or male sperm, or wounding caused by mating.

However, another intriguing possibility is that males alter female immunity to their own benefit, because of a conflict between the sexes over female reproduction. Although reproduction may appear cooperative, male and female interests may diverge on a female's allocation of resources to current or future reproduction and the remating of females to other males. In some species it is known that males transfer seminal fluid at mating that contains proteins with the function of manipulating female physiology, including female immunity, in ways that benefit males. However, females may counter and evolve resistance to these manipulative compounds. This results in sexually antagonistic coevolution, with an arms race between males and females. The dynamic evolutionary process can lead to males of different genotypes differing in the effect of their seminal proteins, and female genotypes differing in their response to seminal proteins.

This battle should depend on what is known as a genotype-by-genotype interaction, where the outcome depends on the combination of male and female genotypes. This is the context of my work, which seeks to understand more about the interactions between reproduction and immunity by testing if mating has an effect on the female immune response and a genotype-by-genotype interaction influences female immunity post-mating.

My study organisms, decorated crickets (*Grylodes sigillatus*), have been a focal study organism for investigating sexual conflict due to the nuptial gifts that males offer to females during mating. The term gift is misleading though, as they are known to affect female behav-

ior in ways that benefit males. Both the gift and the ejaculate transferred by a male at mating contain a cocktail of proteins that could manipulate female physiology, including female immunity.

I first compared mated and virgin females to address if mating affects female immunity. Then using a crossing design with all possible matings between males and females of three genotypically distinct lineages, I investigated how male genotype, female genotype, and their interaction affected female immunity. I carried out physiological assays of female immunity including measuring cellular immunity, non-cellular antibacterial immunity, and an important enzyme in a process that leads to the melanization of foreign invaders. Mated females showed an increase in one measure of cellular immunity, relative to virgin females. As predicted, I also found that cellular immunity is affected by a male-female genotype-by-genotype interaction.

My findings, contributing to our understanding of how mating affects immunity, were presented at the Spring 2019 Phi Sigma Research Symposium and the 17th annual Ecology and Evolution of Infectious Diseases meeting at Princeton University, and published in *Heredity* (DOI: 10.1038/s41437-020-00384-8). I am very honored to have received the Edward L. Mockford and Charles F. Thompson Summer Fellowship, and I am grateful to everyone who has contributed to it and its continued support of our science.

Phi Sigma Biological Sciences Honor Society promotes student research and outreach

The Beta Lambda chapter of Phi Sigma Biological Sciences Honors Society was founded here at Illinois State in 1966. We are devoted to promoting biological sciences education and working closely with the School of Biological Sciences by sponsoring our Annual Research Symposium, research fellowship and social events.

In spring 2019, Phi Sigma hosted its 20th annual Spring Symposium at the Bloomington-Normal Marriott Hotel & Conference Center in Uptown Normal, with Dr. Hollis Woodard from the University of California Riverside as our keynote speaker. She gave a wonderful talk on the behavior and physiology of bees in extreme and changing climates. At the symposium, we had eight oral presentations, over 50 poster presentations, and just under 500 people in attendance. Phi Sigma awarded approximately \$1,500 dollars in travel scholarships and in undergraduate awards. The combination of our keynote speaker along with the astounding research from all our presenters made this symposium a great success. Special thanks to Ashley Waring for planning Phi Sigma's 2019 Spring Symposium.

Shortly after the Spring Symposium, Phi Sigma awarded \$12,000 to graduate students through the R.D. Weigel Research Grant Program to 23 different recipients. Not only is the R.D. Weigel Research Grant Program an opportunity to earn funding for research, it also provided an opportunity for graduate students to participate in the grant reviewing process. Each Weigel Grant submission was reviewed by several graduate students to rank the competitiveness of each grant, and eventually determine the allocation of funding. Near the same time, the E.L. Mockford and C.F. Thompson Summer Research Fellowship was awarded to one Ph.D. and two M.S. students (see awards page below). This fellowship provides summer funding for graduate students, allowing them to focus on making significant progress on their research. Thanks to Dr. Jan Dahl for chairing for the 2019 Mockford-Thompson Review Committee.

To finish off the spring semester, Phi Sigma held the annual Spring Banquet at Crestwicke Country Club. New Phi Sigma members were initiated, numerous graduate and undergraduate awards were presented, and the 2019-20 Phi Sigma Executive board was initiated.

After a summer filled with research and planning, Phi Sigma hosted two Welcome Week events to welcome back all returning members and introduce new graduate students to Phi Sigma. We provided dinner for two nights to foster an opportunity of new and returning graduate students to meet and relax before the start of another busy and productive academic year.

At the end of September 2019, Phi Sigma hosted our second annual Weigel Seminar Speaker, Dr. Robin Tinghitella from the University of Denver. The Weigel Seminar series is distinct from our regular weekly seminars, as it provides members of Phi Sigma an opportunity to meet with an outstanding researcher in the field of biology. Dr. Tinghitella spoke

Dr. Don Shepard (biological sciences, Louisiana Tech University) received his M.S. with Dr. Lauren Brown. He returned to give the Alumni Seminar Series in Genetics, presenting "Evolution, Biogeography, and Cryptic Genetic Diversity of North American Woodland Salamander."



Eric Walsh graduated with an M.S. in 2020. Mentored by Dr. Rebekka Darnier, Walsh examined impacts of alternative instructional lab activities for teaching the skeletomuscular system on students' appreciation of anatomy knowledge. Walsh is now teaching anatomy and physiology at Madison Area Technical College in Madison, Wisconsin.

Teni Shosanya, an undergraduate researcher in the Vrailas-Mortimer lab, won the 2021 Charles G. Morris STEM Scholarship. In addition, she is a regular volunteer at the Midwest Food Bank and serves as a college representative/adjunct member of the volunteer advisory board. She enjoys bringing a different perspective during these board meetings. She is also working on projects to help college students become more involved with the food bank and invested in curbing food insecurity. Her future goal is to work in the medical field as a pediatrician and plans on advocating for quality and subsidized healthcare in Nigeria, her home country, and better treatment of patients of color in the U.S.



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Ian Rines, a Ph.D. student in the Sakaluk-Sadd labs, received three external awards in 2020 totaling \$4,400 in support of his dissertation research on the role of nuptial food gifts in manipulating female physiology and reproduction in crickets, a Graduate Research Excellent Grant—RC Lewontin Early Award from the Society for the Study of Evolution, a student research grant from the Animal Behavior Society, and a Sigma Xi award.

