



BioScience Now

News for Alumni and Friends of the Department of Integrative Biology

SPRING 2021

**ALL WAYS FORWARD:
BEING RESILIENT
AND INNOVATIVE**

Read more on page 3.



ZOO 430 TEACHING ASSISTANTS
PREPARE FOR VIRTUAL INSTRUCTION
IMAGE BY SCOTT HARTMAN

From the Chair



Much has happened in the Department of Integrative Biology since we last wrote! Like you, we have experienced immense challenges related to the COVID-19 pandemic. The rapid adaptations our

instructors made in March 2020 to remote instruction were simply remarkable. Our staff were equally impressive as most moved to working remotely from their homes, while others continued to work on-campus providing essential services vital to daily functions. Our researchers adapted in many ways, too, as field research plans were modified or canceled and lab bench time was greatly reduced. Through it all, the resilience and dedication of the iBio community to maintain our teaching, research, advising, and administrative services have been nothing less than inspirational.

The past year also brought a new sense of urgency regarding issues of racial and social justice in our country. This important momentum is magnifying systemic disparity and inequity that calls for just and significant change. Our graduate students and our Climate and Diversity committee (with representatives from all of our department members) have been crucial voices in our discussions and efforts. This important work is essential to create a climate that is welcoming and inclusive for all students, staff, and faculty.

In these challenging times we want to express our gratitude to you. We simply cannot fulfill our mission without a strong team behind us. Thank you for your continued support.

Best wishes,

Jeff Hardin

Raymond E. Keller Professor and Chair

Message from Dean Wilcots

In June, I was honored to assume the role of Dean of the College of Letters & Science, during one of the most challenging times in my 25 years at UW–Madison. As we wrestle with a global pandemic, social unrest, and economic turmoil all at once, I am reminded of what makes a Letters & Science education so timelessly important. The values we teach—compassion, intellectual curiosity, tolerance, and resilience—prepare our students not only to flourish in good times, but to learn, grow, and change during periods of challenge and hardship.

Hard times—particularly times of protest—often bring about change. That’s overdue here at UW–Madison, where many of our students of color have, for far too long, experienced a UW that feels less welcoming to them. We pride ourselves on the world-class experience offered to our students, preparing them for positions of leadership and illuminating their path forward. A key leadership priority for me is creating an inclusive environment where all students can feel at home and thrive.

Another priority is research. We are

an “RI” (preeminent) research institution, and much of this ground-breaking work happens right here in L&S. I intend to support and elevate research opportunities for faculty, graduate students, and undergraduates. The knowledge that we take for granted today is based on curiosity-driven scholarship and creativity that started decades ago. We need those big-picture thinkers to help us solve complex problems and expand the horizons of what we know.

By the time you read this, spring semester will be underway with a mix of remote learning and in-person courses, as well as comprehensive protocols for keeping everyone safe. This academic year will not be easy, but we will not lose heart. We will dig in—because that’s what Badgers do.

Thank you for all you do to support L&S. It means the world to us.

On, Wisconsin!

Eric M. Wilcots, Dean,

College of Letters & Science

Mary C. Jacoby Professor of Astronomy

A bee gathers pollen from the blossoms of a cherry tree in the Longenecker Horticultural Gardens at the UW–Madison Arboretum during spring.



**Department of
Integrative Biology**
UNIVERSITY OF WISCONSIN–MADISON

BioScience Now

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Design
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All Ways Forward: Adjusting during COVID-19 Pandemic



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1. Zoo 430 Comparative Anatomy Teaching Assistants Jacki Whisenant and Aaron Kufner use a document camera to capture the structure of a specimen.
2. For her Scientific Writing Limnology Seminar, Professor Emily Stanley and her students choose to meet at a different Madison park each week.
3. Faculty and staff discussing virtual teaching strategies via Zoom.
4. Faculty Associate Gale Oakes' blue hands on display as she prepares a dissecting video for Zoo 102 Animal Biology lab.
5. Student Diana Tapia shows off her zooplankton samples collected using an integrated tow of the water column in Lake Mendota for Zoo 316 Conservation of Aquatic Resources lab.
6. Home offices were set up to maintain remote academic advising and administrative services.
7. Teaching Assistant Adam Rexroade demonstrates how to use a Van Dorn, a common limnological tool for water collection at discrete depths.

