



SCHOOL OF

BIOLOGICAL SCIENCES

NEWS

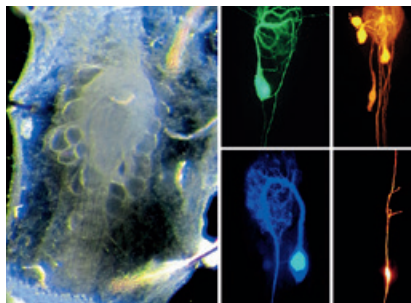
SPRING 2016

Brains studying brains: Neuroscience at ISU

By Wolfgang Stein, associate professor of Neurophysiology, and Andrés Vidal-Gadea, assistant professor of Molecular Neuroethology

Nervous systems are among the most complex and enigmatic structures of the biological world. The workings of our brain define us—how we perceive the world around us, how we learn from experience, how we remember, how we direct our movements, and how we communicate with each other. Neuroscience is the study of how brains and nervous systems function with the ultimate objective of providing a satisfactory account of animal (including human) behavior in biological terms. This ambitious goal comes from the realization that all behavior is a reflection of the function of the nervous system and that the organized and coordinated activity of the nervous system ultimately manifests itself in the behavior of the organism. Accordingly, pathologies of the nervous system can be devastating to patients, their families, and society. Neurological diseases are among the largest world health concerns, affecting over 1 billion people worldwide and more than 50 million people in the United States.

The challenge to neuroscience is to understand how the nervous system marshals its signaling units to direct behavior. The real magnitude of this challenge can perhaps be best judged by the size of the 2015 meeting of the Society for Neuroscience in Chicago, where over 30,000 neuroscientists met to share their findings and ideas. Reflecting both the diversity of interests and approaches that are hallmarks of this field, Illinois State University is home to a vibrant group of neuroscientists primarily based in the School of Biological Sciences. With four new hires in the field of neuroscience in as many years and the advent of new imaging and molecular techniques, scientific doors that were previously closed have been flung wide open at the School of Biological Sciences.



Crustacean neurons stained with fluorescent dyes.

Wolfgang Stein is a cellular neuroscientist who joined ISU four years ago. The main research interests in his lab focus on how rhythmic activity is produced and regulated in the nervous system. Rhythmic neuronal activities underlie some of the most vital behaviors such as locomotion and breathing but also higher cognitive functions. Very little is known about the control and tuning of these activities, although these are essential functions for



In the foreground, Alexandra Yarger M.S. '15 (now a doctoral student at Case Western Reserve University), Abigail Benson '15 (middle), and Marissa Cruz (current M.S. student) dissect nervous system tissue.

Director's message

The 2015-2016 academic year initiated some significant changes in the School of



Director Craig Gatto

Biological Sciences. Walt Greenleaf joined the school staff in May 2015 as accountant. His workload focuses on handling accounts payable and receivable, along with maintaining daily

fiscal activities for the school. We are very happy to have him join our team! The school was also fortunate to welcome two new tenure-track faculty hires this year. Beginning in August, Nathan and Alysia Mortimer joined the school. Nathan, assistant professor of cellular immunology, holds a Ph.D. in Genetics and Molecular Biology from Emory University. His research focuses on understanding how a host and its parasite interact to determine the outcome of a parasitic infection. Alysia, assistant professor of Aging and Physiology, also received her Ph.D. in Genetics and Molecular Biology from Emory University. Her research focuses on how different factors such as aging and exposure to toxins contribute to neurological disorders and muscular dystrophies. Dr. Alan Katz announced his retirement for the end of 2015. He worked at Illinois State in Biology for 40 years as a genetics professor. After admirably serving 25 years as the director of Graduate Studies, Alan stepped down and passed the torch to Dr. Steve Juliano, a distinguished professor of Ecology.

Biology faculty received University recognition last year with Bill Perry receiving the Outstanding College Teaching Award and Laura Vogel receiving the Outstanding University Service Award. In addition, I was humbled to be named University Professor, the highest honor an administrator can receive at ISU. I share this award with the many amazing students who worked in my laboratory over the last decade and a half as they generated all the data that went into the publications and grants that enabled me to be recognized.

ISU Biology continues to be one of the most popular majors on campus and although many disciplines have seen declining numbers of majors over the last few years, Biology has grown nearly 10 percent per year for the past two years and now boasts nearly 700 undergraduate majors and 60 graduate students. This substantial student interest and success in Biology has provided us the justification for University support in faculty recruiting, which has allowed us to maintain our faculty numbers in the face of nine retirements over the last six years.

The school would love to hear from our alumni! Please drop me an email or like us on Facebook and let us know what you're up to. Certainly if you are ever in the area, please stop into the school office and say hello.

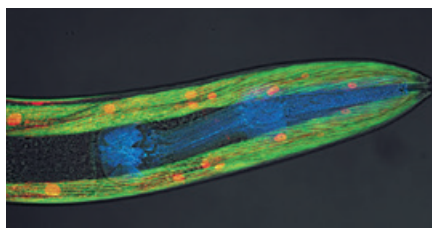
Wishing you much success,



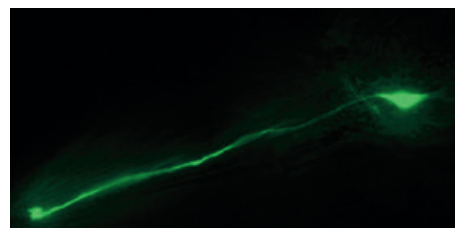
Craig Gatto, Ph.D.
Director, School of Biological Sciences



The 2015 Neuroscience group



Fluorescent muscles in the worm *C. elegans*.



A single worm neuron senses the magnetic field of the earth.

survival and mental health. In his research, Stein uses so called central pattern generators—clusters of rhythmic nerve cells—from crustaceans as a model to study control and robustness of rhythmic neural systems. The small size of these systems permits the inference of general mechanisms of neuronal function and failure. For example, Stein and his students recently showed that even small temperature changes can disrupt the well-balanced flow of ions across nerve cell membranes resulting in the severe impairment of vital neuronal activity. They also demonstrated how these effects can be compensated by the release of neuromodulators, small chemical substances such as dopamine and serotonin that alter nerve cell activity. This concept can now be tested in more complex mammalian brains. Stein and his students also target the neuromodulatory control of rhythmic activity in different behavioral conditions in order to understand how such essential neuronal activities can be maintained throughout the challenges of everyday life.