Logan Sauers of the Sadd lab published his M.S. thesis work in the journal *Evolution*: “An interaction between host and microbe genotypes determines colonization success of a key bumble bee gut microbiota member” [DOI: 10.1111/evo.13853]. Working with bumble bees and their beneficial gut bacteria, he showed that the genotypes of host and bacteria interact to determine colonization. This interaction will affect bee health by determining which bacteria can colonize which bees. Logan, now a Ph.D. student in the Sadd lab, also received a prestigious Lewontin Graduate Research Excellence Grant from the Society for the Study of Evolution.



Sakaluk/Thompson lab Ph.D. student Rachael DiSciullo published the first paper of her dissertation, “Perceived threat to paternity reduces likelihood of paternal provisioning in house wrens” [DOI: 10.1093/beheco/arz082].

Phi Sigma, continued from Page 5

about how changing environments affect animal communication, specifically in the process of securing mates. Also in September, we hosted the annual Fall Picnic at Charlie and Karen Thompson’s house. Burgers and hot dogs were provided by Phi Sigma while we continued the annual tradition of making this event a potluck. We had a wonderful turnout with beautiful weather and would like to give another big thank you to Charlie and Karen Thompson for hosting the picnic at their house!

—Madi Rittinger

Phi Sigma 2021: Moving back to normal

Phi Sigma exists both to promote research and to bring people together, and both goals were far more difficult in 2020. As pandemic restrictions eased, we resumed our in-person events in fall 2021. Spring 2021 started with the virtual “Grad Appetit,” a virtual cookbook and dinner party. Here, Phi Sigmoids shared their favorite hometown, regional, or cultural dish to our recipe book and everyone joined virtually to cook the dish at their place. Grad Appetit started with a simple purpose: to unite the socially distant school members through a mutual love of food. It produced a sense of culinary adventure, sparked a joy of learning new recipes, and allowed us to share our homes and the comfort that cooking brings no matter the distance.

The next big event of spring 2021 was the return of the Phi Sigma Annual Research Symposium. In a virtual setup, this symposium offered students the chance to share their research as oral or poster presentations. Phi Sigma also offered travel grants to the presentation winners. A highlight of the symposium was the keynote speech. We were honored to have Dr. Heather Hines as the keynote speaker. Dr. Hines is an associate professor of biology and entomology at Penn State. The Hines lab investigates genetic, evolutionary, and conservation questions using everyone’s favorite study organisms—bees and wasps! Phi Sigma ended the symposium week with a science communication workshop. We hosted Dr. Sara ElShafie as she ran through an electrifying interactive workshop titled: Science through Story: Engaging Broad Audiences. Dr. ElShafie is a professional global change biologist and science storytelling coach. In addition to holding a B.A from the University of Chicago and an M.S. in earth and atmospheric sciences from the University of Nebraska, Lincoln, she obtained her Ph.D. in integrative biology at the University of California-Berkeley. This workshop focused on the essential skill of engaging broader audiences by improving clarity and producing concise narrative writing.

After a summer break to focus on research, Phi Sigma events for fall 2021 initiated with the traditional Fall Picnic. Members of Phi Sigma were able to socialize, enjoy food, play games, and get to know one another better at our Fall Picnic, which was hosted by Dr. Craig Gatto at his house. Some members grilled food outdoors, while others brought a side dish with them so that everyone could enjoy a variety of food from different cultures.

To engage K-12 students and educators in biological sciences research, Phi Sigma offers an external grant opportunity. This was initiated in 2019, however after a year off, we were able to continue the initiative. The 2021 External Grant was awarded to Katy Klokkenga at Chiddix Junior High School. That year, educators were faced with additional challenges because of COVID-19. Specifically, science teachers were very limited in lab activities due to COVID restrictions. The funds from the external grant will be used to purchase compound microscopes with attached LCD panels. These microscopes can be used for a variety of lab activities, such as focusing, staining, slide preparation, and even learning about properties of light and the physics behind lenses and mirrors. With the help of the external grant, students will be able to observe specimens through the lens of a microscope.

Moreover, we are proud to start off a book donation drive spearheaded by the 2021 Social Chair Gracious Donkor. The concept is to donate books for installing a community library to help disadvantaged communities in Ghana. A Shared Shelf is a budding nonprofit organization in Ghana that believes the cycle of illiteracy in these communities can only be ended by providing access to educational facilities. To this end, Phi Sigma collaborated with them to organize a book donation drive and collect electronic learning devices which were sorted and shipped in Ghana.

During mid-fall 2021, we organized our fourth annual Weigel Seminar. The Weigel seminar was designed to emphasize student professional development through interactions with an established biology researcher. In fall 2021, our Weigel speaker was Dr. Benjamin Parrott from the University of Georgia and the Savannah River Ecology Laboratory. His talk was



Phi Sigma Board of 2021-22. From left: Gracious Donkor, Jack McKermitt, Caitlyn Kant, Tony Breitenbach, Sadia Sultana, Martin Engelke, Jaclyn Everly, Pirmin Nietlisbach

titled “A means to adapt, a means to disrupt: environment-by-organism interactions underlying development and aging.” Quoting Dr. Parrott, “All organisms (including people) are in part a product of the environment experienced during development. These interactions between developing embryos and a wide range of environmental factors have the potential to lead to both adaptive and disruptive responses, with attendant consequences on organismal fitness and individual health.” The seminar discussed these interactions and his work using American alligators as a

model for the influence of developmental exposure to environmental contaminants on subsequent reproductive health.

The final Phi Sigma event for fall 2021 was the Winter potluck. Members, family, faculty, and friends gathered at the Ironwood Golf Course; Phi Sigma provided the main dish, while guests brought a variety of side dishes for everyone to enjoy. After eating, members participated in an ugly-Christmas sweater contest. The contest winner was decided based on who had the loudest applause, which, thanks to Dr. Martin Engelke, could be quantified using a phone app that determined the sound decibels. You can’t argue with the app! Our first-place winner was Bryan Sierra-Rivera. After the contest, members participated in a White Elephant gift exchange which included a number of interesting gifts, some of which included drinking board games and a vintage MC Hammer Action Figure.

Phi Sigma greatly appreciates our current members, alumni, faculty, and staff that all help foster an environment for continued academic and research success. Additionally, we thank all past and present members of Phi Sigma for participating in our traditions and look forward to your many future successes.