Songbirds sing—like humans flock—for opioid reward



Lauren Riters,
professor of integrative biology

What do songbirds and humans have in common? We crave social interaction, and the chemical rewards that flood our brain when we get it.

In a study recently published in *Scientific Reports*, University of Wisconsin–Madison researchers led by Lauren Riters, professor of integrative biology, found that when songbirds sing during non-mating seasons, it’s because singing releases an opioid naturally produced in their brain—that’s right, a compound with the same biological makeup of the highly addictive painkillers.

People have naturally-produced—or endogenous—opioids in our brain released in certain situations, like social situations, that make us feel good. That’s why we like hanging out with friends, Riters says.

These naturally produced, feel-good compounds are also why many songbirds like to sing in large flocks, says Riters, after years of careful study.

“Animals—including birds, including humans—we produce our own endogenous opioids, and they reward behaviors naturally, like sexual behavior or feeding behavior,” Riters says. “Studies show that endogenous opioids also make play rewarding. Songbirds learn their songs, and must practice. When we listened to birds practicing in flocks, it almost sounded as if they were playing around with the notes. Darwin even suggested that birds in flocks may be singing for ‘their own amusement.’ So, we thought if singing is a playful behavior, it should involve opioids.”



ISTOCK/BAHADIR-VENCERI

About six years ago, a researcher in Riters’ lab found a way to reduce the response of the Mu opioid receptors in European Starlings, a type of songbird. This receptor, a protein on the surface of a nerve cell, controls responses to endogenous opioids, and they wanted to figure out if it might regulate what sounded like playful song in birds.

To put this to the test, they had to develop a method in starlings to measure reward associated with singing. Riters’ team used a method called CPP, a conditioned place preference test, where they trained the birds to associate a certain cage with singing. Later, when given a choice between two cages, birds showed a preference for the cage that they learned to associate with their own singing behavior. This shows that birds think of singing in flocks as a positive experience, Riters says.

“How do you ask a bird if it’s feeling good?” Riters says. “This method is really important to studies that we’ve been running. It comes from studies in psychology, and is commonly used to study reward associated with drug use. We adapted it to ask questions about reward associated with singing behavior.”

Once they could recognize what the birds looked like in the reward state, they administered tiny doses of fentanyl, a type of opioid that also binds to the Mu receptor, and found the drug made the birds “sing like crazy.” Then they reduced the response of the opioid receptors and found that starlings no longer showed a CPP for song. This shows, Riters says, that endogenous opioids regulate intrinsically-rewarding bird song.

Riters’ team ran tests over two years. They set up the experiment in an outdoor aviary where they’d observe the birds. Sometimes, Riters says, it



Endogenous opioid release underlies singing behavior in flocks of European starlings. Image by Dr. Jeremy Spool, former PhD student in Ritters Lab.



proved challenging, since so many other factors contributed to the birds singing or not. Ritters says her team had to make the environment as welcoming and relaxing as possible for the birds. For example, if a hawk landed near the aviary, the songbirds wouldn't sing because they'd get stressed out.

The results stood out amongst other research, because most studies of starling song involve the mating season and sexual selection, while the new study focused on song outside the breeding season in large flocks, and its connection with endogenous opioids.

"In terms of communication, not that many people are looking at the rewarding aspects, but definitely people are looking at dopamine, and how that regulates the motivation to communicate," Ritters says. "Dopamine is something that, in humans, motivates your behavior and directs it towards reward."

She says her results might suggest that, in starlings, endogenous opioid-prompted song is evolutionarily advantageous, because singing in flocks allows them an opportunity to practice their song to prepare for the mating season. It might not be the most beautiful to listen to—Ritters likened their chaotic song to freeform jazz—but that's okay. To them, it's just a warm-up for when they start looking for a mate.