Neuromodulators are also the focus of research in several other ISU laboratories. Paul Garris studies the actions of drugs of abuse and of cognitive enhancers on the mammalian dopaminergic systems, while Byron Heidenreich works on the action of serotonin in the brain. Joe Casto complements these studies with his research on the development of sex differences in brain and behavior and on the neural mechanisms of motivated social behaviors. The research interests of the Neuroscience and Physiology group are wide-ranging and include the study of organisms from a molecular, cellular, and behavioral perspective. Multisensory integration and cognitive effects on attention, expectation, and perceptual processing in humans are studied in the laboratory of Amrita Puri, while Alysia Vrailas-Mortimer explores the interplay between aging and environmental factors in neurodegeneration using fruit flies. At the subcellular level, Craig Gatto investigates the structure, function, and biosynthesis of ion pumps, while Epaminondas Rosa Jr. (Physics) examines the biophysics and computational aspects of ion channels on information-processing in the nervous system.

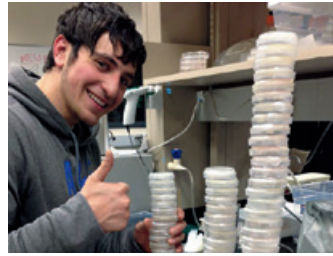
The neuronal mechanisms underlying natural behaviors are studied in the laboratory of Andrés Vidal-Gadea using the tiny nematode worm, *C. elegans*. Worms are superbly suited for these types of studies, owing to their small nervous systems and their amenability to a plethora of genetic and molecular techniques. One of the main research interests in the Vidal-Gadea lab is focused on understanding the neuronal and genetic basis for how animals detect and orient to the magnetic field of the earth, one of the final frontiers in sensory biology. Work by his group described the first set of nerve cells capable of sensing the magnetic field of the earth. Presently, students in the lab are working on a range of topics such as resolving the molecular mechanism by which magnetic force fields are sensed, determining how magnetic information is processed, and evaluating the effect that changing natural and artificial magnetic fields can have on animal development and behavior. This will help us understand how animals make use of this invisible force field, and will shed light on how man-made magnetic fields affect animal migrations, as well as the potential negative health effects of space travel beyond the protection of the earth's magnetic field.

The Neuroscience and Physiology group provides an exciting and challenging academic environment by combining excellence in research with a strong commitment to undergraduate and graduate education. A full curriculum is available to Ph.D. and M.S. students with the goal of training the next generation of neuroscientists and physiologists. We also provide pre-professional students with research training and experience in our Physiology, Neuroscience and Behavior undergraduate sequence. The diversity of interests and approaches in the group makes the School of Biological Sciences an exciting place to learn and conduct neuroscience research—a fact reflected by the more than 70 peer-reviewed papers published by the core group in the last five years.

Undergraduate students learn the utility of *C. elegans* as a model system

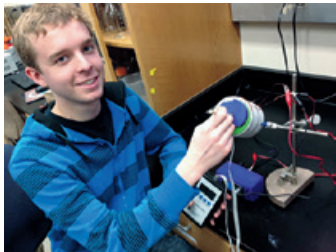
Lucas Barickman and Moe Khalil are Biological Sciences undergraduates working in the molecular neuroethology lab of Andrés Vidal-Gadea, assistant professor in the School of Biological Sciences.

Moe Khalil is a senior interested in biomedical research who joined the lab in January. While reading the news, Khalil learned about a rare genetic disorder called Angelman Syndrome (AS), which results in severe motor and learning deficits. He wondered if he could use the nematode *C. elegans* to contribute to our understanding and treatment of this understudied disease. To that end, he began conducting experiments with animals that model AS by having the same genetic lesion found in AS humans. After several rounds of experiments, Khalil found that AS worms resemble AS humans in having motor and learning deficiencies. He is presently working on an honors thesis where he is investigating the expression patterns of this gene in *C. elegans*. His determination and perseverance in this project resulted in a new investigative line in his lab which will likely result in meaningful contributions to our understanding of AS and to research opportunities for future student researchers who will carry the torch he ignited.



Moe Khalil found that AS worms resemble AS humans in having motor and learning deficiencies.

Lucas Barickman is a senior interested in basic research. During his first semester in the lab, Barickman combined immunohistochemistry and behavioral studies to track the anatomical and motor decline in the muscles of animals modeling Duchenne muscular dystrophy. He next aimed his skills at another project in the lab: the study of the molecular basis of magnetic field detection. He became the first person to tag magnetic particles in the tissues of *C. elegans*. These particles are likely instrumental in the ability of this animal to detect and orient to the earth's magnetic field. Presently, Barickman is combining his skills in an honor thesis that seeks to evaluate the effect of magnetic fields on animal development and health. Specifically, he is rearing animals in the simulated magnetic field of Mars. He hopes to determine if long-term exposure to the much-diminished Martian magnetic field could have detrimental effects on the health of future travelers to this planet.



Lucas Barickman's honor thesis evaluates the effect of magnetic fields on animal development and health.

Students buzzing about immunity and disease

Marc Ashford is a senior Biological Sciences major aiming to pursue a microbiology- or immunology-related graduate program after graduating from ISU. Ashford is currently an undergraduate researcher in the lab group of Ben Sadd, assistant professor of Infectious Disease Ecology. The group's research focuses on understanding variation in the outcome of infections by studying diseases and immunity of bumblebees. Bumblebees are important but threatened pollinators, so understanding bumblebee health is critical. Ashford has been involved in a multi-university collaborative project using a comparative approach to understand more about the functioning of bumblebee immunity and how social living has influenced immunity of these bees. He will continue working in the Sadd lab in his final semester and is excited by the challenge of starting his own self-contained project. Ashford is also dedicated to the advancement of the student population, and among many other events and programs, he has been an active contributor to the Lewis Stokes Alliance for Minority Participation, a National Science Foundation-



Marc Ashford is involved in a research project examining bumblebee immunity and how social living influences immunity.

