connections

College of Natural Science

a magazine for alumni & friends

winter 2022-23

Plants *in* space

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message from the dean

This edition of the College of Natural Science (NatSci) magazine contains a wide range of community highlights and activities that I find inspiring and a great read; I hope that you do too! It contains an awesome deep dive into the science of plants in space, an area of great interest as humanity transitions into a multi-planet species. There is a nice section on the college strategic plan, and we have developed a much more detailed college implementation plan that we are aggressively pursuing. These grassroots documents provide aspirational and ambitious roadmaps to a future where our community continues to grow and thrive through the richness of many voices and viewpoints from alumni, students, staff and faculty that are truly representative and inclusive of the people of the state of Michigan and the United States.

As the core STEM college at Michigan State, it is critical that we educate all students to excel in the many STEM-related jobs that are essential to the vitality of the Michigan and U.S. economies, including in emerging areas such as data science, data analytics, artificial intelligence, cybersecurity and gaming, which have rapidly growing applications in all facets of the economy. We are also very excited to be working with many other MSU colleges on research areas that are critical to our planet.

In broad terms, we group these areas into five buckets: K-16 STEM education research, teaching and learning; plant and environmental sciences; health sciences; and digital innovations, and we remain committed to our core mission of excellence in fundamental biological, chemical, computational, mathematical and physical sciences. Training of undergraduate and graduate students in these areas is essential to the future of science and to driving innovation in the private sector—for example, cutting edge areas such as next generation health technologies, food security, AI, quantum computing and space science and technology.

We are in the process of planning major infrastructure projects to dramatically improve our capabilities in teaching and research related to digital innovations, semiconductors, plant sciences and biotechnology, which are exciting research areas that have a rapidly growing impact on the private sector. The state of Michigan has provided $23 million in support of a complete renovation of the MSU greenhouses that are essential to plant sciences research and student training. Fundraising campaigns are in progress to achieve the goal of proceeding with all of these essential infrastructure projects by early 2024.

FACT

“As the core STEM college at Michigan State, it is critical that we educate all students to excel in the many STEM-related jobs that are essential to the vitality of the Michigan and U.S. economies . . .”

The warmth and generosity of our alumni and donors is a highlight of my role as NatSci dean, and I look forward to alumni events and one-on-one meetings. Our development team is terrific, and the college chairs, directors and faculty are ready to work with them to engage with you in ways that you would find meaningful. Your support of students, faculty and research programs is highly impactful and very much appreciated. Thank you!

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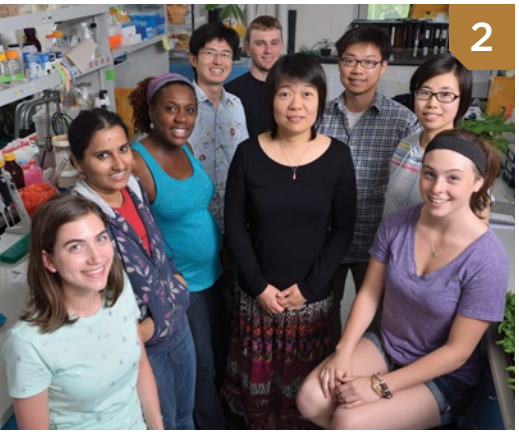
connections

winter 2022-23

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



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ON THE COVER: The moon holds answers, and Michigan State University plant biologist Federica Brandizzi and her team is bringing those answers within reach. Patience, creativity and a cheerful fearlessness are turning insights buried in plant seeds into pathways to the very survival of the human race.

NASA logo used with permisiion.

NatSci releases *collegewide* strategic plan

The MSU College of Natural Science (NatSci) has completed a new strategic plan that articulates a shared vision and direction for the college.

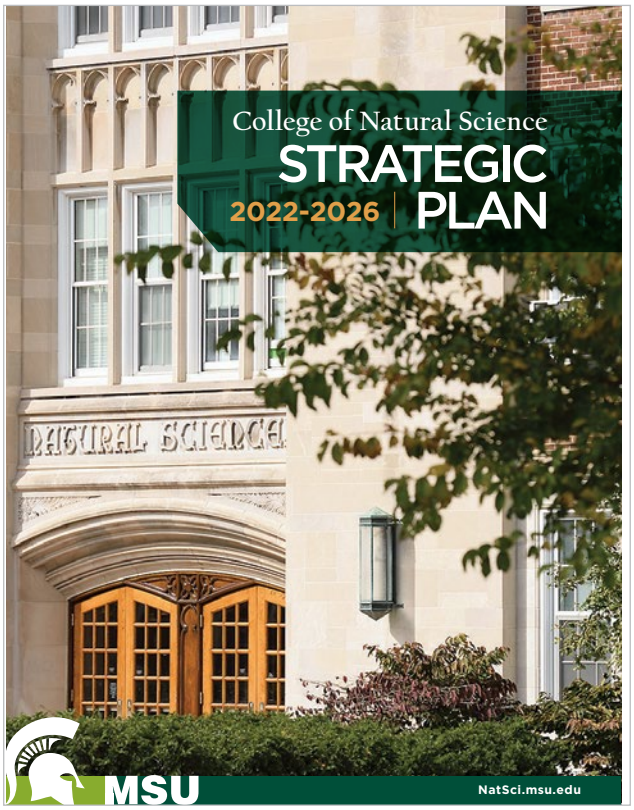
The five-year plan (2022-2026) will serve as a framework for the college's key priorities, including academic excellence and student success, research to advance society's health and well-being, building strong partnerships and collaborations to broaden and strengthen our efforts, and creating a safe, equitable and inclusive environment for all.

"This strategic plan is a co-created consensus document developed by the NatSci community over the past two years to identify strategic priorities, goals and metrics that provide a roadmap for the college as we pursue our vision and mission," Duxbury said. "With this strategy, we clarify our priorities, core values and intended outcomes so that we can effectively channel our energy and resources."

CO-CREATE

"This strategic plan is a co-created consensus document developed by the NatSci community . . . to provide a roadmap for the college . . ."

In the development of the plan, the college strove to be as open and inclusive as possible. This approach involved several phases that began with foundational work conducted by Working Group teams in the areas of DEI; graduate and undergraduate education; research; and vision, mission, and values. A 15-member Strategic Integration Team and Editorial Board/ Writing Team were then established to take this work—along with several rounds of collegewide feedback and input—and develop the strategic plan.



"I am grateful for the dedication and efforts of the initial Working Groups, the Strategic Integration Team and the Editorial Board in keeping the engagement and momentum going," Duxbury said. "It took the input of many individuals to create this plan and I greatly appreciate the contributions made by our students, staff, faculty and alumni to this process."

The strategic plan identifies key goals and action items within six main themes:

- Diversity, equity and inclusion
- Student success
- Research excellence
- Global/national/state priorities and grand challenges
- Communications, development and outreach
- Transparency, accountability and professionalism

"The central four themes of the plan [2-5] speak to what we want to accomplish, while the first and last themes are about how the college needs to go about it," Duxbury said. "The bookends of diversity, equity and inclusion and a commitment to conduct ourselves in ways that contribute to the greater good are threaded throughout the plan and are integral to all that we do."

Among the metrics that were developed to help drive and support the college's strategic priorities and express the aspirations of the plan are:

- IMPROVE INCLUSION. Recruit and retain 25 tenure stream faculty members who increase our diversity. Double the number of students in the Charles Drew Science Scholars program.
- ENHANCE THE UNDERGRADUATE EXPERIENCE. Retain 60 percent of incoming NatSci students through graduation. Boost the number of students proceeding to health professions by 30 percent. Raise the starting salary of employed graduates by 50 percent.
- STRENGTHEN GRADUATE STUDENT SUCCESS. Double our federal training grants. Double career training programs. Improve mentoring of graduate students.
- GROW RESEARCH EXCELLENCE. Double the number of our research programs with Top 5 rankings. Increase federal research funding by 50 percent.
- CULTIVATE COMMUNITY RELATIONSHIPS. Boost participation in community educational and outreach activities by 30 percent. Increase partnerships with key industries and businesses, foundations, and educational institutions by 25 percent. Foster more diverse partnerships.

"This strategic plan is a forward-facing, living document that builds on existing strengths and develops new opportunities in a student-focused academic environment characterized by low barriers and a historic willingness to collaborate and cooperate in education, research and service," Duxbury said.

To keep the plan relevant and nimble will require an ongoing process of broad discussions and considerations as the college navigates its way through what promises to be some interesting and challenging times.

"It is our hope that this plan will spark the vision, insight and innovation necessary to successfully address current and future challenges, and to excel in this rapidly changing world," Duxbury added. "Taking action on our strategy will help us accomplish our mission and move toward the world we envision—a thriving planet and healthy communities through scientific discovery."

Back from the dead: Harlequin frogs overcome extinction

Harlequin frogs are still a threatened species.

A new study by Michigan State ecologists and collaborators in Ecuador has shown that as many as 32 harlequin frog species, *Atelopus*, once thought to be extinct, still survive in the wild.

Infrequent sightings of missing species beginning at the turn of the century spurred researchers to explore their veracity. In 2019, a National Geographic Society grant allowed an MSU team to travel to Ecuador to look for rediscovered frogs across a range of habitats and to bring these disparate reports together. Invaluable contributions also came from local communities in Ecuador.

As the team found frogs, they collected saliva samples for genetic studies and swabbed each frog's skin for microbes. Through DNA analysis, the team discovered that species presumed extinct for a longer time possessed less genetic diversity than those that disappeared more recently. Low genetic diversity makes a species more susceptible to future stressors, including climate change.

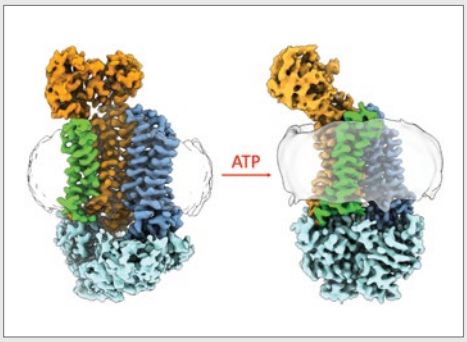
Rediscovered species, however, are not out of danger; future research should include ways to conserve and to protect them.

Researchers: Sarah Fitzpatrick, assistant professor, Department of Integrative Biology, and Kellogg Biological Station faculty member; MSU doctoral student Kyle Jaynes, Fitzpatrick lab.

Peering into the structure of antibiotic resistance

Understanding the proteins that bacteria use to survive antibiotic treatments is a critical step in decommissioning them against potentially deadly infections. A team of MSU structural biologists recently published new, atomically detailed snapshots of a bacterial protein that helps many germs sense and evade antibiotics.

The researchers focused on a protein that contributes to antibiotic resistance by protecting certain bacteria from antimicrobial peptides. The protein lives on the outer membrane of many gram-positive bacteria, where it acts as a sentry to guard the cell from antibiotic attack.



A protein implicated in antibiotic resistance changes its conformation when given ATP.

Cryogenic electron microscopy was used to image the bacterial protein complex. From those images, they built up the 3-D atomic structure of the biological machine and saw how it changed its conformation using adenosine triphosphate. Understanding how these proteins work could allow scientists to clog them with new molecules or develop new antibiotics that evade resistance.

Researcher: Ben Orlando, assistant professor, Department of Biochemistry and Molecular Biology.

Crushing cholera: Promising results for new, longer-lasting vaccine

Cholera is a diarrheal illness caused by the highly transmissible bacteria *V. cholerae* that infects two to three million people a year and kills tens of thousands annually. Oral vaccines on the market last roughly two to five years and are not very effective in young children.

