THE OHIO STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

NEWS FROM THE OHIO STATE DEPARTMENT OF

EVOLUTION, ECOLOGY AND ORGANISMAL BIOLOGY

WELCOME FROM

DEPARTMENT CHAIR

WELCOME to the inaugural issue of the alumni newsletter for the Department of Evolution, Ecology and Organismal Biology at Ohio State. Our intention is to bring you news of the department, highlight some of our current personnel and acquaint or reacquaint you with today's EEOB. We are truly an evolutionary department in more ways than one. The Department of Evolution, Ecology and Organismal Biology was created in 1998 as a combination of the Department of Zoology and the organism-focused faculty from the Department of Plant Biology. In 2009, several faculty from the Department of Entomology joined EEOB as well. Hence, we have a long and diverse past, and this newsletter is one way we hope to connect with and bring together the greater EEOB family.

In this first issue, you will hear about the research of three of our newest faculty: Assistant Professors Gerald Carter, Marta Jarzyna and Frances Sivakoff. You will learn about one of our graduate students, Matt Boot, who is the recipient of a National Science Foundation Graduate Fellowship, and about how Morgan Shaw, a recent graduate from the evolution and ecology bachelor's program, is using her degree as she works with prairie dogs in South Dakota. Lastly, Nate Hofford will tell you about his experiences as an undergraduate in our program working on research with Assistant Professor Steve Hovick.

What we hope is that this newsletter is just the beginning of increased engagement between our alumni and the department. EEOB is very much a family, and you are part of it for life. Let us know how you have used your degree as your life has progressed, follow EEOB on Facebook, and, if you are local, become involved as a volunteer or as a mentor for our current undergraduates. However you do it, please stay involved! We value your input and look forward to continued connections with our alumni.

– John Freudenstein

IN THIS ISSUE

PERSONNEL NOTES

TOM HETHERINGTON

Associate Professor Tom Hetherington retired last summer and now has emeritus status. Hetherington has been a faculty member at Ohio State since 1983, first serving in the Department of Zoology before joining EEOB. His research interests are in reptile and amphibian conservation biology and behavioral ecology, and he plans to continue work on several projects.

GEORGE THOMAS WATTERS VIII

Our department was saddened in October by the passing of George Thomas Watters VIII, known to all of us as "Tom." Tom received his PhD in the Department of Zoology at Ohio State, where he worked on mussels with David Stansbery. Tom took over as curator of the mollusc collections at the end of 2000 following Stansbery's retirement. In that role, he continued to build the collection and worked on databasing it. Tom's expertise in molluscs was much in demand in Ohio, and he frequently held workshops on mussel identification. He was the supervisor of Ohio State's partnership with the Columbus Zoo and Aquarium and the Ohio Department of Natural Resources Division of Wildlife, which includes a program in which native mussel species are reared and reintroduced into suitable habitats. He also continued to pursue his research interests on snails of the Caribbean. Tom will be missed not only for his organismal expertise but for his good humor and sharp wit.

COVER PHOTO:
A native shadbush in bloom on a rocky outcrop along the South Ridge Trail at Acadia National Park.
Photo credit: Nate Hofford

FEATURED FACULTY

GERRY CARTER

Hello! I'm Gerry Carter, and I joined the Department of Evolution, Ecology and Organismal Biology in fall 2018. I'm a behavioral ecologist working on cooperation, communication and social cognition. My long-term research goal is to resolve some longstanding debates about how animals develop and maintain cooperative relationships.

The evolutionary puzzle of cooperation is that cooperative traits benefiting other individuals can be exploited by "cheats" that gain the fitness benefits of others' help without paying the cost. When conflict is high, cooperation can be enforced by mechanisms of partner choice or some form of reward and punishment. When conflict is low, say because the partners have high kinship or fitness interdependence, cheating is inherently unlikely. In complex social relationships, however, the actual extent of conflict can be hard to measure because strategies of cooperation or cheating can be quite subtle.