News

Andrew McDevitt, M.S. student in the Gougis lab, spent last summer working at Harvard University as the Assistant Program Coordinator for the Harvard Forest Summer Research Program in Ecology (HF-SRPE). HF-SRPE is an NSF-funded Research Experience for Undergraduates (REU) program and supported 20 undergraduate students from around the country who conducted research that examined various natural and human disturbances on forest ecosystems. McDevitt organized the educational and professional development components of the program, which included a weekly seminar series, data management workshops, and a research symposium featuring student projects. He also put his education research background to work by synthesizing 10 years' worth of program-assessment data in order to evaluate both short-term and long-term impact on participants. McDevitt will present this analysis at the Phi Sigma Research Symposium in 2016.

Bill Perry, associate professor, has recently joined the ranks of faculty that have obtained a million dollars in grants

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Bill Perry talks to graduate students about his beehive at the Phi Sigma picnic.

School of Biological Sciences News

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Editor: Diane Byers

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Contributors: Austin Harvey, Tyler Malone, Marissa Cruz, and Andrés Vidal-Gadea

Bio.IllinoisState.edu

Student awards

Every year the school gives awards in recognition of the excellent contributions undergraduate and graduate students have made in research, teaching, and service. Many of these are named awards, for those who started the fund or in whose memory the fund was established. Here are the recipients from this past year.

Undergraduate student awards

Barb Bathe Award
Alex Sulek

Biological Sciences Student of the Year
Tyler Malone

Borst Scholarship
Katelyn Genenbacher

Charlena Wallen Award
Christina Jester

Cheung/Brown Publication Award
Austin Harvey

Gletten Scholarship
Dana Mueller

Undergraduate Researcher
Dana Mueller

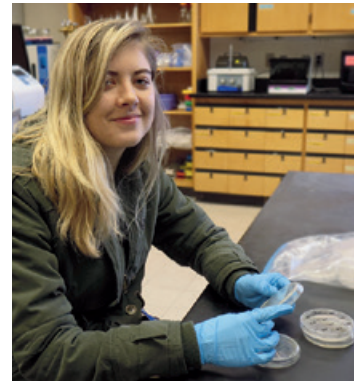
Undergraduate Teaching Assistant
Cal Hackler



Cal Hackler wins the Outstanding Undergraduate Teaching Assistant award.

supported program to promote traditionally underrepresented groups in STEM. Ashford wants to continue in this vein, and combine research with community outreach and education in his future career.

Two other undergraduate researchers in the Sadd lab, Rachel Mandes and Mitchell Czerwinski, are at opposite ends of their respective undergraduate research experiences. Mandes, a sophomore, is working on how immune responses of bumblebees may damage their own bacterial “good guys.” Just like us, all bees carry helpful bacteria in their guts. Mandes is investigating if the immune response inadvertently knocks out some of these beneficial bacteria when responding to foreign and potentially disease-causing microbes. She aims to continue gaining vital hands-on research experience throughout her time at ISU. Czerwinski is a senior carrying out his honors thesis in the Sadd lab, where he has worked since spring 2014. His thesis topic has been tailored to complement direct conservation-related research within the group as he is enrolled in the conservation biology sequence. Pesticides have been touted as a key threat to bee health, and the Sadd lab has previously shown how pesticides and diseases may combine to negatively affect bees. Czerwinski’s thesis research investigates how certain pesticides interact with bumblebee immunity at crucial times during their lives. His experiences at ISU have strengthened his desire to follow a career in conservation research, and he is considering a graduate program in Europe to continue his education.



Rachel Mandes is investigating how immune responses of bumblebees may damage their own bacterial “good guys.”



Mitchell Czerwinski’s honors thesis investigates how certain pesticides interact with bumblebee immunity.

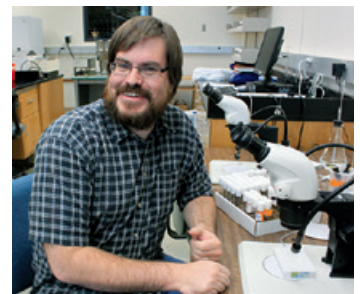
New faculty news

We welcome Alysia Vrailas-Mortimer as an assistant professor of Aging and Physiology in the School of Biological Sciences. Vrailas-Mortimer is teaching Genetics this semester and Genes and Behavior in fall 2016. She graduated magna cum laude for her B.S. in Biology from the University of Tennessee at Chattanooga and received a Ph.D. in Genetics and Molecular Biology from Emory University. Vrailas-Mortimer’s research focuses on understanding how aging and environmental factors like pesticides and toxins contribute to neurodegenerative diseases and muscular dystrophies using the model system *Drosophila melanogaster* (fruit fly). She has published in *Developmental Cell*, *Journal of Experimental Gerontology*, *Genetics*, *Development*, *Journal of Biological Rhythms*, and *Human Molecular Genetics*, among others. Vrailas-Mortimer was a post-doctoral fellow and later a research assistant professor at Emory University before taking an assistant professor position from 2013-2015 at the University of Denver. Vrailas-Mortimer enjoys hiking and is an avid knitter.

We are also pleased to welcome Nate Mortimer as an assistant professor of Cellular Immunology. Mortimer, a native of Canada, obtained a B.S. in Biology and a Ph.D. in Genetics and Molecular Biology from Emory University. In the School of Biological Sciences, he will teach courses in Genomics and Bioinformatics and laboratory methods (Biotechnology II). Mortimer’s research is focused on understanding host-parasite relationships, and particularly on the role of the molecular interactions be-



Alysia Vrailas-Mortimer joins our team as assistant professor of Aging and Physiology.



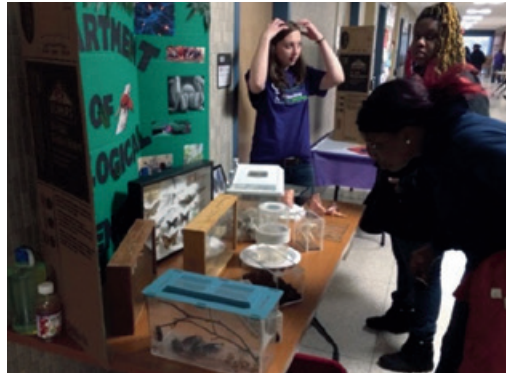
Nate Mortimer is our new assistant professor of Cellular Immunology.

tween parasite virulence factors and host immune mechanisms in determining the outcome of an infection. This research has been published in numerous journals, including *Proceedings of the National Academy of Sciences USA*, *Science*, *PLOS Pathogens*, and *PLOS Genetics*. Prior to joining the School of Biological Sciences, Mortimer completed his post-doctoral training at Emory University and was an assistant professor of Molecular Systems Biology at the University of Warwick (U.K.).

