connections

College of Natural Science

a magazine for alumni & friends

winter2021

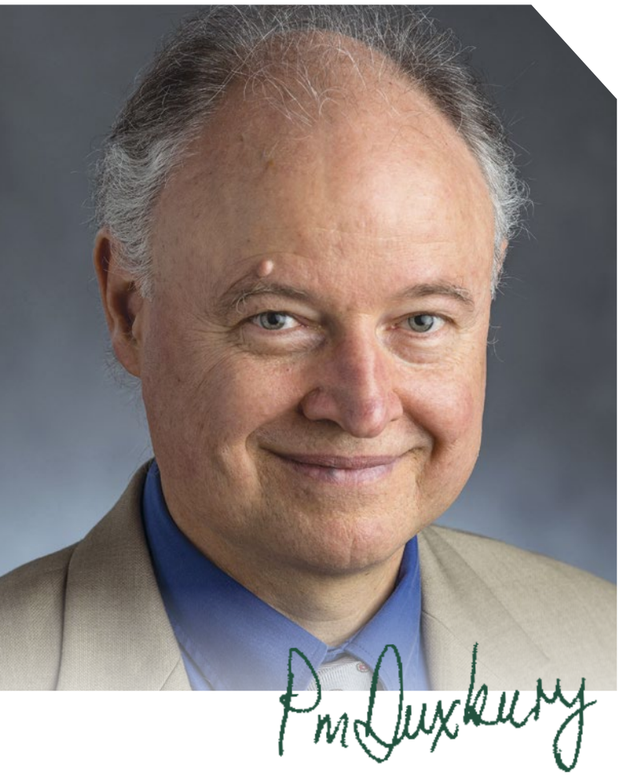
Protecting biodiversity:

The science behind resilience

MSU

NatSci.msu.edu

message from the dean



The last time I wrote to you was in winter 2020 when we were in the midst of transitioning to predominantly online course delivery due to the COVID pandemic restrictions. That transition was carried out very successfully with surprisingly positive responses from students.

For fall 2021, NatSci has moved to predominantly in-person course delivery, while working hard to acknowledge and provide alternative options when necessary for students, faculty and staff members. The university keeps a dashboard of the university community vaccination rate and, at present, more than 87 percent of the MSU community are vaccinated, which greatly curtails the transmission and severe consequences of COVID infections.

We have also resumed in-person options for our alumni and friends events, including an in-person scholarship breakfast and a hybrid Dean's Board of Advisors meeting in October. Planning for spring semester 2021 remains uncertain due to COVID; however, our objective is to cautiously move toward more in-person activities and courses, while being responsive to the many cases that require special safety considerations.

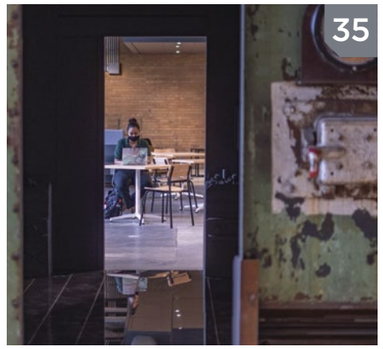
During the past 18 months, our development, communications and advisory staff have done a terrific job of engaging with students and alumni online through town halls and talks by high-profile MSU scientists, and by bringing alumni and students together at virtual events.

Building the NatSci community is particularly important at this time, and we couldn't do this without the help of our alumni, donors and friends. The COVID pandemic has pushed us to a better understanding of how to use a combination of virtual, hybrid and in-person modalities to engage with our community, and we plan to continue developing these approaches. We have also joined MSU Connect—a platform enabling direct connections between alumni and current MSU students. If you would like to participate in MSU Connect, please contact either Sara Ford (fordsar2@msu.edu) or Brian Telfor (telfor@msu.edu).

I'm also pleased to share that, due to its wide-ranging scholarly excellence, the college continues to receive very high national rankings for a range of broad interdisciplinary research and teaching programs, including a No. 1 ranking in nuclear science and astrophysics; a No. 4 ranking in plant biology; a No. 4 ranking in agricultural sciences; a No. 5 ranking in environmental science and engineering; and a No. 3 ranking in veterinary sciences. These programs are characterized by outstanding core research and training that translates to applications impacting Michigan, the broader United States and the world.

EXCELLENCE

"... the college continues to receive very high national rankings for a range of broad interdisciplinary research and teaching programs ..."



connections

winter 2021

The College of Natural Science (NatSci) is home to the biological, physical and mathematical sciences.

Features

Alumni Section

Departments

ON THE COVER: Each fall, millions of North American monarch butterflies join in one of the most ambitious migrations in nature, flying from summer habitats to winter homes thousands of miles to the south. Those east of the Mississippi winter in Mexican highlands, while those west of it gather in either Mexico or along the central and southern coasts of California. Pictured on the cover is a cluster of monarch butterflies *(Danaus plexippus)* captured by Jodi Jacobson/Getty Images at one of their wintering sites.

Also in this issue

Reguera (inset) and her team have revealed that Geobacter bacteria—the rodlike shapes in this microscope image—package uranium into the vesicles, which are seen as the light specks dotting the image. Their discoveries have shown how microbes stand up to a toxic metal, opening the door for applications in recycling and remediation.

These bacteria *clean up* radioactive waste

For decades, scientists suspected that bacteria known as Geobacter could clean up radioactive uranium waste, but it wasn't clear how the microbes did it.

"The biological mechanism of how they were doing this remained elusive for 20 years," said Gemma Reguera, the MSU College of Natural Science microbiologist whose team solved that mystery 10 years ago. Well, three-quarters of the mystery. She's now cracked the rest of the case.

What Reguera discovered in 2011 was that, on one side of their cells, the Geobacter make protein filaments that act like little wires to literally zap uranium. This does two things. For one, the jolt triggers chemical reactions that give the bacteria energy. Secondly, that chemistry traps the uranium in a mineral form, preventing the radioactive material from spreading through the environment.

But those protein wires accounted for just about 75 percent of the uranium that the Geobacter were cleaning up.

"We always knew we were missing something," said Reguera, a professor in the Department of Microbiology and Molecular Genetics. "What we didn't know was what was happening at the cell surface, particularly on the side of the cell that had no wires to immobilize the uranium."

> **"We could essentially make a factory . . . to pull metals out of water."**
>
> **~Gemma Reguera**

REMEDIATE

Now, Reguera's team has the answer. Molecules called lipopolysaccharides coat the cell surface and soak up the uranium like a sponge. This finding could create new ways not only to remediate dangerous pollution, but also to recycle and reclaim increasingly scarce metals from electronics waste.

The next step, Reguera said, is investigating whether the Geobacter and their sponges can be encouraged to pull other toxic metals from waste streams.

"We can ask whether we can make a system for the selective removal of metals," Reguera said. "It would work kind of like a fermenter, where respiring microscopic yeast cells make alcohol, only here, the respiration of Geobacter bacteria would trap toxic and important metals using protein nanowires and the newly discovered molecular sponges."

As the Geobacter soak up uranium, they also start packaging it into vesicles, which are bubble-like orbs coated with the lipopolysaccharides. The bacterial cells release the vesicles and replenish their lipopolysaccharide coating to sop up more uranium.

"It's a mechanism to remodel the cell surface and ensure maximum protection," Reguera said. "The cells produce some vesicles under normal growth conditions but increase production to get rid of the trapped uranium."

Reguera and her team are now investigating how to scale up vesicle production.

"We could essentially make a factory for these vesicles to pull metals out of water," she said.

recentgrants

Following is a sampling of notable grants awarded to NatSci faculty in 2021:

Bruno Basso, MSU Foundation Professor of Earth and Environmental Sciences, is leading a four-year, $2.57 million U.S. Department of Agriculture Natural Resources Conservation Service grant that is part of a nationwide On-Farm Conservation Innovation Trial initiative. Basso and his team will work with farmers across the country as they develop conservation practices that cut losses on unproductive plots and make the most out of more fruitful fields.

Elad Harel, associate professor of chemistry, is lead investigator on a multi-year Department of Defense, Defense Threat Reduction Agency grant authorized for $1 million over two years, with up to three 'option' years of additional funding. Harel's research revolves around developing novel optical methods to greatly accelerate molecular discovery. He and his team will use the award to explore real-time detection of contaminants in biopharmaceuticals by artificial intelligence (AI)-enabled quantum coherence spectroscopy.

Polly Hsu, assistant professor of biochemistry and molecular biology, is leading a $1.2 million National Science Foundation grant to probe plant genetics at a new level to better understand how crops cope with drought. Over the past 50 years, drought has been responsible for about two-thirds of the U.S. crop loss. Hsu's goal is to better illuminate the connection between a plant's genes and its cellular functions as it responds to the stress of water scarcity, which could help growers breed more resilient crops and enable scientists to create new ways to protect plants.

Emily Josephs, assistant professor of plant biology, and her team are shedding light on a mystery of evolution with support from a five-year, $1.9 million Maximizing Investigators' Research Award (MIRA) grant from the National Institutes of Health (NIH): How is it that within the same species, individual responses to stimuli can dramatically differ? Josephs' team is studying plants to understand genetic variation for environmental response.

Kendall Mahn, associate professor of physics and astronomy, will lead a five-year, $1.97 million Department of Energy grant to create a high energy physics instrumentation traineeship in Michigan—the TRAIN-MI Program. With the long timescales of current experiments, students often don't have an opportunity to develop instrumentation skills, which are critical to U.S. technological leadership in high energy physics (HEP). Under this program, students from HEP, nuclear physics and related fields will take dedicated instrumentation courses and have a laboratory experience to gain a rigorous, broad and deep understanding of instrumentation.

Kristin Parent, J.K. Billman, Jr., M.D. Endowed Research Professor, is lead investigator on a five-year, $1.5 million NIH MIRA grant that supports her pioneering research to investigate how viruses known as bacteriophage, or phage, use cell surface proteins to connect to, infect and reproduce inside some of the world's deadliest gut bacteria (e.g., *Salmonella, E. coli* and *Shigella*), destroying them in the process. Understanding how bacteriophage find the right bacterial partner is critical to advancing phage therapy—an alternative treatment to bacterial infections becoming increasingly resistant to antibiotics.

Chris Waters, professor of microbiology and molecular genetics, is the lead on a $2.87 million NIH grant to uncover the genetics behind a six-decades-long cholera pandemic. Cholera is a waterborne disease that infects humans, killing about 100,000 people each year globally. Researchers will investigate 36 genes key to the persistence of cholera to increase understanding of how bacterial pandemics surface, and boost development of new viral therapies to treat bacterial infections.

One million "hops" closer to ending disease endemic in cattle

Many people have never heard of Brucellosis, but farmers and ranchers in the United States forced to cull animals that test positive for the disease and people infected by the animal-transmitted *Brucella abortus (B. abortus)* pathogen that suffer chronic, malaria-type symptoms, certainly have. Brucellosis is an agricultural and human health concern on a global scale. There is no vaccine for humans, and experimental studies of *B. abortus* in its natural animal hosts are technically difficult and rare.

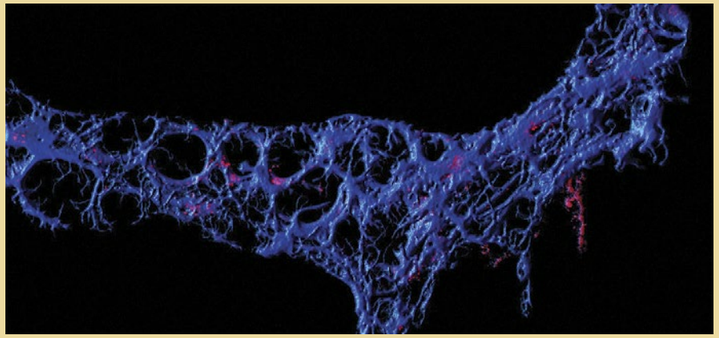
To address this issue, MSU scientists brought sophisticated genomics tools from the lab to the field to gain new insight into how *B. abortus* infects cattle and to help stop the spread of this deadly disease. In the microbiological equivalent to tagging cattle, they harnessed the hopping ability of specialized DNA called transposons to tag individual strains of B. abortus with unique barcodes. This gave them the ability to count how many *B. abortus* bacteria made it from the cow's eye, a common point of infection in the field, to the lymph nodes.

This information is useful for scientists studying the epidemiology of Brucellosis in livestock and wildlife and can help them build better transmission models to help stop the spread of this disease.

Researchers: Sean Crosson, Rudolph Hugh Endowed Professor, Department of Microbiology and Molecular Genetics (MMG); Aretha Fiebig, research associate professor, MMG.

Following your gut: The remarkable role of intestinal cells

Food is essential for life. But for the more than 3 million adults in the United States who suffer from Inflammatory Bowel Disease, or IBD, it is also a daily source of pain and discomfort. Currently, there is no cure for the condition that includes Crohn's disease and ulcerative colitis, and most people with IBD are diagnosed in their 20s or 30s, meaning a lifetime of symptoms such as diarrhea, gastrointestinal pain, cramping and fatigue.



But new research led by MSU scientists is bringing fresh insight to the IBD table—an unexpected connection between specialized cells in the gut called glia and the genes involved in IBD. Not only did the researchers uncover the remarkable role of glial cells in reducing inflammation in the gut, but they discovered that the glia also found an unexpected way to drive the expression of MHC-II antigens and communicate with immune cells—autophagy, or the process of a cell eating components of itself. The glia sacrificed their own bodies to protect enteric neurons from inflammation.

These findings could lead to more effective treatments for one of the most elusive gut problems in the world.

Researcher: Brian Gulbransen, MSU Foundation Professor, Department of Physiology/ Neuroscience Program

Hyena behavior inside and out

The Maasai Mara National Reserve in Kenya, also referred to as the Mara, is one of the richest and most important ecosystems in Africa. It sets the stage for Africa's Great Migration—the annual movement of millions of zebras and wildebeest across the grasslands. Predators such as the spotted hyena also live out their lives in the Mara, providing one of the most important settings for field studies on the planet.

For more than 30 years, MSU hyena expert Kay Holekamp and her students have been observing hyenas as part of The Maasai Mara Hyena Project, amassing a rich dataset about these animals, helping to answer questions previously thought impossible outside the lab, including their most recent one—are there links between hyenas' early social experiences and their stress responses in adulthood?

