Biospheres is published for the alumni, friends, and faculty of the Department Ecology, Evolution, and Organismal Biology at Iowa State University, an academic department in the College of Liberal Arts and Sciences and the College of Agriculture and Life Sciences.

Chair
Jonathan Wendel

Editors
Jacki Hayes
Barbara Pleasants

Writers
Clare Adams
Jer Pin Chong
Kaitlyn Pettingill

Graphic Designer
Jacki Hayes

Please send news about yourself and your family for future Biospheres to:

Biospheres
Iowa State University
Department of Ecology, Evolution, and Organismal Biology
Ames, IA 50011

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries regarding non-discrimination policies may be directed to Robinette Kelley, Director, Office of Equal Opportunity, Title IX/ADA Coordinator, and Affirmative Action Officer, 3350 Beardshear Hall, Ames, Iowa 50011, Tel. 515 294-7612, email eoooffice@iastate.edu.
Hello, Friends, and Alumni!

It is a pleasure to write to you again and provide you with a snapshot of our many ongoing activities.

In the previous issue of Biospheres, we highlighted the impressive diversity of research expertise that exists within the EEOB department. An important aspect of this expertise is that it provides a wealth of opportunities to collaborate with others to further the fields of evolution, ecology, and many other areas in biology. So we thought it might be a nice idea to highlight “collaboration” in this issue, offering illustrative examples of the many ways in which our faculty have partnered with colleagues around the globe to build new and exciting research programs.

Internationally, our partnerships are found as close by as Canada and as far away as China, and scientifically, these encompass studies ranging in scale from the molecular biology of adaptation to global ecosystem science. Each of these many efforts offers unique learning experiences, perspectives, and prospects for scientific enrichment and discovery at the forefront of our disciplines. They also offer our students a wonderful opportunity for experiencing the growth that comes from surmounting the inevitable logistical and cultural challenges that accompany international scientific research. In addition to traversing the globe, many of our faculty have developed some of their best collaborations at home, within EEOB, with others at Iowa State University, or elsewhere in the USA. As described in this issue of Biosphere, an example is the work of Dr. John Pleasants and Dr. Diane Debinski, who are working to save monarch populations with the help of faculty across the ISU campus.

As in the past, we also highlight our amazing staff and faculty, drawing attention particularly to our talented and dedicated Biology staff. In this issue, we also introduce you to our newest faculty member, Grace Wilkinson, who will join us at the start of 2017, and share with you a bit of alumni news.

If you have had the pleasure of visiting campus lately, you may have seen the many changes are happening to Bessey Hall, most notably the gigantic hole on the east lawn which now has morphed into a developing four-story addition. This addition will include eight teaching labs for biology courses, many new research labs for faculty and staff, and two general purpose classrooms, each with a capacity of 90 students. If all goes well, we will be moving in during the fall of 2017. We hope to highlight this exciting physical enhancement to our research and teaching facilities in our next issue.

It is a privilege to be a part of this EEOB family. There are many ways in which you can help us succeed, and toward that end, we have included for your use a form on the last page of this issue of Biospheres. I thank you in advance for your commitment to the future of the department.

I hope you enjoy this issue of Biospheres. Until next issue, please stay in touch!

Jonathan F. Wendel, Professor and Chair
Department of Ecology, Evolution, and Organismal Biology
Iowa State University, Ames, IA 50011
Phone: 515-294-7172; Fax: 515-294-1337;
Email: jfw@iastate.edu
www.eeob.iastate.edu
Research collaborations are nothing new, but today’s modes of communication are making it even easier for EEOB faculty to collaborate with colleagues the world over. But collaborative projects require time investments in travel, meetings and teleconferences, juggling personalities and prioritizing research interests. Is the investment worth the effort?

EEOB faculty, staff, and students would answer this question with a resounding yes. In fact, research collaborations can lead to increased opportunities for research discovery, and also lead to an increase in number of publications, increased publication citation, a wider array of research techniques, and strong recruitment opportunities. In the top scientific journals, like Science and Nature, there is a positive correlation between the number of authors and the impact of the research.