Report from the Biological Sciences Student Association

The Biological Sciences Student Association (BSSA) is a student-led organization that provides useful resources and connections to its members. BSSA is open to all students either

majoring or minoring in Biology. Our organization's mission is to provide more information about Illinois State University's Biology programs and to allow students in the major to interact and make connections with other students and faculty in the biology field. We help our members get involved on the ISU campus by participating in BSSA activities, volunteer work, engaging with the faculty and staff in Biological Sciences, and by providing information on working in research labs. At our meetings we invite various professors from Biological Sciences to come in and discuss their research with our members. This allows BSSA members to be exposed to the many different research opportunities that are available at Illinois State University. The professors present their research and explain the work they are currently working on in their lab, as well as discussing their future research ideas. This opportunity is good for our members because it allows them to be informed about research opportunities that they maybe be interested in.



BSSA at Expand Your Horizons Conference in 2015

At our meetings we also like to do fun activities that allow our members to bond and get to know one another. Previously we have played minute to win it games and went for a scavenger hunt to earn prizes. These social activities allow members to get to know and form connections with other students in Biological Sciences. Every spring BSSA participates in the Expand Your Horizons Conference. At this conference BSSA members work together with the organization to provide interactive displays that will get kids interested in biology, mathematics, and other sciences. It is a great opportunity for us to further a kid's interest in the sciences. In the future, we hope to have more students involved in this awesome organization!

Phi Sigma Biological Sciences Honor Society news and notables

By Kevin Stanley, president of Phi Sigma Biological Sciences Honor Society Beta Lambda Chapter

The Phi Sigma Biological Honor Society is a nationally recognized academic organization promoting both academic and research excellence in the field of biological sciences. As the Beta Lambda chapter at Illinois State University, we recognize those who have excelled academically for both graduate and undergraduate students. Over the past two years (2014 and 2015) there were 12 graduate students and six undergraduate students newly initiated. Along with maintaining academic success, we strive for our members to achieve with their research as well. We aim to aid in our students' success by offering both grants and fellowships on a yearly basis.

Graduate student awards

Cheung/Brown Publication Award
Keith Bowers

Jack Ward Service Award
Amanda Wilson Carter

Mockford-Thompson Award
Sarah Marrochello, M.S.
Erin Dorset, M.S.
Geoff Ower, Ph.D.

Outstanding Biology Teaching Assistants, in memory of Robert and Marion Finn
Jay Pyle
Nate Holton

Phi Sigma Outstanding M.S. Award
Chris Loebach

Phi Sigma Outstanding Ph.D. Award
Keith Bowers

Rilett Scholarship Awards
Jason Hanser
Ashley Hembrough
Sarah Marrochello
Kristina McIntire
Dilini Ralalage
Suranjana Sen
Molly Schumacher
Kiran Tiwari
Lisa Treidel

Robert Gray Ecology Scholarship
Morgan Walder

Tak Cheung/Joni St. John General Education Teaching Assistant Awards
Ashley Hembrough
Pegan Sauls
Morgan Walder



Ashley Hembrough receives her award from Laboratory Coordinator Anne D'Elia.

(million-dollar club). This funding has included grants from the National Science Foundation, the National Oceanic and Atmospheric Administration, and The Nature Conservancy. Perry's research focuses on water quality issues where the chemically intensive agriculture in our region alters the nutrient levels of streams and rivers. Perry's group has been developing and assessing mediation approaches such as wetlands as a filter to decrease the nutrient levels. He also continues researching the ecology and behavior of invasions with *Orconectes rusticus*-rusty crayfish.

Ben Sadd, assistant professor, led an international team to sequence and analyze the genomes of two bumblebee species, the results of which were published in *Genome Biology*. Bumblebees are major natural pollinators but also play a critical role in pollinating food crops. These first genomes illuminate important aspects of bumblebee biology and environmental challenges to bee health.

M.S. student Erin Dorset, with faculty members **Thompson** and **Sakaluk**, presented "Behavior plasticity in response to perceived predation risk in breeding house wrens (*Troglodytes aedon*)" in March at the Animal Behavior Conference, Indiana University, Bloomington, Indiana.

Kristin Duffield, a Ph.D. student in the Sadd and Sakaluk labs, had her first paper published in the *Journal of Evolutionary Biology*. The study increases our understanding of the flexibility of mating strategies when organisms are faced with the threat of infectious diseases. Male crickets increased the attractiveness of gifts they produced for females when faced with a disease-related threat to their survival. In addition, Duffield was awarded a competitive grant of \$1,500 from The Orthopterists' Society to pursue further research in this area.

Sarah Marrochello (Vogel and Bowden labs) presented a workshop talk and poster titled "The effect of environmental temperature on reptilian B cell function" at the Autumn Immunology Conference in Chicago, Illinois, November 2015.

Wolfgang Stein gave informative

Our yearly competitive grants among current Beta Lambda members offer students a chance to earn internal funding for their research projects, providing both an opportunity to be involved in a true grant competition and research-related scientific grant-writing experience. From 2014-2015, Phi Sigma provided over \$22,000 in funding for 37 proposals. Along with these grants, Phi Sigma offers fellowships for two M.S. and one Ph.D. student over the summer. The E. L. Mockford and C. F. Thompson Summer Research Fellowship is competitively awarded assistantships for a full summer salary, supplying winners the fiscal opportunity to solely conduct degree-related research throughout the summer. In 2014 and 2015 the six students receiving these fellowships overall have published one manuscript in *Biochimica et Biophysica Acta* (BBA), one current submission in *Journal of Insect Behavior*, and seven manuscripts in the revision process.

Along with the grants and fellowships, in 2014 Phi Sigma offered a personal and professional development event. With a goal to provide insight and prepare students for careers following completion of their degree, Phi Sigma brought in speakers from jobs in academia, industry and government agencies, concluding the event with a keynote speaker, Shelley Adamo from Dalhousie University. Phi Sigma also sponsors the Biological Sciences weekly seminar series, where speakers from across the country present recent developments in their research. This weekly seminar aims to broaden the perspectives of both students and faculty in our department and provide the wide range of research interests to be brought together on a weekly basis for scientific discussion (always followed by adult beverages).