—Sadia Sultana



Dr. Brinda Desai Bradaric with her undergraduate research mentor, Dr. Paul Garris

Alumni Seminars: From ISU degrees to diverse career paths

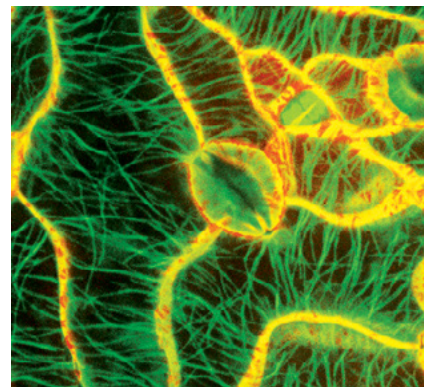
The school’s Alumni Career Seminars continued with stellar talks from alums at two biotechnology companies and Rush University.

Dr. Brinda Desai Bradaric graduated from Illinois State with a B.S. in biochemistry and molecular biology, and then moved on to get her Ph.D. at Rush University in Chicago. While at ISU, she was a very productive undergraduate researcher in Dr. Paul Garris’ lab, and this experience inspired her to specialize in neuroscience. Bradaric was also an

active Phi Sigma Society member in our department. Following her Ph.D., she did postdoctoral research at Northwestern University, working to identify promising drug candidates for treatment of neurological disease. Bradaric returned to Rush as an assistant professor in 2015, where she is a member of the Center for Compulsive Behaviors and Addiction. There she conducts addiction research, teaches courses, trains and advises students, acts as associate discipline director in pharmacology, and is program director for the B.S. in health science program. She visited to present her seminar, “An unexpected career in research and teaching: From neurological diseases to methamphetamine abuse.”

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A 2020 NIH R15 award supports undergraduate and graduate research in Viktor Kirik’s lab on regulation of cell division in plants. Dividing and migrating animal cells feature radial arrays of centrosome-anchored microtubules. Some differentiated animal cells and all plant cells can organize their microtubules without centrosomes. Plant cells provide a useful model system to study microtubule array formation in the absence of centrosomes. The goal of the research is to understand the function of evolutionarily conserved proteins that organize microtubule array in dividing cells.



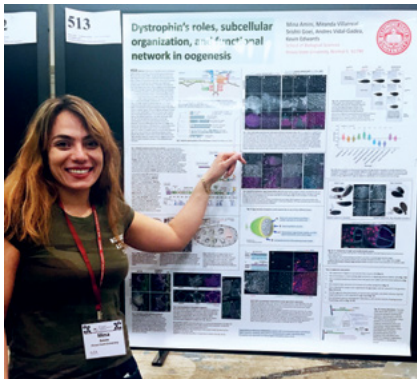
Six ISU undergraduate students (David Myers, Devin Compton, Shira Archie, Megan Cross, Lauren Naeger, and Ashley Virola-Iarussi), one ISU post-bac student (Ashley Salzman) and two ISU M.S. students (Michael Almassey and Julia Martin) from the Vrailas-Mortimer lab are authors on the paper “Drosophila p38 MAPK interacts with BAG-3/starvin to regulate age-dependent protein homeostasis” published in *Aging Cell* [DOI: 10.1111/ace1.13481].

Emily Hansen was selected as the December 2021 Gradbird Scholar. Hansen is researching how a sustainable agricultural practice, planting cover crops, influences soil microbial communities. Her video can be viewed here:

[YouTube.com/watch?v=H31H85U1fjY](https://www.youtube.com/watch?v=H31H85U1fjY).

Kylie Hampton graduated with an M.S. (behavior, ecology, evolution, and systematics sequence) in 2020. In the Sadd and Sakaluk Labs, Hampton used decorated crickets to understand how males influence female immunity after mating and how this depends upon the interaction between the male and female genotypes (see her research report in this issue). This work is published in *Heredity*, with Hampton as first author. During her M.S., Hampton was a co-author on a further four published papers, and she received the School's Outstanding M.S. Student Award in 2020. Hampton now has a position as a research technician with the USDA in Peoria.

Mina Amini presented her work on the genetics of muscular dystrophy protein Dystrophin at the 60th Annual Drosophila Research Conference. Amini completed her M.S. in the Edwards Lab and is now a Ph.D. student at Duke University.



Paige Farchmin published the results of her senior undergraduate research project concerning the consequences of an immune challenge on parental care by male burying beetles that was co-supervised by Anne Eggert and Scott Sakaluk: "Dynamic terminal investment in male burying beetles" [DOI: 10.1016/j.anbehav.2020.02.015]



Alumni Seminars, continued from Page 7



Dr. Banu Kesavaraju



Dr. Michaela McGinn

Dr. Banu Kesavaraju, global technical manager at Valent Bio-Sciences, discussed his work on mosquito control in his seminar, "Applied biology as a post graduate career—Utilizing the passion for research to make a difference in the private sector." As a graduate student at ISU, Kesavaraju worked with Dr. Steve Juliano on invasive mosquitoes, receiving his Ph.D. in 2007 and co-authoring over a dozen articles.

Dr. John Sedbrook's former Ph.D. student Dr. Michaela McGinn went on to become director of external and regulatory affairs for CoverCress Inc., a renewable fuel biotechnology company in St. Louis. She returned to ISU to describe her road to agricultural biotech in her seminar, "Dropout to Directorship: Passion makes Purpose."

These Alumni Career Seminars let our students visualize how their current work can lead to enriching and important careers in just a few short years. The school thanks these alums for taking the time to give seminars and talk 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.

Alumni gift establishes endowed chair

A \$2.5 million gift from the estate of Dr. Fred Gletten '71 has established the Dr. Fred Gletten Endowed Chair in Biological Sciences. Gletten's gift is the largest gift to the School of Biological Sciences in Illinois State history.

"We're honored Dr. Gletten chose to continue his legacy at Illinois State by providing for an endowed chair in his estate," said Dr. Larry Dietz, then-president of Illinois State University. "Dr. Gletten's memory will live on through the students who learn, grow, and engage in transformational research in Illinois State's biology school."