In this issue of Biospheres, we share with you the collaborative work that is happening now in EEOB. Our faculty are working with their academic colleagues across the globe, identifying bamboo species and studying the effects of global climate change on pollinator species, for example. Others are working with private citizens and government agencies to save the monarch butterfly. And still others are harnessing the benefits of our interdisciplinary department to broaden the perspective and expertise of their individual research projects.

Regardless of their interests, EEOB is proving that many heads are better than one when it comes to scientific research in ecology, evolution, and organismal biology.
Conservation and collaboration

The rise of the internet has led to an increasingly smaller world, offering EEOB faculty unlimited possibilities for research collaboration. These partnerships lead to better transfer of knowledge, increased paper citations, and increased access to resources. However, research collaborations often extend far beyond university hallways and research labs. Such is the case for the Iowa Monarch Conservation Consortium project.

The Iowa Monarch Conservation Consortium was established in February 2015, with the help of Iowa farmers, livestock producers, commodity and conservation organizations, Iowa State University’s College of Agriculture and Life Sciences, the Iowa Department of Agriculture and Land Stewardship, and the Iowa Department of Natural Resources. The main focus of the consortium is re-establishing milkweed in Iowa’s landscape. Without milkweed, monarch butterflies cannot complete their lifecycle because it is the only host plant for the monarch caterpillar.

According to Dr. John Pleasants, EEOB Adjunct Assistant Professor, the group is looking at “the best way to get milkweed habitat, monarch habitat, on the landscape. We know that the main reason the monarch population has declined is because we have lost lots of milkweeds, principally from agriculture fields. So we need to put more milkweed back. We can’t put milkweed back in corn and soybean fields so we are looking at other locations, such as CRP (Conservation Reserve Program) land and roadsides.”

The group is working on how to re-establish milkweed with cost and time-effective strategies that will benefit the butterfly. The researchers involved in the project can provide the scientific knowledge to help drive policy change and establish best practices, but scientific findings can only go so far. The conservation efforts require the assistance of private citizens, farmers, and even county road-side managers. Pleasants states that getting those on the ground involved can be one of the biggest challenges to the conservation work. Collaborating with governmental agencies that can provide incentives for program participation can encourage involvement.

While collaborations have their challenges and obstacles, they bring with them a broad range of expertise and experience. The ISU faculty and students of the consortium come from backgrounds as diverse as education, information technology, plant and insect ecology, conservation biology, weed science, and alternative livestock systems. According to Pleasants, this extensive range of expertise allows for a broader range of perspectives, and ultimately greater success in saving the monarch butterfly.

To learn more about the Iowa Monarch Conservation Consortium, please visit their website at http://monarch.ent.iastate.edu.
Greater access to technology and an increasingly globalized world is leading to a rise in international research collaborations. For EEOB faculty, based in the center of the United States, these partnerships create opportunities in far flung locations such as China, Australia, and Brazil, opening doors to even more research prospects and foci.

Dr. Dean Adams collaborates with partners in France, Portugal, Italy, and Australia. During his recent sabbatical in France, he and his international colleagues worked to identify the causes of fluctuating asymmetry and developmental instability in small rodents. But Adams is more known for his work with salamanders. In collaboration with Dr. Annamaria Nistri of the Museo Sorie Naturale in Florence, Italy, he examined how cave-dwelling salamanders’ morphology was affected by unique selective pressures.

Dr. Lynn Clark researches bamboos with Dr. Reyjane Patricia de Oliveira, a professor at the Universidade Estadual de Feira de Santana (State University of Feira de Santana) in Bahia, Brazil. While about 230 species of bamboo have been described, she estimates that there are at least 70 more undescribed species waiting to be discovered. Since an up-to-date database describing phylogeny and morphology isn’t available, one of her goals is to produce an illustrated identification resource for Brazilian bamboos based on their evolution and diversity.

Despite being able to examine molecular and anatomical structures at Iowa State, the crux of her work relies on studying the plants in their natural habitats and collecting complete specimens. As Dr. Clark says, “To be successful, field work must be a joint effort with botanists and others in-country, because local knowledge is invaluable and, in a practical sense, because of permitting requirements. So by its very nature, field work for a researcher like me is automatically international and collaborative. But in a larger sense, many of the colleagues, students and friends I have met while doing field work have also become long-term collaborators who exchange ideas and push the science forward.”