I am developing the common vampire bat as a new model system for mammalian cooperation. Female vampire bats live in complex individualized societies. They invest in long-term social relationships and perform natural and frequent helping behaviors that can be monitored, measured and manipulated over long time periods under controlled conditions. They groom each other like primates, and they regurgitate ingested blood as a food donation for both kin and non-kin that are in need. This regurgitated food sharing involves one individual saving another at an energetic cost to itself. To understand why these bats do this, I combine controlled experiments in captivity with field observations enabled by newly developed biologging technology.

Me (green shirt) with my group "Team Vampire" in Panama.

My experiments test predictions from several theoretical frameworks: inclusive fitness theory, reciprocity and biological market theory. Currently, we are focused on the question of how two strangers come to develop a strong and stable cooperative relationship. We are testing the hypothesis that individuals 'test the waters' of a new potential relationship by making small cooperative investments and escalating them conditionally towards the best partners. This game-theoretic model, called "raising-the-stakes," was published more than 20 years ago, but it has yet to be properly tested in a natural system.

My first year has been really exciting! My lab now includes two undergraduates, three graduate students and a postdoc. MSc student Bridget Brown is doing field experiments in both Ohio and Panama on how bats find and select new roosts. PhD student Theresa Chen is in Switzerland working in collaboration with a lab at the University of Bern to study the role of scent in reciprocal cooperation in rats. PhD student Imran Razik is currently at the Smithsonian Tropical Research Institute in Panama continuing our past work on cooperation in vampire bats. He is focusing on the role of oxytocin and oxytocin receptors in the brain as possible drivers of individual variation in cooperativeness. We hypothesize that some females consistently form new relationships much faster than others, and we want to know why. Undergraduate David Girbino is asking if we can predict the long-term trajectory of a new cooperative relationship based on how the two strangers initially interact during their first encounter.

My postdoc, Simon Ripperger, has led the testing and development of the first method for high-resolution tracking of small-animal social networks in the wild. The system involves a series of 1.5-gram proximity sensors that communicate wirelessly to each other every 2 seconds. This allows us to capture the complete social network of up to 60 bats simultaneously every minute, hour and day in the field. We used this custom-built technology to make several interesting discoveries at our field site in Panama. We found that the bats that cooperated with each other in the lab re-formed and maintained the same social networks when we released them back into the wild. Vampire bat social bonds are therefore not an artifact of stable conditions in captivity, and they can withstand dramatic changes in the physical and social environment. We also found that when bats are immune challenged, they become lethargic and have fewer social encounters. Finally, we found the first clear evidence for social foraging in this species. Undergraduate Emma Kline is studying how these small, bat-borne sensors might influence the behavior of the bats.

For my second year, my first goal is to use pilot data from this summer to write a National Science Foundation grant with colleagues at Ohio State and the University of Cincinnati, who will help me with the more mathematical components for theoretical work. The proposal looks at how individual cooperative traits shape the formation and temporal stability of cooperative relationships and how these relationship dynamics ultimately lead to social network structure. I am also preparing to write a National Institutes of Health grant with collaborators at Cornell University to look at the neuroendocrine basis of cooperation. Finally, I hope to start a captive colony of vampire bats on campus. This colony will be the basis for long-term cognition and social experiments that are not feasible to do during a single field season in Panama. For more information about my research, you can check out my website: ***socialbat.org***.

Outside of research, I co-taught two classes this year: Evolutionary Ecology (with Ian Hamilton) and Tropical Behavioral Ecology and Evolution (with Rachelle Adams), a graduate and upper-undergraduate field course in Panama. In 2020, I will be teaching another Panama Field Ecology Course at the undergraduate level.

> ***"I have been greatly energized and inspired by many people in this department..."***

As a new principal investigator, this is a really exciting time in my life. I have been greatly energized and inspired by many people in this department who have been really supportive as I've been figuring out this new job. My launch committee — John Freudenstein, Meg Daly and Zakee Sabree — gave me crucial advice for my first year. Ian Hamilton and Rachelle Adams have been my informal faculty mentors. I am extremely happy and grateful for my experience so far in this department, the trust and support I have received and the prospects of making my own contributions to help push our department forward toward becoming one of the strongest departments for the integrative study of evolution and ecology.