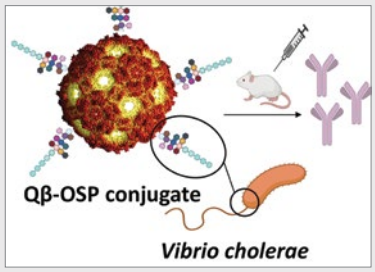


Illustration of a Qβ-OSP conjugate.

In collaboration with an international team, MSU researchers recently announced promising test results for a new, longer-lasting cholera vaccine in the future. The group discovered that by attaching the carbohydrate antigen, O-specific polysaccharide (OSP), from cholera bacteria to virus-like particles called Qß, they could obtain a very strong and long-lasting immune response.

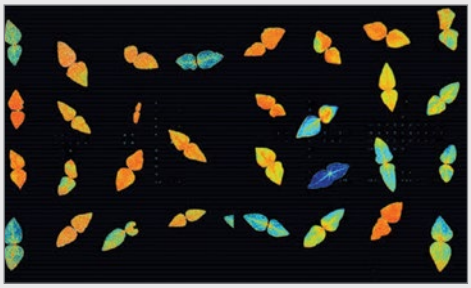
A novel technology using a new antigen carrier was used to link multiple copies of OSP to Qß. After the antibodies of recovering cholera patients recognized the OSP-Qß, one of the researchers immunized mice and then analyzed the results of immunized and non-immunized mice. After three doses of the vaccine, mice had strong antibodies lasting 265 days. A booster after 265 days also showed success. Using mice half the age they typically use helped determine that the vaccine would also be effective in younger children.

Researcher: Xuefei Huang, professor, Department of Chemistry; and Zahra Rashidijahanabad, former MSU Ph.D. student.

researchsamples

Cutting down on one "super fat" could help plants survive climate change

Climate change brings not only warming, but more importantly rapid fluctuations in temperatures, and these can severely impact a plant's ability to use sunlight through photosynthesis.



False-colored image showing the different photosynthetic efficiency of different cowpea plants under chilling stress.

An MSU team has discovered a potential solution in a single fatty acid that has a profound impact on how plants tolerate such chilling events.

To make this discovery, the researchers compared responses of hundreds of cowpea (black-eyed pea) plants with different genetic contributions from two parent plants with very different responses to such chilling events. One parent, from tropical Cameroon, grows well at higher temperature but is severely affected by chilling; and the other, from cooler California, shows the opposite behaviors. The offspring show even more extreme behaviors, with some performing much better and some much worse.

By comparing photosynthetic responses with the different genetics and the composition of different fatty acids, the team pinpointed the properties and genes that control temperature responses. A big surprise was that one specific fatty acid, rather than the overall composition, seems to play a major role. The team was then able to confirm the effects by engineering differences in this fatty acid in a laboratory model plant, *Arabidopsis.*

These findings could allow plants to tolerate a wider range of climactic conditions and places.

Researchers: David Kramer, Hannah Distinguished Professor in Photosynthesis and Bioenergetics; and Christoph Benning, University Distinguished Professor, Department of Biochemistry and Molecular Biology and the MSU-DOE Plant Research Laboratory.

Novel simulations provide insight into removing PFAS from soil

MSU chemists have discovered new information to help remediate "forever chemicals" (more formally known as PFAS) by showing for the first time how they interact with the clay mineral kaolinite in soil at the molecular level.

Having noted that PFAS mitigation strategies focused predominantly on removing PFAS from water—not soil—and that many PFAS studies failed to consider chemical behavior in their analysis of contaminated sites, the MSU researchers performed the first molecular-level simulations of interactions between the most prevalent and problematic PFAS chemicals and the common soil mineral, kaolinite.

Their research showed that not all PFAS behave identically—or even similarly—in how they spread in soil. PFAS with longer carbon chains congregated on the kaolinite in clumps that could be more easily grabbed and filtered from the soil. Shorter-chained PFAS were less likely to clump on kaolinite and remained more mobile in the soil, making them harder to grab.

They concluded that comprehensive chemical knowledge of PFAS at the clay mineral interface, including the length of carbon chains in the soils' chemical components, is critical to developing site-specific degradation and mitigation strategies to prevent PFAS from reaching the groundwater around contaminated sites and, potentially, impacting our food supply. The overall goal in these projects is to reveal interactions that could help protect more people from PFAS exposure.

Image of several types of short- and long-chain PFAS molecules examined to learn about their interaction with soil components.

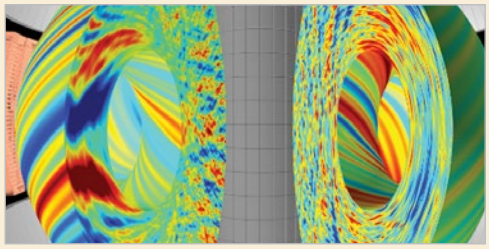
Researchers: Angela K. Wilson, John A. Hannah Distinguished Professor of Chemistry; and Narasimhan Loganathan, senior research associate, Department of Chemistry.

Following is a sample of notable grants awarded to NatSci faculty in 2022:

Daniel Appelö, associate professor of mathematics and computational mathematics, science and engineering (CMSE), is lead investigator on a five-year, $3 million National Science Foundation (NSF) Research Traineeship grant to create a graduate program to help usher in a new era of STEM discoveries. Appelö and his team are working with the NSF to ensure the United States can maintain its leadership in the machine learning space—especially in STEM applications—for generations to come.

Machine learning has the promise to accelerate research in STEM fields.

Christoph Benning, director of the MSU-Department of Energy (DOE) Plant Research Laboratory (PRL), is leading a four-year, $1.1 million NSF grant to bring research into the undergraduate classroom. The project, which looks at how the chloroplast reacts to stress responses in the model plant *Arabidopsis thaliana,* will allow students to learn techniques and concepts used in the lab, and to understand why researchers do what they do. It will also generate knowledge that inspires novel strategies to produce crop plants that easily adapt to changing climate and feed a growing population.



A computer simulation of plasma inside a tokamak, a leading technology in development for fusion energy.

Andrew Christlieb, an MSU Foundation Professor in the Departments of Mathematics and CMSE, is leading a five-year, $15 million U.S. DOE grant to develop new mathematical and computational tools to better model the physics needed to understand, control and sustain fusion. Christlieb, who will direct MSU's Mathematical Multifaceted Integrated Capability Center (MMICC)—one of four new MMICCs announced by the DOE in 2022—will be joined by researchers at eight other universities and national labs across the country to establish the center.

Marcos Dantus, MSU Foundation Professor and a University Distinguished Professor of chemistry, and **Elad Harel,** associate professor of chemistry, will use a three-year, $1.3 million grant from the W. M. Keck Foundation—MSU's first—to start a new revolution in the way we use optical microscopes to understand the living world. The co-investigators' research will push the limits on what light-based or optical microscopes can see, which will bring benefits to a range of scientific and engineering fields.

Erich Grotewold, professor of biochemistry and molecular biology, is the lead researcher on a three-year, $2 million U.S. DOE grant. MSU researchers are working to clear the runway for a new source of cleaner, more sustainable biodiesel and jet fuels derived from a relative of cabbage and cauliflower—*Camelina sativa*. This work will better equip researchers to improve the plant's oilseed yield and establish it as a more viable alternative to current petroleum-based fuels.

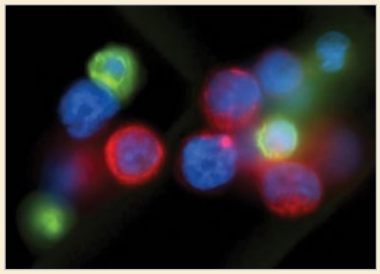
Matt Hedden, professor of mathematics, is lead investigator on a five-year, $1.9 million NSF Research Training program grant that will amplify the university's success in math research by creating communities of undergraduates, graduates, post-graduates and faculty working in topology and related mathematical areas. The goal is to create environments that nurture mentorship and connections and ultimately open doors to more inclusivity and broader recruitment.

Topology is the study of shapes to determine when they are the same or different.

keygrants

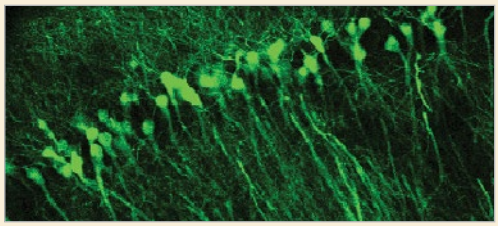
Cheryl Kerfeld, Hannah Distinguished Professor of structural bioengineering in BMB and an MSU-DOE PRL faculty member, is lead investigator on a five-year, $10.65 million U.S. DOE grant. Kerfeld will head one of the nation's newest Energy Frontier Research Centers—The Center for Catalysis in Biomimetic Confinement—which will explore how nature compartmentalizes some of its most important biochemical reactions. This understanding will allow researchers to mimic nature's methods to develop new and more efficient ways to produce important molecules and chemicals to benefit society.

Sophia Lunt, associate professor of biochemistry and molecular biology, is lead investigator on a five-year, $2 million grant funded in part by the National Institutes of Health (NIH). MSU researchers are unveiling and studying chemical clues that could lead to better diagnoses and treatments for a metastatic form of breast cancer—triple negative breast cancer.



A micrograph shows cancer cells (red) found in the blood of a cancer patient.

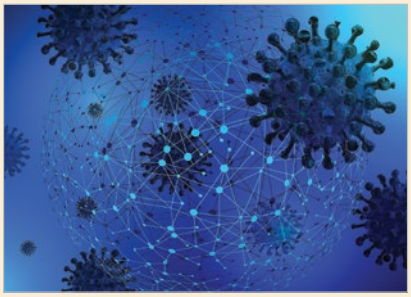
Elizabeth Phillips, senior academic specialist in MSU's Program in Mathematics Education (PRIME), is leading a four-year $2.99 million NSF grant. The project builds on three prior NSF grants that developed a digital collaborative platform using the Connected Mathematics Project (CMP) curriculum. Project activities include continued development and testing of the platform for the complete 7th grade.



Researchers are studying brain circuitry to determine how to best treat depression.

A.J. Robison, associate professor of physiology and director of MSU's Neuroscience Program, is leading a four-year, $3 million NIH grant. Major depressive disorder affects women twice as often as men. Funding from this grant will enable the MSU researchers to continue their investigation of how male and female brains respond to stress differently and how testosterone could be the key to increasing resilience.

Guowei Wei, MSU Foundation Professor of mathematics, will use a five-year, $2.7 million NIH grant to continue developing artificial intelligence (AI) algorithms that predict key features of viruses as they evolve. Wei, an expert in AI, has published nearly 30 papers on COVID-19. Other team members are Yong-Hui Zheng, professor of microbiology and molecular genetics; and Jiahui Chen, a visiting assistant professor.



MSU researchers are developing AI to help forecast future impacts of the coronavirus and other evolving viruses.

The W.K. Kellogg Biological Station (KBS) Long-Term Ecological Research (LTER) program at MSU was awarded a renewal of their foundational grant, reaffirming the program's future and status as one of the country's premier research sites. Established in 1989, the KBS LTER is one of 28 NSF LTER sites nationally and is the only one dedicated to understanding the ecology of agricultural systems. With a focus on row crops, the 34-year-old program studies how agriculture can be environmentally friendly without harming yields. Continuation funding for the program, which will focus on climate change and land use change, began on Dec. 1, 2022, and will run through November 2028.