Dr. Brian Wilsey also extends ISU’s reach across the globe, all the way to the Songnen Plain in China. Wilsey works with Dr. Deli Wang, an internationally known grassland ecologist at the Institute of Grassland Science at the Northeast Normal University, Changchung, China. Together they study grassland ecosystems and community ecology with a special
interest in grazing. One of their more recent papers explores how different herbivores affect plant communities with higher grazer diversity. Wilsey states, “Ecologist from the world over are all part of a collective group studying similar things.” He goes on to explain how challenging these international collaborations can be, citing the time investment required to visit collaborators face-to-face.

Dr. Diane Debinski collaborates closer to home with Dr. Jeremy Kerr of the University of Ottawa, Canada. This five year connection blossomed through professional conference meetings and mutual interests. Together they study the effects of global climate change on pollinator populations on a continental scale. While on sabbatical in 2012, Debinski joined Kerr’s lab for a semester. She recalls, “we synthesized how butterfly species in Canada have shifted in distribution between 1900 and 2010 and assessed the species-specific traits that were associated with these changes in distribution.” The manuscript that resulted (Range dynamics at the wilderness frontier in North America and climate-driven shifts in species trait distributions) is currently under review.

This work is driven by the large, well-kept Canadian databases on butterflies. Dr. Debinski describes the high quality of this ongoing ecoinformatics project: “We were able to use 211,907 georeferenced and dated observations of 312 butterfly species observed across Canada since the end of the 19th century. Each observation is attached to a physical specimen stored in curated biological collections. We had hoped to include U.S. data in this analysis, but the U.S. data were not of the same quality. That project may be something we pursue in the future.”

Not only do Iowa State faculty travel around the world, but they also bring students and scientists alike to ISU. Last year, Wilsey hosted Xiaofei Li, a Chinese student from Northeast Normal University to study grasslands. This year, Dr. Fredric Janzen will welcome a Post Doc from New Zealand to do climate change modeling and his former Post Doc, Dr. Ricky Spencer, will spend his next sabbatical here in Ames working on reptile ecology. With all the international experience Iowa State has, EEOB alumni can feel prepared to be welcomed anywhere in the world.
Collaborating close to home: Interdisciplinary department leads to research partner-

While EEOB collaborations can extend around the world, many take place inside the hallways and offices of Bessey Hall. As an interdisciplinary department, EEOB brings together faculty with a range of expertise offering numerous opportunities to partner on research projects.

When asked about collaborating with his colleagues in EEOB, Dr. John Nason stated, “We may often collaborate with people from other universities because the system is something that somebody else works on. But in terms of methodology we use, we have a lot of that expertise in the department. I am not really an ecologist and so I am interacting with ecologists when I need ecologists. When I need someone who is good at developing theoretical stuff, I can go talk to Dean [Adams]. It’s great that we have Tracy [Heath] here for phylogenetics. I think being part of an E&E department really enhances collaboration.”

In fact, Nason and Heath have recently secured an NSF grant to study the co-evolutionary history among strangling fig (Ficus) and their associated pollinating (Pegoscapus) and non-pollinating (Idarnes) fig wasps. It is a complicated and large-scale project that will require the assistance of colleagues from the Smithsonian Tropical Research Institute Panama, Harvard University, University of Maryland, and Cornell University.

The figs have a special obligate pollination mutualism with specific wasps. Each fig has a species specific wasp that pollinates its flowers and in turn the wasps lay their eggs in a subset of the fig seeds and the wasp larvae develop at the expense of the fig seeds. A fig fruit is a nursery that contains developing seeds and developing wasps. When the larvae mature they gather the pollen of the fig plant and fly off to start the process over again.

“From the plant’s perspective, it can’t live without the wasp. It’s a textbook case of mutualism,” according to Nason.

While figs are common, any one particular species is rare and lacks a set flowering season. So when one tree is releasing wasps, the nearest tree that might be receptive is kilometers away. When fig fruits are ready to be pollinated, they give off special volatile chemicals and the wasps are attuned to the special chemical signals of the host.