FRANCES SIVAKOFF

My name is Frances Sivakoff, and I am an assistant professor in the Department of Evolution, Ecology and Organismal Biology, with my primary appointment at the Ohio State Marion campus. I started this role in fall 2018, and I was previously a postdoctoral researcher in Ohio State's Department of Entomology. I am an insect ecologist who studies the factors that regulate arthropod abundance and distribution — from common agricultural pests to rare endangered butterflies — across agricultural, natural and urban landscapes. In particular, I investigate how habitat quality influences arthropods to improve habitat management and promotes ecosystem services.

I feel very fortunate to be starting as an assistant professor at the same institution where I completed postdoctoral work. It has allowed me to hit the ground running with already established collaborations and an understanding of the Ohio State system. In collaboration with several colleagues in the Department of Entomology (Mary Gardiner and Reed Johnson), I am continuing to investigate the effect of heavy metal contamination on pollinator health and pollination services. As interest in managing urban greenspaces for pollinator conservation increases, conservation practitioners are faced with new challenges unique to urban environments. Environmental contamination from cities' industrial pasts result in urban soils generally having elevated levels of heavy metals, and little is known about the effects of prolonged exposure to these contaminates on bees.

A Megachile bee foraging at bird's-foot trefoil (Lotus corniculatus) at The Wilds. Photo: John Ballas

Frances Sivakoff (right) and undergraduate Anna Starkey taking a break from field work at The Wilds. Photo: John Ballas

During summer 2019, I established a new collaboration with one of my departmental mentors, Karen Goodell, at The Wilds (***thewilds.columbuszoo.org***), the nearly 10,000-acre conservation center of the Columbus Zoo and Aquarium where Goodell has worked since 2009. Together with Goodell, Rebecca Swab (director of restoration, The Wilds), and Andy McCall (associate professor, Denison University), I am exploring the impacts of reclaimed surface mine land soil properties on plant-pollinator interactions. The Wilds is one of the largest areas of recovering reclaimed surface mine land in North America, and across the property, sites vary in their reclamation requirements, with early sites having little to no revegetation or restoration guidelines. Across different reclamation ages we are measuring heavy metal loads in soils and correlating soil properties to plant traits and pollinator foraging behavior. As part of this project, I brought on a stellar undergraduate, Anna Starkey, to lead data collection. Starkey has also started an independent project studying the color of bird's-foot trefoil (*Lotus corniculatus*) across these different sites using calibrated photographs.

My first year as an assistant professor was also busy with teaching. At the Marion campus, I teach small classes and lead not just lecture, but lab as well. While this is a lot of work, I love the ability to connect concepts learned in lecture to physical experiments in lab and really get to know my students. I primarily teach Introductory Biology for Non-Majors, which I love because I get to introduce students to a veritable cornucopia of biology. I embrace the challenge of making the course material in what may be their only science class interesting and relevant. I learned a lot over the course of my first year, and I am constantly working to improve my courses and teaching.

> ***"I love the ability to connect concepts learned in lecture to physical experiments in lab and really get to know my students."***

In this second year, it feels great to have a better idea of what I'm doing, and I'm treasuring both my teaching at the Marion campus and research at the Columbus campus. I'm looking forward to expanding my lab (see ***u.osu.edu/sivakofflab/join*** to join or read more about us) and continuing to mentor undergraduates at both campuses in research projects.

MARTA JARZYNA

My name is Marta Jarzyna, and I joined the Department of Evolution, Ecology and Organismal Biology at Ohio State in August 2018. I am a macroecologist and global change biologist working on assembling the evidence for biodiversity change and understanding the mechanisms promoting the emergence of biodiversity patterns. Despite the ongoing global biodiversity crisis and decades of research into the mechanisms underlying biodiversity dynamics, no consensus has been reached about the interplay of different processes, specific ecological and functional attributes of biodiversity, and spatial and temporal scales. This impedes the work of monitoring and conservation programs, but it also interferes with all-important forecasting of biodiversity change and its implications for ecosystems and human well-being. Careful characterizations of spatiotemporal variation in biodiversity will also become increasingly important as climate change continues to impact the biota. Through my research, I aim to document the key interacting factors and develop sound characterizations of biodiversity change to advance more predictive ecological science. My work often uses computational approaches and big data such as multi-species distributional and trait repositories, and as such, I am also affiliated with the Translational Data Analytics Institute at Ohio State.