Danny Caballero, Lappan-Phillips Associate Professor of physics education, received an American Physical Society–Excellence in Education Award as part of a national team of faculty members known as the Partnership for Integrating Computation into Undergraduate Physics. The team has established a site and a process for the peer-review and dissemination of high-quality instructional materials to achieve the goal of lowering the barriers to integrating computation into physics curricula.

Yuehua Cui, professor of statistics and probability, was named a 2022 Fellow of the American Statistical Association (ASA). He was recognized for outstanding contributions to methodology development and applications in statistical genetics and genomics; for exemplary mentoring of graduate students and junior researchers; and for significant service to the profession.

Marcos Dantus, MSU Foundation Professor, University Distinguished Professor of chemistry, and adjunct professor of physics, received the prestigious 2023 American Chemical Society Ahmed Zewail Award in Ultrafast Science and Technology. He is recognized for his outstanding and creative contributions to fundamental discoveries and inventions in ultrafast science and technology in the areas of physics, chemistry, biology or related fields.

Sarah Evans, associate professor in the Department of Microbiology and Molecular Genetics and at the Kellogg Biological Station, was named to the North American cohort of the Earth Leadership Program. She is one of 22 leading scientists named to the 2022 program.

Erich Grotewold, professor and chair of the Department of Biochemistry and Molecular Biology, and **Jiming Jiang,** an MSU Foundation Professor and interim chair of the Department of Plant Biology, were named 2022 Fellows of the American Society for Plant Biologists (ASPB).

Gregg A. Howe, MSU Foundation Professor in the Department of Biochemistry and Molecular Biology and MSU-DOE Plant Research Laboratory faculty member; **G. Philip Robertson,** University Distinguished Professor of ecosystem science and a W.K. Kellogg Biological Station (KBS) faculty member; and **James Tiedje,** Professor Emeritus, Department of Microbiology and Molecular Genetics, and founding director of the MSU Center for Microbial Ecology, are among 11 MSU scientists named to the 2022 Highly Cited Researchers List compiled by Clarivate Analytics in recognition of being among the world's most influential scientists.

Emily Josephs, assistant professor of plant biology, received the 2022 ASPB Early Career Award, which recognizes outstanding research by scientists at the beginning of their careers. This award is made annually for exceptionally creative, independent

Christoph Benning, MSU Foundation Professor, MSU Distinguished Professor and director of the MSU-DOE Plant Research Laboratory, was elected a Senior Member of the National Academy of Inventors. Benning is internationally known for his research on plant lipid metabolism, including his work identifying and applying the WRINKLED1 gene— a genetic switch that allows plants to accumulate seed oil (vegetable oil). Plant seed oil is a basic food component and a precursor for biodiesel production.

"I'm greatly honored to become a Senior Member of the society," Benning said. "Translation of basic research into useful applications is gratifying for any researcher. What better goal can there be than one day seeing basic findings made in the lab applied to products beneficial to humankind."

Benning was one of only 83 academic inventors and the first from MSU to be elected to this group in 2022.

faculty honors

Gregg Howe, MSU Foundation Professor in the Department of Biochemistry and Molecular Biology and the MSU-DOE Plant Research Laboratory, was named a Fulbright U.S. Scholar for 2022-23. Howe, internationally known for his work on plant resilience and how plants respond to insect attacks, will head to Japan to apply cutting-edge genetic technologies to the development of crop plants that will contribute to sustainable agriculture and food security.

"It's an honor to be selected as a Fulbright Scholar," Howe said. "I hope to use this opportunity to initiate new lines of research on plant defense mechanisms and to establish collaborations with plant scientists in Japan." The collaboration will include a student exchange program between MSU and the University of Tsukuba's T-PIRC.

Howe's research project will investigate the mechanistic basis of growth-defense tradeoffs in the domesticated tomato *(Solanum Lycopersicon)*, an important crop in many regions of the world.

contributions by an individual who is generally not more than seven years post-Ph.D.

Five NatSci faculty members received 2022 NSF Early CAREER Awards: **Huan Lei,** assistant professor of CMSE and statistics and probability; **Elizabeth Munch,** assistant professor of CMSE and mathematics; **Mohammad Maghrebi,** assistant professor of physics and astronomy; **Julia Ganz,** assistant professor of integrative biology; and **Johannes Pollanen,** assistant professor of physics and astronomy and the Jerry Cowen Endowed Chair of Experimental Physics. Collectively, over the next five years, they will receive more than $3.7 million in NSF funding.

Huey-Wen Lin, associate professor of physics and astronomy, and computational mathematics, science and engineering; and **Danny Caballero,** Lappan-Phillips Associate Professor of physics education, were elected 2022 Fellows of the American Physical Society (APS) for significant and innovative contributions to physics.

Keith Promislow, professor and chair of the Department of Mathematics, was named a 2022 Fellow of the Society for Industrial and Applied Mathematics for his contributions to rigorous asymptotic reductions, development of novel models and their applications, and service to the applied mathematics community.

Cheryl Sisk, Distinguished Professor of behavioral neuroscience and psychology, received the 2022 Daniel S. Lehrman Lifetime Achievement Award from the Society for Behavioral Neuroendocrinology for her outstanding career as a researcher and educator.

James Tiedje, Professor Emeritus, Department of Microbiology and Molecular Genetics, received the 2023 Lifetime Achievement Award from the American Society of Microbiology to honor his sustained contributions to the microbiological sciences. Although he officially retired in 2019, he remains active in research.

Berkley Walker, assistant professor of plant biology and MSU-DOE Plant Research Laboratory faculty member, received the 2022 ASPB Robert Rabson Award, which recognizes postdoctoral scholars and faculty-level early career scientists who have made excellent contributions in the area of bioenergy research.

Erica Wehrwein, associate professor of physiology, was named the 2022 Arthur C. Guyton Distinguished Educator by the Teaching Section of the American Physiological Society during the annual Experimental Biology meeting in Philadelphia. She was recognized for her teaching excellence and passion.

Angela K. Wilson, John A. Hannah Distinguished Professor of Chemistry, was elected an honorary member of Iota Sigma Pi, a national honor society for women in chemistry. The award is the organization's highest honor, bestowed triennially on an outstanding woman chemist for exceptional and significant achievement in chemistry.

Pl

Federica Brandizzi,
MSU Foundation Professor of plant biology

ants *in* space

Seeding a sustainable future

The moon holds answers, and a Michigan State University plant biologist is bringing those answers within reach. Patience, creativity and a cheerful fearlessness are turning insights buried in plant seeds into pathways to the very survival of the human race.

"Look at the moon," plant biologist Federica Brandizzi said from her MSU laboratory. "It's a spot in the sky and now I know it's something we can grab."

She said this just days after taking a special delivery from NASA—cardboard boxes cradling seeds fresh off a space trip that stretches the concept of being "out in the field." MSU sent those seeds on the Artemis I mission, Nov. 16, for a 25-day, mind-blowing 1.4-million-mile ride.

This is the third time Brandizzi's team has put plants in space (see timeline on pages 14-15).

The seeds of the model plant *Arabidopsis thaliana* flew farther than any spacecraft built for human transport has ever flown. They looped 40,000 miles through two giant donuts of radiation around Earth called the Van Allen Belts and traveled beyond the far side of the moon. The seeds were subjected to unknown conditions of gravity, vibration, radiation and temperature that were literally out of this world.

The seeds on the unmanned Orion spacecraft rode with other experiments that will help address important questions that humanity needs to answer as spacefaring missions carrying people become longer and more ambitious. Brandizzi's team stake in that long game: How will that long-term human presence feed itself?

"The short answer is that space travelers will need to grow their own food," said Brandizzi, an MSU Foundation Professor in the College of Natural Science and the MSU-DOE Plant Research Laboratory. "There are no grocery stores on the moon (yet) and launching care packages of food to astronauts simply isn't sustainable."

She is also deeply invested in another long game. Feeding human exploration of space is a step toward facing the urgent reality that creating human-sustaining real estate on a changing planet is necessary.

"Our resources on Earth are limited," she said. "We need new space because Earth is limiting. I have three children, and it makes me realize we must make sure there is a future for them."

Plants grow differently in space than they do on Earth. Astronauts in the International Space Station (ISS) have tended lush vegetables and flowers in compact high-tech gardens. But the ISS, while a crucial first step, still is a comparatively small one—orbiting a mere 245 miles above. The moon is nearly 1,000 times farther with exponential challenges. And long-range NASA plans include making lunar farming a waystation for provisioning Mars.

So, over the past few decades, scientists have been working to compensate for those changes by better understanding plant biology and finding out what it will take to allow plants to survive and maybe even grow better on another planet.

From previous experiments, scientists have learned that space can reduce the levels of protein building blocks, or amino acids, that keep living organisms—including plants—strong on Earth. The same amino acids would also be nutritious for people who eat the plants.

The Brandizzi lab experiment was one of four selected by NASA's Space Biology Program for the Artemis 1 mission to better understand how deep space affects terrestrial biology. The team received their seed experiment (pictured above) back from NASA on Jan. 5.

Brandizzi's lab selected seeds enriched with those amino acids, making them not only potentially more fit for space travel, but also more nutritious. They were packed up along with regular seeds for comparison. This experiment will allow the MSU team to see if fortifying the seeds on Earth could create a more sustainable path to growing healthier plants—and food—in space.

The team's experiment is one of four selected by NASA's Space Biology Program to better understand how deep space affects terrestrial biology. Accompanying MSU's seedlings aboard Artemis's Orion spacecraft were a yeast experiment led by the University of Colorado-Boulder, a fungus experiment led by the Naval Research Laboratory and an experiment with photosynthetic algae led by the Institute for Medical Research, a nonprofit research corporation.

"In space, there are so many variables, so many things that plants have never experienced before," Brandizzi said. "For example, without Earth's gravitational pull, plants are weightless in space. And without Earth's shielding atmosphere, plants encounter higher doses of cosmic rays."

FRONTIER

"In space, there are so many variables, so many things that plants have never experienced before."

A decade of plants in space

Brandizzi turned her attention to plants in space a decade ago. By then, it was becoming clear that reaching was becoming a signature of her scientific pursuits. She grew up on a farm in Italy that included crops and she learned about their potential and the respect plants were due. A life of science was tantalizing—a way to build a tribe of like-minded adventurers to explore big ideas. She also lucked out that her own tribe—her parents—supported that streak.

"I saw a lot of people going for the safe ride," she said. "I was fortunate that my family let me go. I was unleashed in all the possible ways. If you think about all the things that can happen, you would never leave home."

She left Italy for a postdoctoral fellowship at Oxford University. Six years later, she took the epic leap of accepting a job at the University of Saskatchewan in Saskatoon, Canada. She was beginning to understand fear was a limiting factor. Subtract fear and the vistas expand.

In October 2006, her next leap was to Michigan State. She is a leader in the Great Lakes Bioenergy Research Center (GLBRC), a U.S. Department of Energy-funded research center dedicated to developing sustainable biofuels and bioproducts. Her research plate was full and thriving. She had three children and is emphatic that the support she has received from MSU empowered her both to raise her family and expand those fascinating vistas.

"What has fascinated me about America is the idea of choosing what you want to do—that mindset that you can do anything if you put in hard work," she said. "I wanted to reach frontiers I could not have explored in my home country. I was fascinated by sending an organism into space. It's like a dream. I look into the sky and wonder if I can reach it. To push those frontiers."

