

HAPPY HOLIDAYS



Letter from the Chair

Dear Esteemed Alumni and Friends,

I am delighted to present the 2023 edition of the Department of Biological Sciences newsletter. Within these pages, you will discover the ongoing dedication of our faculty and staff to advancing our research capabilities, enriching educational opportunities for our students, and fostering meaningful outreach and engagement with our local communities.

This past year marked a transition in our administrative team with the departure of Ms. Cristine Thomas and Ms. Sandra Molvern, our valued Administrative Assistants. We extend our heartfelt gratitude to both Cristine and Sandra for their exceptional service to our department. Fortunately, we are pleased to welcome Ms. Kristie Sturmoski and Ms. Stephanie Stanton as our new Administrative Assistants. A warm welcome to Kristie and Stephanie!

Additionally, we bid farewell to Dr. Monica McCullough, a cherished colleague. We express our sincere appreciation to Dr. McCullough for her outstanding contributions to our students and wish her the best in all her future endeavors.



Holiday Gingerbread contest for faculty, staff and students

Our undergraduate and graduate programs in Biological Sciences continue to flourish, boasting one of the highest numbers of majors within the College of Arts and Sciences and the University. As you peruse the following pages, you will witness the accolades earned by our students both within and outside the university. Many have presented their research findings at local, national, and international scientific conferences, showcasing the strength of our academic community.

I trust you will find this update from your department insightful. I encourage you to share your thoughts on our successes and areas for improvement. Your feedback is invaluable as we strive to enhance the services provided to our students, alumni, and friends.



Lastly, I extend my deepest gratitude to our alumni, donors, and friends for your unwavering support. Your generosity significantly impacts our department's teaching and research mission, enabling expanded opportunities for student travel to research sites, attendance at scientific conferences, and the provision of fellowships and awards for exemplary scholarship and research. Thank you for your continued commitment!

Go Broncos!

Warm Regards!

John Spitsbergen, Chair Department of Biological Sciences

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Editor: Cindy Linn

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FACULTY FOCUS:

DAVID W. RUDGE

David (Dave) Rudge was hired by the Department of Science Studies in the fall of 1999. He has had a joint appointment since the summer of 2001. His primary appointment is in the Department of Biological Sciences; his secondary appointment is in the Mallinson Institute for Science Education (MISE). Dave completed his M.S. (Biological Sciences) and his Ph.D. (History & Philosophy of Science) at the University of Pittsburgh. He was promoted to full professor in 2018. Dave is a true renaissance man, having published peer reviewed journal articles as a biologist, a philosopher and as a historian. With regard to the latter, he is perhaps best known for his work on H.B.D. Kettlewell’s classic investigations of the phenomenon of industrial melanism in the peppered moth, *Biston betularia*, in the early 1950s.

Shortly after his appointment at WMU, Dave shifted the focus of his research to science education. He served as PI on a large (\$900K) NSF Science Technology, Engineering and Mathematics Teacher Preparation (STEMTP) Grant with co-PIs Bill Cobern, Robert Poel, Paul Vellom and Charles Pearson, entitled “Enlist, Equip and Empower (E³): An Integrated Program for Middle School Science Teachers.” It was a collaboration with Grand Valley State University (Dr. Julie Henderleiter, who was the original PI on the project) and involved substantial outreach to two area school districts (KPS, Vicksburg).

Dave and his MISE graduate students investigate how stories (narratives) from the history of science can promote the learning of and about science. Eric M. Howe, his first doctoral student, studied the impact of a six lesson long capstone unit based on the history of research on sickle-cell anemia affected preservice teachers’ perceptions of multiple issues associated with the nature of science. Dr. Howe’s research was particularly memorable in that Anthony Allison, a pioneer on sickle-cell research, was a member of his dissertation committee and gave a talk



as part of our department’s seminar series.

Dr. Janice M. Fulford, Dave’s second doctoral student, pursued her research with reference to the history of H.B.D. Kettlewell’s investigations of industrial melanism. Dr. Cody T. Williams, his third doctoral student, pursued his doctoral studies with reference to Gregor Mendel’s investigations of inheritance in pea plants and is currently Director of the Science and Mathematics Program Improvement (SAMPI) here at WMU. Dr. Dai “Pearl” Peng, another of Dave’s students, studied the impact of a story developed with reference to the discovery of the structure of DNA. Her project was particularly innovative in that it shared the story twice: first from the perspective of James Watson and Francis Crick in a manner that highlighted the role of creativity and imagination in science, and second from the perspective of Rosalind Franklin, which drew attention to cultural and gender issues.



Yet another recent student of Dave’s, Dr. Allison Witucki pursued her dissertation work this past year on the impact of a course based undergraduate research experience (CURE). This research was funded on our colleague Wendy Beane’s NSF Career Grant. Dr. Beane served as a member of the dissertation committee.

Two peer reviewed science education papers have already been published as a result of this collaboration!

Dave regularly teaches *BIOS 1120 Principles of Biology*, a large lecture course taken by health science majors and others wanting to satisfy a general education requirement as part of WMU’s Essential Studies program. He first offered the course using a “flipped classroom” approach: students were asked to watch a lecture, read a chapter, take a quiz and do homework all outside of class, with in-person class meetings used for questions and group work. As a result of the covid pandemic, he revised the course for online asynchronous delivery. Over the course of his career Dave has received multiple teaching awards, including the department’s *Dr. Darrell R. Latva Biological Sciences Teaching Excellence Award* (2017) and the *College of Arts and Sciences Faculty Teaching Award* (2018). In 2022 he was named *College Science Teacher of the Year* by the Michigan Science Teacher Association. This past year, he was named a recipient of WMU’s *Faculty Distinguished Teaching Award*!

Dave serves (with Dr. Brian Tripp) as faculty senator for the department. He also regularly hosts the visits of science education researchers as part of the department’s seminar series. In his spare time Dave is an avid genealogist and family historian.



Faculty focus:

DONALD KANE: ASSOCIATE PROFESSOR

Genetics Class Gets Personal

About seven years ago, on Valentine's Day, Rachel and I bought some 23andMe test kits, really just for fun. 23andMe is one of the personal genomics companies that provides consumer genetic testing. As soon as you get your results back, you immediately have about 3000 relatives, people closely and distantly related to you via your great, great great, great great great, and, yes, great great great great grandparents, most of whom you have probably never heard of. Those are 5th cousins, by the way. Many of the new family names I was introduced to meant nothing, but every once and while you see one that brought back memories of my grand parents talking in the corner in serious tones, discussing Uncle Rein (Hylkema) or Aunt Harinka (Monkelbaan nee DeLang).

23andMe colors chromosomes depending on from where in the world those chromosomes originated. My green Polish chromosomes from my Dad paired with the blue Dutch and light blue Irish chromosomes from my Mom. And to add a bit of scandal, there was a fair bit of Danish in my Dutch and Polish lines, probably introduced in the 17th century by various sailors using some sort of weird DNA injection method.

The real and remarkable power about all of these new relatives and places is that they are REAL relatives and places, not stories handed down through the generations. You are connected by your DNA to all of these people, thousands of people, and it is not hearsay. And, in the interest of full disclosure, it turns out my 100% Irish grandma was one quarter Swiss. Sorry, Grandma!

It is no wonder that law enforcement started to take advantage of these DNA links to connect old murder cases to their killers. Because of these connections, things that were once impossible are now very possible. In 2018, the Golden State Killer was identified using DNA testing combined with genealogy; many of his DNA samples were from the 1980s. Now these methods are routinely used to identify any criminal that leaves any sort of DNA evidence.

Recently, a version of these methods led to solving a the mysterious origin of one of my relatives, my Aunt Woodie. In 1927, a two-week old baby girl was abandoned in the back seat of a car on Woodside Ave, in Buffalo, NY. She became Mary Jane Wood. That little foundling went through a foster homes as a kid and eventually ended up in Nursing School during WWII. There she met my mother, and then my mother’s dashing Army Air Force brother and now she is my Aunt Woodie. At 96, she’s still with us. A few years ago, her daughter and I managed to convince her to send a DNA sample off to 23andMe. Right away we find that Aunt Woodie is half Italian. Wow. Then, in few months we found a first cousin (once removed) of hers in Batavia NY, about 30 miles east of Buffalo. What with no Italian in him, he was from the other side of the family. He told us who his grand parents were and from that we identified four families of his great grandparents in the 1920 and 1930 censuses, all farm families near Batavia. In one of these four families was one of Aunt Woodie’s parents, we didn’t know which one.

Then, through a third cousin (thrice removed!), we were able to use her maternal mitochondrial lineage to eliminate not just three of the families, but all the males in the remaining family. One of the remaining three young girls could be Aunt W’s mom. Finally, an obituary led us to Aunt Woodie’s mother and her 100% Italian father; his name matched many of her present day Italian relatives. In the summer of 2019, Aunt Woodie went to Batavia and visited her parent’s graves and present day relatives, for an introspective look at what might have been.

The remarkable thing about this story is that it was made possible by having that singular DNA connection between Aunt W and her cousin from Batavia. Because hers was not a formal adoption, no written records existed that could have ever made that link. We were thinking that how personal genomics tests work and how the information they generate is used would be a nice addition to our Genetics course, and so one of our Teaching Assistants, Tanya Petrachkova, decided to introduce personal genomics into our class. Early in the semester she suggested that students do 23andMe; usually the results will be back in about six weeks, and the semester will not have ended.

Then, in the last recitation of the semester, she showed students how to download their raw genetic data from the 23andMe website; it is a gigabyte sized spread sheet containing all the tested loci and the data for each pair of loci (one from mom and one from dad). For the students that elected not to have their genomes done, Tanya mysteriously produced data on the remains of four humans from a cave in France. She then had the students figure out appearance, traits and wellness by assessing the linkage to certain loci and figuring out what they meant. The lists are long, but, for example, eye color and hair curliness would be in “appearance”; bitter taste and muscle composition would in “traits”; and early onset obesity and thrombophilia would be in “wellness”. (Strangely, the human cave remains looked allot like Tanya, me, and several of the students in the lab.)

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For her efforts, Tanya won a University Wide Teaching Award in 2019. Her recitation is still one of the favorites in our Genetics course. Will our students become the genetic counselors and genealogists in the future? Let’s wait and see.



Fig Legend: Left to right, Tanya’s father, Don Kane, Rachel Warga, Tanya’s mother, and Tanya Petrachkova. Her parents were on a visit from Ukraine to Kalamazoo in 2019. Tanya returned to Kiev in 2020, but left after the war started and is now in Montreal, Canada as a postdoctoral fellow, learning French and doing new sciencey things.

FACULTY FOCUS:

JOHN
SPITSBERGEN:
CHAIR

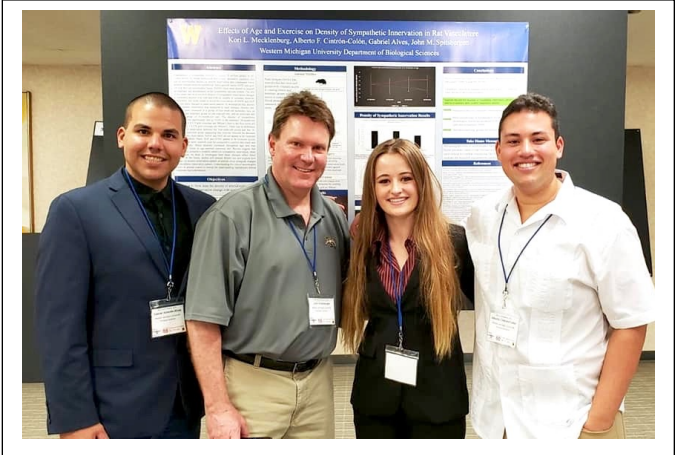
John M. Spitsbergen is a professor of biological sciences at Western Michigan University who has dedicated his 27 years at WMU to understanding the impact of sedentary aging and disease on the peripheral nervous system and whether exercise can be used as a counter measure to slow or reverse those changes. After receiving his PhD in pharmacology/toxicology and neuroscience from Michigan State University in 1991 and postdoctoral training from the University of Virginia, Dr. Spitsbergen joined the WMU faculty in 1996 where he established a highly productive neuroscience research laboratory.