Phi Sigma also hosts and sponsors an annual research symposium that has now occurred successfully for 16 consecutive years, expecting 16 successful years to follow. We give students at ISU a chance to showcase their research with both oral and poster presentations. Each year internal judges assess the different presentations and award travel grants for the winners. The entire day, open to the public, concludes with a keynote speaker, who in 2015 was the highly respected Jaap de Roode from Emory University. de Roode presented an interesting talk on the interaction between parasites and toxic milkweed plants on Monarch butterfly behavior. In this coming year's Research Symposium, we look forward to a seminar by Michael Kavanaugh from the University of Montana whose research is focused on the structural and functional properties of glutamate transport (both membrane bound transporters and channels), which is the primary neurotransmitter involved in mediating excitatory response in neurological pathways. As a final note on this coming year, we plan to have this event include multiple universities from around the state, such as Illinois College, Illinois Wesleyan, and Western Illinois University, to name a few. We are aiming to diversify the research presented, as well as develop the in-state connections the School of Biological Sciences maintains with other biology departments across the state.

Finishing the year off strong, Phi Sigma will hold its annual spring banquet, where we host an event for new member initiation and a plethora of awards for everything from top TA to thank-you awards to faculty, showing appreciation for their investments to departmental improvements. This is a thank you to the entire department, faculty, students, and staff alike for another successful year at ISU. Phi Sigma would like to extend our gratitude for all of those current and former members involved in the process of promoting research and academic success. We thank those alumni who have been involved in our traditions and appreciate all they have done, congratulating their success and looking forward to their many future accomplishments.



Current Phi Sigma officers: Bottom row, left to right, are Kevin Stanley (president), Aderinsola Odetunde (secretary), Morgan Walder (vice president), and Nicole Wilson (treasurer). Top row, left to right, are Amy Boyd (bookstore manager) and Andrew McDevitt (social chair).

Alumni return to share their research

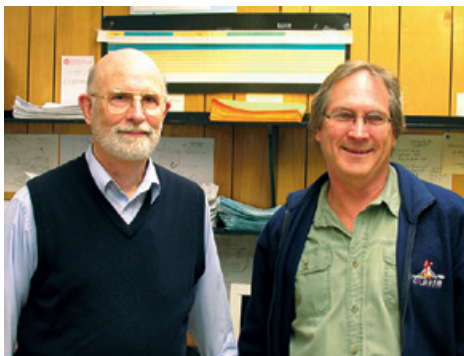
Many scientists visited us over the past year to share their research, many of whom were alumni. If you are ever interested in attending our seminars, current schedules can be found on the school's homepage: Biology.IllinoisState.edu.

Ben Marks, M.S. '00 gave a presentation ("Avian diversification in the African tropics") as part of the school seminar series during the spring 2015 term. He is currently the head of Zoological Collections at the Field Museum of Natural History and returned to Illinois State University to give a presentation on his research on tropical bird speciation processes. Marks received his M.S. working with Angelo Capparella, associate professor, on the level of endemism in the wedge-billed woodcreeper. Marks continued his research work in avian systematics at Louisiana State University, receiving his Ph.D. in 2008. After several years of working with bird collections in Louisiana and Texas, he returned to Illinois to his position at the Field Museum.

Jonathan Bauer received his M.S. in '07 working with Distinguished and Emeritus Professor Roger Anderson. He is currently a post-doctoral researcher at Indiana University. He gave a presentation on his research "Plant-microbial interactions in secondary succession and their application to ecological restoration."

Donald Price received his M.S. in 1986 working with Emeritus Professor Charles Thompson. Currently, Price is a professor in the Biology Department at the University of Hawaii at Hilo. He presented his current research on evolutionary aspects of the Hawaiian *Drosophila* ("Rapid evolutionary diversification of Hawaiian picture wing *Drosophila*"). He is currently director of the Tropical Conservation Biology and Environmental Science Graduate Program at the University of Hawaii at Hilo.

Richard F. Pfeltz Ph.D.'99 is currently a staff scientist in the Microbiology Research and Development, Department of the Diagnostics segment of Becton Dickinson. Pfeltz gave a presentation entitled "Industry Research and Development: Navigating the Corporate World" as part of the Alumni Seminar in Genetics Series in spring 2015 term. When at ISU, Pfeltz did his dissertation research on vancomycin intermediate-susceptible methicillin-resistant *Staphylococcus aureus* (MRSA) with Distinguished Professor Brian Wilkinson. Pfeltz joined Becton Dickinson in 1999. Becton Dickinson is a Fortune 500 manufacturer of FDA- and USDA-regulated in-vitro infectious disease diagnostics, medical devices, and microbiology supplies that employs the Six Sigma business-management strategy. He is currently Becton Dickinson-Baltimore's biosafety officer and manager of its Research and Development Tuberculosis laboratory. Areas of expertise include product development, detection and culture of bacteria, fungi and mycobacteria, growth media formulation and chemical analysis, antimicrobial susceptibility testing, rap ID diagnostic methods, protein expression, fermentation, clinical MALDI-TOF mass spectrometry, laboratory automation, and novel technology evaluation. He has also made four trips to Africa for Becton Dickinson's President's Emergency Plan of AIDS Relief initiative to build tuberculosis diagnostic capabilities.



Donald Price with his graduate mentor, Charlie Thompson.



Ben Marks and Angelo Caparella with honey creepers.

demonstrations at the Alpha Phi Omega Children's Carnival at the Bone Center. Kids did electrocardiograms and muscle EMGs, observed live neuron recordings, and got up-close with several insect species. (See the slideshow: <http://bit.ly/1O6LaOF>).

Christine Hodges, M.S. published her work in the *Journal of Evolutionary Biology* this year (Hodges, C.J., E.K. Bowers, C.F. Thompson, and S.K. Sakaluk. 2015. Cascading costs of reproduction in female house wrens induced to lay larger clutches. *Journal of Evolutionary Biology* 28: 1383-1393). This paper answers the question of what limits clutch size in house wrens, a question that has been under study in the school's Avian Ecology Laboratory since the 1980s.