In 2012, Brandizzi applied for a NASA grant to understand the mechanisms of how plants coped with the unique stress they would undergo when taken from their home planet. The grant application said, "to facilitate plant life in space, it is crucial to acquire a better understanding of the genetic changes that enable plant cells to respond to spaceflight stress."

Her group already had identified a protein that regulated stress responses and argued they'd need to put plants with a well understood genome—*Arabidopsis*—in what they called a hostile environment to get a better idea of how that protein worked. Understanding how plants respond to that kind of stress opens doors to developing plants better equipped to cope in a new world. There also was a proposed bonus development: understanding and helping plants with space stress management could also design coping mechanisms for what scientists call "other multicellular organisms"—humans.

Taking flight: Grad student plays key role in NASA experiment

Joanne Thomson *is a Ph.D. student in MSU plant biologist Federica Brandizzi's lab. She is in the Cell and Molecular Biology Program with a dual major in Molecular Plant Sciences and is also an Integrated training Model in Plant And Compu-Tational Sciences (IMPACTS) fellow.*

The following is an interview with Joanne Thomson about her role and contributions to the recent NASA experiment provided by the Brandizzi lab:

How did you get involved in this project?

I had expressed interest to Federica about working on the space biology project. When she asked me to be involved in this project, I was extremely excited. I thought it would be a fantastic opportunity to deepen my understanding of plant biology and work with plants in a unique way. My dream job is to work for NASA in the Space Biology Program as a plant molecular biologist, researching how plants respond, acclimate and adapt to the space environment. I hope to continue working on science directly involved with Artemis and eventually Lunar and Mars habitations.

What is your role in this project?

I will profile branched-chain amino acid levels in seeds flown on the lunar orbit flight and a synchronous ground control conducted at the Kennedy Space Center. Because radiation affects amino acid quality and quantity, we expect changes in total amino acid levels and that the increased level in radiation-sensitive amino acids will be reduced in spaceflight seeds compared to ground control seeds.

What excites you about working on the Artemis project?

I believe that our work will make a major contribution to NASA's current goal of returning astronauts to the Moon under Artemis, to explore deep space and eventually travel to Mars and beyond. We will need plants, and the plants we take must be able to survive harsh environmental conditions. Through the development of this project, we will be able to enrich general knowledge of the basic biological principles for space flight of seeds.

The maiden voyage for her work included lessons that went far beyond the innerworkings of the plants. Packing for travel in space is about supreme efficiency on all levels—how much room an experiment can take up, how finite resources are, and how low gravity effects the simplest tasks. For instance, even watering plants demands creativity, since water won't fall, but instead floats around and clump into buoyant blobs.

Working with the NASA team

Brandizzi learned to work on a team with skilled NASA professionals who don't think like biologists, except when it comes to the dedication to make every inch of space and every experiment work. Because science in space means only one chance to get it right.

"We knew we had to set the experiments to perfection because you have only one shot," Brandizzi said. "You appreciate the urgency of making everything perfect." See sidebar on page 16 to learn about pre-experiment preparation before executing the Artemis I space seeds project.

PRECISE

"We knew we had to set the experiments to perfection because you have only one shot."

She also said the NASA team shared a growing passion for life with the engineers, leading to shared values that their little dishes of seed sprouts were no more or less valuable

Federica Brandizzi (right) and Joanne Thomson look at some of the seedlings that returned from lunar orbit on the Orion spacecraft.

than the rodents or fungi on board. She recognized that the high level of professionalism and the back-and-forth learning will ultimately be key survival skills to expand human's territory beyond Earth.

In April 2014, the group loaded *Arabidopsis thaliana* seeds edited to override defects in anticipated stress responses, along with standard seeds. They were stacked compactly into sleeves called BRIC-PDFUs—Biology Research In Canisters-Petri Dish Fixation Units—and loaded onto NASA's Falcon 9 craft bound for the International Space Station.

Brandizzi and her team watched the NASA live feed of the Falcon 9 launch, acutely aware of the fragility of those Petri dishes, the little seeds and life itself. The hallmark of a space launch is noise and flame. The rocket's camera gave the experience an onboard perspective.

"I cried," she said. "It was so beautiful to see it trembling. There was a sense of peace that it had begun."

Timeline

2012

Federica Brandizzi applies for first NASA grant.

2014

Arabidopsis seeds flew on the Falcon 9 rocket to the ISS, where astronauts tended the seeds.

Photo credit: NASA—International Space Station

The ISS astronauts tended the seeds, which ultimately sprouted into skinny, stressed-out plants. With little gravity and light to control them, they grew out of their evolutionary comfort zone, their stems and roots sprawled in all directions.

> **"The preparation is intense, it's tiring, but it is so rewarding."**

These sprouts returned to Brandizzi's lab so the team could begin to understand the genetic changes that would inform what plants needed to grow properly in space. In 2015, she submitted and received another NASA grant to again put another experiment up to build on those findings, tweaking mutant plants' stress responses.

Second time around

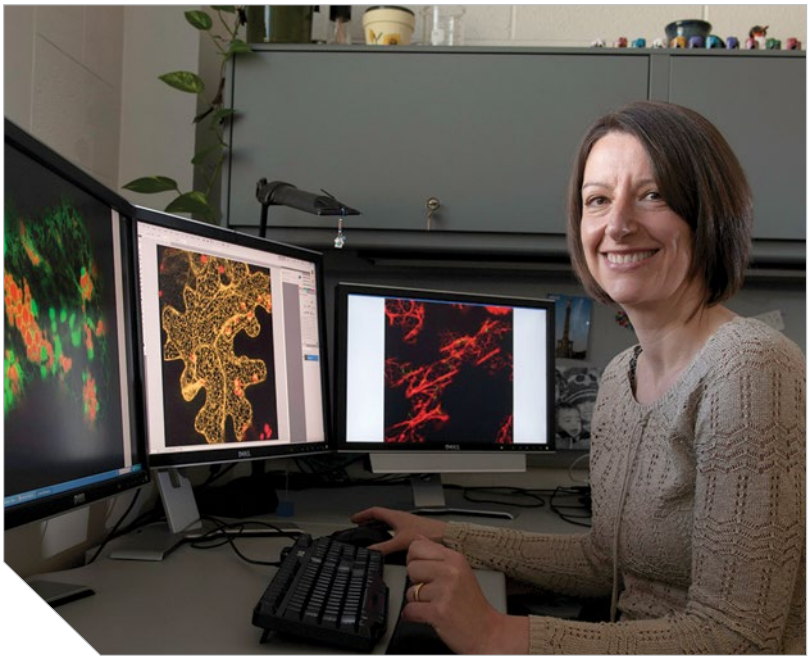
This led to the second plants-in-space experience being in orbit via the SpaceX CRS12 mission to the ISS in August 2017. (Originally scheduled for December 2016, it was delayed several times.)

In 2018, she applied for space on the Artemis I flight. It was time, they submitted, for *Arabidopsis thaliana* to face new stresses to answer new questions.

"I had lived through this two times already," she said. "The preparation is intense, it's tiring, but it is so rewarding."

After the first launch, Brandizzi took the intensity-weary-reward equation to heart, taking up running marathons. Twenty-one of them.

"I love to think when I run," she said. "I am in my zone with no emails or phone calls, and I formulate work ideas (sometimes crazy ones) when I run. It has taught me that anything is possible, that I can push frontiers, and nothing can stop me, unless I let it."



Federica Brandizzi is an internationally recognized plant biologist whose research interests focus on the investigation of the mechanisms for establishment and maintenance of organelles of the secretory pathway in growth and stress in plants.

2017

Second mission to the ISS with a new batch of Arabidopsis seeds.

2022

Third Artemis mission with Arabidopsis seeds onboard the Orion spacecraft.

Photo credit: NASA—Orion spacecraft

Pre-experiment preparation for the Artemis I space seeds project

- Temperature profiles were chosen to be used in during the simulated mission.
- Germination and viability testing of mutants was conducted after incubation in extreme temperatures.
- For each temperature tested, seeds from each genotype were packaged into vials, wrapped in parafilm, and placed in a single 50 ml tube.
- Seeds were treated with the temperatures/durations indicated in a specified timeline.
- After the growth period, plates were imaged and percent germination and viability determined.
- Germination after treatment with different temperatures were then compared to determine any deleterious effects of these temperatures.

Jumping disciplinary fences to pursue answers

Now the well-traveled seeds are back in East Lansing, Mich. Joanne Thomson, a Ph.D. student in Brandizzi's lab (see sidebar about Joanne on page 13), analyzes the seeds after their return trip. While the science is exhilarating, she said the one-chance nature of the work comes with its own unique stresses.

SEEDS

"That's the greatest thing about *Arabidopsis*—the sheer volume of science we're able to get back with these tiny seeds."

"When I knew NASA would be delivering the seeds, I had a lot of anxiety," Thomson said. "I couldn't sleep! I kept wondering what if the truck crashes? What if the building burns down?"

The seeds, dark brown and about as small as celery seeds found in a spice rack, arrived on campus without incident, coddled in 12 50ml test tubes with screw-top vials wrapped in layers of protective material. Thomson carefully—very carefully—unpacked them. Some went into -80°C storage for future work. To ensure results can be replicated, some of the seeds stayed at the Kennedy Space Center in Florida, with the conditions carefully coordinated to be the same in both spots.

The trick, she said, is to use as few seeds as possible when working to understand how the amino acids may have changed.

"The experiments were planned in advance so we knew the minimum amount of seeds we would need. Thinking ahead, we included more seeds than required for possible experiments in the future," she said. "That's the greatest thing about *Arabidopsis*—the sheer volume of science we're able to get back with these tiny seeds."

NASA work is not Thomson's first federal gig. Before entering academia, she served in the U.S. Army, deploying to Iraq in 2008 to Camp Falcon near Baghdad, which operated as a combat outpost. She served as a driver and security for a lieutenant colonel. Even as she left active duty to pursue biological studies, she took a job in the U.S. Army Reserves as a motor transport operator and was a sergeant by her service's end.

Joanne Thomson, a Ph.D. student who played a key role in the lab's seed experiment with NASA, spins down seeds in a microfuge tube using a mini centrifuge to sterilize them.

Photo credit: NASA—Artemis I

NASA launched its Artemis I mission on Nov. 16, 2022. Artemis I, an uncrewed Moon-orbiting mission, was the first major spaceflight of NASA's Artemis program. Artemis I marked the return of the agency to lunar exploration originally begun as the Apollo program decades earlier.

"Fear is the worst enemy of imagination . . . We say, 'this is cool so let's go for it—this sounds like so much fun.'"

IMAGINE

develop interdisciplinary skills in plant genomics and computational data analysis.

Thomson's willingness to jump disciplinary fences to pursue answers embodies what Brandizzi identifies as her group's success—a certain disregard for fear.

"The trademark of what we do that works for us is that we are a bit dangerous. We value energy and curiosity, and we are a bit reckless," Brandizzi said. "Fear is the worst enemy of imagination, so we are fearless and perhaps a bit naïve. We say, 'this is cool so let's go for it—this sounds like so much fun.'"

"NASA to me is much more than a funding agency," Thomson said. "I think of all scientists as performing acts of selfless service, that scientists truly care about the needs of other people. We are working hard to make the world a greater place here on Earth and beyond. I feel very grateful and proud to be a part of that."