The objective of this particular project is to understand the host-recognition mechanism associated with volatile signals and the impact of host-shifting pollinators to introgression gene flow in fig hosts. Fig wasp pollinators co-evolved with their hosts to specialize in detecting the distinctive volatile chemical signals and recent studies suggest that fig wasp pollinators may switch host or visit a pair of fig host species.
Dogma of the past stated that a one-to-one relationship existed between the fig and the fig wasps and the thought process was that the phylogeny of the wasp should match up perfectly with the phylogeny of the fig trees. However, data from fifteen to twenty years ago do not demonstrate this perfect relationship.

"Is it really that this one-to-one relationship is totally wrong and we really misunderstood the whole interaction? Or is it that it’s largely, or mostly true? To answer those kinds of questions, we need really well resolved phylogenies for the plants, for the pollinators, and these parasites. That’s the main reason Tracy is on board. She’s one of a handful of people worldwide who are just super-experts at phylogenetic methods. She was a natural addition."

But Heath’s intradepartmental collaboration extends beyond her work with Nason. She is also collaborating with Dr. Amy Toth to reconstruct the phylogeny of 60 wasp species within the genus Polistes. The project began because of a shared rotational Bioinformatic and Computational Biology student, Kevin Quinteros. In the first year of study, BCB students rotate among three or more research labs to determine where they will do their Ph.D. research. In Quinteros’ case, he rotated among Toth, Heath, and Nason.

Heath stated, “When he [Quinteros] started working with me, we were looking at the work that had previously been done and realized that the phylogeny for the genus Polistes wasp was based on a single mitochondrial gene and a handful of morphological characteristics, but all done within a non-statistical method for building phylogeny. We figured this would be a good opportunity for Kevin to understand the process of doing a comparative phylogenetic study.”

Per his interdisciplinary graduate program, he will continue with two faculty advisors, in this case Heath and Nason, as joint mentoring is viewed as a critical component of the BCB program. With Heath and Nason, Quinteros will explore his interest in the mechanisms of recognition and do so within a comparative phylogenetic framework using the fig and fig wasp project.
Turtles immune to old age? Maybe not, according to new Iowa State University research

by ISU News Service

Researchers at Iowa State University are rethinking the long-held conventional wisdom that turtles don’t suffer some of the ravages of old age.

Nearly 30 years of data collected on painted turtles in the Mississippi River near Clinton, Iowa, show that females suffer a steep dip in fertility before the end of their lives, a finding that flies in the face of what scientists have believed about turtles and aging. A team of ISU scientists recently published its findings in the Proceedings of the National Academy of Sciences, a peer-reviewed academic publication.

“Turtles are these icons of longevity,” said Fredric Janzen, professor of ecology, evolution and organismal biology. “People assumed there was never a cost to reproduction right up to the end of life.”

Janzen found that the painted turtles enjoy a long period of relatively graceful aging, as the researchers expected. But that long plateau consistently ended with a steep drop in fertility near the end of the females’ lifespans. The older females tended to lay larger eggs, which would normally improve the odds of successful offspring, but the data show just the opposite.

“This was a rare opportunity to look at the data and go, ‘wow, that’s weird.’ It’s one of those head-scratching moments,” Janzen said.

Anne Bronikowski, a professor of ecology, evolution and organismal biology, has studied senescence, or the way in which organisms deteriorate as they age, in multiple species, including humans. She also happens to be Janzen’s wife, and the wealth of turtle data he’d gathered presented an attractive opportunity to run demographic analyses on adult survival rate senescence. But the results of that analysis came as a surprise.

“Similar to the finding that reproduction declines, we also found that survival rates decline as the turtles age but at rates slower than mammals – including humans and non-human primates,” Bronikowski said. “Our next steps are to delve into the cellular mechanisms that afford turtles these lower mortality rates.”

The researchers recently received a grant from the National Institutes of Health to study the cellular and genetic mechanisms that allow turtles to delay their reproductive aging and the onset of their age-related frailties, she said.

Female painted turtles reach maturity between 5 and 8 years old and can live to reach about 25 years old. The researchers said the turtle lifespan shares some similarities with humans, who also take years to mature and tend to have long lives. That means studying turtle senescence may have implications for human health and aging, Bronikowski said.