Dr. Spitsbergen’s early work elucidated mechanisms by which innervation of vascular tissues is altered with development of high blood pressure. He later expanded his efforts to study somatic motor innervation, and age-related declines that disrupt connections between the spinal cord and muscles. His research has revealed a steady decline in motor neuron health with sedentary aging and methods to slow muscle deterioration in the elderly.

Over the past decade, Dr. Spitsbergen has provided key insights into the neuromuscular causes of sarcopenia and frailty. His recent studies suggest exercise and nerve growth factors as potential methods for preserving mobility and independence in aging populations.



Through his meticulous basic science research, Dr. Spitsbergen has significantly advanced understanding of motor control from the spinal cord to the muscles. His work has been funded by grants from the National Science Foundation, National Institutes of Health, American Heart Association, and other sources for over 25 years. He has mentored over 100 undergraduate researchers, many from groups underrepresented in the sciences, and chaired the thesis committees of 40 graduate students. Dr. Spitsbergen exemplifies the profound scientific impact of persistent curiosity, rigor, and mentorship over an entire career.



Biological Sciences Distinguished Alumni Achievement Award

SCOTT HODGES, DDS, MS

Dr. Hodges is an endodontist (a dental specialist that focuses on saving teeth) and is this year’s Department of Biological Science’s Distinguished Alumni Achievement Award recipient for 2023. In October, Dr. Hodges delivered an enthusiastic and exciting discussion of his path through life that has led him to the senior endodontist that he is today in Battle Creek Michigan. Dr. Hodges received his BS from WMU in 1982 where he was an award recipient of the Lee Honors College. It was during his time at WMU that he decided his life dream was to become a dentist. However, Hodges’ failed the first attempt at the Dental Admissions Test. As he considered how to rebound from the failed exam, he began to refine his long-stated boast that he wanted to be a dentist to get rich. It was during this time that he met his future wife, Mary, who had a strong religious faith and belief in Scott that won him over. He spent the entire summer between his junior and senior years studying for the DAT re-take and was rewarded with remarkable scores after making a pact with GOD: “If I get into Dental School, I’ll commit to helping people.” It became his purpose for becoming a dentist. Dr. Hodges received his degree in dentistry from the University of Michigan School of Dentistry, worked for the next two years in Arizona with the US Public Health Service and then returned to the University of Michigan to earn a MS degree in endodontics. “Dentistry is important! The first thing you notice about someone is their smile, especially if teeth are missing.”



Part of being a dentist on international mission trips is fixing your own equipment, as Hodges demonstrates here.



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The title of Dr. Hodges talk at WMU was “Ask Seek Find.” He discussed how people that asked questions affected the path of his life. “Can I sit by you?” asked his future wife that has led to a very adventurous life. He emphasized that we need to always ask questions and never take education for granted as it has the potential to open incredible opportunities. We are “crazy blessed” in the United States. Dr. Hodges should know, as he has taken his dentistry skills around the world several times a year for the last 20 years to provide oral healthcare to those who wouldn’t otherwise receive it.

Some of the places he has provided free dental care to includes the Dominican Republic, Guyana, Costa Rica, Jordan, South America, the West Bank, Lebanon and rural Alaska. His teams have treated 8,253 patients, provided 7,000 cleanings, completed more than 6,000 restorations and performed many other procedures such as extractions, root canals, sealants and radiographs.

During his talk, Dr. Hodges emphasized that we should try to seek out the betterment of others, to go somewhere, to put yourself in situations where you meet people and always seek out the good in others. “Seek and you shall find.” Seeking out others in non-traditional settings has given Dr. Hodges great adventures and it changes inherent biases that people have of those from different places.

Finally, Dr. Hodges spoke about finding a life where he can live life large. He has gained so many rewards by helping those around the world with his dental care and with the help of his many volunteers that include dental students and technicians. A better smile gets many people through anxious experiences to make just about everything better.

We really enjoyed Dr. Hodges motivational seminar in the Department of Biological Sciences and are so happy that he met his future wife in Wood Hall many years ago when she asked the simple question: “Can I sit by you?”



2023 BACH LECTURER: DR. GREG M. DELGOFFE

Established in the memory of Michael K. Bach, Ph.D.

Dr. Greg Delgoffe honored us as a Michael K. Bach Lecturer in Biological Sciences at Western Michigan University on November 10, 2023. Dr. Delgoffe is an associate professor at the University of Pittsburgh School of Medicine and is the Director of the Tumor Microenvironment Center. His exciting seminar focused on his studies about the immune system’s T cell fate and function. In his seminar entitled:



“Overcoming metabolic barriers to effective cancer immunotherapy”

Dr. Delgoffe discussed how your immune system has the power to protect you against foreign and domestic invaders. However, what happens if these mechanisms go wrong? Dr. Greg Delgoffe and his team at the University of Pittsburg are working with a B16 melanoma model to improve T cell immunotherapy. In 2004, melanoma had a 0% survival rate, now with the help of their research, this has drastically improved to 10-39%

By looking at pathways involving mitochondrial biogenesis, they were able to upregulate PGC1alpha, a biogenesis marker usually repressed in tumor cells, and significantly decreased tumor function with T-cell immunotherapy. This led to the conclusion that mitochondria are not only powerhouses of the cell, but metabolic dysfunction within mitochondria can play a role in resistance to T-cell immunotherapies. The future using immunotherapy looks very promising. We thank Dr. Delgoffe for his visit and for the insight into his exciting transformative research.



Article written by Samantha Luzadre, a MS graduate student in the Department of Biological Sciences.

Dr. Delgoffe with Dr. Pam Hoppe

BIOS ALUMNI PRESTIGIOUS AWARD:

Dr. William Bowerman won a Lowell Thomas Award from The Explorers Club in Oslo Norway in 2023. Named for the broadcast journalist and explorer Lowell Thomas, this annual award is given thematically to a group of outstanding explorers to recognize excellence in domains or fields of exploration. Dr. Bowerman is a graduate from WMU’s Biological Science program and was a past recipient of our Alumni Achievement Award. Our alumni are truly influencing the world in very positive ways!

Dr. Bowerman with his son at the Kon-Tiki Museum in Oslo



HADLEY LECTURER:

S. Carolina Córdova, PhD



The title of her talk was: “From roots to riches: Building carbon wealth in agroecosystems.” Dr. Córdova discussed how the best soil has the highest amount of organic material (i.e. carbon). Soil gets into soil from plants or from additive such as manure and fertilizer. In her seminar, she discussed different ways to build healthy soils. One way involved a nature-based solution where the soil is kept covered, physical disturbances are reduced, livestock is integrated on the soil and prairie strips are created. The second way to build healthy soils is technology based that includes precise nutrient management, improved irrigation and use of artificially intelligent designed tools. However, to make significant change in organic carbon levels in soil, it typically takes a minimum of 3-5 years.

Dr. Córdova honored us with a seminar in October as our prestigious Hadley Lecturer. Dr. Córdova is an assistant professor and statewide soil health specialist at the University of Nebraska in Lincoln, NE in the Department of Agronomy and Horticulture. Her research aims to conceptually and experimentally unite soil health and the sustainable intensification of agriculture while studying mechanisms to increase carbon sequestration and reduce farmer reliance on synthetic fertilizers. She strives to integrate agroecological principles, biogeochemistry, and modeling in my research and teaching to understand soil-plant-atmosphere interactions in important agricultural settings across temporal and spatial scales. Settings ranging from low-input and high diversity (e.g., forest, perennial grasses) to contrasting field cropping systems (e.g., cash crops).



Dr. Cordova with sponsor Kathryn Docherty

Dr. Córdova is also affiliated with ongoing research at the Kellogg Biological Station here in Michigan where the goal is to build and maintain healthy soil and to analyze cropping systems and soil carbon accrual. She has been involved in examining carbon levels in ten field plots that have been analyzed for over 25 years. Three categories of field plots have been created to study over time that include: annual rows, managed perennial systems, and successional systems. The organic carbon levels have been measured regularly over a long period of time and most differences have been found in the top layer of soil. In her talk, she discussed how important different types of root systems affect carbon stabilization and measured

root to shoot ratios over time as well as the accumulation rate of root growth over years.

Dr. Córdova ended her seminar emphasizing the potential of plants for biofuel use. We thank Dr. Córdova for her visit and for the insight into her exciting research.



Faculty Activities:

The majority of faculty members in our department have active funding for their research programs. Included below is a list of external grants, publications in scientific journals, and presentations by faculty and students at scientific conferences. As you can see our faculty and students are active in publishing in top scientific journals and in giving presentations at major national and international scientific conferences. We are convinced that a strong and vibrant research environment enhances our student’s educational experience and adds value to a degree from our department.

Grant Funding 2023

Todd Barkman

Title: From a jack-of-all-trades arise masters of few: uncovering the evolutionary patterns and processes driving multigene family functional diversification.
Source: National Science Foundation, Division of Molecular and Cellular Biosciences Core Programs.

Todd Barkman (Co-PI, Andre Venter PI)

Title: Mechanisms and Applications of Protein Analysis by Desorption Electrospray Ionization-Mass Spectrometry (DESI-MS).
Source: National Science Foundation

Wendy Beane (PI)

Title: Reactive Oxygen Species Signaling in Wound Healing vs Tissue Repair.
Source: National Institutes of Health (NIGMS)

Wendy Beane (PI)

Title: Quantum Biology: Magnetic Field Effects on Stem Cells.
Source: WMU Faculty Research and Creativity Activities Award (FRACAA) 2023-2024.

Wendy Beane (PI)

Title: RCN: Instrumentation for Quantum Biology (which aims to set up a formal community of interdisciplinary and multi-country researchers in the emerging field of Quantum Biology).
Source: National Science Foundation

Wendy Beane

Title: Promoting Advances in Quantum Biology Through Interdisciplinary Exchange
Source: WMU Presidential Innovation Professorship

Devin Bloom

Title: Collaborative Research: Investigating the factors shaping marine-derived freshwater fish radiations in tropical rivers of Australia and New Guinea.
Source: National Science Foundation.

Devin Bloom

Title: Systematics and Evolution of Migration in Clupeiformes (Herring, Sardines, Shads, Anchovies and Their Allies).
Source: National Science Foundation, Division of Environmental Biology

Kathryn Docherty (co-PI, Christine Sprunger, PI)

Title: Exploring the efficacy of prairie strips as a soil health promoting practice.
Source: United States Department of Agriculture – Sustainable Agriculture Research and Education

Kathryn Docherty

Title: Mid-Career Advancement Grant: Incorporating carbon use efficiency into strategies for ecosystem restoration and REU Supplement
Source: National Science Foundation

Kathryn Docherty (co-PI, Ellen Badger Hanson, PI)

Title: Exploring the Effects of Prairie Restoration Management on Soil Microbial Carbon Storage
Source: United States Department of Agriculture, Sustainable Agriculture Research and Education Graduate Fellowship Program

Jackie Eng (PI, Michelle Hrivnyak, co-PI)

Title: Biological Implications of Gender Roles in Mobile Pastoralist Societies.
Source: National Science Foundation

Sharon Gill

Title: Referential alarm calling as a window into the mechanisms and evolution of a complex cognitive phenotype.
Source: National Science Foundation

Dave Karowe

Title: Research Experience for Undergraduates (University of Michigan Biological Station).
Source: National Science Foundation

Ben Koestler

Title: Identifying the formate-sensory mechanism in Shigella flexneri.
Source: National Institutes of Health

Ben Koestler

Title: How bacterial communication contributes to disease.
Source: WMU Faculty Research and Creativity Activities Award (FRACAA) 2023-2024.