The explosion of genomics has yielded datasets with the potential to revolutionize plant sciences; and this means plant biologists need to know how to wrangle big data. Last year, Thomson won a National Science Foundation Research Traineeship (NRT)—IMPACTS Award, which is a unique opportunity to

Where on the Web

To find out more about the space seeds, click on these related links:

https://msunatsci.info/WILXseeds

https://msunatsci.info/ScienceAtNasa

https://msunatsci.info/WKARArtemis

https://msunatsci.info/ShareTheScience

https://msunatsci.info/SeedsPodcast

NatSci student *earns prestigious* Churchill Scholarship

Samuel Sottile, a senior majoring in advanced mathematics in the Michigan State University College of Natural Science (NatSci), has been named a Churchill Scholar.

Samuel Sottile, an advanced mathematics senior in the College of Natural Science, is MSU's 18th Churchill Scholar. He will attend the University of Cambridge, where he plans to pursue a Master of Advanced Study in the Mathematics Part III program.

The 18th Churchill Scholar from Michigan State, Sottile's scholarship award places MSU in the top 10 nationally (tied for No. 7) and No. 1 in the Big Ten for Churchill Scholars.

Established in 1959 by the Winston Churchill Foundation of the United States, the Churchill Scholarship offers American students of exceptional ability and outstanding achievement the opportunity to pursue graduate degrees in engineering, mathematics, or the sciences. The scholarship supports one year of master's study at Churchill College, University of Cambridge, England.

"All Spartans can be proud of this recognition of Samuel's accomplishments," said MSU Interim President Teresa K. Woodruff, Ph.D. "Churchill scholarships are highly competitive, focusing on recipients' prior academic and research achievements. I have no doubt Samuel will continue to distinguish himself in his graduate mathematics studies at the University of Cambridge and beyond."

> **"I am looking forward to spending a year at Cambridge at one of the best mathematics programs in the world."**
>
> **~Samuel Sottile**

As a first-year student, Sottile was awarded a Professorial Research Assistantship from the Honors College. During his first two years at MSU, he served as a research assistant at the National Superconducting Cyclotron Laboratory.

Over the years, he has conducted significant research at MSU and beyond, including projects supported by the National Science Foundation, with the University of Michigan-Dearborn and University of California, Davis.

Sottile was awarded a Goldwater Scholarship as a junior in recognition of his research. He is from College Station, Texas, and graduated from Allen Academy in Bryan, Texas.

"I am honored to receive the Churchill Scholarship, and I would like to thank everyone who has helped me over the years," said Sottile, who is also an MSU Honors College student. "Additionally, I would like to thank MSU for helping me achieve my potential. I am looking forward to spending a year at Cambridge at one of the best mathematics programs in the world."

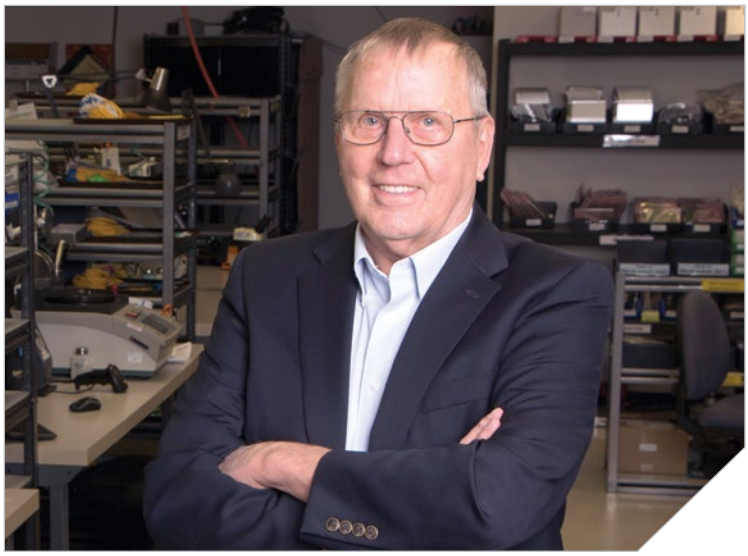
MSU mathematics professor Willie Wong said he has no doubt Sottile will become a leader in his research.

"What impresses me most about Sam is not his immense mathematical talent, which is plainly evident to his teachers, his peers, and anyone who cares to hold a mathematical conversation with him. Rather, it is the healthy skepticism with which he approaches the subject," Wong said. "His depth of knowledge came from his skepticism of his own self; our paper together improved due to his skepticism of his co-authors; and the novel results of our collaboration owe much to his skepticism of conventional wisdom."

At the University of Cambridge, Sottile plans to pursue a Master of Advanced Study in the Mathematics Part III program.

Alum discovers his *"flight path"* for a successful career

Like many high school graduates, Roger Wolthuis (M.S., physiology, '65; Ph.D., physiology, '68) was searching for his place in life. Not wanting to go to college—much to his father's dismay—he joined the U.S. Air Force, where he was trained as an instructor in aviation physiology. This piqued his interest in the field of physiology.



Roger Wolthuis

The Air Force quickly showed him the value of a college education, and he entered the University of Maryland night school program. After leaving the Air Force, he completed his undergraduate degree at the University of Michigan. But it was MSU's graduate program in physiology that finally launched his career.

"Once I got invested in the MSU program, I wasn't searching anymore," said Wolthuis. "The physiology program at MSU was fundamental to everything I've done since then. It was a life-changing experience."

"Once I got invested in the MSU program, I wasn't searching anymore."

~Roger Wolthuis

VALUE

After earning two advanced degrees at MSU, he was hired to develop and operate the new NASA Cardiovascular Research Laboratory at the Manned Spacecraft Center in Houston, Texas. In this capacity, his staff was responsible for frequent testing of all Apollo and Spacelab astronauts, including before and after each manned mission. Six years later, he moved to the United States Air Force School of Aerospace Medicine in San Antonio, Texas, where he worked as a research scientist in cardiology.

In 1979, he joined Medtronic, where he helped develop tools to solve heart issues, and build better devices for human implantation. In 1983, Wolthuis joined a startup (Metricor Inc.) as vice president of medical product development, where he worked with allied medical device manufacturers in the development of fiber optic sensors and systems for medical applications.

In 1990, he founded Metrilab, a small company that developed a catheter for use in coronary arteries to measure coronary size precisely. Seven years later, he founded RJC Enterprises, which focused on the design and manufacture of fiber optic sensor products that are now used worldwide for critical clinical measurements. He holds four U.S. patents.

"Physiology is a baseline discipline for careers in medicine, teaching, pharmaceuticals and medical device development," Wolthuis said. "Physiology provides an incredible baseline of important information that people in those environments use on a daily basis."

He credits outstanding MSU professors for his life-long success. In appreciation of his MSU education, Wolthuis has made donations in support of applied research in the lab of Erica Wehrwein, associate professor of physiology.

"This donation was essential to support my research and teaching in human physiology," Wehrwein said. "There are few labs doing integrative research on basic physiology in human subjects, or training students in these practices."

"My main focus for most of my life has been in the development of tools to better understand physiology and medicine," Wolthuis said. "I'm well past retirement age, and still get excited to come into the office every day. We have technology that continues to evolve. Products continue to get better. What's not to like about that!"

Setting a *new standard* in STEM education

Michigan State University is one of five institutions selected by the Association of American Universities (AAU) to pioneer new and better approaches for evaluating teaching and learning in undergraduate STEM departments.

MSU chemistry faculty are leading the effort to take a new vision for evaluation of teaching engagement centered on student learning from concept to practice in undergraduate STEM departments. Project leaders are, left to right: Timothy Warren, Lynmarie Posey and Melanie Cooper.

Experts agree that the current methods used to assess teachers in science, technology, engineering and mathematics courses are fundamentally flawed, despite being used at universities across the United States. Now, with support from the Sarah Gilbert and Carl Wieman Charitable Fund, AAU is working to address those flaws.

To do this, AAU has enlisted MSU's Department of Chemistry to serve as one of the leaders in creating more meaningful and productive methods that can be implemented at any university.

"These are meant to be demonstration projects," said Timothy Warren, a Barnett Rosenberg Professor and chair of the Department of Chemistry. "We have plans for an experiment, and we're looking forward to running it to come up with more effective ways to use teaching evaluation to improve student performance."

"That's what we really want; we want to support student learning," said Melanie Cooper, professor of chemistry and a Lappan-Phillips Professor of Science Education. "And the typical ways of evaluating teaching haven't really helped that."

Warren and Cooper are leading the new AAU-backed project, along with Lynmarie Posey, associate professor of chemistry and associate dean for undergraduate studies in the College of Natural Science. The team's proposal grew out of work the college was already doing to revisit its existing evaluation process, which relied heavily on student evaluations, as is the norm.

LEAD

"We are excited to lead the effort to take this new vision . . . from concept to practice."

"We are excited to lead the effort to take this new vision for evaluation of teaching engagement centered on student learning from concept to practice," Posey said. "This project in the chemistry department will serve as a pilot for the approach that we hope to see implemented across the college."

Research shows that student evaluations do not correlate with student learning or the effectiveness of teaching, AAU pointed out. MSU isn't getting rid of student evaluations, but it is adding new components designed to support faculty as they become more engaged in the process and give them more agency in their development.

"The traditional approach to faculty teaching evaluations does not really provide a way to improve. When you get an evaluation, you're either happy, frustrated or confused," Warren said. "The scores and comments don't necessarily put you on a path to progress."

IMPROVE

"If you engage with the process, there's no way that your students don't see improvement."

What the department is doing is integrating a reflective component. Teachers will set a learning goal and assess how well students reach that goal, which is typical. The new component is asking teachers to reflect, in writing, on what changes they can make to improve student performance.

"This reflection sets a direction," Warren said. "It charts a path forward on the teaching side and student performance side."

By implementing those changes, then assessing and reflecting again, faculty members become engaged in a continual cycle to promote growth. They can also start to ask better, more targeted questions on their student evaluations, Cooper said. That, in turn, makes those evaluations more useful moving forward.

"I am delighted that MSU's own Department of Chemistry is at the vanguard of evaluative reform. Faculty in the College of Natural Science have consistently demonstrated their commitment to innovate across the pedagogical landscape," said MSU Interim President Teresa K. Woodruff, Ph.D. "Now they are turning a critical eye on how student evaluations fit into that landscape. I have no doubt AAU, and MSU educators in particular, will benefit from the new student-performance components our chemistry educators are building in the teacher evaluation process. These faculty are a case study in why MSU is known as a leading educational institution."

One of the first experiments of its kind in higher education, this MSU demonstration project is part of a national effort to create more meaningful and productive methods for evaluating teaching and learning in undergraduate STEM departments—not only at Michigan State, but at any university.

Setting a *new standard* (cont.)

The key goal of the AAU demonstration project is to better support student learning and improve student performance through reform of teaching evaluation.

And though this may sound like a straightforward plan, it's outside-the-box thinking for STEM in higher education.

"If you engage with the process, there's no way that your students don't see improvement," Cooper said. "But this is hard. This is something that people are not used to doing."

As Warren said, it's an experiment. But scientists are good at experiments and MSU's chemists are eager to perform this one. The department's faculty voted unanimously in support of the new approach. The project also has seven chemistry faculty members serving in advisory roles: Assistant Professor Selvan Demir; Professor Jetze Tepe; Professor Thomas Hamann; Director of Undergraduate Programs Chrysoula Vasileiou; Director of General Chemistry Amy Pollock; Professor David Weliky; and Professor Gary Blanchard, who is also chemistry's associate chair for education.