Also contributing to the paper were Daniel Warner of Auburn University and David A.W. Miller of Pennsylvania State University. Warner was a former post-doctoral researcher in Janzen’s lab and was one of the original undergraduates who worked with Janzen in the 1990s, and Miller is a former ISU graduate student.
EEOB welcomes new faculty member

The EEOB department is excited to welcome their newest faculty hire, Grace Wilkinson! Dr. Wilkinson grew up in Minnesota where she developed a deep passion for lake ecosystems. She discovered her calling, limnology, while an undergraduate at St. Olaf College. She was attracted to the field’s interdisciplinary approach. Her graduate work at the University of Virginia involved fundamental questions about relatively pristine lakes in northern Wisconsin. Since then her focus has shifted to combining basic and applied science to address environmental problems such as water quality.

Dr. Wilkinson now studies the ecology of lakes and how stressors such as climate change can influence lake function. By better understanding changes in inputs from watersheds, we can better predict how lakes will respond to stochastic stressors in the future. Developing these tools from well-informed science can lead to better management of lake ecosystems and the ecosystem services – drinking water, flood control, and recreation – they provide.

Clark receives Peter Raven Award

Dr. Lynn G. Clark received the Peter Raven Award at the Botany 2016 meetings in Savannah Georgia. The American Society of Plants Taxonomists presents this award to a plant systematist who has made exceptional efforts at outreach to nonscientists.

Dr. Clark’s outreach efforts include her involvement with The American Bamboo Society, a nonprofit organization whose members include plant scientists, horticulturalists, landscapers, and gardeners. As Director of the Ada Hayden Herbarium and the Pohl Conservatory, she frequently hosts educational tours for school children. In addition, Clark created the “Bamboo Biodiversity” website with former student and collaborator Anna Gardner. She also contributed to the development of “The Grasses of Iowa”. This image rich website supports information about native and invasive grasses of Iowa. Clark is also one of the authors of Grasses in Your Pocket: A Guide to the Prairie Grasses of the Upper Midwest.
Westgate honored with LAS Institutional Service Award

Senior Teaching Lab Coordinator, Linda Westgate, was recognized by the College of Liberal Arts and Sciences for her history of exemplary institutional service. Her dedication to undergraduate science education has been instrumental to the growth of the undergraduate Biology Program.

Since 2000, Westgate has coordinated BIOL 211L and BIOL 212L, required laboratory courses for all Biology majors as well as many students in other programs. As ISU enrollment has increased, enrollment in these labs has grown as well. Working with the director of the undergraduate Biology Program, Dr. Jim Colbert, Westgate has overseen a complete overhaul of these courses, including their content, teaching approaches, learning objectives and classroom facilities. Westgate currently coordinates 129 laboratory sections per year, each of which is three hours long. These require four dedicated laboratory classrooms that are in use from 7:00 AM to 10:00 PM daily. Over 34,000 undergraduate students passed through these courses from Fall 2000 through Spring 2015. This past year, Westgate’s activities affected approximately one of every 20 undergraduate students at ISU.

More honors for biology program staff

As testament to the quality of Iowa State University’s Biology Program, the College of Liberal Arts and Sciences recognized two more staff members for their services to the Biology 211L and 212L courses. Teaching Lab Coordinator, Chanda Skelton, recently received the P&S Excellence Award. Teaching Laboratory Associate, Brittany Tawes, was awarded the P&S Outstanding New Professional Award.

Skelton received her M.S. from Iowa State University in 2007 and worked as a Research Technician in the Ada Hayden Herbarium for the following two years. In 2009, she joined the Biology Program and now serves as a Teaching Lab Coordinator for Biology 212L.

Tawes graduated with a M.S. from Iowa State University in 2014 and joined the staff of the Biology Program that same year. Tawes has a remarkable ability to identify, innovate, and solve problems that arise. She takes care of things, with no fuss, including the Biology 212L classes that run from 7:00 am to 10:00 pm four days a week.
EEOB students enjoy first GSO-sponsored field trip

This past April, nine EEOB students and some family members explored Omaha’s Henry Doorly Zoo and Aquarium. This trip was sponsored by EEOB’s Graduate Student Organization and organized by Tori Pocius and Hilary Haley.

Graduate students were excited to see if their favorite species were on display and how the Omaha zoo would present the intersection between conservation and public outreach. By interacting with all the different species, graduate students were able to reignite their passion for biology and explore the zoo with other likeminded individuals.