Using several molecular biology techniques, including next generation DNA sequencing, the team found that markers with respect to maternal care and stress hormones were related to genes found in humans to be associated with aging and immune function. Their findings suggest that maternal care early in life is a very important determinant of adult behavior, and that a hyena's social networks, particularly during the subadult (teenage) phase, matter in terms of DNA methylation and adult stress hormone concentrations.

Researcher: Kay Holekamp, University Distinguished Professor, Department of Integrative Biology

A quantum leap for molecular simulations

Developing improved materials for things such as energy storage and drug discovery is of interest to researchers and society alike. Quantum mechanics (QM) is the basis for molecular and materials scientists who develop these useful, futuristic products. The challenge is that the QM calculations to describe the many properties of molecules and the materials they make up require a lot of computer power.

To address this issue, an MSU and University of California, San Diego–led team of researchers developed software that takes advantage of powerful graphics processing units, or GPUs, for these complex QM calculations of molecules. The software enables researchers to address problems that would otherwise be computationally intractable in a range of research areas such as computational materials design, catalyst design and drug design.

The code can also be used in a high-throughput fashion to generate data for Artificial Intelligence–based molecular design approaches, such as developing improved materials and drugs.

Researchers: Kenneth Merz, University Distinguished Professor; Joseph Zichis Chair; Department of Chemistry and Department of Biochemistry and Molecular Biology; Madushanka Manathunga, MSU postdoctoral scholar

Uncovering how some corals resist bleaching

Coral reefs are beautiful and diverse ecosystems that power the economies of many coastal communities. They're also facing threats that are driving their decline, such as the planet's warming waters.

This threat hit extreme levels in 2015, when high temperatures were turning corals white around the globe. Kaneohe Bay in Hawaii was hit hard; nearly half of its corals bleached.

Hidden in the aftermath of this extreme event, however, were biochemical clues as to why some corals bleached while others were resistant—information that could help reefs better weather warming waters in the future.

These clues have now been uncovered by researchers at MSU and the University of Hawaii at Manoa. The researchers discovered chemical signatures in the corals' biology, or biomarkers, that are present in organisms that were most resistant to the bleaching.

This previously hidden insight could help researchers and conservationists better restore and protect reefs around the world.

Researcher: Robert Quinn, Department of Biochemistry and Molecular Biology

faculty honors

Dean DellaPenna has been elected to the National Academy of Sciences (NAS). He is among 120 new members and 30 international members elected to the NAS in 2021 in recognition of their distinguished and continuing achievements in original research.

DellaPenna, a University Distinguished Professor, an MSU Foundation Professor and a faculty member in the Department of Biochemistry and Molecular Biology, is an internationally recognized leader in research on plant metabolism and medicinal plant genomics.

"My first reaction was shock," DellaPenna said. "I think I said, 'Are you kidding me?' I am deeply honored to be elected as a member of the National Academy of Sciences. This incredible recognition would simply not have been possible without the combined talents and efforts of colleagues and past and current lab members over the years, and our shared love of science."

DellaPenna joins 10 current MSU faculty who are members of NAS and four MSU faculty who are members of its two associated organizations, collectively referred to as the National Academies of Sciences, Engineering and Medicine.

Bruno Basso, MSU Foundation Professor of Earth and Environmental Sciences, and Skidmore College collaborator Kristofer Covey, are inaugural recipients of a $250,000 prize from the Morgan Stanley Institute for Sustainable Solutions Collaborative for their groundbreaking project, My Soil Organic Carbon, or MySOC. Basso is using MySOC—a platform that measures soil carbon through app-led field methods, sophisticated remote sensing technology and biophysical modeling—to build the first-ever U.S. carbon soil inventory.

Teena Gerhardt, associate professor of mathematics; and **Ilya Kachkovskiy**, assistant professor of mathematics, both received highly competitive National Science Foundation Focused Research Group grant awards. In collaboration with principal investigators from institutions across the country, they will use their three-year grants to advance research in some of the most exciting questions in topology, geometry and mathematical analysis.

Two NatSci researchers are recipients of 2021 National Science Foundation Early CAREER Faculty Awards—**Arjun Krishnan,** assistant professor of computational mathematics, science and engineering, and biochemistry and molecular biology; and **Songqiao "Shawn" Wei,** Endowed Assistant Professor of Geological Sciences. Krishnan will use his $704,889 grant to develop machine learning approaches that will automatically annotate publicly available samples from human and major animal models on a massive scale. Wei will use his $501,597 grant to conduct research to help advance our understanding of seismic interpretation, upper-mantle dynamics and material recycling in the Earth's interior.

Richard Lenski, Hannah Distinguished Professor of Microbial Ecology, is the 2021 recipient of the prestigious Society for the Study of Evolution's Lifetime Achievement Award in recognition of his remarkable research, outstanding mentorship and noteworthy service to the evolution community.

Elena Litchman, professor of aquatic ecology, is the recipient of the 2021 G. Evelyn Hutchinson Award from the Association for the Sciences of Limnology and Oceanography (ASLO). The award is presented each year to a limnologist or oceanographer who has made considerable contributions to knowledge, and whose future work promises a continued legacy of scientific excellence.

Shannon Manning and **Kristin Parent** have been selected for the 2021-2022 American Society for Microbiology (ASM) Distinguished Lecturer Program. The ASM selects only the most celebrated researchers as participants in the unique program. Parent conducts pioneering research using electron cryo-microscopy and 3D image reconstruction methods to better understand the underlying mechanisms that control virus infection and decipher the process of virus assembly. Manning's research focuses on the molecular epidemiology and evolutionary genetics of some of the most virulent bacterial pathogens threatening human health today, including E. *coli*, *Salmonella* and *Group B Streptococcus.*

Beronda Montgomery, MSU Foundation Professor of biochemistry and an MSU-DOE Plant Research Laboratory faculty member, is the recipient of the 2021 Mentoring Keynote Lecture Award from the American Society of Cell Biology in recognition of her work related to effective mentoring in research environments. She was also named a 2021 Fellow of the American Society of Plant Biologists in recognition of her distinguished and long-term contributions to plant biology and service to the society.

Gemma Reguera, professor of microbiology and molecular genetics, received the 2022 Alice C. Evans Award from the American Society for Microbiology (ASM) for her outstanding contributions toward the full participation and advancement of women in the microbial sciences. The award is given in memory of Alice C. Evans, the first woman elected ASM president in 1928. Reguera was also named editor-in-chief of *Applied and Environmental Microbiology.* She began her term on July 1.

Frances Trail, professor of plant biology, is the recipient of two prestigious honors in her field of study—mycology. Trail was recently named a 2021 Fellow of the American Phytopathological Society for her outstanding and innovative research in the biology of plant pathogenic fungi. She was also honored with the 2021 Mycological Society of America Weston Award for Excellence in Teaching, which is awarded annually to an outstanding teacher of mycology at the undergraduate and graduate levels.

Frederi Viens is one of a select group of 23 scholars worldwide who have achieved what has been dubbed the Institute of Mathematical Statistics (IMS) Annals quadfecta. The IMS publishes four flagship "Annals" research journals, considered to be top periodicals in each of their respective subfields—statistics, probability, applied statistics and applied probability. The rare feat involves publishing at least one paper in all four of IMS's journals.

Elise Zipkin, associate professor of integrative biology, has been awarded a Fulbright Senior Scholar Fellowship, which will send her to Israel for four months of research and teaching in 2022. Teaming up with Tel Aviv University (TAU) microclimate prediction scientists, Zipkin developed a research and teaching proposal that bridges their disciplines. She plans to lead a series of four full-day workshops for graduate students at TAU and study how climate change affects ecologically and economically important insect species in the Middle East.

The international IceCube Collaboration, which includes several researchers from MSU, was awarded the 2021 Bruno Rossi Prize by the High Energy Astrophysics Division of the American Astronomical Society for the discovery of a high-energy neutrino flux of astrophysical origin. **Claudio Kopper,** associate professor of physics and astronomy; and **Nathan Whitehorn,** assistant professor of physics and astronomy, were the two lead authors of the 2013 analysis that discovered the neutrino flux for which IceCube received the prize.

Protecting biodiversity:

The science behind resilience

The butterfly effect: *Setting biodiversity research* in motion at MSU

One of the greatest natural events on Earth takes place every fall across central North America. That's when millions of monarch butterflies begin their journey south through Texas to a microclimate perfect for overwintering—the Oyamel Fir Forest of central Mexico.

Some monarchs travel an astonishing 3,000 miles to arrive in Mexico in early November each year for Día de Muertos, but since the mid-1990s, the number of returning monarchs has mysteriously plummeted to 20 percent of what it once was.

Scientists debated the cause for years. Habitat loss, illegal logging, ice events, mass mortality and failed breeding success were proposed.

But none of these fractured hypotheses told the whole story until Michigan State University researchers tapped into a resource that turned out to be greater than the sum of its parts—an enormous number of observations recorded by a combination of researchers, volunteers and citizen scientists that cast a data-net wide enough to identify the most recent culprit: climate change.

What is biodiversity?

Earth is filled with vital variation—from the billions of known and unknown microorganisms to the enormous diversity of fish, amphibians, plants, insects, reptiles, mammals and birds interacting at different scales and on different landscapes, sparking evolution and adaptation. And life, as Darwin noted centuries ago, is even more varied within species than between species. There are more than 350,000 species of beetles and 5,000 species of frogs, with more being discovered every day. And when it comes to microbes, high-throughput genetic sequencing points to trillions of species.

The shapes, sizes, textures and colors that make up the earth's biodiversity are not just beautiful, but also extremely useful, and have immediate societal impacts. Nature, from the tallest trees to the tiniest plankton, provides the oxygen we breathe. Small molecules found in plants are the building blocks for 70 percent of cancer drugs and key to battling antimicrobial resistance. Failing ecosystem health has been linked to increasing rates of infectious diseases

that transfer from animals to humans, such as COVID-19. Plant and animal diversity, along with insect pollinators, safeguards the world's food supply, and the variety of natural resources such as oceans, forests, wetlands and lakes are vital for protecting and building human infrastructure.

As climate change accelerates, combined with urbanization, direct exploitation of species, pollution, invasive species and disease, entire ecosystems are threatened, increasing degradation and extinction rates, especially in biodiverse hotspots such as the tropics. A global crisis of this magnitude needs science with a scope and urgency to match, and Michigan State, with the largest number of macrosystems biologists in the United States, is poised to meet the challenge.

This story showcases researchers in the MSU College of Natural Science (NatSci) who, in collaboration with scientists in other colleges, universities and institutions, are making an impact in addressing significant challenges in every major biological system. Their sophisticated and impassioned research is expanding our understanding about the drivers of biodiversity and providing scientifically based actions we can take to protect it.

> **Can species, such as monarchs, withstand the stress involved with climatic change and bounce back, or not?**
>
> **~Phoebe Zarnetske**

Insects, reptiles and amphibians

Harnessing data to protect the future, now

Biodiversity is fading, and fast. One million of the eight million plant and animal species on Earth are at risk of extinction, according to a recent report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services of the United Nations. Imperative questions about how and where future biodiversity shifts will happen under climate change cannot be answered unless scientists are able to analyze data at broader spatial and temporal scales.

Phoebe Zarnetske, associate professor in the Department of Integrative Biology (IBIO), and her Spatial and Community Ecology lab, or SpaCE, are pioneers in collecting and organizing massive amounts of ecological data to understand how species interactions and geodiversity are interacting with climate change to drive precipitous biodiversity shifts.

"Our data collection points to ecosystems that have been resilient to climate change in the past or have shifted to deal with current environmental conditions through movement, adaptation or evolution," Zarnetske said. "Can species, such as monarchs, withstand the stress involved with climatic change and bounce back, or not?"

Utilizing open-source data, SpaCE conducted the largest freshwater insect data census in the United States, filling a major data gap and improving our understanding and ability to predict patterns of insect biodiversity. The lab also plays a key role in ongoing analysis and aggregation of a 30-year data collection effort by the National Science Foundation's (NSF) newly formed National Ecological Observation Network, or NEON, one of the largest standardized data collection networks in the world.

Zarnetske's research is also proving essential to predicting the ecological outcomes of some of the newest and most controversial climate change intervention proposals, such as solar geoengineering, which proposes to block a portion of the sun's radiation with sulfate aerosols.

"We need to better understand the possible impacts of solar geoengineering on everything from soil microorganisms to monarch butterfly migrations to marine systems," said Zarnetske, whose research shows that under both geoengineering and climate change scenarios, some insects and mammals win, and some lose—information crucial for conservation programs. "All of our ongoing projects span spatial scales collectively, and each informs the other."

Mitigating the insect apocalypse

Elise Zipkin, IBIO associate professor and director of the Ecology, Evolution, and Behavior program, or EEB, (see sidebar on right), specializes in uniting diverse data sources on a variety of taxa into integrated models, including a first-of-its-kind flexible statistical modeling framework—the Integrated Community Model—that considers all available data sources to forecast species populations in relation to projected climate change.

"We cannot ignore the growing amount of opportunistic citizen science data, but it comes with huge challenges—no design, no randomization—all the things the scientific community knows are important for making an inference beyond the area of study," explained Zipkin, whose Quantitative Ecology Lab combined thousands of observations recorded by citizen scientists through apps such as iNaturalist with data from researchers to shed light on the monarch mystery. "My lab is asking: What can we do with this wealth of data? How can we make these data valuable for basic and applied research?"

In a seminal study conducted in Panama, Zipkin and her team used long-term data sets tracking amphibians and reptiles to build statistical models showing snake diversity metrics change after catastrophic losses in amphibians. The rarest snakes may be losers in that case, while other snakes increase in body size. In a collaboration with the U.S. Geological Survey, the Zipkin lab integrated amphibian biodiversity data across spatial scales to statistically evaluate factors influencing their survival and directly inform management decisions. And, with a grant from the Midwest Climate Adaptation Science Center, the Integrated Community Model is being used to understand the apocalyptic decline of insects nationwide.

> **. . . understanding which species are declining, and why, is critical to develop effective conservation plans and policies that can protect biodiversity.**
>
> **~Elise Zipkin**

ECOLOGY EVOLUTION BEHAVIOR
MICHIGAN STATE UNIVERSITY

Ecology, Evolution, and Behavior (EEB)

In the late 1980s, a group of MSU biologists thought that if they could collaborate with each other more easily, it would lead to less overlap, better research and more teaching opportunities. They began to envision a way to break out of their silos.