Currently, my lab includes two PhD students, Colin Sweeney and Arjun Venkatesan, and two postdoctoral fellows, Collin VanBuren and Brooks Kohli. Although the details of some of their doctoral projects are still being developed, Sweeney will explore how habitat fragmentation and connectivity changes impact species shifting their geographic ranges following climate change. My previous work showed that, perhaps counterintuitively, fragmented landscapes support ecological communities that are more robust to climate change than communities typically found in contiguous habitats.

Sweeney will build on this research to understand what makes certain species and communities — and the landscapes in which they are found — vulnerable to changing climatic conditions. Venkatesan is also interested in the biotic effects of global change and will focus his research on mountainous regions, where the impacts of climate change are some of the strongest. He will investigate the differences in biodiversity patterns between latitudinally and longitudinally extending mountain ranges (e.g., the Rockies and the Himalayas) to see whether the shape and latitudinal position of the range interacts with the impacts of climate change.

Kohli's research will focus on the relative roles of biotic and abiotic drivers underpinning community coexistence along large-scale spatial and environmental gradients and their implications for the maintenance of community functions. Similarly to Venkatesan, Kohli will use the elevational gradients of the world's main mountain regions to test how mammals' functional diversity varies from benign to harsh conditions and across local, regional and global scales. Focusing on the functional aspects of biodiversity is crucial not only because they convey a range of functions to ecosystems and humans that are now under increasing threat from global change, but also because functional characteristics play an important role in determining species or community response to environmental perturbance. We hope that focusing on trait-based and functional ecology will ultimately allow us to make generalizable ecological predictions.

Finally, VanBuren's work has extended my research program to include paleoecological and paleontological evidence. The paleoecological and fossil record provides a ledger of evolutionary successes and failures that can help explore relationships between species, traits and environments across timescales rarely studied in traditional ecology. Specifically, VanBuren is investigating the dynamics of small mammal communities through the Late Quaternary (approximately last 26,000 years) to elucidate the mechanisms of community assembly that operate across millennia and assess the joint effects of rapid environmental and biotic change. The Late Quaternary provides a valuable ecological analog for the expected biotic response to anthropogenic climate change because the magnitude of climatic change during that era matches the magnitude of predicted anthropogenic climate change over the next few centuries.

I am truly looking forward to my second year at EEOB. Not only will I continue to mentor my current students and postdocs in their research, but I will also kick-start a new research project, funded by a recent grant from the National Science Foundation. This new project will leverage data collected at different spatial and temporal scales from a number of sources — the National Ecological Observatory Network, eBird, the Breeding Bird Survey and the Christmas Bird Count — to obtain dynamic estimates of taxonomic, functional and trait, and evolutionary diversity of birds across North America. The project will quantify change in those biodiversity facets over the course of 50 years and use novel cross-scale modeling techniques to determine how much that change depends on the spatial and temporal scale as well as the effects of climate change. By providing the first continent-wide empirical assessment of spatiotemporal scaling of multifaceted bird diversity change, the project has the potential to resolve ongoing debates about the magnitude and direction of biodiversity change. If you would like to learn more about this or other projects, visit my website at ***majarzyna.com***.

> ***"EEOB at Ohio State provides a fantastic environment to do cutting-edge research, and I am truly grateful for the opportunity to develop my research program here."***

EEOB at Ohio State provides a fantastic environment to do cutting-edge research, and I am truly grateful for the opportunity to develop my research program here. In the coming years, I look forward not only to expanding my research horizons, but to also better getting to know my fantastic colleagues in EEOB and beyond.