Ben Koestler

Title: Identifying the Substrate of BdcA
Source: WMU CAS Interdisciplinary Research Initiative Grant, 2023-2024

Cindy Linn

Title: Recovery of functional visual pathways in the adult mammalian brain using an alpha7 nAChR agonist after blast exposure.
Source: Department of Defense

Yan Lu (Silvia Rossbach, co-PI)

Title: BIORETS: Research Experiences for Teachers in the Biology of Plants, Animals, Microorganisms, and their Environments.
Source: National Science Foundation

Silvia Rossbach

Title: Characterization of Microorganisms Involved in Hydrocarbon Degradation at a Crude Oil Spill Site.
Source: Grant from Enbridge Energy

Dave Rudge, Co-PI (PI Heather Petcovic)

Title: MI STAR
Source: Michigan Technological University

Tiffany Schriever

Title: Effects of riparian restoration and dam removal on plant and animal communities along the Kalamazoo River
Source: Great Lakes Restoration Initiative (GLRI) coordinated through the EPA Great Lakes National Program Office (GLNPO) under the US Department of the Interior.

Tiffany Schriever

Title: The impact of isolation on biodiversity and food web structure in interdunal wetland environments of Lake Michigan: a case study of Beaver Island archipelago and North Manitou Island.
Source: CAS Interdisciplinary Research Initiative Grant

Tiffany Schriever

Title: Ecology, hydrology and biogeography of interdunal wetlands.
Source: CAS Discovery and Dissemination Grant

Maarten Vonhof

Title: Field Application of Chitosan to Halt the Progression of White-Nose Syndrome in Bats.
Source: National Fish and Wildlife Foundation

2023 Published Papers

(**Bold** = Biological Sciences Faculty, underlined = Biological Sciences Graduate Student, *italicized* = Biological Sciences Undergraduate Student)

Nicole M. Dubs, Breck R. Davis, Victor de Brito, Kate C. C. Samantha J. Hack, **Wendy S. Beane**, and Kelly Ai-Sun Tseng. (2023) Biophysics at the edge of life and death: Radical control of apoptotic mechanisms. *Frontiers in Cell Death Vol 2*: DOI=10.3389/fceld.2023.1147605.

Kinsey LJ, Van Huizen AV, and **Beane WS** (2023), Weak magnetic fields modulate superoxide to control planarian regeneration. *Frontiers in Physics* 10:1086809. <https://doi.org/10.3389/fphy.2022.1086809>

Wang, M., Sun, X., Cao, B., Chiariello, N.R., **Docherty, K.M.**, Field, C.B., Gao, Q., Gutknecht, J.L.M., Guo, X., He, G., Hungate, B.A., Lei, J., Niboyet, A., Le Roux, X., Shi, Z., Shu, W., Yuan, M., Zhou, J., Yang, Y. (2023) Long-term elevated precipitation induces grassland soil carbon loss via microbe-plant–soil interplay. *Global Change Biology*. 29(18): 5429-5444. <https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.16811>

Badger Hanson, E., and **Docherty, K.M.** (2023) Mini-review: Current and Future Perspectives on Microbially-Focused Restoration Strategies in Tallgrass Prairies. In: Invited Review for the Special Issue “The Role of Microbial Genomics in Restoration Ecology”. *Microbial Ecology*. 85(3): 1087-1097. <https://doi.org/10.1007/s00248-022-02150-1>

Ma, X., Wang, T., Shi, Z., Chiariello, N.R., **Docherty, K.M.**, Field, C.B., Gutknecht, J.L.M., Gao, Q., Gu, Y., Guo, X., Hungate, B.A., Lei, J., Niboyet A., Le Roux, X., Yuan, M., Yuan, T., Zhou, J., Yang, Y. (2023) Nitrogen deposition affects microbial functional capacities, including carbon utilization. *Microbiome*. 10, Article number: 112 <https://doi.org/10.1186/s40168-022-01349-1>

Paige V. Blinkiewicz, Makayla R. Long, Zachary A. Stoner, Elizabeth M. Ketchum, Sydney N. Sheltz-Kempf and **Jeremy S. Duncan**. (2023) Gata3 is required in late proneurosensory development for proper sensory cell formation and organization. *Scientific Reports* 13, 12573 <https://doi.org/10.1038/s41598-023-39707-0>

Monaco, M.L.; Idris, O.A.; **Essani, K.** Triple-Negative Breast Cancer: Basic Biology and Immuno-Oncolytic Viruses. *Cancers* 2023, 15, 2393. <https://doi.org/10.3390/cancers15082393>

Monaco, M.L.; Idris, O.A.; Filpi, G.A.; **Kohler, S.L.**; Haller, S.D.; Burr, J.E.; **Eversole, R.**; **Essani, K.** Multiple Administration Routes, Including Intramuscular Injection, of Oncolytic Tanapoxvirus Variants Significantly Regress Human Melanoma Xenografts in BALB/c Nude Mice Reconstituted with Splenocytes from Normal BALB/c Donors. *Genes* 2023, 14, 1533. <https://doi.org/10.3390/genes14081533>

Lawson SL, Enos JK, **Gill SA**, Hauber ME. 2023. Red-winged blackbirds nesting nearer to yellow warbler and conspecific nests experience less brood parasitism. *Ecology and Evolution*.

Sblendorio JM, **Gill, SA**. 2023. Migrating male warblers (Parulidae) sing during spring stopovers. *Wilson Journal of Ornithology*. (in press)

Lawson SL, Fernandez-Duque F, Enos JK, Kleindorfer S, Ward MP, **Gill SA**, Hauber ME. 2023. Lack of Anti-parasitic Referential Alarm Calls in the Galapagos Yellow Warbler Population Allopatric from Obligate Brood Parasites. *Behavioral Ecology and Sociobiology* (in press)

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Kostiuk, B., Becker, M.E., Churaman, C.N., Black, J.J., Payne, S.M., Pukatzki, S., and **Koestler, B.J.** "Vibrio cholerae Alkalizes Its Environment via Citrate Metabolism to Inhibit Enteric Growth In Vitro." *Microbiology Spectrum* (2023). <https://journals.asm.org/doi/10.1128/spectrum.04917-22>

Spitsbergen JB, Webster SE, **Linn CL**. 2023. Functional changes in the adult mouse retina using an alpha7 nAChR agonist after blast exposure. *Neuroscience*, 512: 1-15.

Gao H, McCormick A, Roston RL, **Lu Y** (2023) Editorial: Structure and Function of Chloroplasts, Volume III. *Frontiers in Plant Science*. 14: 1145680. <https://doi.org/10.3389/fpls.2023.1145680>

Witucki A**, **Rudge DW**, Pleasants B, Dai P, **Beane WS**. (2023) Redesigning a course based undergraduate research experience for online delivery. *Biochem Mol Biol Educ*.

Witucki, A.M., **Beane, W.**, Pleasants, B., Peng, D. & **Rudge, D.W.** (2023) An Explicit and Reflective Approach to Teaching Nature of Science in a Course-based Undergraduate Research Experience. *Science and Education*. DOI: 10.1007/s11191-023-00441-8.

Witucki, A.M., **Rudge, D.W.**, Pleasants, B., Peng, D. & **Beane, W.** (2023) Redesigning a Course Based Undergraduate Research Experience for Online Delivery. *Biochemistry and Molecular Biology Education* DOI: 10.1002/bmb.21780.

Estella A. Atekwana, Eliot A. Atekwana, Leonard O. Ohenhen, and **Silvia Rossbach**. Biogeophysics for Optimized Characterization of Petroleum-Contaminated Sites, in: J. García-Rincón et al. (eds.), *Advances in the Characterisation and Remediation of Sites Contaminated with Petroleum Hydrocarbons, Environmental Contamination Remediation and Management*. https://doi.org/10.1007/978-3-031-34447-3_9

Austin, A.R. and **Schriever, T.A.** 2023. Created wetlands support similar communities of low conservation value as established wetlands in Michigan. *Wetland Ecology and Management* 31(4):1-17. <https://doi.org/10.1007/s11273-023-09931-6>

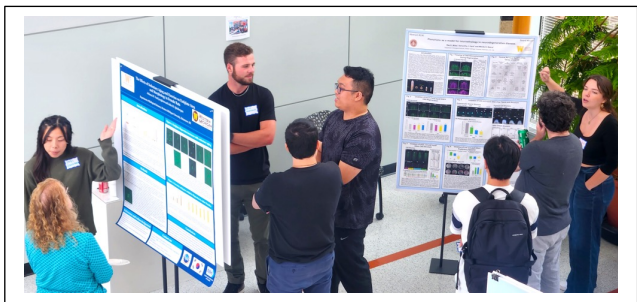
Stewart, N. and T.A. **Schriever**. 2023. Local environmental conditions drive species replacement in Great Lakes interdunal wetland macroinvertebrate communities. *Freshwater Biology* 68:46-60. **Journal cover photo DOI: [10.1111/fw.14008](https://doi.org/10.1111/fw.14008)**

Nienhaus, H., SW Fitzpatrick, **D.D. Bloom** and T.A. **Schriever**. 2023. Dispersal ability and biogeographic factors influence gene flow of three aquatic insects in Great Lakes interdunal wetlands. *Freshwater Science* 42(1):88-103. **Journal cover photo <https://doi.org/10.1086/723893>**

Stareczek, S. Loureiro, M. D'Anatro, A., **Thompson, A. W.**, and Ortí, G. River drainage rearrangements and the phylogeographic pattern of the annual fish *Austrolebias arachan* (Cyprinodontiformes; Rivulidae). In Press. *Zoologica Scripta*.

Mathavarajah, S., **Thompson, A. W.**, Stoye, M. R., T., Quinn, T. A., Roy, S., Braasch, I., and Dellaire, G. Suppressors of cGAS-STING are downregulated during fin-limb regeneration and aging in aquatic vertebrates. In Press. *Journal of Experimental Zoology, Part , Molecular and Developmental Evolution*

Berbel-Filho, W. M., Pirro, S., **Thompson, A. W.**, Lima, S. M., Consuegra, S., and Betancur, R. (2023). The Complete Genome Sequences of three species from the killifish genus *Kryptolebias* (Rivulidae, Cyprinodontiformes). *Biodiversity Genomes <https://doi.org/10.56179/001c.77448>*.



Research mixer at WMU

Presentations

(**Bold** = **Biological Sciences Faculty**, underlined = **Biological Sciences Graduate Student**, *italicized* = *Biological Sciences Undergraduate Student*)

Hack SJ and **Beane WS.** (2023) Probing the relationship between bioelectric signaling and reactive oxygen species (ROS) accumulation during adult tissue repair. Cell Bio 2023: the Joint Meeting of the American Society for Cell Biology (ASCB) and European Molecular Biology Organization (EMBO). Boston, MA. *Selected Talk for S. Hack.

Hack SJ, Vučković J, Qureshi E, and **Beane WS.** (2023) Probing the relationship between bioelectric signaling and reactive oxygen species (ROS) accumulation during adult tissue repair. Cell Bio 2023: the Joint Meeting of the American Society for Cell Biology (ASCB) and European Molecular Biology Organization (EMBO). Boston, MA. *Poster.

Hack SJ and **Beane WS.** (2023) Planar cell polarity (PCP) signaling controls organ scaling during *in vivo* adult tissue regeneration. Cell Bio 2023: the Joint Meeting of the American Society for Cell Biology (ASCB) and European Molecular Biology Organization (EMBO). Boston, MA.

Hack SJ and **Beane WS.** (2023) The Role of TRPA1 in planarian photoreception. International Society for Eye Research XXV Biennial Meeting. Gold Coast, Queensland Australia. *Invited Talk for S. Hack.

Hack SJ, Van Huizen AV, Kinsey LJ, and **Beane WS.** (2023) ROS separately modulates wound healing and regeneration through a threshold mechanism. 41st Annual Kalamazoo Community Medical and Health Sciences Research Day. WMU Stryker School of Medicine, Kalamazoo, MI. *Selected Talk for S. Hack. *Won Second Place, Best Graduate Oral Presentation.

Hack SJ, Van Huizen AV, Kinsey LJ, **Beane WS.** (2023) *In vivo* modulation of ROS thresholds controls separate gene expression programs during wound healing vs regeneration. Society for Developmental Biology (SDB) 82nd Annual Meeting, Chicago, USA.