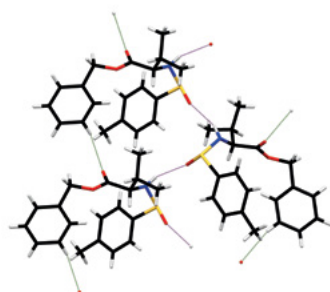
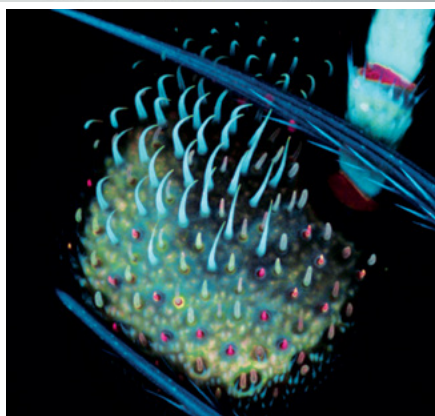
Gletten came to Illinois State in 1968 on a football scholarship. He majored in biology and initially aspired to become a high school biology teacher and football coach. After graduating with a degree in biological sciences, Gletten completed a master's degree in microbiology at Howard University.

While pursuing the degree, Gletten met Dr. Floyd Malvo, who became dean of Howard's Medical School. Malvo encouraged Gletten to pursue medicine as a career. He was accepted by several medical schools and chose to attend Howard University School of Medicine. He later completed an internship, residency, and fellowship in gastroenterology at UCLA Wadsworth V.A. Hospital. After finishing comprehensive training, Gletten taught for more than 20 years as an assistant clinical professor of medicine at UCLA. He also established a successful medical practice in Los Angeles alongside two other gastroenterologists.

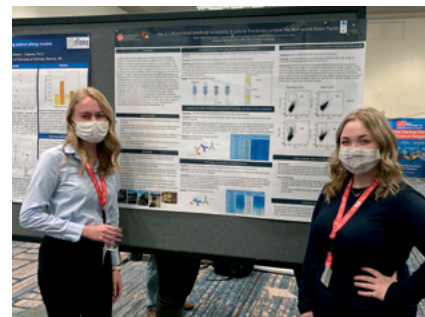
Gletten's estate gift honors the foundation in science he received at Illinois State and supports the scholarly work of a distinguished biology faculty member. The gift enhances the body of research produced by the School of Biological Sciences and ensures the program's impact on future scientists who desire to contribute to the life sciences. Students will also benefit from the opportunity to study under the distinguished scholar who will hold the Dr. Fred Gletten Endowed Chair.

Biological Sciences Students recognized in ISU Image of Research competition

We congratulate the four Biological Sciences honorees from Illinois State's 2021 Image of Research competition (below). This new contest invites students to submit a compelling image with a brief narrative explaining how the image relates to their research. Entries from across the University were displayed on the contest site (StudentResearch.IllinoisState.edu/Opportunities/Image) and evaluated by a committee of jurors, including professional painters and photographers.



Undergraduate honors students Allison Mool and Hanna Paton with the Vogel/Bowden group's "Turtle Team" presented a poster of their research project at the Autumn Immunology regional conference in Chicago. Both received travel awards from conference organizers for their abstract. Studying how the immune system in reptiles can protect them from disease, the students combined field and laboratory research to identify B lymphocytes and antibodies in red-eared slider turtles.



The seventh annual Charles Morris STEM Social featured keynote speaker Dr. Jennifer Parker, who earned her B.S. in biological sciences and chemistry at ISU, subsequently went on to Stanford, Yale, Harvard, Rush, and Northwestern University hospitals, and is now a dermatology resident at Temple University's Lewis Katz School of Medicine. Actively engaged in efforts to increase diversity in medicine, her advocacy efforts involve ensuring health care technology innovations reach underrepresented and vulnerable populations. Parker spoke about challenges and lessons from her STEM path as a woman of color. She also met with undergrads interested in medicine.



Biological Sciences Student Association Promotes Undergraduate Research

The Biological Sciences Student Association (BSSA) is a student-led organization aimed at providing an intellectual and social network for undergraduate students interested in the many fields of Biological Sciences. Our goal is to create connections between our members, faculty and community.

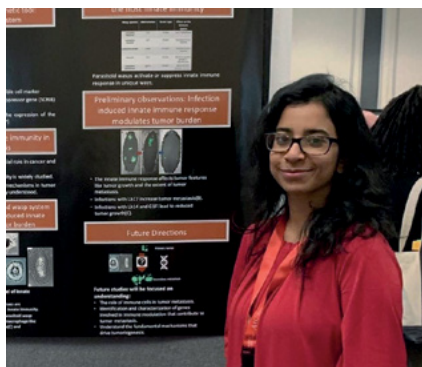
We are open to all students with a passion for biology and interested in helping the community. We provide students with the resources and tools necessary to gain the most from their experience as an undergraduate student at Illinois State University. We have many volunteer opportunities, fundraising events, and networking opportunities.



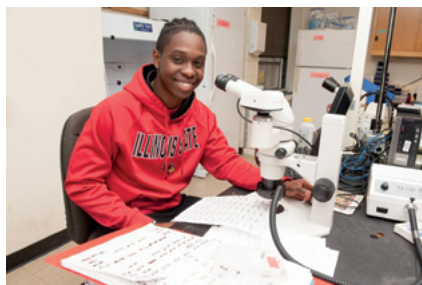
BSSA fall 2019 poster presentations

Continued on Page 10

Nathan Mortimer's undergraduate researcher Jordann Trainor and Ph.D. student Pooja KR characterized how a parasitoid battles its host's immune system in their publication, "Immune Cell Production Is Targeted by Parasitoid Wasp Virulence in a *Drosophila*-Parasitoid Wasp Interaction" [DOI: 10.3390/pathogens10010049].



Earon Grinage performed research in the Juliano and Sadd labs. He is now working to become a physician-scientist and is currently a scholar at the University of Illinois at Chicago Portal to Biomedical Research Careers Post-Baccalaureate Education Program (UIC PBRC-PREP).9].



STEAMTalk is a science podcast produced by the ISU Center for Mathematics, Science, and Technology, and features talks with Biological Sciences students and faculty. Catch it here: steamtalkpod.blubrry.net

The Alumni Seminar Series in Genetics featured Brian Wilkinson's former Ph.D. student Dr. Jennifer Koehl (née Schmidt) from Saint Vincent College, who presented "Biology Scholars: Literature, Laboratory and Leadership Program."