AAU has bought into the experiment, too, investing one of its five $100,000 grants in the department. This grant, though, is about more than the funding. AAU is saying that this is a problem that needs to be solved and one that should be solved by AAU members, Cooper said.

"The very fact that AAU said that AAU institutions have to do something about this problem, that gets attention way beyond the money," she said.

INNOVATE

"AAU believes in us, and they see us as leaders in education. This is one of the first experiments of its kind in higher education."

"AAU believes in us, and they see us as leaders in education," Warren said. "We are very fortunate to be on the cutting edge at MSU with Melanie's leadership and the work already being done in NatSci. This is one of the first experiments of its kind in higher education."

MSU colleges work *to diversify students* entering medical school

At just eight years old, Deja Rice knew she wanted to become a physician in an underserved community.

A group photo of Drew alumni following the Drew/CHM Medical Preparation Opportunity Lecture.

Deja Rice

That passion was shaped by spending countless hours with her late mother, who suffered from sickle cell disease, in emergency rooms, hospital wards and critical care units where overworked medical providers struggled to keep up with the volume of patients. It was a sign of inequity.

But Rice knew putting M.D. after her last name would be challenging. Rice grew up in an underserved area of Detroit, Mich., and knew she would need academic and financial support to continue her pursuit of becoming a doctor. Michigan State University had a solution.

The Charles Drew Science Scholars program is a residential program in the Michigan State University College of Natural Science (NatSci) that has worked to diversify the STEM talent pool and workforce for more than 40 years. The program has a legacy of providing robust academic experiences for nearly 2,000 scholars to date through academic coaching and tutoring, career advising and professional development. The program prioritizes students from groups historically underrepresented in science and mathematics fields. Dozens of Drew Scholars have gone on to pursue medicine at institutions nationwide, including MSU's College of Human Medicine (CHM) and College of Osteopathic Medicine (COM).

"This experience has allowed me to aspire to become a family physician in an urban, underserved area of Michigan . . ."

~Deja Rice

DIVERSIFY

"Becoming actively involved in the Drew Scholars program offered me the ability to learn many new skills. I was exposed to resume building, tutoring, academic counseling, research and presentation opportunities and much more," said Rice, now a Drew alum who matriculated into MSU's College of Human Medicine through the program. "This experience has allowed me to aspire to become a family physician in an urban, underserved area of Michigan because of my passion to serve the community and increase primary prevention methods."

Rice's educational journey was shaped by a unique partnership between MSU's Colleges of Natural Science and Human Medicine, a partnership that is increasing diversity among the medical student community. Through CHM's Medical Preparation Opportunity, Drew Scholars can gain acceptance into medical school early—potentially saving thousands of dollars in medical school application fees and travel costs, while helping to ensure a more diverse medical workforce.

Since the partnership began in 2014, 20 Drew Scholars from diverse backgrounds, including Black, Latinx and Indigenous students have gone on to enroll in CHM, while dozens of others have pursued medical school at other institutions.

"We appreciate our partnership with the College of Human Medicine, providing an enhanced pathway for admission to our Drew Scholar students," said Jerry Caldwell, director of the Charles Drew Science Scholars program. "This collaboration will allow our premedical students to have the opportunity for early and consistent engagement with the medical school through programming to prepare, develop and become strong candidates for early admission to the college."

Carl H. Brubaker, Jr. Professorship

James D. Hoeschele (Ph.D., inorganic chemistry, '69) has made a $1 million gift to establish the Carl H. Brubaker, Jr. Professorship in honor of Brubaker, who was on the MSU faculty from 1952 until his death in 1992. Hoeschele worked in Brubaker's lab as a graduate student. "My research experience with Professor Brubaker was extremely valuable and crucial to landing an exciting research position at the Oak Ridge National Laboratory," said Hoeschele, who returned to MSU—as a faculty member—in 1970 and worked in the lab of Barnett Rosenberg, best known for the discovery of the anti-cancer drug cisplatin. "I am truly indebted to Professor Brubaker for his guidance during my research with him and especially for alerting me to the available position in the laboratory of Dr. Barnett Rosenberg," Hoeschele said. "Obtaining this [faculty] position changed the direction of my career and is responsible for a very satisfying and productive career." Tuo Wang, associate professor in the Department of Chemistry, was installed as the inaugural Carl H. Brubaker, Jr. Professor in 2021.

Min Chen Graduate Award for Computational and Earth Sciences

Colleagues and family members of Min Chen have established the Min Chen Graduate Award for Computational and Earth Sciences in her memory. Chen, who died in July 2021, was an internationally recognized expert in computational seismology, data science and earth science. She joined the MSU faculty in 2017 as an assistant professor with joint appointments in the Department of Computational Mathematics, Science and Engineering and the Department of Earth and Environmental Sciences (EES). Chen was a leader in efforts to improve diversity, equity and inclusion in her departments and had an active curiosity about how to improve culture and processes in academia. This endowment fund serves to continue Chen's legacy at MSU through supporting efforts to promote diversity, and future trainees in computational and earth sciences. "Min Chen is still very much on our minds," said Jeffrey Freymueller, EES chair and Endowed Chair for Geology of the Solid Earth. "Her former postdoc recently published a paper in *Science* that produced the best image yet of the crustal magmatic system beneath Yellowstone. The work used methods that she pioneered and started before her untimely death."

William M. and Mary King Conner Natural Science Scholarship Fund

Bill (Ph.D., mathematics, '70) and Mary (Ph.D., chemistry, '70) Conner established the William M. and Mary King Conner Natural Science Scholarship Fund in 2011. "Over the years, as we read about increases in college expenses and the debt many students had upon graduation, we often thought back on our days at MSU. We both had assistantships then that were enough to cover all our expenses; and when we graduated, we had no savings, but we also had no debt," Bill and Mary said. "The College of Natural Science helped us financially in the advancement of our careers, so we decided to give back by helping the college support future generations of students. We initially added the college to our estate plan, but later decided to start a fund immediately so we could appreciate its benefits while we are still alive—and we're so glad we did." Bill went on to a career in the software industry, and Mary earned a second Ph.D. (human genetics) at the University of Pittsburgh, where she spent the rest of her career as a professor of genetic toxicology.

H. Wilson Cunningham and Jane A. Carstairs KBS Research Equipment and Instrumentation Fund

H. Wilson Cunningham (M.S., aquatic ecology, '77) and Jane A. Carstairs (Ph.D., dairy science, '78) established the H. Wilson Cunningham and Jane A. Carstairs KBS Research Equipment and Instrumentation Fund at the W. K. Kellogg Biological Station (KBS) in the College of Natural Science. "The opportunity to work at KBS was a dream come true for an aspiring young aquatic ecologist," Cunningham said. But as a research assistant at KBS (1975 through 1978), he broke an expensive piece of equipment that required the professor's research grant dollars to be diverted to the repair. This endowment provides funds to maintain and expand the facility's infrastructure instrumentation so research funding goes directly toward the research work. "Advancement of scientific knowledge should not be restrained for the lack of money for tools," said Cunningham, who was an analytical chemist and operations and business manager in the printing industry for 30 years before retiring in 2013. Carstairs spent two years developing international training programs for the U.S. Department of Agriculture before transitioning to financial program management in private industry until her retirement in 2014.

Jeffrey N. and Betty A. Smith Student Award in Chemistry

Jeffrey N. (M.S., synthetic organic chemistry, '71) and Betty A. Smith intend to make gifts in the amount of at least $50,000 to create the Jeffrey N. and Betty A. Smith Student Award in Chemistry. By establishing this endowment in the department, the donors hope to help provide the foundation and support for future students to succeed in chemistry at MSU. Jeff and Betty earned their undergraduate degrees at Kent State University in chemistry and early childhood education, respectively. Jeff later earned his master's degree in synthetic organic chemistry from MSU and then worked in the pharmaceutical industry. Betty earned her master's degree in early childhood education at Western Michigan University. Jeff helped to make new pharmaceuticals available to alleviate pain, and Betty helped to educate the next generation. They believe that everyone should contribute to the advancement of society. "Because of the success we enjoyed throughout our careers, and our appreciation for these educational opportunities, it is our wish to help make these wonderful experiences available for other students," Jeff said.

The Woodford Family Fellowship in Nuclear Physics

Brent A. Woodford (B.A., accounting, '84) intends to make a $500,000 future gift to MSU to establish The Woodford Family Fellowship in Nuclear Physics. He established this endowed graduate fellowship because of his personal passion in learning and understanding the field of nuclear physics. "I've always been fascinated by the unknowns of how the universe operates and impressed by those who could make progress in figuring it out," said Woodford, who is currently the executive vice president of controllership, finance and tax for The Walt Disney Company. Prior to joining Disney in 2003, he was vice president and controller of Yum! Brands, Inc., and controller of PepsiCo's international restaurant division. He was also employed by A.G. Edwards & Sons, Coopers & Lybrand and at KPMG in its Dallas and London offices. "Coming from a small-town family where no one had ever gone to college, MSU was an amazing catalyst in my life," Woodford said. "I established this fellowship because I want to give back; I appreciate what MSU did for me, and I want others to be able to have the same experience I did."

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, 2022.

NatSci Dean Phil Duxbury (center) poses with NatSci honorees at the 2022 MSU Investiture for Endowed Faculty (L to R): François Greer, Timothy Warren, Jonas Becker and Danny Caballero. Not pictured: Thomas O'Halloran and Aman Yadav.

NatSci faculty members *honored at* all-university investiture

Six Michigan State University College of Natural Science (NatSci) faculty members were among 36 honored at the 2022 Michigan State University Investiture for Endowed Faculty on Sept. 14, 2022, at the MSU Wharton Center for Performing Arts in the Great Cobb Hall.

The event celebrates MSU's commitment to academic excellence and innovation by bestowing faculty recognition at the university level on those who hold endowed chair, endowed professor and MSU Foundation Professor positions.

NatSci's 2022 honorees are:

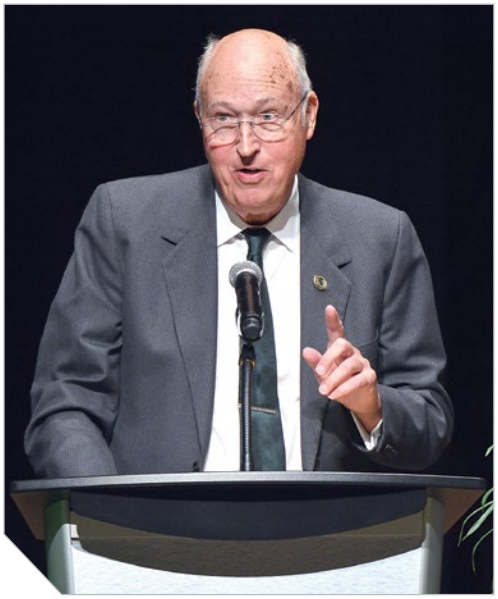
- **Jonas Becker,** Jerry Cowen Chair of Experimental Physics, Department of Physics and Astronomy. Becker is an assistant professor of physics and is the primary investigator for the Solid-State Quantum Physics Optics Group within the Quantum Optical Devices Laboratory. His research focuses on experimental quantum information science using optically active systems in solid-state hosts, such as defects in synthetic diamond and rare-earth-doped crystals.
- **Danny Caballero,** Lappan-Phillips Professor of Science Education, Department of Physics and Astronomy. Caballero is an associate professor of physics education who studies how tools and science

ENDOW

"Endowed positions such as these are a pinnacle of academic achievement, an accolade that these faculty members truly deserve."

practices affect student learning in physics and the conditions and environments that support or inhibit this learning. His work employs cognitive and sociocultural theories of learning and aims to blend these perspectives to enhance physics instruction at all levels.