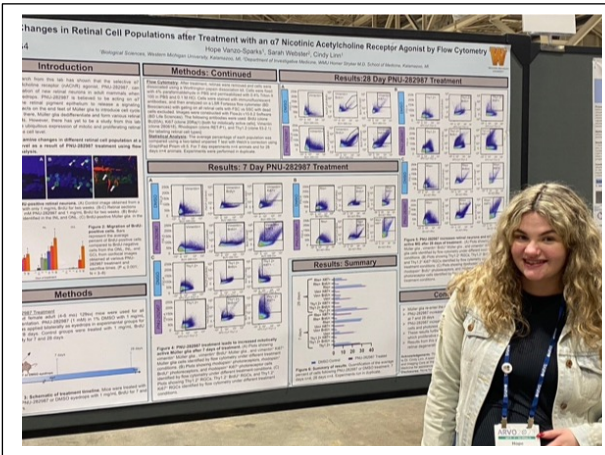
Miller RD, Hack SJ, **Beane WS.** (2023) Planarians as a model for neuroethology in neurodegenerative disease. Society for Developmental Biology (SDB) 82nd Annual Meeting, Chicago, USA.

Kinsey LJ, McClenny ZW, Qureshi S, and **Beane WS.** (2023) Reactive oxygen species (ROS) levels modulate blastema growth. 5th North American Planarian Meeting (NAPM), Portland, OR.

Acharya P, Hack SJ, *Nolff CC*, **Beane WS.** (2023) Apoptosis regulates *in vivo* tissue regeneration and neurogenesis. 41st Annual Kalamazoo Community Medical and Health Sciences Research Day. WMU Stryker School of Medicine, Kalamazoo, MI.

Kinsey LJ, McClenny ZW, and **Beane WS.** (2023) Weak magnetic fields as a tool to control tissue growth via reactive oxygen species. 41st Annual Kalamazoo Community Medical and Health Sciences Research Day. WMU Stryker School of Medicine, Kalamazoo, MI. *Selected Talk for L. Kinsey. *Won First Place, Best Graduate Oral Presentation.

McClenny ZW, Qureshi S, Kinsey LJ, and **Beane WS.** (2023) Levels of Reactive Oxygen Species Regulate the Degree of Tissue Regrowth at the Wound Site. 41st Annual Kalamazoo Community Medical and Health Sciences Research Day. WMU Stryker School of Medicine, Kalamazoo, MI.



Hope Vanzo-Sparks (PhD graduate student) presenting her research at ARVO in New Orleans

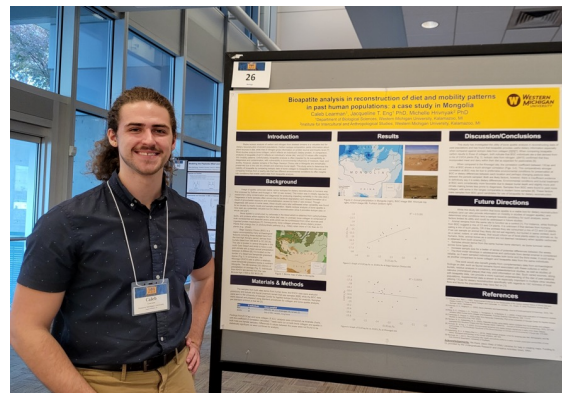
Hack SJ and **Beane WS.** (2023) Cell Signaling Controls the Termination of Adult Tissue Growth. WMU Research and Creative Activities Poster Presentation Day, Kalamazoo, MI. *Won Best Poster Award.

Hack SJ and **Beane WS.** (2023) Planar Cell Polarity Signaling is Required to Terminate Regenerative Growth in the Planaria *Schmidtea mediterranea*. International Society for Regenerative Biology (ISRB) Webinar Series. *Selected Talk for S. Hack.

Hack SJ and **Beane WS.** (2023) Planar cell polarity signaling is required to terminate new tissue growth *In Vivo*. National Graduate Student Symposium (NGSS), St. Jude Children's Research Hospital. Memphis, TN.

Vučković J, Kinsey LJ, and **Beane WS.** (2023) Weak magnetic fields alter ROS-mediated signaling during regeneration. Quantum Biology Gordon Research Conference: Emerging Methodologies to Investigate Quantum Effects in Biology. Galveston, TX.

Kinsey LJ, McClenny ZW, and **Beane WS.** (2023) Weak magnetic Fields control stem cell-mediated tissue growth by altering superoxide levels. Quantum Biology Gordon Research Conference: Emerging Methodologies to Investigate Quantum Effects in Biology. Galveston, TX. *Selected Talk for L. Kinsey.



Caleb Learman presenting his research at the annual West Michigan Regional Undergraduate Science (WMRUGS) Research Conference, held at the Van Andel Institute in Grand Rapids

Beane WS. (2023) Investigating Stem Cells as Quantum Sensors. NIH National Center for Advancing Translational Sciences (NCATS) Quantum Information Sciences (QIS) and Quantum Sensing in Biology (QSB) Scientific Interest Group Seminar. *Talk

Beane WS. (2023) Manipulating Tissue Repair with Weak Magnetic Fields. The Guy Foundation 2023 Autumn Series: Quantum Biology and Space Health Programme. Virtual Series. *Talk

Beane WS. (2023) Introduction to Weak Magnetic Fields and Stem Cell Growth. Quantum Biology and Cancer Meeting: Quantum Biology Primer session. Convened by Cancer Research UK (CRUK) and The Guy Foundation. London, UK. Hybrid Meeting; *Virtual talk.

Beane WS. (2023) Development During Adulthood: Using Planarians to Understand Tissue Repair. Central Connecticut State University, Advances in Developmental Biology (BMS 490/540) course, Fall. *Talk

Beane WS. (2023) Evidence for Quantum Spin Modulation of Stem Cells *In Vivo*. QuEBS 2023: Quantum Effects in Biological Systems Workshops. University of Surrey, UK. Hybrid Meeting; *Virtual talk.

Beane WS. (2023) Planaria, Regeneration, and Environmental Influences. Lynn University Biological Sciences Dept. Seminar Series. *Talk

Beane WS. (2023) Reactive Oxygen Species (ROS) and Stem Cells. The Guy Foundation Symposium: Advancing Terrestrial Health: Lessons from Space. Virtual Symposium. *Talk

Ali, M.M., *A. Shebrain*, and **C.A. Byrd-Jacobs.** 2023. Phagocytic response patterns to chemical ablation of the olfactory epithelium in adult zebrafish. Kalamazoo Community Medical and Health Sciences Research Day.

Ebendick, B.E., S. Var, and C.A. Byrd-Jacobs. 2023. Neuroplasticity in the zebrafish olfactory bulb after immune modulation. Society for Neuroscience annual meeting.

Ebendick, B.E., S. Var, and C.A. Byrd-Jacobs. 2023. Immune modulation effects on neuroplasticity in zebrafish. Michigan Chapter of the Society for Neuroscience Annual Meeting.

Ebendick-Corpus, B.E., S.R. Var, and C.A. Byrd-Jacobs. 2023. The effects of immune modulation on the recovery rate of zebrafish olfactory glomeruli after deafferentation. Kalamazoo Community Medical and Health Sciences Research Day.

Rozofsky, J., J.M. Pozzuto, and C.A. Byrd-Jacobs. 2023. Potential sexual dimorphisms in mitral cell dendritic structure with growth, injury and recovery in adult zebrafish. Society for Neuroscience annual meeting.

Rozofsky, J., J. Pozzuto, and C.A. Byrd-Jacobs. 2023. Potential sex differences in mitral cell dendritic morphology following injury and recovery. Kalamazoo Community Medical and Health Sciences Research Day.

Badger Hanson, E. and K. M. Docherty. 2023. Exploring the Effects of Prairie Restoration Management on Soil Microbial Communities and Carbon. Oral Presentation. Midwest-Great Lakes branch of the Society for Ecological Restoration Annual Meeting, Baraboo, WI.

Docherty, K. M., E. Badger Hanson, and L. A. Brudvig. 2023. Using microbial taxa-area relationships to understand how prairie restoration management choices influence community heterogeneity. Oral Presentation. Ecological Society of America Annual Meeting, Portland, OR.

Badger Hanson, E., L. A. Brudvig, and K. M. Docherty. 2023. Exploring the effects of management choices on soil microbial communities and soil carbon in tallgrass prairie restoration. Oral Presentation. Ecological Society of America Annual Meeting, Portland, OR.

Flosky, S. P., M. Nippa, E. Badger Hanson, and K. M. Docherty. 2023. Bacterial communities associated with a vulnerable plant species (*Baptisia lactea*) in four Michigan conservation areas. Poster Presentation. Ecological Society of America Annual Meeting, Portland, OR.

Learman, Caleb, Eng, Jacqueline, and Hrvinyak, Michelle. Bioapatite analysis in reconstruction of diet and mobility patterns in past human populations: a case study in Mongolia. Poster presented at the 17th Annual West Michigan Regional Undergraduate Science (WMRUGS) Research Conference. Nov. 4, 2023.

Hrivnyak M, **Eng J**, Abdykanova A, and Tabaldiev K. Connecting economy, environment, and subsistence regimes: a bioarcheological exploration along the Medieval Silk Roads and steppes of Inner Asia. Paper presented at the 58th International Congress on Medieval Studies. 2023.

Koestler, B.J. “Metabolism-Mediated Signaling During Shigella Pathogenesis.” Microbial Adhesion and Signal Transduction, Gordon Research Conference, talk. July, 2023.

Churman, C.N. and Koestler, B.J. The role of c-di-GMP Specific Phosodiesterase's (PDE's) in Regulating Shigella flexneri Phenotypes. Mid-West Microbial Pathogenesis conference.

Linn DM, Spitsbergen JB, Webster SE, Linn CL. 2023. An alpha7 nicotinic acetylcholine receptor agonist, PNU-282987, induces new RGCs to affect pERG and pVEP recordings in a mouse glaucoma model. ARVO abstract, New Orleans LA.

Vanzo-Sparks HK, Webster SE, Linn CL. 2023. Changes in retinal cell populations after treatment with an alpha7 nicotinic acetylcholine receptor agonist by flow cytometry. ARVO abstract, New Orleans LA.

Vanzo-Sparks HK, Webster SE, Linn CL. 2023. Changes in retinal cell populations after treatment with an alpha7 nicotinic acetylcholine receptor agonist detected by flow cytometry. Wmed Research Day, Kalamazoo MI.

Austin, A. and T.A. Schrieffer. 2023. Do created compensatory wetlands form cookie-cutter communities? Michigan Wetlands Association conference.

Naive, Mark Arcebal K. & Quakenbush, J. Peter (2023). A new species of *Sonerila* (Melastomataceae) serendipitously discovered in Pasonanca Natural Park, Zamboanga City, Southwestern Philippines with notes on *S. Woodii*. *Taiwania* 68(3): 318-322. DOI: 10.6165/tai.2023.68.318

Diller, S. and T.A. Schrieffer. 2023. Ecological Responses to Dam Removal and Habitat Restoration in the Kalamazoo River Area of Concern. 2023 Great Lakes Area Of Concern Conference. September 13-14

Diller, S. and T.A. Schrieffer. 2023. Ecological Restoration after Dam Removal: A Case Study on the Kalamazoo River. American Fisheries Society meeting. August 21-24

Austin, A. and T.A. Schrieffer. 2023. Distribution and Phylogeography of Michigan's Lost Salamander - The Western Lesser Siren. Joint meeting of Ichthyologists and herpetologists. July 12-16

Morin, M. and T.A. Schrieffer. 2023. Macrophytes and Wetland Characteristics Influence Anuran Occurrence and Abundance in Laurentian Great Lakes Interdunal Wetlands. Society of Wetland Scientists meeting. June 27-30

Schrieffer, T.A. 2023. Macroinvertebrate biodiversity patterns of interdunal wetlands. Michigan Wetlands Association conference. September 12-15

Schrieffer, T.A. 2023. Ecological connections within and among fragmented Laurentian Great Lakes interdunal wetlands. Freshwater Sciences conference. June 3-7

VanGyseghem, Juliana, M. and Spitsbergen, John, M. The effects of sedentary aging and exercise on end plate area and morphology in female rats. Annual Kalamazoo Community Medical and Health Sciences Research Day, 2023.