Biological Sciences Student Association, continued from Page 9

One thing we are passionate about is undergraduate research participation. We tour labs each semester so that students are aware of the opportunities that a research lab has to offer. We work to connect students and faculty to promote a diverse learning experience. Undergraduate research is a unique opportunity that Illinois State University has to offer, and we hope every student has the chance to take advantage of that.

Each fall, BSSA hosts an undergraduate research symposium that gives students the opportunity to present their research as oral presentations as well as poster talks. Their passion for each project was clear and demonstrated the knowledge they have gained from their experience in research labs. This is a great opportunity for students to network with peers and faculty.

In addition to undergraduate involvement in research, we aim to promote student involvement on and off campus. As a club, we have volunteered with Habitat for Humanity, Salvation Army, and the Miller Park Zoo. We hosted the second annual "Terrarium Night" to raise money and increase awareness of biological sciences here on campus. This event allowed students to take a break from the stress and create their own personal terrariums. It was a great success and was enjoyed by many students.

Spotlight on the Jennifer Grogg Student Teaching Stipend Award

The 2019-20 Jennifer Grogg Student Teaching Stipend Award was awarded to Nayeli Partida of Aurora, Illinois. This annual award provides a \$500 living stipend for a student while they are student teaching for the School of Biological Sciences. Partida completed her student teaching at Larkin High School in Elgin during the fall 2019 semester and is now a high school science teacher with East Aurora School District 131.

This award is available through the great generosity of alumnus Dr. Jennifer Grogg, who was the Illinois State biology teacher education coordinator and student advisor from 1999-2005. Prior to that, she taught biology I and II at University High School (U-High) for 17 years, where she co-developed an interdisciplinary upper-level problem-based learning course, "Bioethics and the Law." She received her B.S. in history/biology education at Bradley University, an M.S. in health/secondary education at ISU, and her Ed.D. in secondary education/teacher training at ISU. She currently lives in Tucson, Arizona.

Grogg's favorite subjects in school were always history and biology, and she wanted to teach biology so she would be knowledgeable about scientific developments and transfer this knowledge to a new generation. She remarked, "It was a thrill teaching at both the high school (U-High) and collegiate levels, being in the midst of science education at both state and national levels, writing and administering grants, and helping develop the teacher education program in biological sciences at ISU."

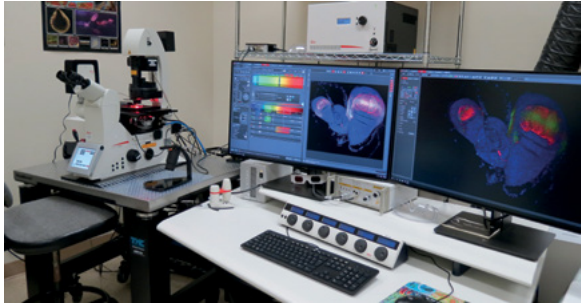
She recalls her love of working with high school freshmen at U-High for 17 years, then getting into what was then "cutting edge" problem-based learning with the upperclassmen in the interdisciplinary curriculum "Bioethics and the Law." This was jointly developed by Grogg and a social studies teacher. She says that two highlights from her career were witnessing students grasp the implications and applications of science/biology content applied to real life and seeing biology student teachers successfully complete their student teaching semester.

Grogg hopes that this annual gift will help ease the demands of living expenses for our student teachers. She stresses the importance of higher education in her background, "It was never in my middle-class upbringing or those of my peers to not get a good education or training/skill to be a successful citizen. Living here in a large Southwestern metropolitan area (Tucson) where many do not get to college, I see firsthand what life is like without a good education or skills: low wages, poverty, homelessness, hopelessness for a better life. Education will pull people out of that dilemma, but it must be readily accessible and affordable. That is why living in Central Illinois with ISU so close by and affordable was such a gift to me."

The School of Biological Sciences and the biology teacher education program are grateful to Dr. Grogg for her years of generous support.

—Cynthia Moore

Advanced Bioimaging Facility offers a powerful tool to visualize cells and tissues



The ISU advanced confocal microscope system in the Science Lab Building

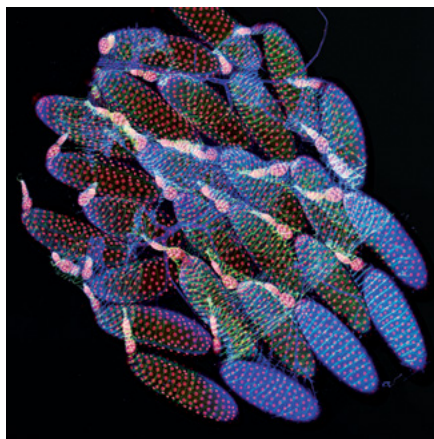
istics of fluorescent molecules in cells and tissues. Since confocal microscopes are widely used in biomedical and biotechnology research, the new equipment allows ISU to provide highly valuable training opportunities for undergraduate and graduate students. Informational videos and a gallery of some of our favorite images are available at the facility website, IllinoisState.edu/Confocal.

In confocal microscopy, a molecule of interest is fluorescently tagged, for example with a fluorescein-type dye, green fluorescent protein, or other labels. Each dye or fluorescent protein has a unique wavelength at which it is optimally excited. The new SP8 system employs four lasers to excite these dyes, including a white light laser that can generate any wavelength from 470 nm (blue) to 670 nm (red). Once excited, the dyes emit light that is captured by high-sensitivity, low noise detectors and turned into an image one pixel at a time. The system has five fluorescence detectors, allowing five dyes to be recorded at once. The user controls the exact wavelength range of emission light sent to each detector. By varying these excitation and emission controls, one can obtain a complete 2D “spectral fingerprint” for each pixel in an image. This reveals the set of fluorescent molecules present in each part of a cell or tissue.

The SP8 system integrates this spectral capability with another fluorescence technology called fluorescence-lifetime imaging microscopy (FLIM). In FLIM, a different dimension of the fluorescence process is measured: the length of time it takes for the molecule to release its emitted photon, on the order of nanoseconds. This value is affected by the chemical environment, and thus it can provide a readout of important events in the cell. For example, FLIM can identify whether two proteins physically interact in response to a stimulus.