- **François Greer,** Van Haften Endowed Professor in Deductive Literacy, Department of Mathematics. Greer is an assistant professor whose research is focused on algebraic geometry, with a specific focus on moduli spaces of Calabi-Yau varieties. Greer spent 2020-2021 at the Institute for Advanced Study, conducting NSF-funded research into the relations between quasimodular forms and Gromov-Witten theory.



Dan Van Haften (mathematics, '70), provided the donors' remarks at the 2022 MSU Investiture for Endowed Faculty.

- **Thomas O'Halloran,** MSU Foundation Professor, Departments of Chemistry and Microbiology and Molecular Genetics (also College of Human Medicine). O'Halloran is a professor whose research focuses on the discovery of soluble metal receptor proteins, the pathways they participate in, and the mechanisms by which they regulate cellular events and the physiology of the organism.
- **Timothy Warren,** Barnett Rosenberg Endowed Professor, Department of Chemistry. Warren is a professor and chair of the Department of Chemistry. His research group is focused on developing environmentally friendly new methods for organic synthesis, exploring the interconversion of nitrogen and ammonia as carbon-free fuel, and decoding ways that biology communicates using nitric oxide as a molecular messenger.
- **Aman Yadav,** Lappan-Phillips Professor of Computing Education, Department of Computational Mathematics, Science and Engineering (also Department of Counseling, Educational Psychology and Special Education, College of Education). Yadav is a professor of educational psychology and educational technology and also serves as associate director of computer science education in MSU's CREATE for STEM Institute. His research focuses on preparing teachers to embed computational thinking practices and computing in the classroom.

"The faculty members recognized at this investiture bring outstanding creativity and innovation to NatSci scholarship from the mathematical and physical sciences to the chemical and biological sciences," said Phil Duxbury, NatSci dean. "They address societal opportunities and challenges—from new technologies, such as quantum information science; to education innovation; the molecular and cellular foundations of health sciences; and understanding the mathematical foundations of fact-based communications. Endowed positions such as these are a pinnacle of academic achievement, an accolade that these faculty members truly deserve."

In addition to its faculty honorees, NatSci was represented at the ceremony by NatSci alumnus Dan Van Haften (mathematics, '70), who provided the donors' remarks at the investiture. Van Haften gifted funds to establish the Van Haften Endowed Professorship in Deductive Literacy, which honors his parents, the late James and Esther Van Haften, who set a lifelong example of support for learning.

THINK

"Mathematics is important to teaching people how to think logically."

The inaugural Van Haften Endowed Professorship was awarded to François Greer in 2021. Greer, an assistant professor in the MSU Department of Mathematics who studies algebraic geometry, was an honoree at this year's investiture.

"Mathematics is important to teaching people how to think logically," Van Haften said. "A faculty position devoted to deductive literacy will raise awareness throughout MSU and help influence logical thinking in many disciplines."

For a complete list of all of MSU's most distinguished faculty members—respected leaders and innovators within our campus community and in their disciplines—visit https://msu.edu/honored faculty/.

1940s

Manley Mandel, M.S., microbiology,'47; Ph.D., microbiology, '52, celebrated his 99th birthday.

1950s

Gary Chartrand, mathematics, '58; M.S., mathematics, '60; Ph.D., mathematics, '64, is Professor Emeritus of Mathematics at Western Michigan University. He is the recipient of the University Distinguished Faculty Scholar Award and the Alumni Association Teaching Award from Western Michigan University. He also received an award as managing editor of the best new journal—*Journal of Graph Theory*—published by the Association of American Publishers. He received the 2021 Stanton Medal from the Institute of Combinatorics and Its Applications and has been awarded four research grants from the Office of Naval Research and one from the National Science Foundation.

Jean Wolfgram Hull, research in food and nutrition, '58, was awarded the top educator award, State of Hawai'i, the Kunimoto Memorial Award, from the University of Hawai'i Community Colleges in 2000. Hull was awarded the Good Taste Award from the American Academy of Chefs in 2021; the award is for an Academy Fellow who has been actively involved in furthering the culinarian's greatest achievements. Hull also spearheaded a campaign, raising $250,000 for culinary scholarships.

1960s

Barb Frey, biological science, '65; M.S., zoology, '67, taught for 31 years in the Biology Department at Oakland Community College, Auburn Hills, Mich., before retiring in 1999. She remains involved with and connected to MSU, including serving as vice president of the Oakland County MSU Alumni Club.

1970s

Steven J. Goetsch, physics, '72 (Honors College), received the Marvin M.D. Williams Professional Achievement Award in July at the 64th annual meeting of the American Association of Physicists in Medicine (AAPM) in Washington, D.C. He has been a member of the AAPM since 1974.

Beth Kanell, chemistry, '72, is a published author. Kanell's short story, "What Was Cut," appears in *Frankly Feminist: Short Stories by Jewish Women from Lilith Magazine*, published by Brandeis University Press in October 2022. Her poetry recently appeared in *Amethyst Review* and *As It Ought To Be Magazine* and is scheduled for 2023 publication in *Soul-Lit*. She provides feature articles linked to Vermont history in *The North Star Monthly*.

Jan Hillson, geology, '73 (Honor's College), is a rheumatologist and immunologist, currently serving as SVP of Clinical Development for Proventio Bio, a biotech company developing novel therapies to address serious autoimmune and alloimmune disorders. The company's lead molecule, Teplizumab, is undergoing review by the FDA as a potential treatment to prevent or delay Type 1 diabetes in people at high risk of becoming dependent on insulin.

Mark Uhrich, zoology, '74, worked for the U.S. Geological Survey as a hydrologist for more than 30 years, first in Lansing and then in the Pacific Northwest, where he worked on Mount St. Helens, as well as on rivers and streams throughout Oregon. Uhrich, who specialized in river sediment transport, retired in 2014, but then returned to work as a Hydrologist Emeritus and has recently published a fact sheet on a 40-year history of river sediment from Mount St Helens. He currently serves on the Oregon/SW Washington Spartan Alumni Board.

Burrell Shirey, B.S., physical science, '76; M.S., geology, '83, retired this past year after 40+ years as a geologist for the state of Michigan. He rose from a journeyman geologist in the Water Supply Division in the old Michigan Department of Public Health to section chief of the Geological Services Section of the Remediation and Redevelopment Division of Environment, Great Lakes and Energy (formerly the Department of Environmental Quality).

Tom Taylor, M.S. geology '79, Ph.D.; geology '82, has written a book titled *Sandstone Petrography, Petrology, and Modeling* published by SEPM. Taylor retired from Shell Research and splits time between

Tucson, Ariz., and Pagosa Springs, Colo.

Richard A. Yost, Ph.D., chemistry, '79, along with MSU professor, Chris Enke, invented the triple quadrupole mass spectrometer, which has become the world's most popular mass spectrometer, with annual sales of more than a billion dollars. That instrument is now used to test every baby born in the United States. and in most developed countries for inherited diseases. Yost is professor and head of analytical chemistry at the University of Florida and was recently inducted into the National Academy of Inventors.

1980s

Paul Groll, zoology, '81, has been employed by the state of Michigan's Department of Technology, Management, and Budget for more than 27 years. In 2020, he took a new position as director of emerging technology research. In this role, he monitors and studies web news and vendor sources to keep the CTO and executive team current on emerging technologies and critical security attacks, challenges and defenses.

Robert Townsend, biological sciences, '87, is an internal medicine physician.

William Sullivan, biological science, '88, completed medical school at Emory University in Atlanta, Ga., and his residency in physical medicine and rehabilitation (PM&R) at Northwestern University/ Rehabilitation Institute of Chicago. He is currently professor and residency program director of physical medicine and rehabilitation at Vanderbilt University in Nashville, Tenn., and service chief of PM&R at Veterans Affairs Tennessee Valley Healthcare System. He is a past president of the North American Spine Society, the largest multi-specialty medical spine society in the United States.

1990s

Jiu Ding, Ph.D., applied mathematics, '90, has taught full-time as a professor at the University of Southern Mississippi. His book, *Out of Chaos: My Mathematical Affection with Tien-Yien Li*, was published by Shanghai Press of Science/Technology Education in September 2021. The late Dr. Tien-Yien Li was Ding's Ph.D. thesis advisor and a University Distinguished Professor; he died in June 2020.

Kenneth Filchak, zoology, '94, received the University of Notre Dame Joyce Teaching Award for 2019-2020—his second time receiving this award.

Frank Louws, Ph.D., botany and plant pathology, '94, is head of the Department of Horticultural Science at North Carolina State University in Raleigh.

Holly Holman, microbiology, '96, joined a research lab at Addenbrooke's Hospital, part of Cambridge University (England) as a summer intern following graduation from MSU. Holman began graduate studies in virology at the University of Glasgow in Scotland, in collaboration with colleagues at the Children's Hospital in Cincinnati, Ohio. Holman is currently an assistant professor at the University of Utah in the Department of Biomedical Engineering.

Scott Nowak, biochemistry, '97, was recently promoted to professor of biology in the Department of Molecular and Cellular Biology at Kennesaw State University. He was also named the associate vice president for research at Kennesaw State University August 1st, 2022.

Susan Terrell, zoology, '97, M.D., '01, is board certified in internal medicine, but branched off into palliative care in 2011. She provides inpatient palliative care at Mercy Health St. Mary's in Grand Rapids, Mich; teaches MSU College of Human Medicine medical students who rotate through their palliative care department; and provides outpatient care for Lacks Cancer Center at St. Mary's.

Jennifer Haeger, zoology '99; D.V.M. '02, earned her Master Beekeeper Certificate from Cornell University in 2021. She currently serves as a board member and mentorship team coordinator for her local bee club, the Ann Arbor Backyard Beekeepers (A2B2), where she helps educate beekeepers and the public on beekeeping and pollinator health and welfare.

2000s

Arica Drummond-Clay, zoology and finance, '00; M.B.A., business administration, '04, was promoted to VP, HR Business Partner Supporting Customer Distribution Experience (CDx) Organization within the McKesson Pharmaceutical Solutions and Services (PSaS) Business Unit, effective August 16, 2022. Drummond-Clay joined McKesson (Fortune #7) in November 2017 as the director, HRBP for the Corporate and PSaS Finance teams, and since that time held roles of progressive responsibility. Drummond-Clay is based at McKesson Las Colinas, Texas, headquarters.

Allison Hopkins, botany and plant pathology, '01, was recently promoted to associate professor in the Department of Anthropology at Texas A&M University in College Station. Her research focuses on peoples' use of plants for food and medicine in Latin America.

Dan Bouk, computational mathematics, '02, has written a book, *Democracy's Data: The Hidden Stories in the U.S. Census and How to Read Them* (Farrar, Straus and Giroux, MCD Books).

Suzanne (Smokevitch) McMurry, environmental biology/botany, '05, is a naturopathic doctor specializing in integrative oncology in the Seattle area. She completed a two-year residency at Indiana University Goshen, was named a fellow in the American Board of Naturopathic Oncology (FABNO) and is the founder of Naturopathic Cancer Treatment, a telehealth integrative oncology clinic in Shoreline, Washington.

Joshua Bilsborrow, M.D., MHS, microbiology, '09, was promoted to assistant professor of medicine (rheumatology) at Yale University School of Medicine.

Tequila Jones, microbiology, '09, started a contamination control consulting company in 2016.