Lexus K. Baxendale, Allexia Galentine, and John M. Spitsbergen. The Role of GDNF in Minimizing the Effect of Aging on the Neuromuscular System. BIORETS poster session, 2023.

Graduate Student activities:

Student Activities

The past year has been an outstanding one for students in our programs in Biological Sciences. Students were included 24 times (4 undergraduate students and 20 graduate students) as co-authors on papers published in peer-reviewed scientific journals (see above), students gave 35 presentations at scientific conferences (see above) and received numerous grants and awards (see below).

Graduate Student Awards



Joanna Sblendorio as recipient to numerous well-deserved awards

Sara Diller received an award from the General Endowment fund from the Society for Freshwater Science to offset costs associated with her research investigating food web response to dam removal and habitat restoration on the Kalamazoo River.

Adam Austin was awarded an Environment Research Grant from the Pierce Cedar Creek Institute for his research on the distribution and phylogenetics of Michigan’s lost salamander – The Western Lesser Siren!

Samantha Hack: Graduate College Dissertation Completion Fellowship. Western Michigan University Graduate College. Proposal Title: *Exploring the role of cell death in neuron regeneration.*

Samantha Hack: Early Career Researcher Travel Award – International Society for Eye Research

Samantha Hack: Fred Hutchinson Cancer Institute PRIMeD Program; Selected Attendee – Seattle, WA

Samantha Hack: St. Jude National Graduate Student Symposium; Invited Attendee - St. Jude Children’s Research Hospital, TN

Julie VanGyseghem was awarded the George and Beatrice Fisher Gerontology Dissertation Prize from the Graduate College at WMU.

Keke Ray - Assessing the novel use off a combinatorial referential alarm call to denote a brood parasite from the American Ornithological Society

Keke Ray - won the Outstanding Poster Award at the joint meeting of the American Ornithological Society and Society of Canadian Ornithologists in London Ontario this August for her poster 'Assessing the use of functionally referential combinatorial calls in red-winged blackbirds’.

Zachary Stoner - was awarded an NIH Intramural Research Training Award (IRTA) Fellowship with National Institute on Deafness and Other Communication Disorders (NIDCD)

Ruchi Ojha: Graduate College Dissertation Completion Fellowship. Western Michigan University Graduate College. Proposal Title: Cyclic-di-GMP regulated pathogenesis in *Shigella*.

41st Annual Kalamazoo Community Medical and Health Sciences Research Day

Luke Kinsey - first place for graduate student presentation

Samantha Hack – second place for graduate student presentation

16th annual Creative Activities Poster and Presentation Day – WMU Graduate College

Samantha Hack – First Place

Alyssa Lopez – Runner Up



Department of Biological Sciences Travel Award

Sara Flosky

Ellen Badger-Hanson

Angela Solis-Sarat

Keke Ray

Karla Kelly

Darby Finnegan

Western Michigan University Graduate College Research Awards

Adam Austin

Bahar Saadaie Jahromi

Enish Pathak

Jacob Mastenbrook



Western Michigan University Graduate College Travel Grants

Ellen Badger Hanson

Samantha Hack

Jana Vuckovic

Hope Vanzo-Sparks

Bonnie Ebendick

Keke Ray

Department Nomination for Graduate Research and Creative Scholar Awards - WMU Graduate College

Enish Pathak – Masters Student Teaching Award

Alyssa Lopez – Accelerated Masters Student Research Award

Christian Smith - Masters Student Research Award

Joanna Sblendorio - Ph.D. Student Teaching Award

Joanna Sblendorio - Ph.D. Student Teaching Award – All University Award

Samantha Hack - Ph.D. Student Research Award

Samantha Hack - Ph.D. Student Research Award – All University Award

(*Winner)

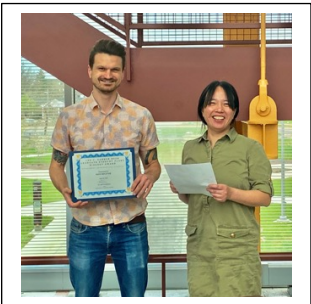
Biological Sciences Graduate Student Awards

Joanna Sblendorio - Charles River Research Excellence Award – PhD

Alex Kolstoe – Leo C. Vander Beek Graduate Student Plant Biology Award

Luke Kinsey - Distinguished Biological Sciences Graduate Student

Adam Austin – Charles River Research Excellence Award – MS



Biological Sciences Undergraduate Student Awards

Jake Fanizza - Presidential Scholar in Biological Sciences

Syed Daniyal - Merrill Wiseman Award in Microbiology

Emily Lulofs - Hazel Wirick Scholarship – **Awarded through Kalamazoo Garden Club**

Gabriel Vroman - Delano Scholarship – **Awarded through Kalamazoo Garden Club**

Zac McClenny - Distinguished Senior in Biomedical Sciences

Jossalyn Rogalski - Distinguished Senior in Biology

Nastia Chan - Distinguished Pre-Professional in Biological Sciences

Andrew Kaczmar – Charles River Research Excellence Award

Nancy Chau - Colin J. Gould Memorial Scholarship

Caitlyn Nolf - Frank Hinds Zoology Award

Martina Acosta - Frank Hinds Zoology Award

Emily Moore – Dr. Scott and Mary Hodges Scholarship (pre-Dental)



Andy Kaczmar – CAS URCA – fall and spring semesters

Caleb Learman – CAS URCA

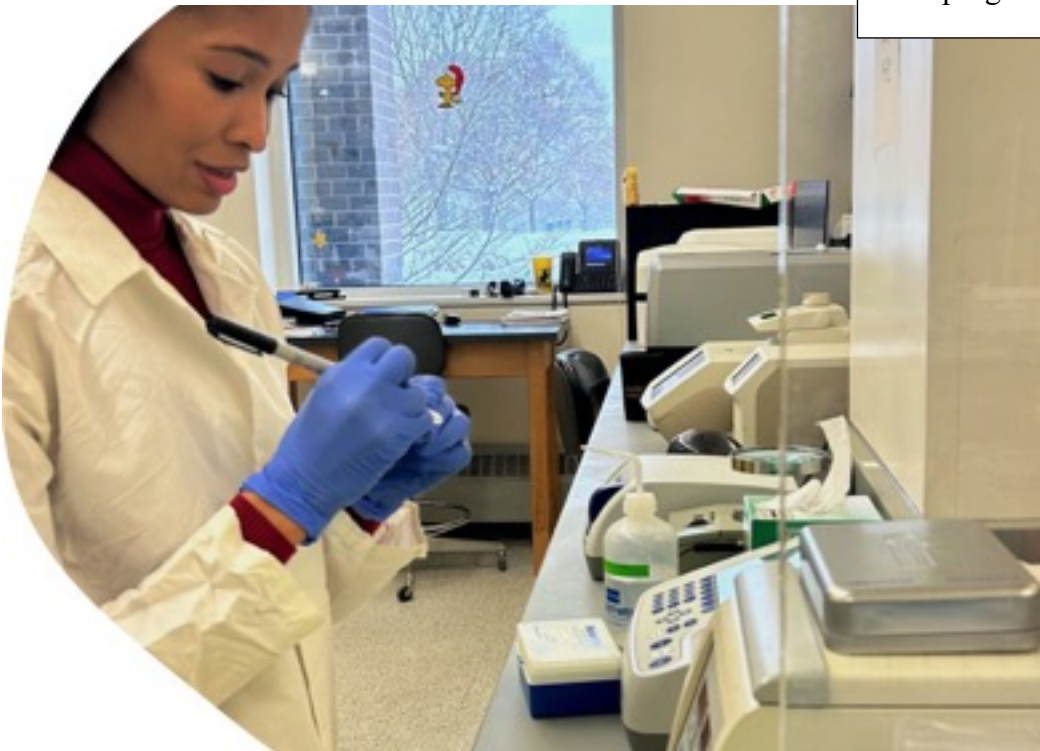
Martina Acosta – CAS URCA

Noah Schley – CAS URCA



Graduate Student Focus

Candice Churaman,
Ph.D. graduate student



This research is important as antimicrobial resistance (AMR) has grown into a grave public health threat. In March of 2023, the World Health Organization (WHO) warned that there are too few antibiotics to combat the challenge we face with the exponential increase in AMR. C-di-GMP is ubiquitous in bacteria. By understanding the role and function of c-di-GMP signalling systems, novel drugs can be created to target these systems.

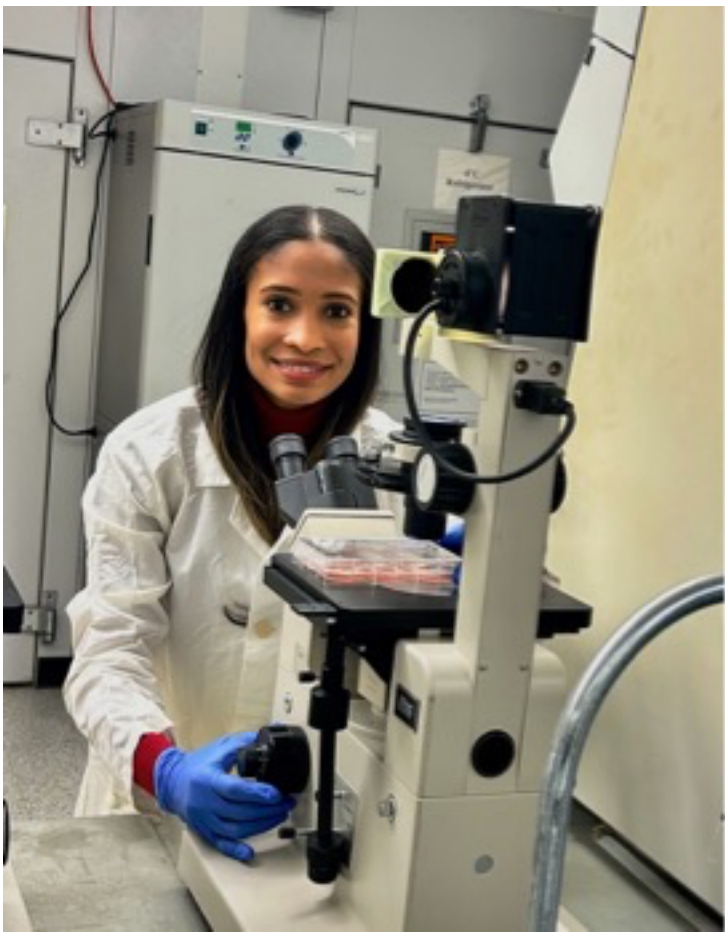
Everyday has been a new experience, since joining Koestler’s lab. I was able to build upon my foundation by gaining new knowledge and acquiring skills that I have always wanted. While gaining all of this knowledge and skill is good, being able to share what I have learnt is better. As such, I enjoy mentoring undergraduate students that come into our lab to gain hands on experience in research.

Outside of the lab, I enjoy spending time with my family and friends, travelling, hiking and kayaking.

Hi, I am Candice. I come from the most southerly Caribbean Island State of Trinidad and Tobago. At the University of the West Indies, St. Augustine campus, I pursued a bachelor’s degree in Biology and Biotechnology and then went on to pursue a Master’s in Biomedical Sciences at the University of East London. Subequently, I did an internship at the Royal London Hospital and went on to work at the Caribbean Public Health Agency (CARPHA). Whilst working at CARPHA, I interacted with many persons who aided my development as a Scientist. Training and working in a BSL3 laboratory, allowed me to develop a plethora of skills both on and off the bench. Some of these transferable skills have really laid the foundation for me entering Western’s PhD program.

I am a third year PhD student in Ben Koestler’s lab. In our lab, we study *Shigella flexneri*’s c-di-GMP turnover enzymes, their impact on *Shigella*’s cellular function and in turn *Shigella*’s phenotypes. Additionally, we also examine how *Shigella* uses its metabolism to control pathogenesis; for example, we study how the metabolic by-product formate regulates the expression of *Shigella*’s virulence genes.