Professors Don Hall and Guy Bush founded The Ecology and Evolutionary Biology program in 1986 to encourage collaboration across departments. Recently renamed Ecology, Evolution, and Behavior (EEB), the program has grown into a diverse community of researchers and students studying life across the globe—from molecules to the biosphere—and has become an internationally recognized leader in these fields.

EEB now includes a dual degree program for doctoral students, a specialization for master's students and postdoctoral fellowships. It has 70 core faculty, 110 graduate students, 42 postdoctoral students and more than 500 alumni. Members attend weekly research seminars, bi-weekly student colloquia, an annual research symposium and several other networking events.

EEB faculty from 12 MSU departments across five colleges bring their individual expertise to new projects, working together on cutting-edge research and on educating the next generation of life scientists. Learn more at **https://eeb.msu.edu**.

"Data integration is the future," Zipkin said. "Ultimately, understanding which species are declining, and why, is critical to develop effective conservation plans and policies that can protect biodiversity."

Nick Haddad, IBIO professor and a faculty member at MSU's Kellogg Biological Station (KBS) Long-Term Ecological Research (LTER) site (see sidebar on page 14), has devoted his career to understanding the inextricable link between ecosystem restoration and biodiversity to prevent extinction of some of the rarest world's butterflies.

"One of those butterflies is St. Francis' Satyr, located only on one army installation, Ft. Bragg, North Carolina," said Haddad, whose book, *The Last Butterflies*, highlights the effects of human activity and climate change on rare butterflies. "Within this tiny range, the butterfly population totals about 3,000, and without restoration, the butterfly will go extinct."

> **. . . insects are declining by about . . . 10 percent per decade. At this rate, insect loss will unravel ecosystems and their function.**
>
> **~Nick Haddad**

The Haddad lab applies both experimentation and ecological principles to preserve biodiversity and practically moves mountains to investigate how these delicate insects respond to changes in their environment.

"The butterflies live in open wetlands that are created by beaver and maintained by fire, so to simulate those conditions, we do what beavers do—we create dams, and remove hardwood trees by cutting them down and carrying them out," Haddad said. "Then we study how butterfly populations respond."

The decline of the monarch and St. Francis' Satyr is emblematic of a more widespread loss of insects across the United States.

"We know that insects are declining by about two percent per year, or 10 percent per decade." Haddad said. "At this rate insect loss will unravel ecosystems and their function. Until we know the degree to which climate change, habitat loss and pesticides play a role, it will be extremely difficult to address biodiversity loss."

Plants

Restoring natural and agricultural landscapes

Haddad and Lars Brudvig, professor in the Department of Plant Biology (PLB), are MSU's lead investigators for an NSF Long-Term Research in Environmental Biology grant at the Savanna River Site in South Carolina. There, the scientists study restored patches of savanna continually managed by the U.S. Forest Service that serve as superhighways for plants and animals. The project has shown an annual increase in the number of plant species over time, proving that corridors are a viable way to increase biodiversity.

"Ecosystem restoration projects are increasingly recognized as central to addressing the biodiversity and climate crises," Brudvig said. "Restoration ecology, a scientific field that informs efforts to actively repair ecosystems damaged or destroyed by humans, has great potential to stem and, perhaps, reverse biodiversity declines by confronting the greatest threat to biodiversity—habitat loss."

Brudvig's research demonstrates that humans can heal past land-use damage. At the Savanna River Site, his lab conducts large-scale restoration treatment experiments of previously restored longleaf pine ecosystems in areas with and without histories of agriculture. They found that the effects of restoration outweighed the costs from a plot's previous land use two-to-one.

"There will be no one-size-fits-all approach to confronting the biodiversity crisis, but by understanding the determinants of conservation success, I'm confident we can tailor plans that will work across the variety of challenges present," said Brudvig, whose lab is now predicting restoration outcomes by evaluating the restoration responses of other taxa such as pollinating insects, small mammals and soil microbes.

In the lab of Marjorie Weber, PLB assistant professor and EEB faculty member, students and postdocs work to understand how plants evolve beneficial traits in response to complex interactions with other species such as pollinators, herbivores and pathogens, a major driver of biological diversity.

In a study funded by an NSF Dimensions of Biodiversity grant, they examine the evolutionary dynamics of mite domatia—small structures on wild grape plants that house beneficial mites as bodyguards. They also investigate a similar arrangement between plants and ants.

"Our goal is to understand how interactions with their natural enemies has impacted the diversity of the plant species we see today," Weber explained. "As the earth's habitats become altered, species interactions worldwide are shifting and breaking down, so understanding the role these interactions play in generating and maintaining biodiversity will be key to conservation efforts."

> **Our goal is to understand how interactions with their natural enemies has impacted the diversity of the plant species we see today.**
>
> **~Marjorie Weber**

Preserving biodiversity and food for the future

David Lowry, PLB associate professor, has devoted his career to understanding how biodiversity evolves in the first place, through the processes of adaptation and speciation. The Lowry lab combines ecological, evolutionary and genetic scientific approaches in its research into three model plant systems of evolutionary genomics: Monkeyflowers, common bean and grasses.

"Monkeyflowers have successfully adapted to a wide array of different habitats across western North America, including toxic copper mine tailings, coastal salt spray zones, alpine regions and the geysers of Yellowstone National Park," explained Lowry, whose team has identified candidate genes involved in the local adaptation of both the coastal and inland exotypes of Monkeyflowers. "By aggregating experimental data from comparative studies of this species, we can identify patterns in how they evolve adaptations to different habitats that, in turn, lead to reproductive isolation and the formation of new species."

Understanding plant speciation is key to predicting how plants may respond to future abiotic stress and to cultivating diversity into agriculturally important plants such as beans and switchgrass, producing more resilient crop species that can withstand drought, heat and excessive moisture.

"Beans are an important crop in Michigan and the biggest source of vegetable-based proteins in Africa and Latin America, but they are susceptible to heat stress and, by 2050, available land for growing beans will be cut in half," said Lowry, whose team has identified regions where geography drives gene adaptation responsible for flowering time, biomass production and disease resistance—regions

> **Ecosystem restoration projects are increasingly recognized as central to addressing the biodiversity and climate crises.**
>
> **~Lars Brudvig**

Long-term agricultural research: LTER and LTAR

Agricultural systems face many stressors, including climate change, demands on limited resources and a growing population. MSU's W.K. Kellogg Biological Station (KBS) is home to two long-term agricultural ecology programs investigating paths toward a productive, sustainable future.

KBS LTER
Kellogg Biological Station
Long-term Ecological Research

More than 100 scientists from MSU and around the world work in KBS's Long-Term Ecological Research (LTER) program, part of a national network of LTER sites established by the National Science Foundation. By observing cropping systems and native spaces, researchers investigate how to best manage biological resources to control pests, mitigate climate change and build soil health. Learn more at **https://lter.kbs.msu.edu**.

kbs ltar
Kellogg Biological Station
Long-Term Agroecosystem Research

KBS is also part of the Long-Term Agroecosystem Research (LTAR) Network of 18 research sites nationwide. The sites were established by the USDA to develop strategies for increasing agricultural production in sustainable ways. KBS LTAR focuses on agriculture of the upper Midwest with the goal of advancing food production and benefits to the environment, farmers and society. Learn more at: **https://www.canr.msu.edu/ltar**.

We're looking for smart, feasible ways for growers to reincorporate diversity into the agricultural ecosystem.

~Will Wetzel

important for conservation. "Having scientists identify populations that have the greatest potential to survive in the future is going to be the most effective way to maintain biodiversity."

Will Wetzel, assistant professor in the Department of Entomology and IBIO, is shedding light on how plant variety in agricultural landscapes—a constructed environment that often lacks the diversity of species found in natural systems—can increase resilience.

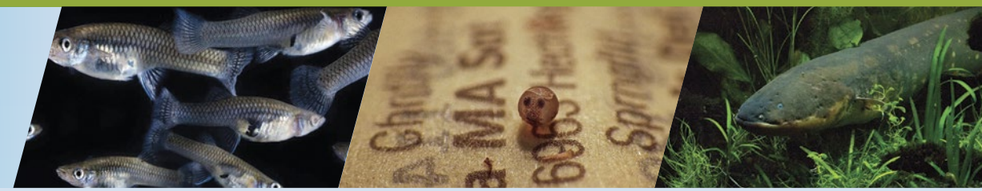
"We hope to figure out how we can re-engineer natural levels of plant defense diversity into cropping systems in a way that will keep pest densities low and prevent pest outbreaks, while limiting our reliance on chemical pesticides," said Wetzel, whose lab is part of EEB, KBS and MSU's Plant Resilience Institute. "We're looking for smart, feasible ways for growers to reincorporate diversity into the agricultural ecosystem."

Wetzel's lab developed ways to simulate the effect of more frequent extreme heat waves on potatoes, Colorado potato beetles and milkweed plants, contributing to the growing data on how the interactions of climate and biological diversity effect agricultural and natural systems.

That type of basic research data is the foundation for researchers such as Bruno Basso, MSU Foundation Professor in the Department of Earth and Environmental Sciences and KBS, faculty member, to build sophisticated, scalable technology helping policymakers and farmers around the globe achieve more sustainable and resilient agricultural systems in the face of climate and environmental change. His groundbreaking research links remote sensing technology with soil and crop modeling to show that 30 percent of the corn and soybean acreage across the U.S. Midwest is constantly unprofitable and unproductive.

"We can now deliver 'prescription' maps for any field of the entire Midwest indicating which areas should be planted with native vegetation, increasing the benefits associated with greater biodiversity while sequestering carbon and improving soil health," said Basso, who calls it a win-win for people and nature. "We need a systemic transformation at an unprecedented speed and scale to build biodiverse, climate-resilient food and energy production systems, and my research integrates vast amounts of data from soil, plants and the environment to achieve this ambitious goal."

Fish



Testing the waters of evolution and adaptation

"Biodiversity is the sum of new species minus existing species going extinct. We are currently living through a major extinction event on our planet, so the second part of the equation is super important," said Jason Gallant, IBIO associate professor. "But the other part of this equation is just as important—where does new diversity come from?"

Gallant's Electric Fish Lab explores novel phenotypic and behavioral traits involved in animal communication signals using weakly electric fish from Africa known as mormyrids—one of the most rapidly diversifying groups of fish in the world because of their amazing ability to make and perceive electricity.

"In a given year, we are characterizing the insects in a stream these fish may eat, the behavior of the fishes when they mate and many aspects of the physiology and genetics of these diverse, successful and fascinating creatures," said Gallant, who conducts fieldwork in Gabon in Central Africa. "We think the evolution of their electrical signals facilitates the speciation process by helping them find food and attract mates in a way no other animal group can, but it turns out that not all groups speciate at the same rate, and some of their adaptations lend themselves to generating new species more rapidly than others."

Understanding the genetic mechanisms behind how fish evolve extreme developmental tricks is key to uncovering built-in evolutionary solutions to extreme changes in the environment, said Ingo Braasch, IBIO assistant professor well-known for establishing gars and bowfin, archetypical fishes native to the Great Lakes, as key model organisms to spur research in evolution. His most recent work investigates the evolutionary adaptations of annual killifishes that live in small ponds in Africa and South America.

"Annual killifishes have evolved a fantastic adaptation to the dry and wet known as developmental arrest," Braasch explained. "When the pond dries, the adult fish die, but the eggs they laid in the soil will wait in a state of developmental arrest until water returns to hatch. This is an example where nature found a solution to deal with an extreme environment, and by understanding how they solved it genetically, we can potentially predict how other species may be able to respond to droughts."

Understanding the rate of speciation and how behavioral traits spark evolutionary change has been a 25-year-long priority for Janette Boughman, IBIO professor and a leading expert on diversification in the threespine stickleback. Her lab takes advantage of a unique ecosystem in Iceland where more than 50 individual highland lakes, ranging from the oldest at 12,000 years to the youngest at just 50, provide a stunning natural laboratory to investigate the processes of adaptation.

"Iceland is an evolutionary powerhouse to study the consequences of human-made changes on biodiversity," said Boughman, who has seen how sediments from increasing glacial melt can cloud formerly crystal-clear water, impairing the stickleback's vision and forcing them to adapt more quickly than in the past. "We want to know; will they evolve different vision or switch to different senses? How fast will this occur, and can we use our findings to determine whether species will adapt, speciate or go extinct under novel and stressful conditions?"

If we better understand the processes that create biodiversity, then we can better protect those processes and biodiversity itself.

~Janette Boughman

With support from an NSF Dimensions of Biodiversity grant, Boughman and her team discovered predictable stickleback adaptations to murky water that included enhanced touch sensations on their bodies to facilitate schooling behavior and prey-finding. Even more compelling, the adaptations eventually converged to be similar, even if the ancestors were of a different phenotype.

"Speciation is the engine that causes and creates biodiversity, and it is such an important process," said Boughman. "If we better understand the processes that create biodiversity, then we can better protect those processes and biodiversity itself."

Gideon Bradburd, IBIO assistant professor and co-PI on grants in the Boughman lab, uses novel statistical methods for inferring and visualizing complex spatial patterns of genetic information. National Institutes of Health–funded research in his lab has the potential to shed light on some of the biggest remaining mysteries in evolutionary biology and ecology.

"We know a fair amount about biodiversity at the species level, but we still know comparatively little about genetic diversity in natural populations, especially across broad groups of species and at a global scale," said Bradburd, who is leading an NSF-funded project to understand what drives levels of genetic diversity in the world's oceans. "Knowing how genetic diversity is distributed across space and time can inform our understanding of the health of organisms and their environment and be used to guide conservation efforts."

In working to address these questions, Bradburd and his colleagues discovered an alarming lack of metadata—data that provides information about other data in public genomic databases—and are calling on the research field to improve genomic biodiversity data archival processes and subsequently the ability to monitor and conserve global genetic diversity.

> **A major focus of our work is figuring out how and why genetic variation matters for population persistence . . .**
>
> **~Sarah Fitzpatrick**

Through field and lab work in both wild and captive populations of fish, Mariah Meek, IBIO assistant professor, and her lab collect tissue samples from individuals across populations to determine the molecular basis for variation and design tools that improve our ability to monitor and conserve biodiversity.

"Genomic diversity is the most fundamental level of diversity, upon which all other biodiversity is built," Meek said. "Despite its foundational nature, it is often overlooked in sustainability efforts in favor of the diversity one can see."