A paper on alternative mating tactics in burying beetles by **Tess Piening Mulrey**, a recent M.S. graduate co-advised by Drs. Anne Eggert and Scott Sakaluk, was recently published in the journal *Animal Behaviour*, the flagship journal for both the North American Animal Behavior Society and the British Association for the Study of *Animal Behaviour*. Her study was the first to provide evidence of males adjusting their investment in alternative tactics based on experience with reproductive resources as adults. Her paper was selected by the editor to be featured in the "In Focus" section of the journal, an impressive recognition of Piening Mulrey's work. (Mulrey, T.E.P., Eggert, A.-K. and S.K. Sakaluk. 2015. Switching tactics: phenotypic plasticity in the alternative mate-finding tactics of burying beetles. *Animal Behaviour* 108: 175-182.)

In September, Associate Professor **John Sedbrook** published an opinion piece in *Crain's Chicago Business* on renewable fuels; you can read it here: <http://bit.ly/1PxEieN>

Last year, we told you that **Austin Harvey**, as an undergraduate researcher in Tom Hammond's lab, had authored a paper in the journal *Genetics*. Building on that training, Austin has now moved on to graduate school at the University of Oregon, where he was awarded an Outstanding New Student scholarship in 2015.

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Even a small increase in temperature can have devastating effects on nervous system function. The **Stein Lab** studied why these effects occur and how they can be alleviated. The results were published in September in the prestigious journal *PLoS Biology* (Städle, C., Heigle, S. and Stein, W. 2015. Neuromodulation to the rescue: compensation of temperature-induced breakdown of rhythmic motor patterns via extrinsic neuromodulatory input. *PLoS Biol* 13(9): e1002265).

Kevin Edwards' lab published a cover article in the journal *Developmental Dynamics*, "Controlled expression of *Drosophila* homeobox loci using the Hostile takeover system" by N. Javeed et al. (*Dev Dyn.* 244:808-25). The paper presents phenotypes associated with the improper expression of developmental regulators,



Misexpression of the Bithorax Complex leads to the conversion of the adult head capsule (wild type, left panel) into an extended, appendage-like structure (right panel).

the homeobox genes, using the fruit fly (*Drosophila*) model system. Misexpression of one region of the genome, in the Bithorax Complex, leads to drastic repatterning of body parts, such as the conversion of the adult head capsule (wild type, left panel) into an extended, appendage-like structure (right panel). Interestingly, this line misexpresses a long noncoding RNA that lies between two homeobox genes, highlighting the potential of regulatory RNAs to control developmental decisions.

Kristin Duffield, a Ph.D. candidate from the School of Biological Sciences, presented her research at the annual Animal Behavior Conference sponsored by the Center for the Integrative Study of Animal Behavior at Indiana University in Bloomington, Indiana. Duffield, who is co-advised by Ben Sadd and Scott Sakaluk, is broadly interested in how investment in reproduction changes

Alumni Day honorees give career insights and guidance to students

The School of Biological Sciences invited Krista Kirkham, M.S. '05; Laura Zimmerman, M.S. '09 Ph.D. '13; and Sandrine Clairardin '09, M.S. '12, back to ISU to recognize their achievements in establishing themselves in successful careers. They were also chosen to represent a diversity of careers within biology, namely working for a non-profit organization, in academia, and for public schools. During a career panel within our school, they each gave a formal presentation about their road from ISU to their current positions with many insights on how ISU assisted them on their way. Each concluded their presentations outlining the day-to-day dynamics of their current positions and what they love most. This was a very informative panel for all of the attendees. They were honored at the University Alumni Day luncheon, which they attended in the company of Laura Vogel, professor and associate director of our school. If you would be interested in being considered for this next year please send an email to Diane Byers (dlbyer2@ilstu.edu), chair of the school's public relations committee. Tell us about your current career and how ISU helped to get you there. In the subject line include "Alumni Day 2016." Please send by July 1, 2016.



Alumni honorees, Sandrine Clairardin (from left), Laura Zimmerman, and Krista Kirkham pictured with Associate Director of the School of Biological Sciences, Dr. Laura Vogel.

Sandrine Clairardin

Clairardin teaches biology at Romeoville High School. She has a long-standing interest in science education and works to promote an enthusiasm for science in all students. Clairardin received her bachelor's degree in the School of Biological Sciences' teacher-education sequence and her master's degree examining mechanisms of endocrine disruption. She received a prestigious Science to Achieve Results Fellowship from the Environmental Protection Agency.

Laura Zimmerman

After completing her doctorate, Zimmerman spent a semester as a visiting assistant professor at Wofford College in Spartanburg, South Carolina, before returning to her undergraduate alma mater, Millikin University, where she is now a full-time assistant professor of Biology. She teaches immunology and volunteers with the women's basketball team.

Krista Kirkham

At Illinois State, Kirkham worked with Associate Professor Bill Perry and earned her master's in the Conservation Biology sequence. Her thesis examined algal dynamics in streams to determine if land-use changes led to alteration in water quality. Now Kirkham works for The Nature Conservancy. She focuses on the assessment of mitigation efforts at reducing nitrate loading to streams. Since 2012 she has been on the board of the Parklands Foundation.

Graduate student research: Erin Dorset

My research aimed to explore behavioral plasticity in response to the perception of predation risk in birds and to describe any fitness-related costs that may be associated with such plasticity. I performed this research using the house wren (*Troglodytes aedon*) as my study organism at the Mackinaw Study Area in McLean County, Illinois. I enlarged the entrance hole of experimental nestboxes to a diameter of 5.0 cm from the standard (control) 3.2 cm to increase

perceived predation risk and video-recorded these nests to score adult behaviors. I also closely monitored all nests for hatching success, early hatchling survival, nestling body condition, and fledging success.

I found that females showed plasticity in vigilance behavior, with experimental females spending significantly less time in vigilance than control females. Additionally, males and females showed plasticity in nestling provisioning. Experimental males increased provisioning and experimental females decreased provisioning with increasing brood size, whereas control males and females behaved similarly and were unaffected by brood size. However, females did not show plasticity in incubation or brooding behavior. I found no evidence of fitness-related costs of behavioral plasticity, because treatment did not affect hatching success, early hatchling survival, nestling body condition, or fledging success. Thus, house wrens show behavioral plasticity in response to perceived predation risk, but this plasticity does not appear to be costly.