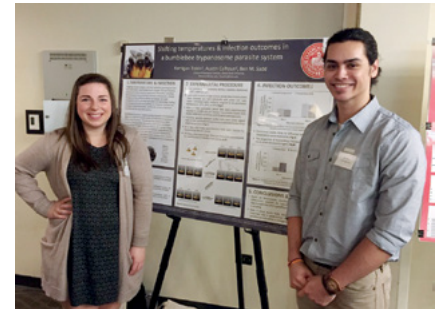
Since its installation, over 70 students and researchers from 16 labs have used the confocal, and the facility has served as a focal point for ISU outreach efforts, hosting local grade schoolers and high schoolers, international visiting students, and a congressional delegation. Numerous undergraduates use the facility, and the annual confocal microscopy training course for grad students (BSC411) has been opened for undergraduate enrollment as well, as BSC356. The facility enables us to tackle a wide array of research questions. It has been used by the Dr. Nate Mortimer lab to study behavior of tumorous cells in *Drosophila*, and for his PNAS article [doi: 10.1073/pnas.2017460118] characterizing the mechanism of “self” versus “nonself” discrimination by the fly immune system.

The Hammond lab has used it to analyze expression of foreign genes in fungal cells [doi: 10.1101/2020.12.29.424703], the Engelke lab has imaged motor proteins in cultured cells, and the Dahl lab uses the spectral imaging capabilities to characterize the effects of anti-bacterial compounds. A confocal 3D projection of developing egg chambers in a phorid fly was a winning entry in the 2021 Vector Labs Microscopy Image Contest (Edwards lab, *right*). Please contact Kevin Edwards (kaedwar@IllinoisState.edu) for any questions concerning outreach activities with the facility.



Funded by an award from the Major Research Instrumentation program of the National Science Foundation, Illinois State opened a new advanced bioimaging facility in 2019. This core facility features a Leica SP8 confocal microscope, which brings new imaging and analysis capabilities to ISU and the region. The microscope allows users to document the localization, movement, spectra, and chemical character-

Master’s students Kerrigan Tobin and Austin Calhoun together with undergraduates Abe Martinez and Madeline Hallahan from the Sadd lab published “Infection Outcomes are Robust to Thermal Variability in a Bumble Bee Host-Parasite System” [DOI: 10.1093/icb/icz031]. The work demonstrates that fluctuations in temperature within frequently experienced ranges do not affect the infection of bumble bees with an important trypanosome parasite and has implications for understanding the threats to important pollinators in our changing world.



The Borst Memorial Scholarship was awarded to Cecilia Canizela, a molecular and cellular biology major. She conducted research in the Juliano Ecology Laboratory since her freshman year, studying how *Wolbachia* parasitic infection affects interactions of *Culex pipiens* and *Aedes albopictus* mosquitos. She has presented her research at the Phi Sigma Symposium and the Entomological Society of America Annual Meeting. Canizela has received a National Sigma Xi Grant Aid of Research grant. She is now a medical student at the University of Illinois College of Medicine Peoria.



Sadd/Sakaluk lab graduate students Kylie Hampton and Ian Rines, with post-doctoral fellow Dr. Kristin Duffield, helped write up the results of experiments conducted by three undergraduate students, Christine Poppe, Jeannine Oldzej, and Jenny Harper. The resulting paper, “Effects of inbreeding on life-history traits and sexual competency in decorated crickets” revealed differential sex-specific effects of inbreeding on mating competency. [DOI: 10.1016/j.anbehav.2019.05.027]. Duffield, now a researcher with USDA-ARS, also authored “Macronutrient intake and simulated infection threat independently affect life history traits of male decorated crickets” [DOI: 10.1002/ece3.6813], and “Inbreeding alters context-dependent reproductive effort and immunity in male crickets” [DOI: 10.1111/jeb.13478].



Congratulations to Distinguished Professor Dr. Scott Sakaluk on his retirement after 34 years on the ISU faculty.

In Memory of George Kidder III



Dr. George Kidder III passed away January 22, 2021, at the Mount Desert Island Hospital in Bar Harbor, Maine. George was the chairman of the Department of Biological Sciences from July 1984 through August 1991. He guided the department through a period of transition and strongly promoted enhancement of research and quality teaching. He is survived by his wife of 63 years, Elizabeth (Beth), two children, five grandchildren, and one great grandchild.

George continued as Professor Emeritus in the Department of Biology through July 1999. In August 1999, he moved to Salisbury Cove on Mount Desert Island in Maine and joined the MDI Biological Laboratory (MDIBL) as a senior staff scientist. He remained in that position until 2015 when he retired, although he continued doing research at MDIBL in collaboration with colleagues. George had been doing research during the summers at MDIBL starting in 1975 and switched to a full-time staff member in 1999.

George was a man of many interests in research and in his personal life. He obtained his A.B. from Amherst College, Amherst, Massachusetts in 1956 and his Ph.D. in plant physiology from the University of Pennsylvania, Philadelphia, in 1961. He was a postdoctoral research fellow in biophysics in the Biophysical Laboratories, Harvard Medical School from 1962-1964. He held faculty positions at Connecticut Wesleyan University and the University of Maryland School of Dentistry before moving to ISU in 1984.

George’s research covered a broad range of topics including respiration by fungi, hydrogen ion secretion by gastric mucosa from bullfrogs, dogfish sharks and skates, mitochondrial respiration and electromyography in blue mussels and zebra mussels. In his later years, his research focused on the energetics of osmoregulation in killifish, a euryhaline fish indigenous to Maine. With the support of a large National Science Foundation Grant (with two co-investigators, R. Preston, C. Petersen), George and his co-investigators mentored over 40 NSF Fellowship students recruited from ISU and Maine for a period of six years. George had an excellent knowledge of electronics and computers and was a very inventive person who could build novel apparatus. For example, he constructed an automated system to measure weight loss or gain in killifish exposed to osmotic stress. He also built an optical table to video record schlieren patterns in water as killifish swam from seawater to freshwater. In his last few years as an MDIBL staff member, George was part of the Community Lab at MDIBL that focused on restoration of eelgrass beds in Frenchman Bay. He invented biodegradable grids, measured bay currents with radiosonde buoys, and measured eelgrass respiration characteristics. He had over 160 publications.

George was a talented musician, singing in various choruses at ISU and playing the clarinet in community orchestras. In Maine, he played in the Town Band in Bar Harbor that held weekly concerts for the public on the City Green in the summers. George was also an avid sailor, and until recently owned a sailboat that was used on a weekly basis to enjoy the beautiful scenery in Frenchman Bay and MDI. George was well-read and enjoyed classical and Victorian literature, from which he would quote on occasion to his friends and colleagues. George had a deep passion for science and research, and he lived his life well in pursuing that passion.