NEWS AND UPDATES

RISSING CO-AUTHORS *TIME* EDITORIAL WITH BROOKE AND BEVIS

Professors Steve Rissing of EEOB, John Brooke of history and Michael Bevis of Earth sciences co-authored an editorial in the Sept. 20 issue of *Time* magazine, in which they combine their respective expertise in history, geophysics and biology to explain the past, present and future of climate change.

2020 MUSEUM OF BIOLOGICAL DIVERSITY OPEN HOUSE

March 21, 2020 // Doors will be open between 10 a.m. - 4 p.m.
Free admission and free parking

Mark your calendars — the 2020 Museum of Biological Diversity Open House takes place rain or shine on March 21, 2020. Enjoy a day of biodiversity exploration and discovery. During the event you can get a behind-the-scenes view of our world-class collections (insects, mites, plants, fishes, molluscs, birds, mammals and animal sounds), plus meet the faculty, staff and students who study the flora and fauna of Ohio and the world. You can also engage in a number of hands-on activities, including our Arthropod Petting Zoo, Seedling Planting, Bugs-in-Goo, the Bug Drawing Station and more at this family-friendly, fun-for-all-ages favorite.

CARTER AND RIPPERGER RESEARCH FEATURED ON **NPR** AND **OHIO STATE NEWS**

EEOB Assistant Professor Gerald Carter and his postdoctoral fellow, Simon Ripperger, offer a rare glimpse into wild vampire bats' friendship-like behaviors and new insights into how social structures form. This type of cooperation in vampire bats is rare: Individuals pay a cost to help others. The researchers were interviewed by NPR and also featured in Ohio State News.

LISLE GIBBS HONORED

Provost Bruce McPheron and a group of leaders from the College of Arts and Sciences and the Office of Research surprised Professor Lisle Gibbs with a Distinguished Scholar Award. Only six awards are given university-wide. Congratulations, Lisle!

AAAS FELLOWS NAMED

Bryan Carstens and Laura Kubatko were two of seven Ohio State researchers elected as fellows of the American Association for the Advancement of Science, one of the most prestigious honors a U.S. scientist can receive.

STUDENT/ALUMNI HIGHLIGHTS

NATE HOFFORD // UNDERGRADUATE

I'm an undergraduate researcher in Assistant Professor Steve Hovick's lab. One of our broad aims is to better understand the evolutionary and ecological drivers of invasion success, a topic that is important but nuanced to communicate. As a developing scientist, I have been on both the presenting and the receiving ends of ineffective scientific communication, which has made me realize my own interests in becoming a better communicator. This summer, I had the chance to merge invasion biology and communication through Ohio State's Second-Year Transformational Experience Program (STEP). STEP awards up to $2,000 to students to pursue an independent project of their design. Using these funds, I purchased a camera and traveled to Acadia National Park to pursue a journalistic study of the region and its invasion research.

Located on the coast of Maine, Acadia National Park is well known for its rich forests, striking wildflower communities and rolling mountains. According to the National Park Service, approximately 25% of known species in the park are non-native, with several considered to be high-risk invaders. For my project, I wanted to present invasive biology and other issues facing the park as a narrative, where people could contextualize examples and concepts.

To understand the central challenges of the park, I engaged people from several different perspectives in Acadia: a researcher, an invasive plant manager and a local botanist. Active long-term management in the park reduced the prevalence of many serious invasive plants, and abiotic conditions had minimized the spread of others. Jesse Wheeler, who is the park's exotic plant management coordinator, emphasized the need for continuous monitoring and management of invaders that are under control (e.g., purple loosestrife) and those that are currently high risk for spreading and impacting native systems (e.g., glossy buckthorn). Nicholas Fisichelli, the director of science and education at the Schoodic Institute, a research partner of the park, noted that abiotic conditions of Acadia's local environment — including thin and acidic soils — can hinder non-native spread. However, he stressed that climate change could be a counteracting factor that facilitates non-native species establishment. Jill Weber, a park consultant and self-proclaimed "nature nerd," also spoke about the implications of climate change on park ecology. Winter flood and freeze events have occurred with greater frequency in recent years, leading to sapling die-offs and altered forest successional patterns.