"When the birds are singing they're also practicing motor patterns that they will later use in more serious adult contexts," Ritters says. "They're also learning how to produce a vocalization that gets a social response, and they also learn how to attract a female, for example."

Ritters thinks the release of opioids might also encourage sociable behavior for these songbirds. Humans have endogenous opioids that do just that, and Ritters' research may also have implications for human sociality and even mental health. When humans interact in a social context, like hanging out with friends, their brains also release endogenous opioids, just like the songbirds.

Ritters believes birds and mammals share the common ancestor in which these social rewards evolved, so there's a chance parts of their work can be generalized to humans.

In this case, the importance of sociality to both humans and songbirds cannot be understated. When humans don't receive enough social interaction, they might become depressed or experience other negative mental health conditions because their brains aren't producing those endogenous chemicals anymore. For example, people with social anxiety might not want to hang out in social groups, because

they might have negative interactions. By studying birds, Ritters says, maybe they can find ways to promote positive social interactions.

"We think that studying this kind of gregarious positive social play in songbirds is providing a unique way to come up with new ideas for treatments that might promote positive interactions in humans," Ritters says. "During this pandemic and social distancing, we are missing our flockmates, right? And without contact with our flockmates, without socializing in our groups, I think we're really deprived of opioid release."



Faculty & Staff Updates



Thoma Receives Excellence in Teaching Award

Faculty Associate Sharon Thoma is one of the recipients of the 2020 Alliant Energy James R. Underkofler Excellence in Teaching Award recognizing extraordinary teachers at UW System universities. Sharon's primary teaching focus is Zoology 101, a large introductory biology course with 700–900 students per semester. She encourages critical thinking and relates science to matters outside the classroom. Sharon works to make the classroom feel small by getting to know students, moving around the lecture hall to facilitate student interactions, and bringing natural items, such as plants and insects, for students to pass around during class. Some students have decided to major in the biological sciences because of Sharon's enthusiasm for the field, personalized approach, and caring mentorship.

2020 Bucky's Award for Outstanding Leadership

The Peer Learning Association (PLA) was awarded the 2020 Bucky's Award for Outstanding Leadership. This award recognizes a student organization that demonstrates excellent use of leadership skills to work toward a positive change on campus and in the surrounding community while consistently manifesting the core values of UW–Madison's Leadership Framework. The PLA coordinates free guided group study sessions that supplement specific undergraduate courses. Distinguished Faculty Associate Jean Heitz helped organize the PLA in 2000 and served as its advisor for twenty years before she passed away in June 2020. Jean was the recipient of the 2019 Bucky's Award for Best Advisor recognizing her contributions with the PLA.



Turner Recipient for Multiple 2020 Awards

Professor Monica Turner was the recipient of two prestigious 2020 awards: the Benjamin Franklin Medal in Earth and Environmental Science and the Eminent Ecologist Award from the Ecological Society of America (ESA). The Benjamin Franklin Medal cited Monica's contributions to the understanding of how changes in large-scale patterns associated with natural processes, such as forest fires, and human activities, such as urbanization, can affect not only ecological systems but also the social and economic well-being of society. The Eminent Ecologist Award honors a senior ecologist for an outstanding body of ecological work or sustained ecological contributions of extraordinary merit. Monica's work has crystallized landscape ecology as a discipline and has shaped the field into a quantitative discipline grounded in theory about processes that influence landscape dynamics. Through her conviction that human diversity enriches science and society, her commitment to the next generation of scientists, and her passion for continued scientific innovation, Monica has shaped the culture and discipline of ecology.



Shaping Our Future: New Faculty Hires

The Department of Integrative Biology is growing! We are pleased to announce the hiring of seven new faculty in 2020 and 2021. "We are excited to welcome an outstanding cohort of scholars who bring a diverse set of viewpoints and experiences to our department as we look to build upon our excellence," says Chair Jeff Hardin. Learn more about these innovative new faculty members in our next newsletter.