—Robert Preston

All in a day’s work for the Turtle Team

Dr. Rachel Bowden and Dr. Laura Vogel continue a collaborative project to understand how a turtle’s immune system contributes to their longevity. Funded by the National Institutes of Health to provide research experiences for undergraduate students, student researchers spent the summers studying white blood cells from red eared slider turtles to better understand how they fight infections. On a typical morning, Turtle Team members grabbed their waders, insect repellent, and some rather smelly thawed bait (while the turtles thought it had a lovely scent, the students disagreed) and headed out to the field site. They paddled canoes, baited, and set

traps. The next day, it was back in the canoe to pull the traps, carefully remove any snapping turtles, and collect the sliders. Back on shore, the turtles were numbered, measured, and a blood sample taken before releasing them. In the lab, students prepared and counted the blood cells and learned to use the flow cytometer to analyze the antibody producing B cells. The students battled hot and humid days, flooding in early springs, and very low water levels in late summer that required dragging the canoe around through the mud. Despite the weather setbacks, the students had a successful research experience.



Summer 2021 Turtle Team members: from left Rosario Marroquín-Flores (Ph.D. student), Christen Fairow (M.S. student), Clare Blaney (visiting undergraduate), Tony Breitenbach (Ph.D. student) and Molly Frank (undergraduate).

Neuroscience expert Dr. Jessica Adams joins Biological Sciences



My name is Dr. Jessica Adams, and I joined the staff at Illinois State in fall 2019 as a researcher and lab manager for the Engelke lab. I also perform research part-time in the Vidal-Gadea lab.

I received my B.S. from the University of Tennessee in biology with an emphasis on biochemistry and cell biology. I then worked as a technician at the University of Wisconsin in a laboratory studying rodent models of multiple sclerosis and other demyelinating disorders. This experience kindled a passion for neuroscience, and I attended the University of Michigan to earn my Ph.D. in Neuroscience. There, I joined the laboratory of Dr. Malcolm Low, who is focused on a specific subpopulation of hypothalamic neurons that express proopiomelanocortin (POMC).

POMC neurons are known to be very important in regulating food intake behavior, and mice that lack POMC in the hypothalamus are morbidly obese. My thesis project involved exploring and characterizing other behavioral effects, and their neural correlates, in this knockout mouse model, particularly pertaining to spontaneous and induced locomotor activity, voluntary exercise, and regulation of the HPA stress axis. Thereby I aimed to gain some insight into how these neural systems are intertwined.

After completion of my Ph.D., I worked as a postdoctoral fellow in the lab of Dr. David Olson at the University of Michigan. There, I studied a different population of neurons, those that express glucagon-like peptide-1 receptor (GLP-1R). These neurons also regulate food intake behavior and are a target of a large and effective class of anti-obesity medications. I used genetic mouse models, behavioral assays and viral tract tracing to elucidate the physiological role of GLP-1R neurons in normal body weight regulation and to gain insight into how we could pharmacologically target the system more effectively.

Here at ISU, I have moved away from neuroscience, but I am excited to be able to apply the many skills that I learned in my Ph.D. and postdoctoral work toward answering new research questions. In the Engelke lab, we use molecular cloning techniques, mammalian cell culture and advanced microscopy to study the regulation of motor proteins and their involvement in various cellular processes. In the Vidal-Gadea lab, I also use molecular cloning techniques to generate transgenic *C. elegans* strains in order to further understand the normal physiological function of the dystrophin protein as well as how its disruption can lead to the disease Duchenne's muscular dystrophy.

In both labs, I have had the pleasure of working with and training many graduate and undergraduate students.

2019-2020 Awards

School of Biological Sciences Awards

E.L. Mockford and C.F. Thompson Summer Research Fellowship Awards
2019: M.S., Casey Gahrs, Kylie Hampton; Ph.D., Kiley Hughes
2020: M.S., Josselyn Gonzalez, Elliott Lusk, Elyse McCormick; Ph.D., Logan Sauers

Dr. H. Tak Cheung/Dr. Lauren Brown, Phi Sigma Student Publication Award
2019: Kristin Duffield and Dylan Poorboy.
2020: Nick Rhoades

Robert Gray Ecology Scholarship
2019: M.S., Kate Evans; Ph.D., Ian Rines.
2020: M.S., Madison Rittinger

Charlena Wallen Award
2019: Earon Grinage. 2020: Paige Farchmin

Jack Ward Service Award
2019: Rachel Sparks. 2020: Ashley Waring

Outstanding Biology Teaching Assistants
2019: M.S., Ashley Waring; Ph.D. Kristina McIntire
2020: M.S., Brad Smith; Ph.D., Ashley Waring

Drs. H. Tak Cheung/Joni St. John Endowment for General Education Teaching Assistant Awards
2019: Kara Baldwin, Tony Breitenbach, Brad Smith
2020: Natalie Burrell, Laurel McGinnis, Liisi Vink-Lainas, Jaclyn Everly

Phi Sigma Awards
2019: M.S., Logan Sauers; Ph.D., Kristin Duffield
2020: M.S., Kylie Hampton; Ph.D., Margaret DeMaegd

Rilett Scholarship Awards
2019: Mini Amini Moghaddam, Chance Bainbridge, Austin Calhoun, Rachael DiSciullo, Malihe Esfahanian, Kate Evans, Kylie Hampton, Kiley Hughes, Kristina McIntire, Rosario Marroquin-Flores, Pooja Kadaba Ranganath, Nick Rhoades, Ian Rines, Madison Rittinger, Logan Sauers, Brad Smith, Rachel Sparks, Monica Tamrazi, Ashley Waring
Unfortunately, the 2020 competition had to be canceled due to the pandemic.

Continued on Page 14

Undergraduate Awards

Undergraduate Researcher

2019: Paige Farchmin. 2020: Abe Martinez

Undergraduate Service Award

2019: Emma Hartness. 2020: Amanda Klingler

Undergraduate Teaching Assistant

2019: Merryl Clemons. 2020: Rachel Eggleston

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

2019: Cecilia Canizela. 2020: Kennadi LeDoux

Barbara Bathe Biology Teacher-education Award

2019: Eric Jones. 2020: Tim Linden

Bohn Nielsen Healthcare Pre-Professional Scholarship

2019: Olu Bamidle, Emma Hartness, Jackson Stephenson. 2020: Krutil Patel

Dr. Fred Gletten Memorial Scholarship

2019: Hannah Swift, Caroline Grace Vazquez. 2020: Jennifer Miller

Jennifer Grogg Student Teaching Stipend Award

2019: Jamie Bauer. 2020: Nayeli Partida



For more information, visit
Homecoming.IllinoisState.edu

Dahl NIH grants investigates bleach resistance in uropathogenic E. coli

Assistant Professor Dr. Jan-Ulrik Dahl of Biological Sciences was awarded a \$443,840 grant from the National Institutes of Health (NIH)/Institute of Allergy and Infectious Diseases to uncover the secrets of an insidious bacterium that is known to be the major cause of urinary tract infections.