I was curious about how these professionals communicated with the public, and each person stressed how important this facet of their job was. The central theme of each answer was the importance of connecting the community and visitors of the park to the land, using techniques like citizen science initiatives, volunteer invasive removals and interactions with tourists at high-traffic park sites.

Based on the insights I gained from these conversations, I will be creating a short documentary, writing a blog and presenting talks summarizing my experience with the goal of using these diverse mediums to reach a wider audience. While I learned a lot about Acadia through this trip, the most important takeaway for me was the dedication, collaboration and thoughtfulness of the people who work to protect the park. Their passion to involve those around them and effectively communicate their work is an important model for scientists as a whole.

MATT BOOT // PHD STUDENT

Eco-evolutionary dynamics of the mercenary-ant symbiosis

I study a network that includes three ant species. Within the mercenary-ant system, two ant species are social parasites that exploit a fungus-growing ant host in fundamentally different ways. The two social parasites compete with each other for host colonies, but one is persistent and defends acquired host nests, while the other is destructive and quickly burns through host nests. The two parasites should have antagonistic effects on host adaptation through antagonistic competition. However, biotic selection pressures are unlikely to be uniform through space or time.

Co-evolutionary systems are valuable because they allow us to test evolutionary principles in reference to strong and persistent ecological interactions, providing insight into how biological variation can influence the evolutionary trajectory of a species. To explore this eco-evolutionary interplay, I plan to study how geographic variation in abundance of these parasites and frequency-dependent selection influence trait variation in the host ant. I am combining approaches from functional ecology, population ecology and population genetics to model trait dynamics between the symbiotic organisms with the goal of better understanding how variation and complexity can influence our expectations for biological outcomes.

MORGAN SHAW // ALUMNA '18

Alumna working to save North America's rarest mammal

My name is Morgan Shaw, and I graduated with my Bachelor of Science in evolution and ecology in December 2018. Currently, I am working as a biological field technician on a collaborative research project for the U.S. Geological Survey, National Park Service, U.S. Forest Service and Prairie Wildlife Research in South Dakota within Badlands National Park and Buffalo Gap National Grassland. We study plague ecology and management on black-tailed prairie dogs, mice and voles in an effort to conserve the black-footed ferret, North America's rarest mammal. Plague is a fast-moving disease transported by fleas and is highly detrimental to prairie dog populations, which comprise over 90% of the black-footed ferret diet.

Prairie dogs are also a keystone species within the Great Plains, with at least 136 dependent species. I am currently trapping and tagging prairie dogs and other small mammals, collecting biological data on body size and condition and collecting information on ectoparasite loads. The goal of this project is to evaluate the effects of differing plague treatments, including the systemic insecticide fipronil and fungi dust. We hope that by investigating plague countermeasures, we are able to increase the success of ferret reintroductions and keep the prairie ecosystems balanced.

DONATION OPPORTUNITIES

We thank you for your support of the Department of Evolution, Ecology and Organismal Biology at Ohio State. If you wish to make a donation to enhance our work and create opportunities for our students, please consider directing your contribution to one of these priority funds listed below.

EEOB ADVANCEMENT FUND // **316071**

FRIENDS OF TRIPLEHORN INSECT COLLECTION // **314967**

AQUATIC ECOLOGY RESEARCH FUND // **306320**

MUSEUM OF BIOLOGICAL DIVERSITY // **305368**

JEN FOREN TETRAPOD FUND // **647175**

OSU HERBARIUM FUND // **307052**

MUSEUM OF ZOOLOGY // **303015**

To make your gift online, visit ***giveto.osu.edu*** and search for the desired fund name or number. Questions? Please call **614-292-2141** or email **ascadvancement@osu.edu**.

THE OHIO STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

DEPARTMENT OF EVOLUTION, ECOLOGY AND ORGANISMAL BIOLOGY
318 W. 12th Ave.
300 Aronoff Laboratory
Columbus, OH 43210

Non-Profit Org.
U. S. Postage
PAID
Columbus, Ohio
Permit No. 711

STAY UP-TO-DATE WITH THE DEPARTMENT!

eeob.osu.edu

Email: eeob@osu.edu

614-292-8088