One of their latest instruments combines the CRISPR-Cas13a Specific High-sensitivity Enzymatic Reporter unLOCKing system, or SHERLOCK, with artificial intelligence capabilities to develop low-cost, rapid field-deployable species identification tools.

"As scientists, we need to come together across fields with policymakers to develop bold new conservation solutions and proactive communication efforts," Meek said. "Science can inform every step of the way by identifying gaps in our understanding of the causes of species and ecosystem resilience, working to fill those gaps and then monitoring and evaluating solutions to ensure their effectiveness."

The processes and places that drive biodiversity also drive Sarah Fitzpatrick, IBIO assistant professor, to actively apply fundamental knowledge from ecology and evolution to improve biodiversity conservation efforts. Her KBS lab combines genomic tools, mark-recapture methods and experiments to study how evolutionary processes such as gene flow, drift and selection affect population dynamics and diversity patterns.

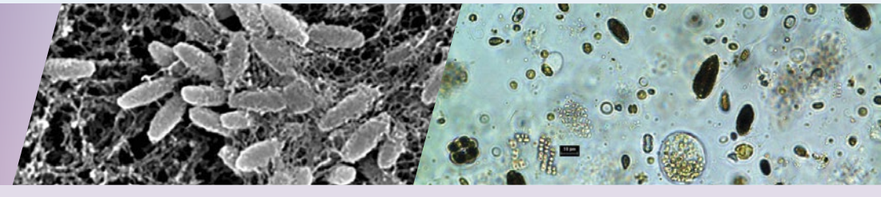
"In some cases we study model organisms, such as Trinidadian guppies or Eastern mosquitofish, which are not themselves endangered, to do experiments that will inform conservation of actual endangered species," Fitzpatrick said. "By combining genetic and demographic data on their survival and reproduction, we are able to inform management strategies."

The Fitzpatrick lab is helping design and monitor these strategies for several threatened and endangered species, including Arkansas darters, Florida Scrub-jays and Michigan's Eastern massasauga rattlesnakes.

"A major focus of our work is figuring out how and why genetic variation matters for population persistence, and how to manipulate it through genetic rescue, for example, to help save declining populations and species," Fitzpatrick said. "Conservation biology has famously been compared to cancer research in that both are crisis disciplines where actions must often be taken before all the facts can be assembled. The greatest contribution science can make is to keep assembling those facts, to reduce risk when carrying out a certain strategy or action—because doing nothing is also risky."

> **Genomic diversity is the most fundamental level of diversity, upon which all other biodiversity is built.**
>
> **~Mariah Meek**

Microbes



Supporting biodiversity by land and by sea, invisibly

"The charismatic biodiversity of macrofauna is easy to appreciate with your eyes, but microbial species emerge and go extinct all the time," said Ashley Shade, associate professor in the Department of Microbiology and Molecular Genetics. "Microbes are the most diverse of all known organisms and dominate two domains of the tree of life, so understanding what microbiomes are and how they provide support is critical to conservation efforts of the macrofauna."

In the Shade lab, scientists investigate the ecological and evolutionary dynamics of microorganisms in extreme conditions to discover the general rules of microbiome resilience and how they can be applied to other environments. With support from the USDA and the Great Lakes Bioenergy Research Center, the Shade lab stresses agricultural plants with drought and excess nitrogen to investigate how their roots recruit specific microbes to gain resilience and how that's passed on to the next generation of plant.

> **The charismatic biodiversity of macrofauna is easy to appreciate with your eyes, but microbial species emerge and go extinct all the time.**
>
> **~Ashley Shade**

"Initially, we worked on building a foundational understanding of the plant microbiome," Shade said. "Now, we are thinking about microbiome management strategies by working with microbial collections from the environment and testing traits of those bacterial isolates for supporting plant health and resilience related to climate change."

Shade credits her graduate students for the painstaking work involved in isolating, sequencing and maintaining specific

> **Accurate predictions of carbon cycling and climate change will be essential for human adaptation and mitigation efforts . . .**
>
> **~Sarah Evans**

microbes from the environment—work that is paying off. Their investigations show microbial communities are innately resilient to stress, and Shade is excited to discover and harness this capacity to recover.

"Microbiome data are currently underutilized," Shade said. "To capitalize on the big data, we need collaborations with modeling and data scientists for insights into the baseline ecosystems, and we need to train students to analyze it and produce models that can make sense of data that exists already."

Microbial diversity plays an extraordinary and largely unknown role in biogeochemistry processes and agricultural services and Sarah Evans, IBIO associate professor, is digging deep into how microbes interact with plants and soils to build resilience in agricultural systems from the ground up.

"We investigate how microbes power carbon and nitrogen cycling to influence climate change, and the role microbial diversity plays in ecosystem services such as soil fertility, water quality and carbon cycling," said Evans about her KBS-based lab that used a combination of biogeochemical analyses, field manipulations and models in an NSF-funded study. "Accurate predictions of carbon cycling and climate change will be essential for human adaptation and mitigation efforts, and this project quantifies a critical component to improving the accuracy of carbon models—the global response of soils to severe drought.

"It is critical to understand how microbes support other organisms because some may be able to rescue some species in decline," Evans added.

Two MSU Foundation Professors, Elena Litchman and Christopher Klausmeier, use their KBS labs to conduct comparative investigations into how climate change is impacting the fate of aquatic microbial biodiversity, such as plankton. Photosynthetic marine microbes serve as the foundation for the earth's oxygen production, the aquatic food web and global energy and nutrient cycles, but basic questions about how species diversity affects their ability to organize and adapt remain unanswered.

"My research focuses on understanding how different species respond to rapidly changing environments due to warming and other anthropogenic impacts, such as increases in nutrients and land-use changes," Litchman explained. "Because species differ in their traits, in the future some species will be winners and some losers, and this can dramatically change biodiversity."

Some of Litchman's seminal biodiversity work was conducted more than a decade ago in Siberia's Lake Baikal, the world's largest and most-diverse lake fueled by a unique planktonic food web. Litchman said that the lake serves as a model for shaping predictions about the effect of climate change on similar ecosystems, such as those in polar and subpolar regions.

"Our work on Lake Baikal showed that endemic species of tiny algae and zooplankton may be declining due to lake warming and declining ice cover," Litchman said. "These unique communities are being replaced by other species, including toxic algae, and this can threaten other unique species, including the world's only freshwater seals, nerpas."

Both Litchman and Klausmeier currently have an NSF grant to determine the trait and genetic diversity of phytoplankton species isolated from four lakes in southwest Michigan with different levels of nutrients, light and zooplankton predation.

"It's been long recognized that ecology and evolutionary biology are really two aspects of the same field, but in recent years there has been an upswing in models that combine this perspective," said Klausmeier, a theoretical ecologist. "Our work will contribute to this ongoing synthesis by showing how the same environmental factors drive both species diversity and genetic diversity within species."

Working together to connect the dots

Even as the number of species dwindle, biodiversity data and research are exploding in size and sophistication. The next step, according to Zarnetske and Zipkin, is connecting the dots between scales, models and methods through data analysis and integration so that scientists and students can capitalize on their research and become more than the sum of their individual parts.

"MSU is one of the top institutions in the world for macrosystems science—a science that involves quantifying and predicting across spatial scales to address complex global change impacts on biodiversity," said Zarnetske, who is spearheading the new Institute for Biodiversity, Ecology, Evolution, and Macrosystems, or IBEEM (see sidebar below). "We need to leverage data and expertise from scientists across many disciplines that is accessible and publicly available, not hidden away in file drawers."

Zipkin agrees that solving the biodiversity crisis is well beyond what one lab alone can do and training the next generation of scientists is key to those efforts.

"We have tremendous breadth in the types of model organisms that our scientists work on, and we can combine this learning to predict locations that are good for biodiversity in the future so we can target conservation efforts," Zipkin said. "By partnering with industry, nonprofits and the state, we can figure out how we get the best bang for our buck because, in the end, conservation dollars are going to be limited. We want to be effective in where we put our resources."

"Scientists need to think about the implications of basic research and the pressing needs of the planet as we enter the sixth mass extinction," Zipkin added. "About 30 percent of EEB graduates work in non-government organizations and government positions, and that number is growing because they are committed to taking their training in research and going out into the world and putting it into practice through communications and policy. Their passion and dedication gives me great hope for the future."

Institute for Biodiversity, Ecology, Evolution, and Macrosystems (IBEEM)

To help protect biodiversity around the world, conservationists, policymakers and wildlife managers use models to guide their actions. With the advances of macrosystems science, these models can now provide a broad picture of biodiversity by quantifying changes within species, communities and ecosystems across space and time. Researchers can now analyze data spanning days to decades, and regions to the whole globe.

To integrate macrosystems science into current and future research at MSU, a diverse group of students, postdocs, and faculty members are coming together across disciplines to form the Institute for Biodiversity, Ecology, Evolution, and Macrosystems (IBEEM). More than 25 principal investigators in ecology, evolution, Earth science, computer science and statistics lead research and training across five colleges, making it one of the largest collaborations within a university in those fields anywhere in the country. IBEEM will bridge the gaps between biodiversity research in individual labs and programs.

The institute opened this fall with seed funding from the MSU Foundation. The overarching goal of this collaboration is predicting how biodiversity and ecosystems respond to global change. IBEEM will advance MSU's reputation and visibility in ecology and evolution, while positioning itself as a leader in macrosystems science.

The evolution *of two successful* careers

He has been an engineer, folk musician, song writer, author and—most recently—a scholar of evolution. She has been a TV weather anchor, host of a television talk and entertainment show, and Mississippi Young Career Woman of the Year (1973). Brad (B.S. '65, M.S. '66, civil engineering) and Cathy (Boyette) Hoot have certainly led diverse and successful lives.

Cathy and Brad Hoot

"MSU did a great job preparing me for my career," said Brad, who served in Vietnam after receiving his degrees from Michigan State University and then joined the Chicago District Corps of Engineers (COE). "I never lacked in my understanding of anything . . . I don't recall anything ever coming up during my career that I didn't feel prepared for."

Brad and Cathy met when he was working in a COE hydraulics laboratory in Vicksburg, Miss., and she worked for WLBT-TV, the CBS affiliate in Jackson, Miss. They married in 1970.

They recently established the Bradley and Cathy Hoot Endowed Fellowship in Evolution—the first such fellowship in MSU's College of Natural Science. The endowment is for graduate fellows focused on evolution research at MSU.

Brad's interest in evolution versus creation was piqued by debates he had with Cathy's father.

"Cathy's dad and I used to have really great discussions on evolution versus creationism. He was a creationist. I took his opinions seriously. He made some good points. It forced me to read a lot and look up a lot of research, to see both sides of it," Brad said.

The fellowship endowment agreement states that preference will be given to graduate students who would be willing to engage with alternative thinking.

"I hope the recipient would represent the evolution side in any kind of debate or public exposure—to try to get the thinking that's behind it out to the public," Brad said. "The decision-making system should be based on scientific methods."

"I share the same views that Brad does," Cathy said. "Science needs to be the driving factor in just about everything we do. We can certainly see how important that has been in dealing with COVID. Science is really important from the standpoint of having a valid education for the future."

"We want the endowment to focus on students who not only do microbiology and paleontology, but those who can present the different kinds of thinking between creationism and evolution so people can make intelligent decisions," said Brad, who is also working on a book about the subject.

The Hoots feel it's imperative that they invest in MSU with this endowment.

"I appreciate MSU," Brad said. "I recall hearing the statement: 'Michigan State tries to give as quality an education as it can to as many people as it can.' That resonates with me. I like to support that."

"I may be a Mississippi girl, but after visiting the MSU campus, and being married to Brad for 50 years, I can tell you right now, I'm definitely a Spartan!" Cathy said.

And together, these two Spartans will make the world a better place.

PREPARED

"I don't recall anything ever coming up during my career that I didn't feel prepared for."

A conversation *with NatSci DEI assistant dean,* Amber Benton

Amber Benton joined the MSU College of Natural Science (NatSci) as its assistant dean for diversity, equity and inclusion (DEI) on April 12, 2021. She heads the college's newly formed Center for Inclusion, Community and Belonging.

Q: Tell us a little bit about your background/career history prior to joining NatSci.

AB: I am originally from Las Vegas, Nevada, where I obtained my master's degree in educational leadership. During my master's program, I knew I wanted to complete a doctoral degree, but wanted to focus on increasing my work experience in higher education. From there, I worked in for-profit education, but I wanted to move into nonprofit higher education, so I began to job search. I was offered a position at Michigan State University's College of Engineering as an academic advisor and decided to relocate. After a couple of years in the college, I was encouraged to pursue a position with MSU's James Madison College (a residential college focused on public and international affairs) as director of diversity programming and student engagement. During that time, I completed my Ph.D. in higher, adult, and lifelong education (HALE) in the MSU College of Education, where I focused on student success for Students of Color in STEM.

Q: What attracted you to join NatSci as its inaugural DEI assistant dean?

AB: I was encouraged by colleagues on campus to pursue the position based on my doctoral research and experience working in DEI. I was interested in the position because it would combine two areas I am passionate about: STEM success and DEI. It was a bonus that it was an inaugural position and that I would get the opportunity to create a DEI vision and contribute to the college's strategic planning.

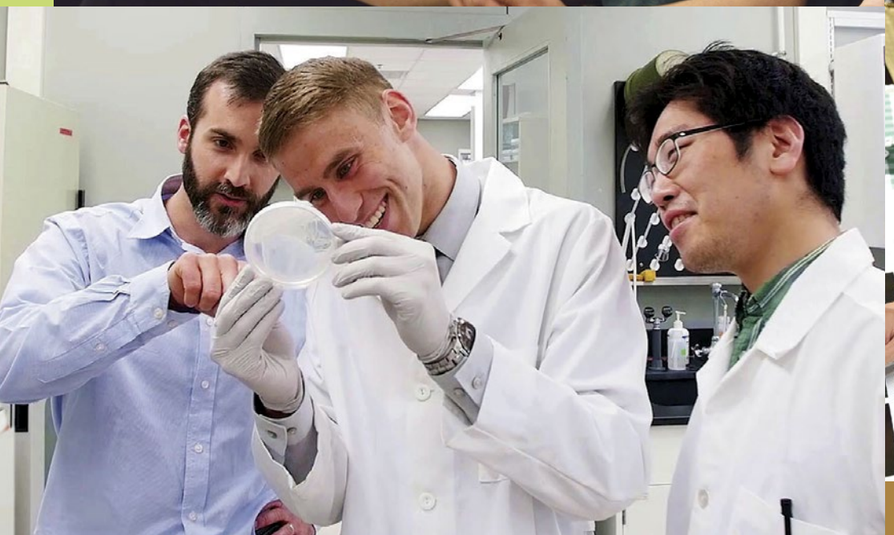
Q: What are your key priorities for the college over the next several years?