The grant, titled “Redox-regulation in Gram-negative Bacteria,” will fund research in Dahl’s lab to study a type of E. coli that is growing more resistant to the body’s natural defense mechanisms and therefore becomes more difficult to treat.

“Once immune cells detect foreign bacteria that don’t have any business to be in our body, they produce the highly antimicrobial compound hypochlorous acid (HOCl),” said Dahl. “HOCl is also the active ingredient of household bleach, one of the most widely used disinfectants in industrial, medical and domestic settings, which damages the bacterial proteins and kills the pathogen.

“These little bleach factories as part of our innate immune defense are very efficient, however, pathogens have evolved efficient bleach defense systems, which we now want to better understand.”

The effects of bleach are complex and can include changes in bacterial behavior, for example switching on numerous bacterial biofilm genes to stimulate biofilm formation. Dahl’s lab discovered that uropathogenic E. coli, the main cause of urinary tract infections, are significantly more resistant to the internally produced bleach than E. coli in the intestines and identified the responsible bacterial defense systems [DOI: 10.1101/2021.08.31.458474]. The three-year grant will help fund the ongoing studies, including two graduate students and three undergraduate students.

“We want to study the molecular secrets of increased bleach resistance in more detail,” said Dahl.

The Dahl lab reviewed the sophisticated adaptive strategies that bacteria have developed to enhance their survival during HOCl stress in the article “Bacterial Defense Systems against the Neutrophilic Oxidant Hypochlorous Acid” [DOI: 10.1128/IAI.00964-19]. They have also been developing new approaches to study antimicrobials: Ph.D. student Sadia Sultana recently authored “Extraction and Visualization of Protein Aggregates after Treatment of Escherichia coli with a Proteotoxic Stressor” [DOI: 10.3791/62628]. Along with the research advances, the NIH grant will also provide students professional avenues.

“This is an excellent opportunity for my students to excel in research, develop all the skills required for the next step in their career, and to expand their network when they present their findings at local, national, and international conferences,” said Dahl.

In fact, Ph.D. student Sadia Sultana has recently been elected as the co-chair for the 2024 Gordon Research Seminar on Microbial Stress Response, which will open the door to her own, independent research career.

—Rachel Hatch, Kevin Edwards



The Dahl lab

New Ph.D.s awarded

Dr. Kristina McIntire graduated with her Ph.D. in 2020. McIntire completed her multi-faceted doctoral project on host-parasite ecological and evolutionary interactions, using larval mosquitoes and their species-specific protozoan parasites as a model system, and working in Dr. Steve Juliano's lab. Her dissertation yielded two first-authored publications in the journals *Ecology* and *Invasion Biology*, along with another in review for the journal *Evolutionary Ecology*. McIntire won the School of Biological Sciences award for Outstanding Ph.D. student in 2021. McIntire is also an undergraduate alumna, completing her B.S. degree in 2014. As an undergraduate, she was the recipient of the David W. Borst fellowship for undergraduate research and produced another first-authored paper in the journal *Ecology*. In July of 2021, McIntire moved on to a position as a post-doctoral researcher at the University of Michigan, working in the laboratory of Dr. Meghan Duffy, working on disease ecology of *Daphnia*.

Dr. Kara E. Baldwin graduated with her Ph.D. in 2020. Mentored by Dr. Rebekka Darner, Baldwin examined the impact of undergraduate research experiences on preservice STEM teachers' understanding of authentic scientific practices. She now teaches Scientific Inquiry in ISU's School of Teaching and Learning and coordinates outdoor and informal learning experiences at ISU's Center for Mathematics, Science, and Technology.

Dr. Rachel Sparks graduated with her Ph.D. in 2021. Mentored by Dr. Rebekka Darner, Sparks investigated how transformative experiences related to evolutionary understanding are fostered in general education biology, particularly among preservice teachers. While at ISU, she received numerous awards and grants acknowledging her research productivity and potential, totaling to over \$8,000. Sparks is now a post-doctoral associate at the University of Nebraska-Lincoln, working with Dr. Jenny Dauer to explore how science instruction fosters scientific literacy regarding localized socio-scientific issues, such as water usage in Nebraskan agricultural lands.



Brice Jarvis, John Sedbrook graduation

Dr. Brice Jarvis earned his Ph.D. with Dr. John Sedbrook and authored "CRISPR/Cas9-Induced *fad2* and *rod1* Mutations Stacked With *fae1* Confer High Oleic Acid Seed Oil in Pennycress (*Thlaspi arvense* L.)" [DOI: 10.3389/fpls.2021.652319]. Jarvis is currently lab director for Premier Medical Group (Bloomington).

Dr. Daniel L. Goldberg, mentored by Dr. Angelo Capparella, authored "Calling owl: Rails adjust vocal activity rates in response to changes in predation risk" [DOI: 10.1676/1559-4491-132.4.1038]

Dr. Christy Fornero and Dr. Trevor Rickerd each completed their doctoral work in the Kirik Lab, and co-authored "Papillae formation on *Arabidopsis* leaf trichomes requires the function of Mediator tail subunits 2, 14, 15a, 16, and 25" [DOI: 10.1007/s00425-018-3063-y]. Fornero is now a research associate at UT Southwestern Medical Center.



Dr. Daniel Goldberg, Dr. Brice Jarvis, and Dr. Rachel Sparks, with Dr. Angelo Capparella and Dr. Rebekka Darner, at their doctoral hooding.

Biological Sciences Image of the Year winner: Eggshell signals

Hodges et al. (2020) studied whether differences in house wren eggshell pigmentation are used as a signal of the health of the mother in their article "Connecting the dots: avian eggshell pigmentation, female condition and paternal provisioning effort." Photo by Kara Hodges. See DOI: 10.1093/biolinnean/blaa002.





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