My current research explores how *Shigella flexneri* six c-di-GMP specific phosphodiesterases (PDEs) impact their phenotypic expression. c-di-GMP is a second messenger known to regulate various cellular functions such as virulence, biofilm formation and cell cycle progression in bacteria. Its production by diguanylate cyclases (DGCs) and hydrolysis by specific PDEs allows for its homeostasis within the bacteria cell. Its signalling and the interaction between DGCs and PDEs with other proteins are poorly understood. In my research, I am looking to determine how each of *S.flexneri*’s PDEs impact their virulence, biofilm and acid resistance phenotypes. I am also interested in determining what other proteins these PDEs are interacting with and determining the function and mechanism behind these PDEs and their interacting partners.



Graduate Student Focus

Keke A. Ray: MS graduate student

I’d say I look comfy at my desk in the Gill Lab these days, headphones on, pouring over spectrograms, R code, and a million Excel sheets. This will likely be the last year of my master's degree, where I’ve spent the last 2 years studying how red-winged blackbirds communicate the presence of threats. The colony of blackbirds I’ve studied the past two summers at our field site in Paw Paw, MI are very familiar with my antics; I’m always violating their privacy and getting too close to their nests to look inside, putting out fake predator models to rudely record their alarmed responses, and basically following them around like the paparazzi. If you had told me I’d be doing any of these things a few years ago (especially the sitting at a desk part), I would have laughed hysterically.



Although a native Michigander of the Yooper variety, I’ve spent much of my adult career anywhere but Michigan. I graduated from Kalamazoo College in 2014 with a BA in Biology and promptly started the “seasonal circuit” - picking up whatever seasonal biology jobs felt right at the time and happened to be in beautiful places. For 8 years I trapped small mammals, measured plants in clearcuts, hooted for owls, and searched for endangered seabirds from boats and planes, just to name a few. I bounced from Wyoming to New Mexico, back to Michigan, and out again to Oregon and Washington where I settled a bit more permanently. I fell in love with the North Cascades and the birds, the stormy Pacific and the big Doug Firs, and the humid winters and dry summers. I’ve always loved hiking and learned that if I wanted to see more pretty things all I had to do was move a little faster, so I started running in the mountains on my off days, packing a beer for the summit.



In 2018 I started working for a non-profit called the Institute for Bird Populations (IBP) in Washington – they monitor the birds in the national parks out west and I decided it might be cool to get to know western birds a bit better. When I learned to bird by ear for this job, I felt like I suddenly arrived on an alien planet. How had I worked outside for so many years and basically ignored every sound I’d ever heard?! I was obsessed with birds, yes, but learning bird vocalizations expanded my world, like learning a new language or getting a car as a teenager. I spent the next 4 summers working for IBP as a crew lead, I taught the new crews their birds and how to not die when you’re backpacking for 4 months straight.

In 2020 things changed for everyone; this was no different for me and was when I decided to head to grad school as my next step. I wasn’t sure what this would look like as a half-feral field biologist, but I knew I was only scratching the surface of the taxa I cared so much about. When I saw Dr. Gill’s posting for a master's student studying birds in her “Sound Ecology Lab”, I figured if that wasn’t the perfect fit for me then I wasn’t sure what would. Familiar with mostly applied science, her work was like nothing I had ever seen before, a mix of studies on communication and cognition, and gee, had I ever stopped to think about how the sounds I loved so much were really ways of communicating? I moved cross-country for the second or third time and together we developed my master’s work to investigate how blackbirds might use some of their many call types in specific sequences to convey the presence of threats, which has evolved into this incredible look into the use of linguistic analysis to decode avian vocal sequences. Again, WOOSH, my world expanded; when you realize not only the depth of meaning that species can communicate but the sheer diversity in modes of communication, well, I think it changes you.

You only get to do so many things with your life and I think it’s wonderful and wild that I returned to Michigan to take a deep dive into how birds communicate. I’m so thankful to have met and worked with so many other incredible grad students and undergraduates, mentors, and the real reason I’m here, Sharon. When I’m not listening to birds, looking at birds, or talking about birds, I spend my time reading science fiction/fantasy, walking around aimlessly, running with my friends, talking about the weather, laughing at myself, eating ungodly amounts of chocolate, and spending time with my partner, friends, and the strangest, sweetest kitty in the world, Princess Buttercup.



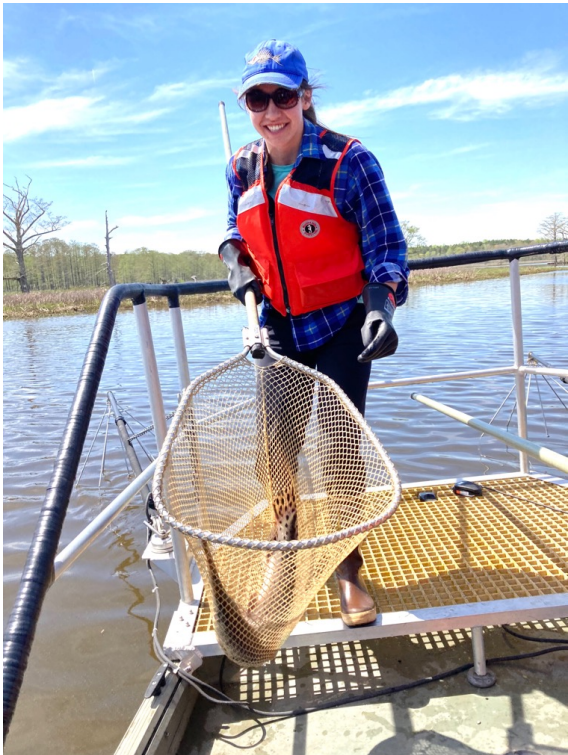
Keke with her lab mate and colleague, Karla Kelly

Graduate Student Focus

Darby L. Finnegan
MS graduated student



Hello all! I recently completed my M.S. with the Bloom Lab, where we study the evolution and ecology of fishes. My interest in fishes, and their migration especially, really began while growing up in Idaho. Salmon born deep in the Idaho wilderness migrate all the way to the ocean and back again, and my fascination with how fishes are able to do that has led to a variety of different field jobs and research positions over the years. I began as a snorkel surveyor in alpine streams, monitoring juvenile salmon. Hours of watching fish swim, and maneuvering through riverine environments myself, ignited a lasting fascination in how fishes have adapted to take advantage of their fluid environment. After that, I was split between two worlds: one world, where I pursued my research interests in fish functional morphology and biomechanics at various labs throughout the US and abroad, and another world, where I followed my love of being in the field, working in remote Alaska to monitor migratory pink salmon as they moved upstream to spawn.



These interests ultimately led me to the Bloom Lab, where I was able to combine my interests in functional morphology and migration. For my thesis work, I studied how migration and trophic ecology shape locomotory adaptations across Clupeiformes, a group of fishes that contains herring, shads, and anchovies. This research has allowed me to travel to several museum collections, including the Smithsonian and the Field Museum, and it has even allowed me to go out in the field to collect some of these fishes in Connecticut and Virginia. I have had the privilege of mentoring several undergraduate students during my time at Western, and it has given me great joy to see them develop as independent researchers themselves. I think that as a team, we have learned a great deal about how migration shapes the evolution of locomotion in fishes.

When I'm not in the lab, I like to be outside as much as possible, where I enjoy hiking, rafting, paddleboarding, fly-fishing, surfing, and cross-country skiing. One of my favorite graduate school de-stressors is climbing, and it has progressively taken up more of my time as my obsession grows. I also like to play the flute and guitar, especially when I can play with my family! I recently took a job as a fish and wildlife biologist with Washington Department of Fish and Wildlife, where I monitor and manage salmon populations in the Hood Canal region. When salmonids are spawning, which in the Hood Canal is about 7-8 months of the year, I spend most days in the field, walking or rafting streams to monitor these populations. It feels really special to work with salmon again, especially after devoting so much of my masters to understanding how the migratory behavior employed by these salmon shapes adaptation. This position presents many new, fun challenges, and I look forward to seeing where it takes me!



Graduate Student Focus

*Karla Volyn Kelly,
PhD graduate student*



I came to WMU in 2021 as a master’s student in Dr. Sharon Gill’s lab, earned my degree this past August, and look forward to continuing in Dr. Gill’s lab as a PhD student. I’m originally from Tacoma, Washington, which is a city about 30 miles south of Seattle, nestled between the Olympic mountains, the Cascade Range, and the Puget Sound. Tacoma is known for amazing views of Mt. Rainier, an infamous aroma, the Galloping Gertie bridge, and I attended the high school where the movie, 10 Things I Hate About You, was filmed.



I earned my B.S. at The Evergreen State College in Olympia, Washington in 2017. Evergreen is a very non-traditional university where we didn’t have grades, GPAs, or majors but rather had one-on-one evaluations with faculty, 30-page transcripts, an emphasis on individual progress, and incredible hands-on research experience. At Evergreen I studied everything from DNA sequencing, algal ecology, marine biodiversity, vertebrate evolution, and aquarium care, but really fell in love with ornithology and began to steer my life in a birdy direction.

After graduation, I worked in a variety of marine biology positions doing things like oyster and clam surveys, marine mammal monitoring, and fish egg sampling before I landed a dream job working with endangered and imperiled birds in Western Washington’s remnant prairie-oak habitats, mostly found on Joint-Base Lewis McChord. What started as an AmeriCorps position turned into a full-time job working with vesper sparrows, Western bluebirds, and streaked horned larks. I learned about fire ecology, trained to be a wildland firefighter, and worked on prescribed burns to help maintain prairie ecosystems. I also learned how to drive a tractor, seeded large swaths of prairie, and helped out on the native seed farms.

Although I was very happy in my job, I started to get the grad school itch during the COVID lockdown. Eventually, I found a position in Dr. Gill’s lab that really interested me. The students in her lab had nothing but wonderful things to say about her and my own interactions with her (all virtual) confirmed that her lab would be a great fit and I was so convinced that I packed up my life and headed to Kalamazoo.

My master’s research at WMU focused on communication, decision making, and future planning of nesting female yellow warblers in response to brown-headed cowbirds, which forgo building their own nests and raising their own young in favor of laying their eggs in other species’ nests (called ‘brood parasitism’). We were interested in whether the yellow warblers would change their behavior after hearing cowbird-specific vocalizations when they would be most vulnerable to cowbird parasitism, possibly to dissuade or prevent the cowbird from laying an egg in their nest.

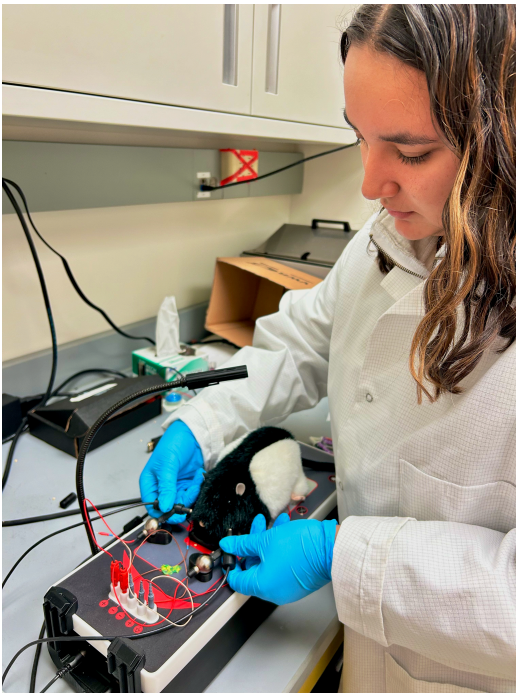
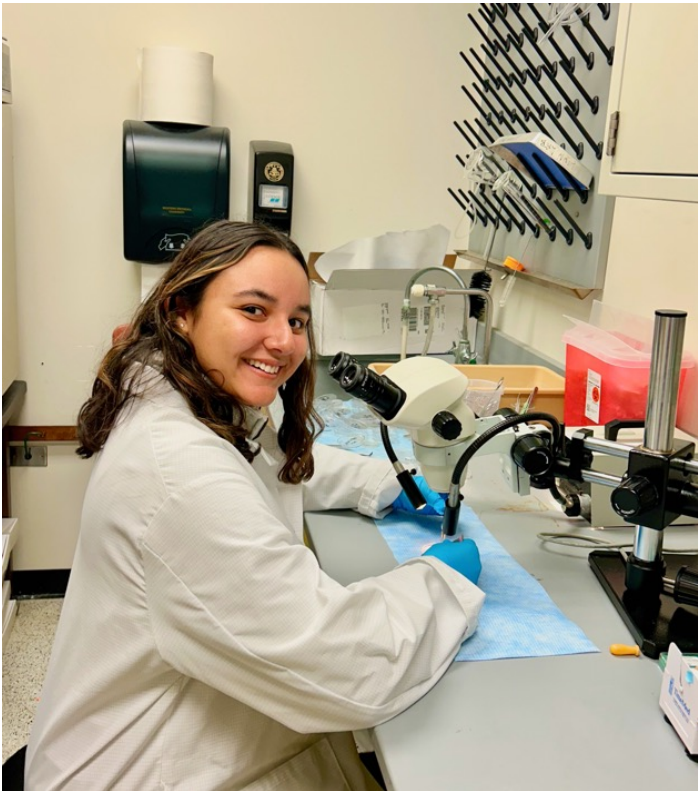


For my doctoral research, I’ll still be working with yellow warblers to study host-parasite interactions, but I’ll be taking a more evolutionary approach. We’re looking forward to some travel opportunities to examine if yellow warblers respond similarly to other species of cowbirds as they do to brown-headed cowbirds, as well as looking into other warbler species to see if they have any similar cowbird-specific vocalizations like the yellow warblers. I’m excited to shift my focus and look forward to new adventures with familiar birds!