AB: In my short time with NatSci, I have identified a few key priorities and areas where I want to focus my efforts. My first priority is to collaborate with colleagues and departments on enhancing the college climate. I want NatSci to be a place where all members feel welcome, valued and productive. My second priority is increasing the racial and gender diversity of our workforce in the college. It is important for students to see that they are represented in the classroom and in leadership. The third priority is to increase the graduate rate for Students of Color in the College. I plan to strategize with our undergraduate directors and departmental leadership on how to reduce opportunity gaps in order to increase the graduation rate. As always, I want to continue to offer educational opportunities to increase understanding around a variety of DEI-related topics.

Dr. Amber Benton

Q: What are your thoughts about what the future of DEI looks like more broadly?

AB: The need for DEI leadership is constantly growing in higher education and in our society more broadly. Based on the U.S. Census, our demographics are changing and our society is becoming more diverse, which means our talent pool is diversifying. This presents a great opportunity to diversify the workforce, especially in STEM fields. However, this also calls for us to have a greater understanding of those around us and those we aspire to have in our organizations.



STORY BY LAURA LUPTOWSKI SEELEY

Dean's Research Scholars: *A decade of* student success

When the College of Natural Science (NatSci) Dean's Research Scholars (DRS) program began in the fall of 2012, Mariam Sayed was a sixth-grade student at Schwarzkoff Elementary School in Sterling Heights, Mich. Her favorite subjects were reading, writing and language. She was involved in Science Olympiad, Social Studies Olympiad, Quiz Bowl and student council. She also played basketball and was on the swim team. She was passionate about and considered becoming a teacher, an astronaut, a foreign services officer and a lawyer—all at age 12!

Today, she is part of the 10th DRS cohort and a member of the Honors College at Michigan State University. She will earn her B.S. in physiology and her B.A. in French in spring 2022 and go on to medical school. She said her aim is to work in underprivileged francophone regions that don't have equitable access to medical resources.

"I have been so fortunate to have such an enriched experience as a student, scholar and assistant researcher," said Sayed, who is president of MSU's French Club and an undergraduate teaching assistant for CEM 141/142. "I know my experiences as a Dean's Research Scholar will pave the way to help me make a meaningful change in under-served communities as a culturally sensitive and well-informed healthcare provider."

On the opposite side of the DRS continuum, Mike Paxhia (biochemistry & molecular biology/biotechnology/genomics &

molecular genetics), who was in the inaugural DRS cohort in 2012-2013, went on to pursue his Ph.D. in microbiology at the University of Georgia as an NSF Graduate Research Fellow. He is currently a post-doc at the Quadram Institute, where he investigates how the metabolisms encoded by bacterial microcompartments influence human health through their influence on the microbial communities of the human microbiome.

"The Dean's Research Scholars program was very influential in developing communication of research across scientific fields, which continues to be important in my new role at an interdisciplinary research institute," Paxhia said. "Presenting my research to diverse audiences was helpful when I went to graduate school and presented my work at national and international meetings."

"The Dean's Research Scholars program recruits a diverse group of excellent student scholars to an intense outreach and leadership program within the college—to enhance their careers, to provide role models for diverse students, and to engage with our alumni and academic community in meaningful ways," said Phil Duxbury, NatSci dean. "Over the past ten years, the DRS program has been very successful and has served as a model for other colleges at MSU."

Each year, approximately 10 undergraduates are selected through a competitive scholarship program, with NatSci alumni participating as interviewers and evaluators.

"The DRS program is an opportunity for undergraduate students to familiarize themselves with complex research methodology, present findings in an understandable manner and improve their public speaking skills," said Laura Colville (statistics, '72), who serves as an evaluator for the program. The students commit to represent NatSci at events and speaking opportunities on campus and around the country.

"As an evaluator, the questions I ask during the interview process help me evaluate the candidates' speaking skills, organization of their answers and ability to communicate complex technical topics in an easy-to-understand manner," Colville added.

"As part of the DRS experience, these students learn how to better communicate to the public about the science or math that they do—a vital skill for anyone in STEM fields and one that will be useful to them throughout their careers," said Angela Wilson, John A. Hannah Distinguished Professor of chemistry in NatSci, and associate dean for strategic initiatives. She works one-on-one with the scholars.

"The important part of the communication is the ability for these scholars to be able to explain their research in lay terms, so anyone can understand it," said Leonard Tabaka (biological science, '64, M.B.A., '75), who has been an evaluator since the start of the DRS program. "One challenge the students face is to be able to explain their research project in 10 words or fewer!"

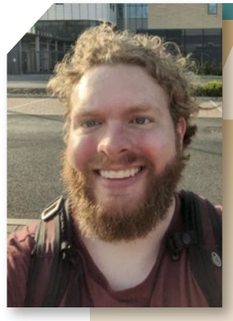
Students also learn basic research techniques and how to work together with a diverse group in the labs.

Tabaka and his wife also provided some of the seed money to launch the program. "It was an opportunity for us to give back to the university to help aspiring students," said Tabaka, who had to work during college to support his own education.

"I never had a chance to do research as an undergraduate student," said James Hoeschele (Ph.D., chemistry, '69), one of the key supporters of the DRS program—from interviewing potential scholars to providing financial support. "It's important for students to have the opportunity to be exposed to what research is about—the challenges and joys of doing research."

"Through the financial support of the Deans Research Scholars program for two years, I was able to fully immerse myself in research and learning to be a scientist," said William Yakah (neuroscience, '19), who began his Ph.D. this fall in the Nutritional and Metabolic Biology Program at Columbia University, N.Y. "I loved the opportunities to present my work to different audiences that were not familiar with my area of research—an experience I have continued to enjoy still today and that would not have been possible without the DRS program."

"The DRS program is also a path for the students to become leaders in their field of study," Colville said.



"The Dean's Research Scholars program was very influential in developing communication of research across scientific fields . . ."

~Mike Paxhia

"Through the financial support of the Deans Research Scholars program . . . I was able to fully immerse myself in research and learning to be a scientist."

~William Yakah

"The Dean's Research Scholars program gave me confidence to pursue leadership roles in interdisciplinary projects and opportunities."

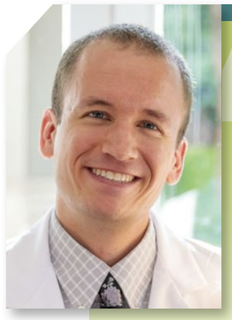
~Thomas Grubb

"My experience as a Dean's Research Scholar was monumental for my acceptance into Duke."

~Don Nguyen

"My time as a Dean's Research Scholar gave me the opportunity to . . . learn from and interact with other talented undergraduate researchers."

~Ally Brown



"Participating in the Dean's Research Scholars . . . provided me with valuable experience in speaking about my scientific work and engaging people of all backgrounds . . ."

~Craig Pearson

"The Dean's Research Scholars program gave me confidence to pursue leadership roles in interdisciplinary projects and opportunities," said Thomas Grubb (mathematics and economics, '17), who is entering his last year as a Ph.D. student at the University of California San Diego. His current focus is on the computational aspects of mathematics. This past summer, he served as an intern on Instacart's Machine Learning team, working on developing efficient ways of uniformly representing data and knowledge; he hopes to find a similar role in industry after graduating this June.

"I always enjoy talking to Spartan undergrads and hearing about the variety and creativity of their NatSci research projects," said James K. Billman (biochemistry, '69), an evaluator for the program. "Technology advances have allowed undergrads to perform projects that only a few years ago would have been graduate student research."

"My experience as a Dean's Research Scholar was monumental for my acceptance into Duke," said Don Nguyen (microbiology, '20), a master's student in the Duke Global Health Institute. As a graduate research assistant in the Duke One Health Lab, he works with pre-pandemic surveillance testing with animal samples from global collaborators. As a project coordinator with Duke Bass Connections, he coordinates a research team that looks to analyze vaccine hesitancy and other health behaviors. He plans to apply to medical schools in the spring.

Craig Pearson (biochemistry and molecular biology/neuroscience, '14) is also pursuing a career in medicine. He completed his Ph.D. in clinical neuroscience at the

". . . my experiences as a Dean's Research Scholar will pave the way to help me make a meaningful change in under-served communities . . ."

~Mariam Sayed

University of Cambridge through the Marshall Scholarship and NIH-Cambridge Fellowship and is now a medical student at Washington University in St. Louis. He is currently taking a one-year leave of absence to undertake a writing fellowship at Boston University.

"Collectively, my postgraduate experiences have prepared me for a career as a physician, researcher and writer. My scholarly interests lie in the medical humanities and narrative medicine—disciplines that seek to understand how personal and collective narratives influence people's experiences of illness and medical care," Pearson said.

"Participating in the Dean's Research Scholars program during my time at Michigan State provided me with valuable experience in speaking about my scientific work and engaging people of all backgrounds in the importance of STEM. MSU remains an outstanding environment for the professional development of its students, and I am grateful to have had this foundation on which to build as I advance in my career," Pearson added.

Interacting with their peers in the DRS program and learning to communicate with a broad range of audiences has been key to many successful career paths.

"My time as a Dean's Research Scholar gave me the opportunity to reflect on how I was communicating about my research and to learn from and interact with other talented undergraduate researchers in my cohort," said Ally Brown (environmental biology/zoology, '20). She joined the Maerz Herpetology Lab within the Warnell School of Forestry and Natural Resources at the University of Georgia, where she is working toward a master's degree in wildlife ecology and management. Her research focuses on the impact of Longleaf pine savanna restoration on snake populations and the factors that influence recolonization of restored habitat. "My hope is that this research can directly inform efforts to manage habitat suitable for at-risk species such as the Eastern diamondback rattlesnake," she said.

"Many generations of Spartans have participated in undergraduate research opportunities, including the Deans Research Scholars," said Mark Ehlert (microbiology, '75), a key donor to the program. "Our best and brightest have gone on to significant careers and life choices. We as alumni should continue to provide support for those students, knowing that these efforts are rewarded."

Tabaka said he hopes to see the program continue. "People see the merits of the program. It has good roots," he said.

"The DRS program has had a huge impact on these students' lives," Hoeschele said. "It has created a group of MSU ambassadors to promote the university and the science, and to inform the public about the quality of students we have here."

"This journey of representing my university as an ambassador and having an outlet to present my research with multiple, inquisitive audiences has helped me discover my growing passion for research and has opened my eyes to a number of new career paths," said Sayed, who sums up her current work in 10 words: neurodiversity research advocating for marginalized groups like non-speaking autistic individuals. "It has also given me the opportunity to connect with a cohort of resilient and innovative young leaders whom I learn from and am able to share ground-breaking ideas with that may change the world someday."

NatSci Dean's Research Scholars (2012-2022)

2012 – 2013

Karen (Beatty) Brzezinski, Naperville, Ill., zoology, '13
Hilary Egan, Blue Ash, Ohio, mathematics/physics '13
Jaya Gupta, Midland, Mich., biomedical laboratory science/human biology, '13
Ariana Koch, Omaha, Neb., human biology/nutritional science, (no degree)
Kraig Koroleski, Hudsonville, Mich., geological sciences, '12
Jacob Ludwig, Lake Orion, Mich., chemistry, '14
Michael Paxhia, Battle Creek, Mich., biochemistry & molecular biology/biotechnology/genomics & molecular genetics, '13
Irina Pushel, Naperville, Ill., biochemistry & molecular biology/biotechnology, '15
Melissa (Tatro) Kelley, Canton, Mich., zoology '14

2013 – 2014

Samuel Akwei-Sekyere, Tema, Ghana, neuroscience/computational mathematics, '16
Brian Chivers, Antioch, Ill., computer science/mathematics, '15
Ariana Koch, Omaha, Neb., human biology/nutritional science (no degree)
Jacob Ludwig, Lake Orion, Mich., chemistry, '14
Michaelyn Lux, Brighton, Mich., chemistry, '14
Megan McNitt, St. Joseph, Mich., chemistry/coaching, '15
Daniel Mitchell, Saginaw, Mich. genomics & molecular genetics/anthropology, '14
Joseph Nutter, Cincinnati, Ohio, physics/economics, '15
Craig Pearson, Bloomfield Hills, Mich., neuroscience/English/biochemistry & molecular biology, '14
Irina Pushel, Naperville, Ill., biochemistry & molecular biology/biotechnology, '15
Matthew Smith, Detroit, Mich., biochemistry & molecular biology, '14
Olivia Spagnuolo, Dansville, Mich., zoology, '14

2014 – 2015

Rebecca (Cassie) Benjamin, Webberville, Mich., neuroscience, '16
Brian Chivers, Antioch, Ill., computer science/mathematics, '15
Sara Denbo, Lindenhurst, Ill., astrophysics/women & gender studies, '17
Bradley Disbrow, Wheaton, Ill., microbiology/international relations, '16
Jacob Gibson, Spring Hill, Fla., biochemistry and molecular biology, '16
Irene Li, Canton, Mich., genomics & molecular genetics/international studies in social science, '16
Sarah Maclachlan, Pittsburg, Pa., zoo and aquarium science, zoology, '16
Megan McNitt, St. Joseph, Mich., chemistry/coaching, '15
Jessica Mudge, Livonia, Mich., neuroscience/psychology, '15
Joseph Nutter, Cincinnati, Ohio, physics/economics, '15
Chiadika Nwanze, Lagos, Nigeria, neuroscience, '16
Irina Pushel, Naperville, Ill., biochemistry & molecular biology/biotechnology, '15
Shaurya Srivastava, Haslett, Mich., human biology, '20

2015 – 2016

Rebecca (Cassie) Benjamin, Webberville, Mich., neuroscience, '16
Sara Denbo, Lindenhurst, Ill., astrophysics/women & gender studies, '17
Bradley Disbrow, Wheaton, Ill, microbiology/international relations, '16
Kiera Fisher, Kalkaska, Mich., biomedical laboratory diagnostics/physiology, '17
Jacob Gibson, Spring Hill, Fla., biochemistry & molecular biology, '16
Laura Hesse, Madison, Ind., microbiology, '17
Clara Lepard, East Lansing, Mich., zoology, '17
Irene Li, Canton, Mich., genomics & molecular genetics/international studies in social science, '16