Erin Dorset studied behavioral plasticity in response to perceived predation risk in house wrens for her master's thesis.

Graduate student research: Geoffrey Ower

The purpose of my research was to measure how density-dependence influences the quantity and quality of adult mosquitoes produced in a field population of *Culex restuans*, an important vector of West Nile virus. When a population that is regulated by density-dependence (e.g., from limited food resources) is perturbed by an extrinsic source of mortality (e.g. predation) it will tend to return to its previous density. This occurs because the population is released from the stronger effect of intraspecific competition, which can result in the same number of individuals surviving (compensatory mortality), or possibly even increased survivorship (over-compensatory mortality). Determining the conditions under which overcompensation occurs in nature is of practical importance for both conserving populations harvested by humans and for biological control of invasive species and vectors of disease. If wildlife managers set inflated harvest quotas based on the assumption that hunting mortality is compensatory when it is actually additive, it could lead to overexploitation, collapse, and even extinction of the



Geoff Ower quantifying density-dependence in a field population of *Culex restuans*.

harvested species. Conversely when the management goal is controlling an invasive species or disease vector that is under density-dependent regulation, overcompensation could cause the targeted species to increase rather than decrease in population size with potentially disastrous consequences.

Graduate student travel: Christy Moore

This summer of 2015 I was able to attend the Plant Biology meeting in Minneapolis, where the latest research in areas ranging from biofuel crop development to the effects of space travel on plant growth were presented. I attended talks on vesicle trafficking, cell division plane orientation, cell shape and division patterning, the mechanics of polarized growth, as well as the renovation of online databases to facilitate the dissemination of scientific knowledge and analysis of new data. I was also fortunate enough to present a poster on one of my own research projects concerning the *Arabidopsis* stuck mutant, which exhibits smaller plant size and swollen organs. It was mapped to a region on the chromosome 5, and some preliminary analyses revealed the possibility of a trafficking defect that causes a cellulose deficiency in this mutant. We are currently using confocal microscopy and biochemical assays to further characterize the nature of the stuck mutation, and in doing so, hope to shed light on the processes of cell wall biogenesis and oriented cell expansion.

when future survival is threatened. She presented a short talk describing research from her dissertation where she measured reproductive effort in the form of the tastiness of nuptial gifts that males give to females during mating. Analyzing the changes in composition of gifts relative to female preferences demonstrated that immune-challenged males produce more attractive gifts. This has important consequences for the male's ability to secure paternity and thereby increase his fitness. Duffield and her colleagues are currently working on a study that explores another form of cricket reproductive behavior, investment of males toward calling to attract sexually receptive females. In this study they are not only investigating the effect of an immune challenge, but also how changes in reproductive effort in immune-challenged crickets may be different between young and old individuals. Results from Duffield's research help increase understanding of the flexibility of the allocation of resources toward reproduction under varying expectations for survival. Duffield plans to present her findings from this project at the 2016 Animal Behavior Conference in the spring.

Aderinsola Odetunde is an M.S. student currently working with Joseph M. Casto, Ph.D. Their lab works with European starlings, and their research interests include neuroendocrinology, field endocrinology, and ecoimmunology. She recently shared her research at the Society of Integrative and Comparative Biology Annual Meeting in Portland Oregon. The poster presentation—"Does blood loss explain ectoparasite-induced changes in nestling development?"—focused on the effects of blood loss and alternative factors of blood-feeding mites on growth and immunity trade-offs in nestlings. Her experiment observed nestlings in three groups: mite-infested nests, blood-loss nests, and non-manipulated nests. Their growth, hematocrit, and hemoglobin were measured three times across 15 days. She found that nestlings in mite-infestation nests suffered decreased growth, and hematocrit compared to control nestlings, while blood-loss nestlings did not show

Continued on Page 10

these deficiencies. She will be conducting further analysis on the immune function of the nestlings to see how it was affected by blood loss and mite infestations, as well as gaining further information on how resource allocation shifts between growth and immunity under these conditions. She plans to continue this work for her thesis, which will include how trade-offs due to parasitism can affect parental provisioning.

Hosting the 24th North American Prairie Conference

The 24th NAPC will include more than 70 invited and contributed oral papers and a poster session on many aspects of prairie ecology, restoration, management and some innovative ideas on working lands. Field trips are planned to large scale high diversity restorations at Midewin National Tallgrass Prairie (19,000-acres & Bison), Nachusa Grassland (3,000-acres and bison), and Efroymsen Restoration at Kankakee Sands (7,000-acres) as well as a diversity of other locations throughout the region. We expected that more than 500 people will attend the conference. The Conference is sponsored by the School of Biological Sciences at Illinois State University. Faculty members Roger Anderson (Chair), Victoria Borowicz, Diane Byers, Scott Sakaluk, and Charles Thompson are members of the steering committee for the conference. We will be honoring Pete Schramm, the individual responsible for organizing the first North American Prairie Conference hosted at Knox College in Galesburg, Illinois in 1968. Please visit www.nap2016.illinoisstate.edu for more information about the conference.



"Rainbow Prairie" Sugar Grove Prairie, Funks Grove, Illinois; photograph by Robert Shaw, Wild Perceptions

ISU Hosted 2015 International Symposium on Biomathematics and Ecology Education and Research (BEER)

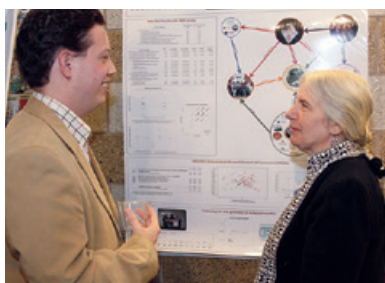
The eighth international symposium on Biomathematics & Ecology: Education & Research (BEER) was held at ISU this past fall; several of the sessions were organized by school faculty. Wolfgang Stein organized a session on "Pushing the Limits of Neuroscience Research with Computational and Mathematical approaches." Steven Juliano organized a session on "Ecological Research." Diane Byers and Victoria Borowicz organized a session on "Combining the Ecological Dynamics of Aboveground and Belowground Processes." In these sessions both local (ISU faculty and graduate students) and out-of-town speakers presented their research. Students from our school also presented at the poster session. The conference originated as an outgrowth from the Biomathematics M.S. sequences in the Department of Mathematics and School of Biological Sciences. Now the BEER symposium has become a larger event held every fall in locations across the country.