In my free time I like to hike, backpack, fly-fish, go birding, ski, and I’m always interested in finding new ways to get outside. I also love to bake and cook, read, sew (not well), and binge the same tv shows over and over (and over) again. I also have a little husky/chow chow/cattle dog mix named Twiggy and I love to play with her whenever she’ll allow it!

Giovanna Victoria
Nolasco De Carvalho

I always knew science was the field for me, but I had no idea that only a couple of years at WMU would help to solidify that my dreams of working in research could be a reality. I was born in Knoxville, Tennessee, and my family relocated to Otsego, Michigan when I was just a few years old, setting the stage for my identity as a proud Michigander—cheering for the Wolverines and playing Euchre was how I spent a lot of my time. From an early age, I remember science being not only the subject I was strongest in, but also the one I most enjoyed. I bounced around a lot of career ideas as a kid, from an astronaut to a scientist, doctor to marine biologist – I just could not seem to settle on one thing. As I got older, the pressures of my community had me settled on a career in medicine. However, it was at WMU that I truly connected with research, thanks to amazing mentorship by the faculty and the support of my friends and family.



Late in my junior year, I met Dr. Linn, who graciously offered me a position as a preparatory assistant for the physiology laboratory sections she oversees. It was in meeting her that I was reassured that research can be a career path for my field of study, and shortly after I began working in her research lab, focusing on Blast Exposure and Glaucoma studies. My Honors Thesis, “Neurogenic Effects of PNU-282987 Treatment on Blast-Induced Ocular Trauma in Adult Mouse Retinas,” funded by a Research and Creative Activities scholarship from the Lee Honors College, has been a rewarding endeavor to undertake. The research focuses on investigating whether the eye drop treatment of PNU-282987, an agonist to the alpha 7 subtype of nicotinic acetylcholine receptors employed in previous studies from her lab, can have a neurogenic effect in addition to a neuroprotective one when applied to blast-exposed retinas. To see the mechanisms behind regeneration has been a fascinating subject, as adult mammalian neurons do not typically regenerate. Learning the techniques, vernacular, and everything in between has been challenging at times, but who doesn’t like a challenge? It’s a strange balance between stress and excitement when trying a new dissection or working with machines I had never seen (or even heard of) before, but I can say with 100% certainty that I have never been happier than when in the lab. Although I have had my hiccups (those dissections are no joke), I am more confident than I have ever been in knowing what I want to do with my future. Studying in a laboratory such as hers has been a real blessing, as I have made some incredible friends among my lab mates and have found a wonderful mentor. We have a lot of laughs!

Getting ready to go to college was very daunting at first. As a first-generation college student, it was a big jump; applying to college was always something I wanted to do but had no experience with. However, in the midst of the pandemic, I got news that not only had I been accepted at Western but was also awarded the MLK G.O.L.D scholarship! It was a huge weight off my shoulders, and being surrounded by peers that had similar experiences to me was very comforting. It honestly feels like the years have gone by in a blink; I have served on the executive board for two student organizations, am a member of the Lee Honors College, made the Dean’s list, and even was a student ambassador! However, even if it were a bit of a blur, I would not trade those experiences for anything. Since I have been at WMU, I have met so many wonderful people, my best friends for life and encouraging faculty. Despite the anxiety about fitting in here, life had a funny way of working itself out.

Although it is bittersweet to know my final year as a Biomedical Sciences student is ending, I am even more excited to be pursuing a master’s degree in Dr. Linn’s lab after graduating. After the Master’s, I hope to pursue a PhD in Neuroscience or an adjacent field, and whether I enter industry or academia, I have confidence that I will be doing something that I love. When I am not geeking out over changing ERG (electroretinogram) waves and attending to my scholarly duties, I enjoy hanging out with my best friends and boyfriend, baking snickerdoodles, watching the latest seasons of the Bachelor/Bachelorette/etc., and playing games of the board and video variety. Go Broncos!



Alumni Quote

The time I spent at Western had a significant influence on my life and future career. My time at WMU influenced my career/life by opening doors in life I never would have imagined. In 2019, I embarked on a transformative journey from Malaysia to Kalamazoo, embracing the role of a first-generation college student. In the BIOS department, I had an amazing advisor (Megan) that helped me ensure a seamless progression towards graduation and successful dental school applications. The dedicated professors in my department went above and beyond, investing time after classes to address my queries and patiently guiding me through challenging coursework. Generous scholarships provided by the department further eased my educational pursuit.

The pinnacle of my four-year journey was my invaluable experience in Dr. Linn's research lab. Immersed in the world of retinal neuroregeneration, I not only gained hands-on lab expertise but also completed an honors thesis under Dr. Linn's guidance. I am profoundly grateful for her mentorship, which propelled me to new Heights. My time at WMU has instilled in me a deep sense of pride as a bronco. I am eager to share my enriching experiences and inspire others to embark on their own remarkable journeys through the support of WMU.

Nastia Chan
Bachelors of Science – 2023
Western Michigan University
Department of Biological Sciences



Outreach Activities

Besides active interest in research, teaching and service to the University, many faculty members are dedicated to outreach activities that bring their research interests and knowledge to the community. Below are just a few of the many outreach activities that faculty and students were involved in for 2023:

- The BIORETS Program:** Yan Lu and Silvia Rossbach received funding from the National Science Foundation to implement a Research Experiences for Teachers Sites in Biological Sciences (BIORETS) program at WMU. This program provides summer research and training opportunities to 36 middle and high school science teachers in the laboratories of WMU faculty mentors over the course of the three-year program (2022 – 2024, <https://wmich.edu/biology/biorets>). The BIORETS program also provides a platform for Biological Sciences faculty and graduate students to integrate research, teaching, and service. Here is the list of the 17 BIORETS teacher participants, their host labs and research projects in Summer 2023:
- **Amy Kendall**, Maple Street Magnet School for the Arts, Rossbach Lab, Regenerative Agriculture: Influence of Soil Texture on Moisture Retention and Soil Temperature
 - **Charlotte Resek**, Baseline Middle School, Lu Lab, Light Exposure and Plant Growth
 - **Cody Brewster**, Mattawan Middle School, Schriever Lab, An Isotopic Analysis on Resource Quality and Food Webs within the Kalamazoo River
 - **Corey Scheffers**, Kalamazoo Christian High School, Thompson Lab, Comparative Genomics of *igfbp* genes across Species of Killifishes
 - **Erica Ruffner-Rowell**, Fennville High School, Rossbach Lab, Cotton Strip Assay & Cellulolytic Bacterial Activity as Measures of Soil Health
 - **James Russell**, Endeavor Charter Academy, Bloom Lab, Differences in Life History Drive Locomotory Adaptation in *Alosa pseudoharengus* (alewife)
 - **Jason Griffith**, Marshall High School, Hoppe Lab, Effect of UNC-82 Protein Kinase Expression on *C. elegans* Body Length

- **Joseph Graber** (Three Rivers High School) and **William Bell** (Climax-Scotts Jr./Sr. High School), Barkman Lab, Does Protein Relatedness Predict Protein Function?
- **Kayleigh Schneider**, Comstock STEM Academy, Bertman Lab, Regenerative Agriculture: Impact on Carbon Concentration and Organic Content in Soil
- **Kimberly Armitage**, Vicksburg High School, Thompson Lab, Killifishes: The Life Cycle and Use of Killi-kits in the Classroom - A Model System to Deepen Core Ideas of NGSS Standards
- **Lexus Baxendale**, Battle Creek Central High School, Spitsbergen Lab, The Role of GDNF in Minimizing the Effect of Aging on the Neuromuscular System
- **Nick Grabemeyer**, Plainwell High School, Beane Lab, Weak Magnetic Field (WMF) Effects on Bioelectric Signaling during Planarian Wound Healing
- **Steve Mammel**, Coloma High School, Rossbach Lab, Soil Treatment Impacts on Yield and Sugar Content of Lettuce and Bok Choy
- **Summer Baker**, Lakeview Middle School, Hoppe Lab, Defects in Viability and Development in *Caenorhabditis elegans* due to Changes in Levels of UNC-82 Expression
- **Thomas Wheatley**, Decatur Jr. Sr. High School, Lu Lab, Effects of NaCl Exposure on the Morphology, Photosynthesis, and Chlorophyll Content of *Arabidopsis thaliana*
- **Tom Whitenight**, White Pigeon High School, Koestler Lab, Phage Effectiveness Against Varying Levels of c-di-GMP in *Shigella flexneri*



The Bioret Participants for Summer 2023

Mattawan AP Biology Students’ Campus Visit: Faculty, staff and students of Biological Sciences hosted the campus visit of ~60 AP Biology students from Mattawan High School on December 5, 2023, as part of the Research Experiences for Teachers Sites in Biological Sciences (BIORETS) program led by Drs. Yan Lu and Silvia Rossbach (<https://wmich.edu/biology/biorets>). The high school students were brought to WMU by their teacher Ms. Ann Ponicki, who participated in the BIORETS summer program in Dr. Cindy Linn’s laboratory. The campus visit started off with a presentation about the College of Arts and Sciences (CAS) by Ms. Gabriela Saliwanchik, Manager of CAS Undergraduate Recruitment and Outreach, and Ms. Diana Blouin, Director of CAS Academic Advising. The students then visited the Finch Greenhouse in Wood Hall and four research laboratories in Haenicke Hall. Dr. Silvia Rossbach, Dr. Yan Lu and graduate students Emily Catania, Jakob Sell and Pragati Singh served as the tour guides.