NatSci Dean's Research Scholars (2012-2022) *Continued*

Sarah Maclachlan, Pittsburg, Pa., zoo and aquarium science, zoology, '16
Lazarius Miller, Detroit, Mich., biological science–interdisciplinary, '17
Chiadika Nwanze, Lagos, Nigeria, neuroscience, '16
Emmalee Skorich, DeWitt, Mich., neuroscience, '16
Shaurya Srivastava, Haslett, Mich., human biology, '20
Katherine Wozniak, Clinton Township, Mich., microbiology, '16

2016 – 2017

Kiera Fisher, Kalkaska, Mich., biomedical laboratory diagnostics/physiology, '17
Dominique Garrison, Detroit, Mich., microbiology, '17
Thomas Grubb, Haslett, Mich., mathematics/economics, '17
Laura Hesse, Madison, Ind., microbiology, '17
Madison Jenner, Traverse City, Mich., chemistry, '18
Clara Lepard, East Lansing, Mich., zoology, '17
Cody Madsen, Battle Creek, Mich., biochemistry & molecular biology/ biomedical engineering, '18
Katherine Magoulick, Fayetteville, Ark., zoology/history, '18
Hananiel Setiawan, Surabaya, East Java Province, Indonesia, physics, '17
Audrianna St. Germain, Brighton, Mich., physiology, '20
Emily Steffke, Beal City, Mich., neuroscience/English, '20
Lucas Werner, Saint Charles, Ill., biochemistry & molecular biology/ political science–pre-law, '18
Kristian Wilks, St. Clair Shores, Mich., neuroscience/genomics & molecular genetics, '18

2017 – 2018

Nahid Savan, Mount Pleasant, Mich., chemistry, '20
Zachary Bezemek, West Bloomfield, Mich., mathematics/ Japanese, '18
Cody Madsen, Battle Creek, Mich., biochemistry & molecular biology/ biomedical engineering, '18
Brendyn Smith, Dexter, Mich., biochemistry & molecular biology, '19
Emily Steffke, Beal City, Mich., neuroscience/English, '20
Matthew Welch, Lansing, Mich., neuroscience, '18
Lucas Werner, Saint Charles, Ill., biochemistry and molecular biology/ political science–pre-law, '18
William Yakah, Accra, Ghana, neuroscience, '19
Ting (Jessica) Yen, Okemos, Mich., biomedical laboratory science, '19
Katherine Magoulick, Fayetteville, Ark., zoology/history, '18
Kristian Wilks, St. Clair Shores, Mich., neuroscience/genomics & molecular genetics, '18
Audrianna St. Germain, Brighton, Mich., physiology, '20

2018 – 2019

Katrina Gensterblum, Pinckney, Mich., mathematics, '20
Ryan Griffin, Macomb, Mich., physiology, '19
Aaliyah Jeter, Saginaw, Mich., chemistry, '20
Don Nguyen, Omaha, Neb., genomics & molecular genetics/microbiology, '20
Jacqline Njeri, Limuru, Kenya, biochemistry & molecular biology/ biotechnology, '20
Shelby Parks, Valdosta, Georgia, zoology, '20
Brendyn Smith, Dexter, Mich., biochemistry & molecular biology, '19
Audrianna St. Germain, Brighton, Mich., physiology, '20
Emily Steffke, Beal City, Mich., neuroscience/English, '20
William Yakah, Accra, Ghana, neuroscience, '19
Ting (Jessica) Yen, Okemos, Mich., biomedical laboratory science, '19

2019 – 2020

Alexandra Brown, Grand Rapids, Mich., environmental biology/zoology, '20
Cade Dembski, East Lansing, Mich., physics/clarinet performance, '22
Joseph Faryean III, Monrovia, Liberia, neuroscience, '20
Aalayna Green, Clarkston, Mich., zoology, '21
Kayley Irwin, Twinsburg, Ohio, physiology, '20
Don Nguyen, Omaha, Neb., genomics & molecular genetics/ microbiology, '20
Jacqline Njeri, Limuru, Kenya, biochemistry & molecular biology/ biotechnology, '20
Emily Steffke, Beal City, Mich., neuroscience/English, '20
Brent Strong, Saline, Mich., physiology, '21
Amanda Ziminski, Manistique, Mich., human biology, '20

2020 – 2021

Alaina Brenner, Haslett, Mich., genomics & molecular genetics/anthropology, '21
Cade Dembski, East Lansing, Mich., physics/clarinet performance, '22
Rachel Dubuque, Hartland, Mich., biochemistry & molecular biology/ biotechnology, '21
Aalayna Green, Clarkston, Mich., zoology, '21
Joshua Klein, Lake Orion, Mich., human biology, '21
Alexandra Korabiewski, Sterling Heights, Mich., biochemistry & molecular biology/ music performance, '22
Jessie Miller, Lockport, N.Y., physics/ astrophysics, '21
Racheal Nassimbwa, Kampala, Uganda, biomedical laboratory science, '21
Mariam Sayed, Sterling Heights, Mich., physiology/French/human biology, '22
Brent Strong, Saline, Mich., physiology, '21

2021 – 2022

Cade Dembski, East Lansing, Mich., physics/clarinet performance, '22
Jack Huber, Albany, N.Y., integrative biology, '22
Alexandra Korabiewski, Sterling Heights, Mich., biochemistry & molecular biology/music performance, '22
Christina Liu, Royal Oak, Mich., environmental biology/zoology, '22
Nakoa Po, Haiku town, Maui, Hawaii, biochemistry & molecular biology/ biotechnology/genomics, '23
Madeleine Russell, Marshall, Mich., microbiology, '23
Mariam Sayed, Sterling Heights, Mich., physiology/French/human biology, '22
Lydia Valtadoros, Ann Arbor, Mich., mathematics/physiology, '24
Eleni Varelas, Albany, N.Y., human biology/psychology, '23
Thomas Wineland, St. Johns, Mich., physiology/chemistry, '22

Charles Drew *Science Scholars:* Re-imagining the future

During its 42-year history, the Charles Drew Science Scholars program has supported the success and well-being of more than 2,000 science and math students at Michigan State University.

The Drew Scholars represent a comprehensive and holistic program of academic and psychosocial support that includes advising, academic coaching and tutoring, career advising and professional development, and a residential living and learning community of scholars. Through these important activities, the Drew program has successfully pursued its mission to broaden participation and increase representation in science and mathematics, and its goal of increasing retention and graduation of underrepresented students in the MSU College of Natural Science.

The program has achieved notable success in both its mission and goal, as its students are highly diverse, and they persist and graduate in their natural science majors at a rate of 85-plus percent—on par with the overall university and college graduation rates. In 2019, during its 40th anniversary, the magazine, *Insight Into Diversity,* cited the Drew Science Scholars program as one of 50 outstanding STEM diversity programs in the United States, and awarded Drew its Inspiring Programs in STEM Award.

While pursuing their life aspirations and career goals, Drew scholars have fully immersed themselves in the scientific enterprise through conducting authentic research with natural science faculty, presenting their research at scientific symposia, establishing and leading student science career organizations, and through service as science and math tutors for their peers, as well as elementary, middle and high school students. After completing a bachelor's degree, Drew scholars go on to professional schools in medicine and dentistry, master's and doctorate degree graduate programs in public health and science, and science-based careers in industry and government.

Drew Science Scholars students at a recent MSU Careers Fair.

The College of Natural Science's Strategic Plan for 2022-2026 includes metrics for student success and expanding the Charles Drew Science Scholars program. Building on the success of Drew's first 40-plus years, the plan is to grow and expand its support and enrichment programs to:

- Prepare students for science graduate study and science-based careers through its mission and goals.
- Increase the four-year graduation rate to greater than 90 percent.
- Double the size of the Drew program with a goal of 120 students entering the program annually by 2026; and increase the number of students that Drew supports from 250 to 500.
- Recruit and retain program leadership and faculty.
- Provide financial support through scholarships to more students in greater amounts, as well as scholarships for study abroad.
- Provide a Summer Bridge Program to welcome incoming, first-year students from underrepresented communities to campus to help ease the transition from high school to a Big Ten university.
- Support more students participating in research with research stipends through the establishment of an Undergraduate Research and Professional Development Fund.

We thank all of those who have contributed to the Drew Science Scholars program over the past four decades. Moving forward, we will continue to pursue private funding to help us realize our vision for this outstanding program. If you are interested, please contact Becky Jo Farrington, senior associate director of development, at farring5@msu.edu or 517-432-9738.



John H. Beaman Memorial Herbarium Fund

Long-time MSU supporter James E. Rodman, Ph.D., (B.S., botany and plant pathology; Honors College, '67) created the John H. Beaman Memorial Herbarium Fund. The endowment honors the memory of Beaman (1929-2015), who was an MSU professor of systematic biology and the curator of MSU's Beal-Darlington Herbarium. Over a 37-year career of teaching, research and counseling, Beaman inspired dozens of students—including Rodman—to study, collect, research, contemplate and enjoy plants. Rodman, who served as program director for systematic biology at the National Science Foundation until 2006, is very involved in a community garden, and describes himself as a "rabid Master Gardener." James Beach (B.S., botany, '76) also contributed to the fund. "While I was an undergraduate, Dr. Beaman transformed my university experience by repeatedly offering research and teaching opportunities. He was an extraordinary academic mentor, and his munificent generosity, patience and thoughtfulness changed the course of my career and my life," Beach said. "John Beaman's legacy is sure evidence of the impact a single faculty scholar can have on incoming students who are still puzzling through all the intellectual and career pathways a large, prestigious university can present." Rodman added, "A plant-collecting trip to Mexico in late summer 1967, with the whole family in tow, is just one of many fond memories of pivotal interventions by professor Beaman that shaped my career in botany; I'm honored to recognize his mentorship."

Mathew J. and Carol Lanphear Joyce Endowed Scholarship

Mat (B.S., chemistry teaching, '81) and Carol (B.A., political science/pre-law; Honors College, '80) Joyce established the Mathew J. and Carol Lanphear Joyce Endowed Scholarship, with preference given to first-generation college students, and residents of Michigan. Eager to see the impact of their scholarship, the Joyces funded the first scholarship with an annual gift. "As a first-generation student, I found my way with advice from mentors who helped me grow as a student and as a person," Carol said. "I arrived at MSU with minimal financial support," said Mat, who worked several jobs on campus to fund his own education while refining his future STEM interests and career plans. This work ethic guided him through his 30-year career with the world's premier aerospace company. "MSU is where we met, made lifelong friendships and formed the foundations of our future careers," he added. Mat is a retired vice president from the Lockheed Martin Corporation; Carol is an attorney who continues to pursue her lifelong interest in politics and community service with a focus on seniors.

John A. King Award for Research in Animal Behavior

Joan M. King (M.S., social work, '67), who has made three Charitable Gift Annuities to MSU, recently established the John A. King Award for Research in Animal Behavior in memory of her late husband, who died in 2014 at age 93. John "Jack" King, who joined the MSU faculty in 1961, was well respected worldwide for his studies in animal behavior. A founding member and president of the Animal Behavior Society, his research centered on how the behavior of animals is affected by their early life experiences. The John A. King Award provides support for a graduate student in the Department of Integrative Biology, with preference given to those with specialties in behavioral, ecological or systemic research on animals. "Learning is a lifelong process," said Joan, who recently turned 92. "Jack was in a position to be taught, to learn from others, and to teach students and serve as a mentor, inspiring interest in animal studies and science. Establishing this endowment in his name seemed to me the right thing to do—to contribute toward the next generation of scientists."

Russell F. and Julie K. Meyer Endowed Scholarship

Russ (B.S., zoology, '74; B.S., physiology, '77) and Julie (B.S., physiology, '75; B.S., microbiology, '76) Meyer have made a future gift to establish the Russell F. and Julie K. Meyer Endowed Scholarship, which will support undergraduates pursuing a degree in the biological sciences. By establishing the scholarship, Julie and Russ are honoring the foundation that MSU provided for their rewarding lives together. She worked as a research scientist at several university laboratories and as a toxicologist in a private contract laboratory; he managed dining operations at Michigan State University, the University of Maine, the University of Missouri and, finally, the University of Nevada, Reno, before retiring. The endowed scholarship pays tribute to exceptional professors like Dick Hill, Don Beaver, and Paul Fromm, who taught them to learn; and celebrates the lifelong friends and memories they made at MSU. "We hope this scholarship will give tangible encouragement to young people as they pursue their own Spartan experiences. To those future Meyer Scholars, we wish professional success as well as a sense of fulfillment, happiness in life and pride in being a Spartan," they said in a statement.

Gerald P. and Jean G. Rakoczy Endowed Scholarship in Natural Science

MSU alumni Gerald "Jerry" (B.S., fisheries and wildlife, '73) and Jean (B.A., history, '74) Rakoczy have established a planned gift to create the Gerald P. and Jean G. Rakoczy Endowed Scholarship in Natural Science. After attending Michigan Tech and Ferris State [College], Jerry transferred into MSU's fisheries and wildlife program in fall 1970. He was initially denied admission, but he persisted. After a personal visit with MSU's admissions representative, he was accepted into the program. "I have always appreciated the fact that MSU gave me a chance to prove myself. It also shows that when life throws you a curve, don't give up on your dream—be persistent, and keep working toward your goal," said Jerry, who retired from the Michigan Department of Natural Resources as a Great Lakes fisheries biologist in 2002. "This was the job I dreamed of having when studying at MSU. Our aim in providing this endowment to MSU for science majors is not necessarily to help someone to become the next Albert Einstein or Marie Curie—although that would be nice—but to help someone . . . have a good life like I did," he added.

NATSCI HONOR ROLL

The College of Natural Science has gone digital with its annual honor roll. To view the list, visit https://natsci.msu.edu/about/giving/donor-honor-roll/. Recognition in this year's honor roll represents contributions through June 30, 2021.

alumni class notes

1960s

James E. Trosko, M.S., zoology, ’62; Ph.D., zoology, ’63, is a retired MSU professor and NatSci alumnus. He recently had two papers accepted for publication, both of which challenge existing powerful paradigms in cancer research and environmental toxicology. These two new publications constitute 47 publications since his retirement in 2014, adding to a total of more than 470 during his tenure at MSU.

Benito Casados, M.S. general science, ’63, published a biographical book—*One Hispanic Man’s Journey*—about his career with NASA as a worldwide lecturer and his work ventures in educational technology.