2020:

Han Wang, assistant professor of neurobiology

Olaf Jensen, associate professor of limnology

Jesse Weber, assistant professor of evolutionary biology

2021:

Katie Drerup, assistant professor of neurobiology

David Ehrlich, assistant professor of neurobiology

Grace Wilkinson, assistant professor of limnology

Aaron Ragsdale, assistant professor of evolutionary biology

Student Stories



Vershawn Hansen

After a video promoting UW–Madison’s 2019 Homecoming left out Black students, a collective of campus groups and individuals formed the Student Inclusion Coalition (SIC). **Vershawn Hansen** was among the co-organizers. “I hope SIC is ultimately able to inspire the next generation of student activists and hold the university accountable, ensuring that the administration will prioritize the safety and adequate support of its students of color,” he says. A Posse scholar from Chicago, Hansen earned a bachelor’s degree in neurobiology, with certificates in global health and environmental studies. During his time on campus, he served for a year as president of the Gamma Epsilon chapter of Alpha Phi Alpha Fraternity, the first intercollegiate Greek-letter fraternity established for Black men. A McNair scholar and undergraduate researcher in the Department of Medical Microbiology and Immunology, he aspires to be a physician.

Riley Book and Jamie Botsch

Lake Mývatn in Iceland is famous for its abundant midges, a type of fly. Mývatn literally translates to “Midge Lake” in Icelandic. However, the abundance of midges varies dramatically between years. In some years, the combined biomass of all the midges emerging from the lake (about the same size as Lake Mendota) is roughly the same as the biomass of ten humpback whales; other years it is equivalent to a household dog. Midges rely on consuming algae to reach such large abundances and reductions in algae likely contribute to population crashes. Zoology graduate students Riley Book and Jamie Botsch, members of Professor Tony Ives lab, aim to identify the causes and consequences of these midge population fluctuations. Riley is investigating the importance of one potential driver of algal communities, water nutrient availability, using surveys and experimental nutrient additions. Jamie’s research combines long-term monitoring and experiments to understand how midges interact with the algal community to shape their population dynamics as well as the dynamics of the algal community. Exploring the dramatic population dynamics of midges and algae in Lake Mývatn will hopefully shed light on how trophic interactions can contribute to complex population dynamics and variation in ecosystem processes worldwide.



Sterling Martin

Growing up in the homeland his *Diné* (Navajo) ancestors called *Dinétab* (The Navajo Nation), Sterling was always interested in becoming a *Diné na’alkaahí* (scientist). Eventually, that interest brought him to Professor Jeff Hardin’s lab. As a biophysics PhD candidate, Sterling is using *C. elegans* to study embryonic morphogenesis by examining genes that interact with adhesion molecules. Through this Sterling hopes to characterize genes that may be important for maintaining cell junctions while cells rearrange and experience tension during embryonic development. Outside of the lab, Sterling seeks to improve science literacy. On *Dinétab*, Sterling helped to found a journal club at *Diné* College where he is helping *Diné* students gain confidence to present and discuss primary research articles from scientific journals. Alongside this, Sterling participates in “Skype a Scientist,” a program which aims to connect students and the general public with scientists to have their questions answered while also giving a face to individuals that are conducting scientific research.

SUPPORT INTEGRATIVE BIOLOGY

The generosity of our donors allows the Department of Integrative Biology to help our students, faculty, and staff reach their full potential. Please consider making a gift to the Integrative Biology Department Fund (#132860093) through the UW Foundation.

[allwaysforward.org/giveto/
integrativebiology](https://allwaysforward.org/giveto/integrativebiology)

Check donations can be made out to the University of Wisconsin Foundation. Please include the fund number on the check.

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NEW ADDITIONS TO THE UWZM

Curator of Collections Laura Monahan greets new articulated cow and horse skeletons. These specimens are on loan from the UW School of Veterinary Medicine to the UW Zoological Museum to use in teaching and exhibition.