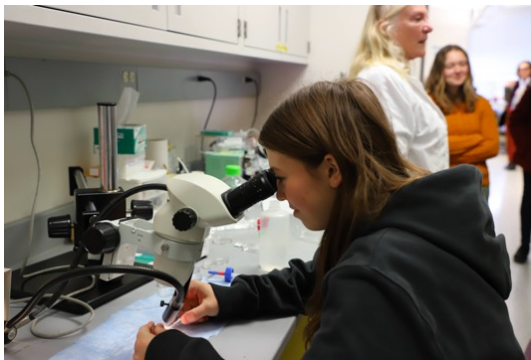
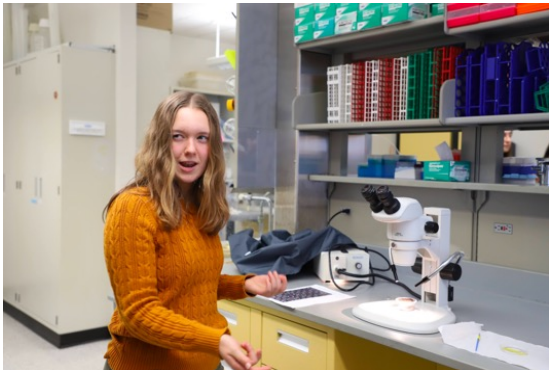
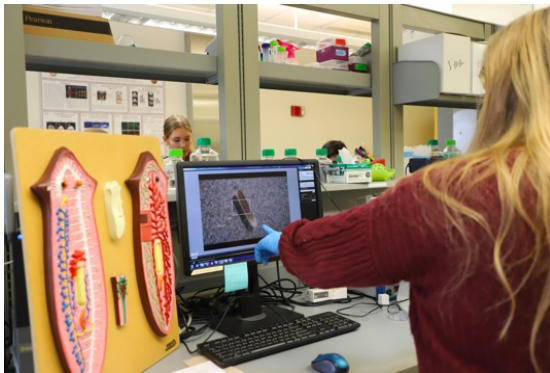
Here is the list of the interactive activities in which the AP Biology students participated during the campus visit:

- Plants in Finch Greenhouse and how aquaponics work, hosted by Mr. Chris Jackson and undergraduate students Keeton Kamil Bigham-Tsai and Rohan Adams;
- Extracting retinas from mice and pinning tissue for processing, hosted by Dr. Cindy Linn;
- How does the planarian flatworm regenerate an entire worm from just a tiny fragment of the original, hosted by graduate student Jana Vuckovic and undergraduate student Anna Tomica in Dr. Wendy Beane’s laboratory;
- Using microscopes to examine living *C. elegans* worms moving on culture plates to see the changes in worm appearance or behavior made by mutations in muscle myosin, collagen or a protein required for normal chromosome segregation, hosted by Dr. Pamela Hoppe and graduate student Hao Peng;
- Killifish embryo development and evolution, hosted by Dr. Andrew Thompson, graduate student Daniel Do and undergraduate students Andy Kaczmar and Martina Veit Acosta.

Overall, this was a successful visit and most of the students showed great interest in the biological interactive activities.



Some images obtained during Mattawan High School Campus Visit



In April 2023, a networking outreach activity was made available for our graduate and undergraduate students at WMU. Representatives from local companies and schools provided information concerning available job and career opportunities. Representatives that provided presentations came from Stryker, Charles River, Zoetis, Kalsec, Perrigo and WMED.



Zoetis representative and principle scientist: Mark Webster

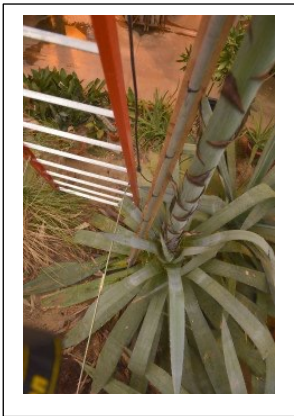


WMED representative and post doctoral fellow: Sarah Webster

Christine Byrd-Jacobs and her graduate student, Bonnie Corpus, gave a tour of her lab to the WMU Graduate College staff. As dean of the Graduate College, she thought it was important for her team to see a research lab and understand the life of a graduate student in STEM.



Celene Jackson with Meteorologist Will Haenni in the WMU greenhouse. Mr. Haenni was visiting to learn about the Agave plant that is at least 50-year-old. Agave, also called the “century plant,” grows a remarkable 3.5 inches daily in preparation of its bloom—the sign it has reached the end of its life cycle.



Additional Outreach Activities:

Sharon Gill’s laboratory hosted and worked with a film crew this summer. The crew, from Wildstar in the UK, was filming for an episode in the upcoming National Geographic 10-part series ‘Underdogs’, narrated by Ryan Reynolds.

Jana Vuckovic (Beane lab) – organized hands-on activities for Portage North middle school students touring campus on November 20, 2023.

Rae Miller and Wendy Beane - STEM Practicum at F.C. Reed Middle School: “Energy and Taxis (Phototaxis and Chemotaxis)” for 63 students across 3 class period (5th grade classes) on June 2, 2023.

Luke Kinsey and Jana Vučković (Beane Lab)- As part of WMU’s QBite program, 2 graduate students spent a week at the University of Nevada, Las Vegas helping the Tseng Lab in the School of Life Sciences start their own quantum biology research program by building them a magnetic shield enclosure and exposure setup, then training their students in its operation. February 14-18, 2023.

Samantha Hack, Luke Kinsey and Wendy Beane – Outreach by Beane lab to kick off a new STEM unit at Vicksburg High School on “Planarian Regeneration and Light Response” for 200 students across 7 class periods (9th grade Biology) on March 8, 2023.

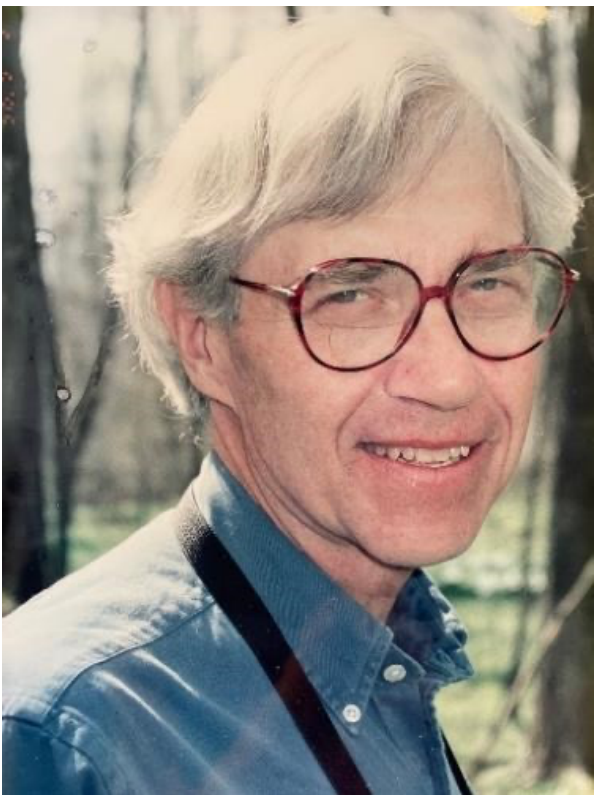
Ellen Badger Hanson (Docherty lab) - offered an Osher Lifelong Learning Institute course “The Wild World of Prairies” in summer 2023.

Tiffany Schriever’s laboratory was filmed and interviewed by Great Lakes Now which resulted in a news article in the Bridge Michigan [Michigan steps up dam removal](#) and a film aired on PBS [Dam removal story](#).

Dr. Schriever was the invited scientist for the Oct. 10th women in STEM event at WMU.

On April 6, 2023, **Dr. Schriever** hosted a STEM experience for Portage West Middle School to learn about Kalamazoo River biodiversity.

In memoriam: Professor Richard D Brewer



Kalamazoo Gazette (Apr. 12-16, 2023)

Our colleague Professor Richard Dean Brewer has sadly passed away in Kalamazoo at the age of 89. Richard was the senior ecologist in Biological Sciences when I began my tenure at WMU in 1991 and he was extremely kind to my wife and I when we arrived in Michigan from England. For 5 years we shared teaching of the senior level ecology course for which he had written his excellent and widely used text book, *The Science of Ecology*, and its companion, *A Laboratory and Field Manual of Ecology*, and it was a privilege to appreciate Richard’s deep understanding and concern for ecological patterns and the natural areas of Michigan and their land use histories.

Richard was born in Murphysboro, Illinois on June 17, 1933 and died at Friendship Village, Kalamazoo on March 25, 2023 where he lived with his second wife, Kay Takahashi. He obtained his BA from Southern Illinois University in 1955 and both his master’s and PhD degrees from the University of Illinois in 1957 and 1959. As soon as Richard finished his doctorate, he and his wife Lucy moved to Kalamazoo where he began his tenure as an instructor in 1959 and raised their two sons Philip and Steven. Richard’s distinguished career at WMU spanned 37 years with his retirement as Professor Emeritus on 31 August 1996. During this time Richard mentored more than 40 graduate students and published some 75 scholarly articles in ecology and ornithology, as well as his *Atlas of the Breeding Birds of Michigan* and his ecology texts. His scholarship was recognized with the Ernest P Edwards award in 1978 and the Michigan Audubon Society in 1991.

Richard’s scholarship and learning greatly facilitated his ability to serve our University and regional communities with the development of WMU’s *Environmental Studies Program* in 1970 and as president of the Board of Trustees of the *Kalamazoo Nature Center*. Professor Brewer also established the *C.C. Adams Center for Ecological Studies* in recognition of the pioneering research of Charles Adams that was highly relevant regionally to WMU and to Richard’s development of his ecology teaching. But perhaps Richard’s most treasured role was as a founding member of the *Southwest Michigan Land Conservancy*, with its important activities in the regional conservation of threatened landscapes.

In addition to his scholarship, Richard was a constructive activist and wrote many letters to the *Kalamazoo Gazette*, all of which are a testament to his concern for our natural resources. Having just feasted thankfully, it seems fitting to offer our deep felt thanks to Richard for everything he gave us at WMU and beyond.

Stephen B Malcolm, Professor Emeritus, Kalamazoo 27 November 2023
https://en.wikipedia.org/wiki/Charles_Christopher_Adams

Some selected publications while at WMU 1959 to 1996

Journal articles on birds:

Brewer, R.D., 1959. Ecological and reproductive relationships of black-capped and Carolina chickadees, *Parus atricapillus* Linnaeus and *Parus carolinensis* Audubon. University of Illinois at Urbana-Champaign. PhD dissertation.
Brewer, R., 1963. Ecological and reproductive relationships of black-capped and Carolina chickadees. *The Auk*, 80(1), 9-47.
Brewer, R. 1967. Bird populations of bogs. *The Wilson Bulletin*, pp. 371-396.
Morehouse, E.L. and Brewer, R., 1968. Feeding of nestling and fledgling Eastern Kingbirds. *The Auk*, 44-54.
Brewer, R. and Swander, L., 1977. Life history factors affecting the intrinsic rate of natural increase of birds of the deciduous forest biome. *The Wilson Bulletin*, 211-232.
Adams Jr, R.J. and Brewer, R., 1981. Autumn selection of breeding location by Field Sparrows. *The Auk*, 629-631.

Journal articles on vegetation and land use:

Brewer, R. 1965. Vegetational features of a wet prairie in southwestern Michigan. *Occasional Papers of the C. C. Adams Center for Ecological Studies* 13:1-16.
Brewer, R. 1985. Seasonal change and production in a mesic prairie relict in Kalamazoo County, Michigan. *The Michigan Botanist* 24:3-13.
Brewer, R., and P.G. Merritt. 1978. Wind throw and tree replacement in a climax beech-maple forest. *Oikos* 30: 149-152.
Brewer, R., and S. Kitler. 1989. Tree distribution in southwestern Michigan oak openings. *The Michigan Botanist* 28: 73-79.
Chapman, K.A. and Brewer, R., 2008. Prairie and savanna in southern lower Michigan: history, classification, ecology. *The Mich. Botanist* 47: 1-48.

Special Faculty Award

Dr. Monica McCullough – Received Dr. Darrell R. Latva Biological Sciences Teaching Excellence Award for 2023.



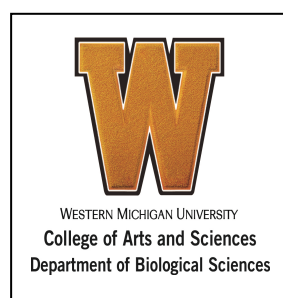
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<https://wmich.edu/biology/giving> Please select “Make a Donation” at the bottom of the page. Donations should be made directly to the Department of Biological Sciences.

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The Department of Biological Sciences
1903 W. Michigan Ave
Kalamazoo, MI 49008-5410



Thank you for considering a gift to the WMU Department of Biological Sciences.
Have a happy holiday season! Go Broncos!!!!



Winner of this year's
Gingerbread contest
submitted by our Student
Workers!!!!