Donald A. Tomalia, Ph.D., chemistry ’68, wrote a review article, “Non-Traditional Intrinsic Luminescence (NTIL): Inexplicable Blue Fluorescence observed for Dendrimers, Macromolecules and Small Molecular Structures Lacking Traditional /Conventional Luminophores,” which was published in 2019 in *Progress in Polymer Science*. Co-authored by MSU Ph.D. graduate student Kayla A.-M. Johnson, it has received more than 100 citations. This rapidly emerging NTIL area led to the organization of the 1st International Conference on Clusteroluminescence held in August in China.

1970s

Richard W Gilpin, Ph.D., microbiology and public health, ‘70, received the 2020 Chesapeake Area Biological Safety Association (ChABSA) Lifetime Achievement Award in recognition of his dedication to ChABSA and the broader biosafety community. His company, Dr. Richard W Gilpin, LLC, operates the Control of Biohazards Course and the GTS Legionella Water Testing Service.

Stewart D. Cole, D.O., zoology, ’72, retired from the practice of medicine on Oct. 1, 2020. He graduated from the MSU College of Osteopathic Medicine in 1975. Dr. Cole’s hometown is Yale, Mich. For more than 16 years, he was a partner and lead radiologist at The Portland Clinic in Portland, Ore.

Burrell Shirey, physical science, ’76; M.S., geology, ’83, retired after 40-plus years from the Michigan Department of Environment, Great Lakes and Energy as manager of the Geological Services Section in the Remediation and Redevelopment Division.

1980s

Patricia MacCabe-LaDuke, D.V.M., zoology, ’80; D.V.M. ’85, founded Canadensis Veterinary Clinic, a small-animal and exotic practice located in the Pocono Mountains of Pennsylvania, in 1989. One of her daughters, Kathleen LaDuke (D.V.M. 2019 Cornell University College of Veterinary Medicine), joined her in practice at Canadensis Veterinary Clinic in July 2020.

Steven M. Palmisano, Sr., microbiology, ‘81, was nominated to the board of directors for the entertaining music series, the FORUM, at Lees McRae College. He is also a member of the music selection committee for the 2023 season.

Dave Westenburg, microbiology ’82, received the inaugural Deans Medal on March 31, 2021, for outstanding commitment to undergraduate student success in the College of Arts, Sciences, and Business at the Missouri University of Science and Technology.

Carmen R. Cid (formerly Carmen R. Cid-Benevento), Ph.D., botany and plant pathology, ’84, is vice president-elect for education and human resources for the Ecological Society of America (ESA). Cid was appointed an ESA Fellow in 2017 and will be directing the new diversity and education programs for the society for the next three years. She did her Ph.D. research at the Kellogg Biological Station under the direction of another MSU College of Natural Science graduate, Patricia A. Werner.

Alan Colter, biological science–interdepartmental, ’85, has served as the health and safety manager with Veolia at the Downriver Wastewater Plant in Wyandotte, Mich., since February 2019. Prior to that, Colter worked in health and safety for 14 years in Wayne County, Mich., and environmental health and safety at Clayton Consultants/Bureau Veritas for 19 years.

1990s

John Ahrens, zoology, ’90, released his first novel, *Trace*, in February 2018. The story features two students, twin sisters, who are Michigan State Spartans. Ahrens is a graduate of both MSU’s College of Natural Science and College of Agriculture and Natural Resources. He went on to dedicate two years as a Peace Corps volunteer serving in Uganda. He currently lives in Brooklyn, New York, where he works for a nonprofit organization promoting energy efficiency.

Christina (Nadolski) Catt, zoology, ’91, is celebrating her 17th year as a veterinary nurse at MSU’s Veterinary Medical Center, College of Veterinary Medicine (CVM). She recently completed the Elite Fear Free Certification for handling of animals and also received the Clinical Appreciation Award for Veterinary Nurse from the Veterinary Nursing Program (2021). Her daughter, Caitlin Catt, received her bachelor’s degree from the MSU CVM Veterinary Nursing Program in 2018, making them the first mother/daughter to graduate from the program.

Kazuya Akimitsu, Ph.D. botany and plant pathology, ’92, was a postdoc with the MSU-DOE Plant Research Laboratory until August 1994, then moved to Kagawa University (KU), Faculty of Agriculture, Japan, in September 1994. Akimitsu became a full professor on November 2005 and was promoted to vice dean of Faculty of Agriculture on October 2013. He currently serves as special assistant to the president, vice director of the International Institute of Rare Sugar Research and Education and council member of education and research. He assumed the role of dean of Faculty of Agriculture in October.

2000s

Angie Adkin, environmental biology/zoology, ’00, received her M.S. degree in 2013 and her Ph.D. in 2018 in animal science from the University of Florida. Adkin recently became an adjunct professor at Santa Fe College and the College of Central Florida, where she teaches animal behavior and equine sciences courses. She is also a host of a top-rated podcast, *All Creatures Podcast*, which explores animal behavior, physiology and conservation.

Danielle Hankinson (Albert), zoology, ’02; M.S., forensic science, ’04, was recently elected president of the American Board of Criminalistics (ABC), which certifies forensic scientists in many different areas; Hankinson’s is molecular biology. She has been a practicing forensic scientist for more than 17 years. She was initially hired by the Michigan State Police in 2004 and also worked for the Virginia Department of Forensic Science. She is currently employed by the Oakland County Sheriff’s Office. She is very active in the community and enjoys teaching law enforcement, college students and the public about forensic science.

Damon Nesby, mathematics, ’02, recently accepted a new position as director of global compensation and incentive administration at Nike. After graduating from MSU, Nesby went on to receive his MBA from Keller Graduate School of Management. He has been working in corporate America for 18-plus years with a focus in human resources, primarily in compensation and benefits. He has worked in a variety of industries across the country, such as consulting, airlines, oil and gas, and aerospace and defense.

Allen Mueller, biochemistry and molecular biology, ’05, recently joined the NIH’s National Institute of Allergy and Infectious Diseases, Vaccine Research Center as scientific operations manager of the Vaccine Immunology Program.

Travis Reed, D.V.M., biochemistry and molecular biology/biotech, ’05; D.V.M. ’09, accepted a position as medical director at the Wisconsin Veterinary Referral Center in Racine/Kenosha, by Ethos Veterinary Health. He continues clinical practice as a board-certified veterinary surgeon at the same clinic.

Rainy Inman Shorey, Ph.D., ecology, evolutionary biology and behavior, ’05, has recently returned to the United States after living and working for seven years overseas in both Poland and Japan for Caterpillar Inc. Shorey moved from her initial role in environmental health and safety, and sustainable development in the United States, to project management and new product introduction in Europe and Asia Pacific. She now supports Lean Leadership Development and just received certification as a Lean Six Sigma Black Belt.

John Strein, human biology, ’07, was part of the trial management team that contributed to the publication of “REGN-COV2: a Neutralizing Antibody Cocktail, in Outpatients with Covid-19,” which appeared in

the Dec. 17, 2020, issue of the *New England Journal of Medicine*.

2010s

Victoria McCoy, mathematics and geological science, '10, co-edited a book—*Fossilization: Understanding the Material Nature of Ancient Plants and Animals*, published by Johns Hopkins University Press in 2021.

Karen Beatty, zoology, '13, is a graduate student in the Huck Institutes of Life Science at Pennsylvania State.

David Kupursmits, physiology, '19, is a second-year medical student in MSU's College of Human Medicine.

2020s

Janet Wetzel, human biology, '20, is a clinical laboratory scientist at Exact Sciences, a biotechnology company in Madison, Wisc. When Wetzel began there, she worked with COVID-19; she now focuses on detecting colorectal cancer earlier via a multitarget DNA test with protein, DNA methylation and DNA point mutation biomarkers.

Recently started a new job, moved or received an award?

STAY CONNECTED

Submit your news via **natsci.msu.edu/alumni** and we'll share it with students and alumni.

in memoriam:

Esther M. Brown (1923-2021)

Esther M. Brown, a great champion and catalyst for Michigan State University (MSU), the Biomedical Laboratory Diagnostics Program (BLD) and the entire laboratory profession, died on June 23, 2021. She was 98 years old.

Brown received her B.S. in medical technology (1946), M.S. in anatomy (1951) and Ph.D. in animal pathology (1955) all from Michigan State College (now MSU).

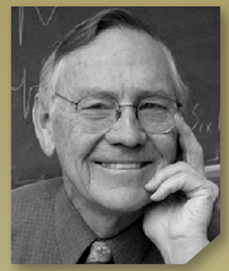
Brown was director of the BLD program at MSU from 1960-1970 and a pioneer and trailblazer for women in STEM fields. She had a deep passion for the laboratory, the university and the students of the program. From her contributions to the curriculum and profession, to the students she taught and mentored and the patients they went on to help, she shaped countless lives and was a true giant in the medical laboratory profession.

Her affection and admiration for MSU and medical laboratory students never wavered. Upon retirement in 1990, her family moved back to Michigan to be closer to her beloved campus and the program she helped grow.

In 2010, she established the Dr. Esther M. Brown Endowment for Biomedical Laboratory Diagnostics, which provides funds for areas of greatest need for the program. She also supported BLD with expendable funds to help upgrade technology and equipment.

You can honor her memory by making a gift in her honor to the Dr. Esther M. Brown Endowment for Biomedical Laboratory Diagnostics by visiting **https://givingto.msu.edu/gift/?sid=1662**.

James L. Dye (1927-2021)



James (Jim) L. Dye, a University Distinguished Professor of chemistry at Michigan State University for more than 60 years, died on Oct. 8. He was 94.

Dye was a member of MSU's emeriti faculty in the College of Natural Science. He began teaching at MSU in 1953. Though he retired in 1994, he continued to conduct research and mentor undergraduate students.

He was one of MSU's most influential and successful researchers and teachers. A pioneer in chemistry, he is best known for his work with alkali metals, earning him recognition as the "discoverer of alkalides and electrides." He co-founded SiGNa Chemistry, which received the Presidential Green Chemistry Challenge Award in 2008.

Dye's scientific accomplishments led to his election to the National Academy of Sciences and the American Academy of Arts and Sciences. He received two Guggenheim Fellowships, a Fulbright Fellowship and the American Chemical Society National Award in Inorganic Chemistry.

Dye conducted his sabbatical research with Nobel Laureates Manfred Eigen, Jean-Marie Lehn and others. He educated countless students and post-doctoral researchers during his six decades at MSU.

The James L. Dye Endowed Chair in Materials Chemistry was created in 2014 to honor and assist new generations of chemists to carry on Dye's legacy.

Donations may be made to the James L. Dye Endowed Chair in Materials Chemistry by visiting **https://givingtomsu.edu/gift/?sid=1668**.

MSU officially opens *new STEM* Teaching and Learning Facility

It would be cliché to say Michigan State University's newest academic building is a product of its environment, but it would also be accurate.

Case in point, the nucleus of this new facility is provided by a campus landmark, the 73-year-old Shaw Lane Power Plant located at Red Cedar Road and Shaw Lane on the MSU campus. Although it was decommissioned in 1975, the power plant has found a fitting second life. The building that once powered campus is now empowering Spartans to innovate ways to learn and share knowledge about science, technology, engineering and math, or STEM.

"At MSU we are constantly evaluating how we deliver a world-class education while also looking forward," said President Samuel L. Stanley Jr., M.D. "What is the future of teaching? What is the future of learning? Nowhere is that more evident than the new STEM Teaching and Learning Facility."

Exploring the more than 150,000-square-foot building—the renovated power plant accounts for about 50,000 of those square feet—confirms that every inch of this building was meticulously planned.

Designed with students in mind, the 21st-century classroom and laboratory spaces are specifically geared toward gateway courses in biological sciences, chemistry, computer science, engineering and physics. When fully scheduled for a semester, there will be nearly 7,000 students in class in the building each week.

Throughout the new building, meeting spaces feature a variety of chair and table styles and heights, creating accessible and inclusive shared spaces for everybody. The building's common areas offer homey light fixtures, plenty of power outlets and ample white boards, making them spaces where students, staff and faculty can meet with each other.

In 2018, the State of Michigan awarded MSU $29.9 million toward the construction of a new, $110 million STEM Teaching and Learning Facility. The building, whose central structure incorporates the former Shaw Lane Power Plant, officially opened on Sept. 10, 2021.

These design principles and values are also evident in the building's formal teaching spaces. In the chemistry and biology labs, service lines carrying air and gas reach the students' benches through columns mounted to the ceiling. In a more conventional lab, these lines would be built into benchtops and potentially obstruct views, especially for students farthest away from the instructor.

Using the columns opens lines of sight and possibilities by helping all students feel more connected and letting instructors more easily identify when students need help. The columns can also be moved to better fit an instructor's needs for a class.

Similarly, work surfaces and storage shelves in labs are mobile, allowing students and faculty members to reconfigure layouts as needed. Larger classrooms for physics and computer science can also transform. Thanks to an abundance of projectors, moveable screens and mobile work surfaces, a classroom can easily shift from optimizing collective instruction to facilitating small-group work.

Simply put, the building was made to adapt to students and educators and what works for them, not the other way around.

Larger classrooms for physics and computer science have transformed these courses. An abundance of projectors, moveable screens and mobile work surfaces allows a classroom to easily shift from optimizing collective instruction to facilitating small-group work.

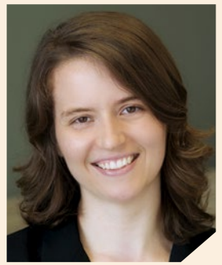
MSU College of Natural Science *honors* 2021 award winners

The Michigan State University College of Natural Science (NatSci) annually selects several alumni, faculty and students for outstanding achievements and excellence.

In 2021, **Patrick Lukulay** (Ph.D., analytical chemistry, '95) received the Outstanding Alumni Award; **Shannon Morey** (B.S., chemistry, '10) received the Recent Alumni Award; and **Shannon Manning**, MSU Foundation Professor of Microbiology and Molecular Genetics, received the Meritorious Faculty Award.