As Monica Cox said, “This excursion allowed the students to interact outside of the office and/or lab, providing a [rare] stress-free environment to discuss hobbies, interests, life, aspirations, etc.” All students on this trip agreed it brought them closer together.
In the mid 1990’s Dr. Anne Bronikowski began monitoring the genetic health and life history of *Thamnophis elegans*, garter snakes found in northeastern California. The populations being studied are found in two different habitat types and differ in life history characteristics. One population inhabits the shores along Eagle Lake, while another lives within the meadows of Lassen National Forest.

Those living along the lakeshore grow and mature faster than their meadow counterparts. They also have higher fecundity and shorter lifespans. The meadow inhabitants actually live twice as long as the lakeshore residents. The differences in life history are correlated with prey availability. Lakeshore snakes have continuous access to fish, as well as plenty of water. The meadow inhabitants experience unpredictable access to frogs and water.

Both meadow and lakeshore habitats are changing due to human activity, drought, and other environmental factors. Now many garter snake populations within these environments have gone extinct. Bronikowski has partnered with Dr. Amanda Sparkman, of Westmont College, and Dr. David Miller, of Pennsylvania State University, to understand the ecological, physiological, and genetic health measures that determine a population’s fate. They are asking why some populations continue to thrive whereas others, in similar habitats, have perished.
EEOB alumnus excels in teaching and research

Dr. Brad Duthie received his PhD from the EEOB Department in 2013, with a minor in Statistics. Working under Dr. John Nason, his dissertation developed new ecological theory to predict the spatial distributions and coexistence of plant-pollinator-parasite species, and of multi-species assemblages of competitors in temporary patch resources.

Dr. Duthie is currently a postdoctoral Research Fellow at the University of Aberdeen in Scotland. He developed a new model on the evolution of animal inbreeding and female multiple mating. He has taught an Introductory Biology course and has been a course contributor for Ecological Modelling, where he developed educational software for teaching population modelling in ecology. In recognition of his commitment to professionalism in teaching and learning, Dr. Duthie was recently inducted into the UK Higher Education Academy as a Fellow.

Schwartz seeks to understand stress responses

Dr. Tonia Schwartz earned her PhD in genetics under the mentorship of Anne Bronikowski and Jo Anne Powell-Coffman. She was awarded a NSF-IGERT Fellowship in Computational Molecular Biology as well as a NSF-Doctoral Dissertation Improvement Grant to study the evolution of molecular stress networks in natural populations of garter snakes.

Following her time at ISU she was honored with a James McDonnell Post-doctoral Fellowship in Complexity Science, which she brought to the University of Alabama Birmingham to study the transgenerational effects of stress using mice and daphnia as model systems.

Schwartz accepted an Assistant Professor position with the Department of Biological Science at Auburn University in 2015 where her research focuses on molecular networks and life history evolution. Using traditional model organisms, as well as avian and non-avian reptiles, her lab works to understand variations and plasticity in stress responses.
Making a Difference

The Department of Ecology, Evolution, and Organismal Biology at Iowa State University is committed to providing outstanding opportunities for the university community. In order to have the resources necessary to take these programs into the future, support for the department is essential. Funding is required to aid the program in developing new opportunities in technology, continuing and advancing outreach activities, and maintaining and expanding current performance and educational opportunities, and supporting students and faculty. To help make a difference, simply fill out the form, drop it in the mail (ISU Foundation, 2505 University Blvd, Ames, Iowa 50010-8644), and check your next newsletter.

For more information about making a gift to the Department of Ecology, Evolution, and Organismal Biology or including ISU in your estate plans, please contact the College of Liberal Arts and Sciences Development Office at 515-294-3607 or the College of Agriculture and Life Sciences Development Office at 515-294-9328.

I wish to support programs in EEOB at ISU. Enclosed is my gift of:

_____ $1000
_____ $250
_____ $100
_____ $50
Other $ _____

Please specify the fund that should receive your gift:

_____ Student Support
_____ General Development
_____ I will request that my employer match my gift

My employer is ________________

Please charge my credit card.

_____ Visa Card# ________________
_____ Mastercard Exp. __________
_____ Discover

Signature ________________ Date __________

Phone # and email __________________________