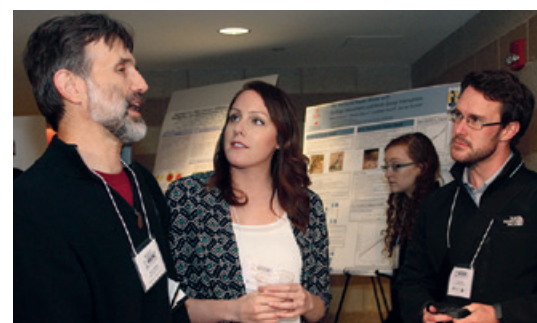
BEER-goers take a break from biomath for a friendly game of soccer.



Carlos Castillo-Chavez, professor of Mathematical Biology and Distinguished Sustainability Scientist at Arizona State University, gave the keynote address.



M.S. student, Andrew McDevitt, and Diane Byers discuss Andrew's poster on career choice in the ecological sciences.

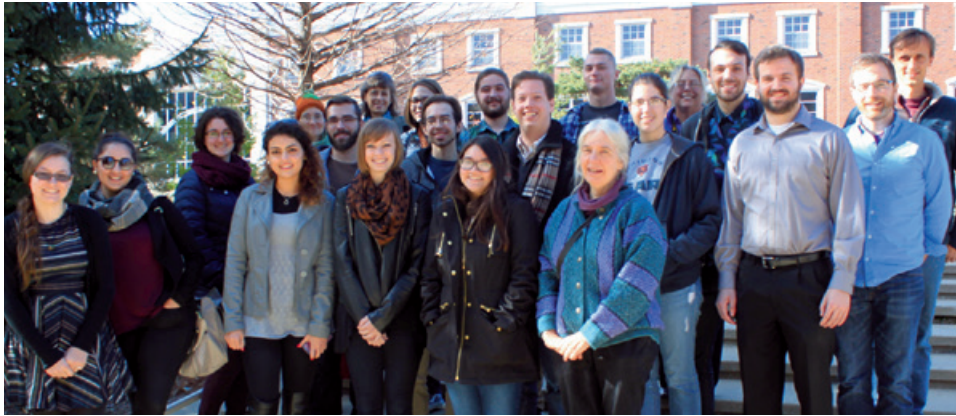


Steve Juliano and Ben Sadd, faculty members of the School of Biological Sciences, talk with doctoral student Kristin Duffield at the BEER poster session.

Integrative Plant Biology and Bioenergy (IPBB) Biannual Meeting

Once again the faculty and students working with plants, algae, and fungi had both their spring poster session and fall research presentations. This fall the presentations included: Robert Philips "*Chamaecrista fasciculata* in Sand vs. Tallgrass Prairies: Exploring the potential for local adaptation" (M.S. student Byers lab); Nicole Wilson "Land Cover Effects on Water Systems: Nutrients and Algae in Stormwater Ponds" (M.S. student Cook and Perry labs); Christy Moore "STUCK, a Gene Promoting Cellulose Deposition and Cell Elonga-

tion in *Arabidopsis thaliana*” (Ph.D. student Kirk lab); Andrew McDevitt “Promoting Forest Ecology and Conservation at the Undergraduate Level” (M.S. student Darner Gougis lab); Nick Rhoades “Meiotic Silencing by Unpaired DNA” (M.S. student Hammond Lab); John Sussman “Turning anecdotal observation into hard fact: Analysis of hemiparasite-tree interactions” (undergrad Borowicz lab); Morgan Walder “*Lespedeza cuneate*-Invader of the Tallgrass Prairie” (M.S. student Borowicz lab); Tyler Telander “BAHD acyltransferases involved in



IPBB Fall 2015 participants

secondary cell wall formation in the grass *Brachypodium distachyon*” (M.S. student Sedbrook Lab); and Malihe Esfahanian “The identification of agronomically-relevant mutants of the new oilseed crop pennycress (*Thlaspi arvense*)” (M.S. student Sedbrook lab). As always, these students gave a great set of stimulating presentations.

\$1.4 million grant to increase the number of STEM teachers

Dr. Rebekka Darner Gougis, assistant professor of biology education, secured a \$1.4 million award from the National Science Foundation to fund a Robert Noyce Teacher Scholarship program at ISU. Over the course of five years, 40 \$20,000 scholarships will be distributed to majors in agriculture, biology, chemistry, geology, mathematics, physics, and technology/engineering who are obtaining their secondary teaching credential. Noyce Scholars agree to teach a STEM field for four years after graduation in a high school that has a high percentage of students who live in poverty. Noyce Scholars will complete a teaching internship during the summer prior to their junior year, in which they co-lead a middle school STEM camp—Discovery Academy—with community educators from Joliet Junior College (JJC). Discovery Academy will focus on preparing for college, including STEM career awareness, and will engage middle schoolers in website design, biological collections, video-game creation, prairie restoration, and daily design challenges. During their junior year, Noyce Scholars will complete a paid research internship working in a lab under the mentorship of a faculty member. Goals of this project are to increase the number of STEM teachers in schools that experience high poverty, engage future high school teachers in authentic research that allows them to learn the practices of science, and increase transfer rate of JJC students to ISU to pursue STEM majors. Within the context of this Noyce program, Darner Gougis is able to conduct research examining how teacher preparation experiences foster scientific literacy and cultural competence when teaching modern diverse classrooms. She hopes that this program is the beginning of a long partnership between JJC and ISU comprising a STEM pipeline that supports students from a diversity of backgrounds as they pursue STEM careers.



Rebekka Darner Gougis is the director of the new Noyce Scholarship program at ISU.



Carola Städele received a prestigious award from the International Society of Neuroethology

Post-doc Awarded Young Investigator Award

Congratulations to Carola Städele for receiving the Young Investigator Award from the International Society for Neuroethology. This prestigious award recognizes doctoral graduate students and early post-doctoral fellows who have shown outstanding promise and have already made a significant research contribution in the field of neuroethology. Carola is invited to present her research findings about how the nervous system copes with detrimental temperature effects in a special symposium at the 2016 Congress of Neuroethology in Montevideo, Uruguay.



Keith Bowers and Beth Weber show off their ugly Christmas sweaters at the Phi Sigma holiday party.



For more information, visit
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