Patrick Lukulay

Lukulay is founder (2018) and president of Technology Solutions for Global Health (Tech-4Health). He first worked for Wyeth and Pfizer, leading teams of analytical chemists to support drug discovery and development efforts. In 2007, he joined United States Pharmacopeia (USP) and became vice president of USP's Global Health Impact Programs. He directed programs aimed at promoting drug quality in developing countries. He envisioned and orchestrated the establishment of USP's Center for Pharmaceutical Advancement and Training (CePAT) in Ghana (now called USP-Ghana), which trains sub-Saharan regulatory authorities to recognize possible counterfeit drugs. He also established the Lukulay Foundation to provide scholarships to needy students in his alma mater high school in Sierra Leone.



Shannon Morey

Morey teaches physics, chemistry and robotics at Abbott Lawrence Academy, and previously taught at East Boston High School. Both student populations are drawn from predominantly urban, low-income, Latinx immigrant communities. Morey has innovated modeling and project-based learning curricula and given generously of her time as a science fair organizer, student government advisor and scholarship coordinator. From 2013-2014, she was the director of education for Science from Scientists, a national science education nonprofit. She has founded three volunteer-led nonprofit organizations: BiteScis, which pairs graduate student researchers with teachers to develop free, online lesson plans; ComSciCon, a national workshop for graduate students interested in science communication; and Chembites, a reader's digest for chemistry research literature authored collaboratively by graduate students.

Shannon Manning

Manning played a crucial role in helping to solve the mystery behind one of the deadliest *E. coli* outbreaks ever, which killed more than 50 people and sickened nearly 4,000 in Germany in 2011. Her research focuses on applying molecular and evolutionary tools to investigate the virulence, epidemiology and evolution of bacterial pathogens—including *Campylobacter jejuni*, Shiga toxin–producing *E. coli* (STEC), *Salmonella*, and group B *Streptococcus*. Manning and her team are decoding pathogens to help with the development of new vaccines and therapeutics. Prior to joining the MSU faculty, Manning was an Emerging Infectious Diseases Research Fellow with the U.S. Centers for Disease Control and Prevention/Association of Public Health Laboratories.

In addition to these honors, several NatSci graduate and undergraduate students were recognized for their outstanding contributions. **Keenan Noyes,** chemistry; and **Patricia Perez-Bonilla,** neuroscience and pharmacology/toxicology, received Tracy A. Hammer Graduate Student Awards. Four students received Dan Bolin Undergraduate Student Awards—**Shivam Chandra,** human biology (minor in bioethics); **Cynthia Sridhar,** neuroscience (additional major in sociology and minor in bioethics); **Megan Thorn,** human biology (minor in health promotion); and Nicole Vezina, biomedical laboratory science.

A "virtual" success: *NatSci's 11th annual Classes* Without Quizzes held online

The College of Natural Science (NatSci) put a twist on their annual alumni event—Classes Without Quizzes (CWQ). For 2021, it was Classes Without . . . well, a classroom. But the event was held nonetheless, the way most classes everywhere have been held this past year—online.

More than 260 alumni, friends and guests registered for the virtual event, which was held on April 24, 2021.

"Our goal today is simple—to show you some of the amazing science we are doing," said Phillip Duxbury, NatSci dean. "We are pleased to see an increase in our program registration this year—most likely due to the convenience of 'attending' online."

The day's "classes" featured three presentations about what researchers have been working on in NatSci labs.

Neal Hammer, assistant professor in the Department of Microbiology and Molecular Genetics, presented "You Are What You Eat: Increasing Our Understanding of the Nutritional Requirements of Bacterial Infection."

Hammer's lab is seeking to discover nutrient sulfur acquisition strategies employed by Methicillin-resistant *Staphylococcus aureus* (MRSA), one of the most common types of bacterial infections in the clinic.

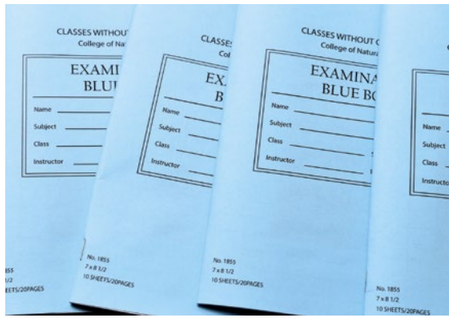
"As long as there are researchers who are continuously identifying new therapeutic targets—and small molecules that inhibit those therapeutic targets—I think we can stay one step ahead of antimicrobial resistance," Hammer said.

Melanie Cooper, Lappan-Phillips Professor of Science Education in the Department of Chemistry, presented "Chemistry, Life, the Universe and Everything (CLUE)."

Cooper is responsible for putting the CLUE curriculum in place 10 years ago.

"Our research focuses on how we can support students' understanding of . . . abstract ideas by designing new curriculum materials and teaching approaches," Cooper said. "For instance, a scientist doesn't run off to a lab and do 50 end-of-chapter problems!" Neither do her general chemistry students.

Johannes Pollanen, assistant professor in the Department of Physics and Astronomy, presented "Building Quantum Technologies . . . One Electron at a Time."



New technologies being developed in Pollanen's lab, and in other quantum labs around the world, have the potential for groundbreaking discoveries with applications across many disciplines, and could lead to novel drug discoveries and new search algorithms for data science.

The 12th annual Classes Without Quizzes will be held April 23, 2022. For more information, contact Sara Ford, alumni relations coordinator, at fordsar2@msu.edu.

show your natsci spirit

T-shirts and polo shirts are now available!
Go to shop.msu.edu/category_s/336.htm. Sale revenues support activities for NatSci alumni, students and faculty, including scholarships, awards and alumni events for you!

What does it mean to be a Spartan?

Every day, Spartans like you make an impact around the world. And every success reminds us that we must carry forward MSU's tradition of empowering learning and discovery across our campus and out into communities everywhere. Together, we can make extraordinary things happen. Annual giving levels are:

Spartan Loyal	$ 100/year
Spartan Proud	$ 500-$999/year

Leadership Circle

Spartan Strong	$ 1,000-$2,499/year
Spartan Great	$ 2,500-$4,999/year
Spartan Bold	$ 5,000-$9,999/year
Spartan Inspired	$10,000-$19,000/year
Spartan Extraordinary	$20,000/year+

Lifetime recognition begins at $50,000.

Learn more at 800-232-4MSU (4678) or go.msu.edu/be-spartan-loyal

NatSci at a glance

The **College of Natural Science (NatSci)** at Michigan State University promotes excellence in **research**, **teaching** and **public service** across the **biological**, **physical** and **mathematical sciences**.

Dean
Phillip M. Duxbury

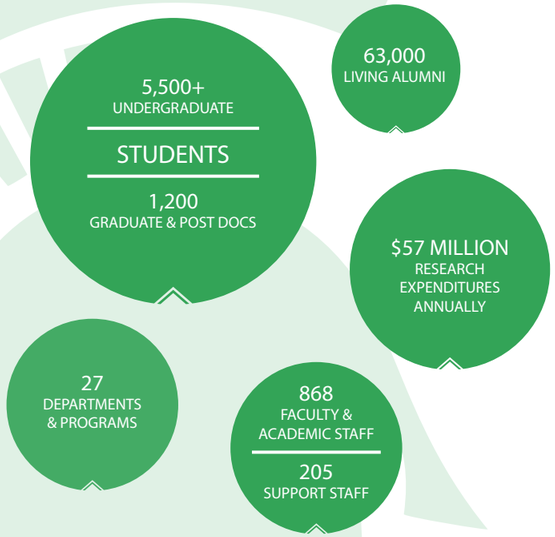
Associate Deans
Eric Hegg, Budget, Planning, Research and Administration
Richard Schwartz, Graduate Studies
Lynmarie Posey, Undergraduate Studies
Cheryl Sisk, Faculty Development
Angela Wilson, Strategic Initiatives

Assistant Deans
Amber Benton, Diversity, Equity and Inclusion
Cori Fata-Hartley, Curriculum Coordination
Heidi Purdy, Academic and Student Affairs

NATSCI DISTINCTIONS

- Global leader in STEM education and research
- Home to:
  - BEACON Center for the Study of Evolution in Action, an NSF Science and Technology Center
  - MSU-Department of Energy (DOE) Plant Research Laboratory
- Partner, U.S. DOE-funded Great Lakes Bioenergy Research Center
- 7 National Academy of Sciences faculty members
- 52 endowed chairs and professors
- No. 1 Nuclear physics graduate program in the nation
- No. 4 nationally in agricultural sciences*
- No. 5 nationally in environmental sciences*
- Top 5 plant biology graduate program nationally

*multi-college effort



NATSCI.MSU.EDU

natsci advancement team

Have questions about giving options or how to go about making a gift to the College of Natural Science?

Our development professionals are always available to help you with any aspect of giving to the college or to MSU:

COREY PALMER

Senior Director of Development
longleyc@msu.edu
517-353-1637

Regional assignments: Arizona, northern California, Georgia, Nevada, Texas

Department/program assignments: Computational Mathematics, Science and Engineering, Earth and Environmental Sciences, Physics and Astronomy, Physiology

KAREN WENK

Associate Director of Development
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517-353-5962

Regional assignments: southern California, Connecticut, D.C., Maryland, Massachusetts, New Jersey, New York (NYC), Oregon, Pennsylvania, Washington, Virginia

Department/program assignments: Biochemistry and Molecular Biology, Chemistry, Kellogg Biological Station, Integrative Biology, Plant Biology

BECKY JO FARRINGTON

Senior Associate Director of Development
farring5@msu.edu
517-432-9738

Regional assignments: Colorado, Florida, Illinois, Indiana, Minnesota, North Carolina, Ohio, Wisconsin

Department/program assignments: Actuarial Science, Biomedical Laboratory Diagnostics, Mathematics, Microbiology and Molecular Genetics, Statistics and Probability, Charles Drew Science Scholars Program, Program in Mathematics Education, Residential Initiative on the Study of the Environment

SARA FORD

Alumni Relations Coordinator
fordsar2@msu.edu
517-884-0290

All events, email communications, requests for faculty and student speakers, Dean's Research Scholars

Ways of giving

CURRENT GIFTS AND PLEDGES

Current gifts can be cash contributions given now that provide immediate impact. Examples of current gifts are cash, securities, gifts of personal and real property (in-kind gifts), bargain sales and gifts of closely held stock.

SECURITIES AND REAL ESTATE

These popular alternatives to cash generate a possible double tax benefit with income tax and potential tax on capital gains.

MATCHING GIFTS

More than a thousand companies throughout the country match employee gifts. Forms are available from personnel offices and websites at these companies.

BEQUESTS

Wills offer another avenue for giving to MSU and can take many different forms depending on the intention.

LIFE INCOME PLANS

A life payment plan allows a donor to make a substantial gift and receive income in return. There are several different types which offer substantial tax benefits.

RETIREMENT PLANS

Careful structuring and gifting of retirement assets can often preserve more assets for heirs while providing a gift to NatSci.

Plan for the future: Use your IRA rollover

Since 2006, Code 408(d)(8) allowed owners of traditional and Roth IRAs to make direct gifts to charity and avoid the income tax that would otherwise be owed on an IRA withdrawal.

IRAs continue to be a tax smart strategy for making charitable gifts under the new SECURE (Setting Every Community Up for Retirement Enhancement) Act, which was signed into law on Dec. 20, 2019. Qualified Charitable Distributions (QCDs) from your IRA can reduce your taxable income, and your gift can make a difference now. Here are the SECURE tax law changes:

- Required Minimum Distributions (RMD) now occur at age 72
- You can still make QCDs at age 70 ½, up to $100,000 annual limit
- Contributions are allowed after age 70 ½ if you are still earning income

If you don't need this income for your day-to-day expenses and would like the satisfaction of seeing your gift make a difference to those we serve today, you can make a contribution of up to $100,000 to MSU or NatSci directly from your IRA.

For more information on gift planning from your IRA, visit http://msu.planmygift.org/a-gift-of-a-lifetime or contact your NatSci development officer (see above).

Generosity, *gratitude provide inspiration* during challenging times

By Corey Palmer
NatSci Senior Director of Development

For the past seven years, great consideration has gone into what to share with all of you.

During the Empower Extraordinary campaign, it was important to share our priorities, provide updates and—most excitingly—share our successes. Post-campaign, I shared our continued commitment to our students and faculty, specifically that we were focusing on identifying ways to build and strengthen the culture of philanthropy in NatSci, while also working with alumni to identify meaningful engagement opportunities.

Then last year happened, and we shared how we were trying to accomplish everything virtually. So, what's happening this year? We are still largely virtual, still committed to supporting our students and faculty, and still focused on engaging with alumni in meaningful ways.

Every spring, our office has the privilege of receiving copies of the thank-you letters that our student scholarship recipients send to their donors. We love reading these letters that share the impact of scholarship support. They leave us feeling inspired and motivated to do more. I've decided to share with you excerpts from some of the letters we received this year with the hope you also feel inspired:

"With the generous scholarship you have granted me, I know I will be able to afford the books and online platforms I need for my courses next semester. I cannot thank you enough for your kindness and the opportunities you have provided me." *~ Briana A.*

"Words cannot express enough how grateful I am for you and your patronage. When I saw that I received this scholarship, I was left beaming. The debt I have accrued throughout my college experience has weighed heavily on my shoulders, and your generosity has lessened that burden enormously." *~ Tyler C.*

"I took the past week to reflect on the scholarship that you both have graciously gifted me. I was without words when I found out and I still am. This scholarship serves as a reminder to me; I am one step closer to accomplishing goals that I never thought were possible. It encourages me to continue putting all my effort into building upon my skills and knowledge for the future. The scholarship motivates me to continue to push through any barriers set in front of me. It is a rewarding feeling, which adds to my motivation, when you know others believe in you and are willing to support you through this process." *~ Gavin F.*

"This really means so much to me and my family because we were struggling with trying to figure out how we were going to afford next year's tuition . . . but you have really helped so much with this scholarship." *~ Raquel S.*

Interested in helping? As in previous years, we have included the various ways to give; if you have questions, I encourage you to contact the NatSci Advancement team (see page 39). We have a great team that will work with you to find ways to give back that are meaningful to you.

As always, thank you and Go Green!

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UPCOMING NATSCI ALUMNI EVENTS—2022

March 15, 2022 – Give Green Day

April 22, 2022 – NatSci Alumni Awards
MSU campus

April 23, 2022 – Classes Without Quizzes
MSU campus; natsci.msu.edu/cwq

June 28 – June 30, 2022 – Grandparents University
MSU campus; grandparents.msu.edu

For more information about upcoming NatSci events, contact Sara Ford at fordsar2@msu.edu or 517-884-0290.

CONNECT WITH NATSCI AND ALUMNI

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