2010s

Alvin Makohon-Moore, zoology, '10, began a faculty position as an assistant member at Hackensack Meridian Health Center for Discovery and Innovation, Nutley, N.J., in May 2022. His lab focuses on defining evolutionary mechanisms that drive tumorigenesis, metastasis and treatment resistance with the goal of discovering therapeutic opportunities that improve patient outcomes.

Nicole Messenger, physiology, '11, is an assistant professor in emergency medicine and in the Department of Orthopaedics at Washington University in St. Louis. She is working part-time as an EM physician and part-time as a sports medicine physician.

Rahman Shah Zaib Saleem, Ph.D., chemistry, '11, received the Vice Chancellor's Award for Teaching Excellence in 2022 from Lahore University of Management Sciences (LUMS) in Pakistan.

Steve Proper, Ph.D., biochemistry and molecular biology, '13, started in August at Western Michigan University Homer Stryker M.D. School of Medicine in Kalamazoo, Mich., as an assistant professor in the Department of Pediatric and Adolescent Medicine.

William R. Lindow, D.M.D., physiology '14, has achieved life membership in the American Dental Association. Life membership is granted to current members who have at least 30 consecutive years of membership.

Kayla Cotterman, M.S. environmental geosciences, '16, recently accepted a new job with the Lochmueller Group, Evansville, Ind., as an environmental scientist.

Jordan Vale, music '15; mathematics, '16, has released a math-themed album with his group, Mr. Vale's Math Class, titled "We Can Help You Out." After working for various educational services during the past eight years, Vale will be tutoring students independently.

Meredith Herman, biomedical laboratory science, '17, is a fourth-year medical student at MSUCOM. Recently, she was one of 23 medical students in the country to receive the College of American Pathologists Distinguished Medical Student Award—which is among the highest honors for medical students pursuing a career in pathology.

Steven Roels, Ph.D., integrative biology; ecology, evolutionary biology, and behavior; and environmental science and policy, '18, has just started a new position as American Bird Conservancy's

alumni class notes

Kirtland's Warbler Conservation Team Coordinator. The Kirtland's Warbler breeds almost exclusively in Michigan in young jack pine forests, and winters in the Bahamas. Roels will be working with federal and state natural resource agencies, university researchers and nonprofits to continue transnational conservation efforts of this iconic species.

Syrena Whitner, zoology and ecology, evolution and organismal biology, '18, is currently living in Hawai'i on the Island of Oahu, pursuing a Ph.D. in marine biology, with a focus on marine fungal ecology. Whitner was previously a lab technician at Scripps Institution of Oceanography.

Mary Panagos, zoology, '19, is pursuing a D.V.M. at MSU's College of Veterinary Medicine. Panagos expects to complete her degree in 2024.

2020s

Robby Palazzolo, zoology, '20, is a biological science technician in Grand Teton National Park in Wyoming. Employed by the U.S. Department of the Interior, his responsibilities include applying herbicide safely, and manually treating invasive plant species; revegetation, restoration and monitoring; and identification of plants in the sagebrush-steppe region.

Joanna Colovas, microbiology, '21; M.S., microbiology and molecular genetics, '22, began an Infectious Disease fellowship with the Centers for Disease Control and the Association of Public Health Labs (APHL) at the Wisconsin Veterinary Diagnostic Lab (WVDL) at the University of Wisconsin-Madison.

Diana Dawood, biochemistry and molecular biology '21, was hired by Pfizer Global Supply in Kalamazoo, Mich., as a full-time colleague as a technician for aseptic plant support in the microbiology department.

Shannon Frank, zoology, '21, is a primate keeper at the Lemur Conservation Foundation in Myakka City, Fla.

Kathrine Gray, environmental biology, plant biology,'21, accepted a new position as education and engagement coordinator with CAKE CISMA—The Cooperative Invasive Species Management Area (CISMA) Serving Charlevoix, Antrim, Kalkaska, and Emmet Counties (CAKE).

William Shuster, medical laboratory science, '21, has taken a full-time position as a clinical laboratory scientist at Sparrow Hospital in Lansing, Mich.

Jaime Martinez Zarate, mathematics, '21, is a first-generation college student. After graduating from MSU, Zarate enrolled in the Edustaff program to become a substitute teacher, teaching elementary school at a Spanish immersion school in Lansing. He also works for Dart Container in Mason, Mich., as an international accounts manager.

Madison Havens, microbiology, '22, recently accepted a research technologist positions with Johns Hopkins University School of Medicine.

J.R. Nosal, environmental geosciences, '22, is pursuing an M.S. in environmental remediation and management at the University of Wisconsin-Madison and expects to graduate in August 2023. Nosal is also working with a professor at Michigan State as he prepares a new textbook. He continues to take clarinet lessons and played in Michigan's Chemical City Band in Midland, Mich., this past summer.

STAY CONNECTED to the College of Natural Science (NatSci)

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

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

NatSci recognizes *outstanding* alumni, faculty, students

Nearly 100 individuals attended the MSU College of Natural Science (NatSci) annual awards program, held April 22, 2022, to acknowledge alumni, faculty and students for outstanding achievements and excellence. The event was held at MSU's Wharton Center in the Jackson and Christman Lounges.

NatSci Dean Phil Duxbury (far right) with 2022 award recipients (left to right): Ed Brown, Meritorius Faculty Award; Mark Ondari, Recent Alumni Award; and James Hoeschele, Outstanding Alumni Award.

James D. Hoeschele (Ph.D., chemistry, '69) received the 2022 Outstanding Alumni Award; **Mark Evans Ondari** (Ph.D., chemistry, '10) received the 2022 Recent Alumni Award; and **Edward F. Brown,** MSU professor of physics and astronomy and FRIB, as well as interim chair of the Department of Computational Mathematics, Science and Engineering, received the 2022 Meritorious Faculty Award.

Hoeschele has been part of the MSU community as a doctoral student, a research fellow, an assistant professor, a collaborative researcher and a major donor. Upon completing his Ph.D. at MSU in 1969, he took a position at Oak Ridge National Laboratory. He returned to MSU in 1970 to work as a cancer research fellow in the lab of biophysics professor Barnett Rosenberg, who is credited with the discovery of the anti-cancer drug cisplatin. Between 1972 and 1994, Hoeschele held various positions before he returned to MSU, where he taught general chemistry. He retired from MSU in 2010. Hoeschele's love of chemistry has saved countless lives and positively impacted hundreds of young minds through his teaching, mentoring and philanthropic support.

Ondari, currently Global Technology Guardian at Corteva Agriscience (formerly Dow AgroSciences/Dow-DuPont), is a Six Sigma Greenbelt. He was a three-time inductee into the CEO's High Potential/Future Fellows, a talent incubation program for highly promising employees at the Dow Chemical Company. He holds more than twenty patents/patent applications from his research at the Dow and Corteva Agriscience. He served as a judge for the A.H. Nickless Innovation Award, which recognizes and engages aspiring STEM high school students in real-world industrial challenges. He has also volunteered at the Great Lakes Region Science Bowl Competition (2012), and Science Olympiad (2010-2013).

Brown, a renowned researcher in the field of nuclear astrophysics, is one of the foremost experts regarding astronomical compact objects. He and his collaborators have made some of the first quantitative studies of how the interior structure of accreting neutron stars could be understood through observations of how they cool. It remains one of the few ways to reduce the timeline—from millennia to just years. Brown has contributed to the open-source MESA (Modules for Experiments in Stellar Astrophysics) code, which has thousands of users worldwide in many subfields of astronomy. He has been involved in the overhaul of several physics and astronomy courses.

In addition to these alumni and faculty awards, several NatSci graduate and undergraduate students were recognized for their outstanding contributions.

Daniel Puentes, physics; and **Ana-Maria Raicu,** cell and molecular biology, received Tracy A. Hammer Graduate Student Awards.

Four individuals received the Dan Bolin Undergraduate Student Award—**Zainab Fayyaz,** neuroscience (minor in Spanish); **Kiinga Kioi,** actuarial science (minor in entrepreneurship and innovation); **Pelli Mechnikov,** neuroscience (minor in Jewish studies); and **Madeleine Russell,** microbiology (minor in bioethics).

NatSci's 12th annual *Classes Without Quizzes* back in the classroom

Classes Without Quizzes (CWQ) was back—in a classroom—for the first time since 2019. The event, hosted by the Michigan State University College of Natural Science (NatSci), had been held virtually the past two years due to COVID-19 restrictions.

On Saturday, April 23, more than 100 alumni, friends and guests attended the event (a hybrid of in-person and online), which was held in the new STEM Teaching and Learning Facility. CWQ gives participants a chance to meet with NatSci faculty members and students, while getting an insider's look at some of the latest research activities being undertaken on the MSU campus.

Mark Ehlert (B.S., microbiology, '75) talks with Dean's Research Scholar Mariam Sayed (physiology, French, human biology, '22) about her research during a networking break at this year's Classes Without Quizzes.

The event consisted of three presentations by MSU faculty.

Kay Holekamp, University Distinguished Professor in the Department of Integrative Biology, presented "No Laughing Matter: Scientific Discovery among the Hyenas." The spotted hyena, also known as the laughing hyena, is an exceptionally interesting animal that can teach us a great deal about topics as diverse as social inequality, cooperation, the evolution of intelligence, disease resistance and even automotive paints, according to Holekamp, who has been studying them in Kenya since the 1980s.

Gemma Reguera, a William J. Beal Distinguished Professor in the Department of Microbiology and Molecular Genetics, presented "Microbes to Power!" The audience learned what makes these particular microbes 'electric' and how Reguera's lab is harnessing their power to solve critical problems threatening economic and environmental sustainability.

Robert Quinn, assistant professor in the Department of Biochemistry and Molecular Biology, presented "A Deep Dive into Mucus, Poop and Tropical Reefs." Quinn's talk focused on three areas of research: the microbiome in cystic fibrosis lung mucus, bile acids in the human gut and the response of coral reefs to global warming.

Two Dean's Research Scholars—Cade Dembski, physics major; and Mariam Sayed, physiology and French major—also presented their research to the audience.

The event wrapped up with a tour of the repurposed building; the central structure of the new STEM facility, which was completed in 2021, is the former Shaw Lane Power Plant, which was decommissioned in 1975. The building that once powered campus is now empowering Spartans to innovate ways to learn and share knowledge about science, technology, engineering and math (STEM).

The **13th annual Classes Without Quizzes** will be held April 22, 2023, and is open to all MSU alumni and friends. For more information, or to be added to the mailing list, contact Sara Ford, alumni relations coordinator, at fordsar2@msu.edu.

NATSCI AT A GLANCE

VISION

A thriving planet and healthy communities through scientific discovery.

MISSION

To use discovery, innovation, and our collective ingenuity to advance knowledge across the natural sciences. Through equitable, inclusive practices in research, education, and service, we empower our students, staff, and faculty to solve challenges in a complex and rapidly changing world.

CORE VALUES

Inclusiveness

Foster a safe, supportive, welcoming community that values diversity, respects difference, and promotes belonging.

Innovation

Cultivate creativity and imagination in the quest for new knowledge and insights.

Openness

Commit to honesty and transparency.

Professionalism

Strive for excellence, integrity, and high ethical standards.

LEADERSHIP

ASSOCIATE DEANS

Eric Hegg, Budget, Planning, Research and Administration

Amy Ralston, Graduate Studies

Lynmarie Posey, Undergraduate Studies

Gemma Reguera, Faculty Affairs and Development

Angela Wilson, Strategic Initiatives

DEAN

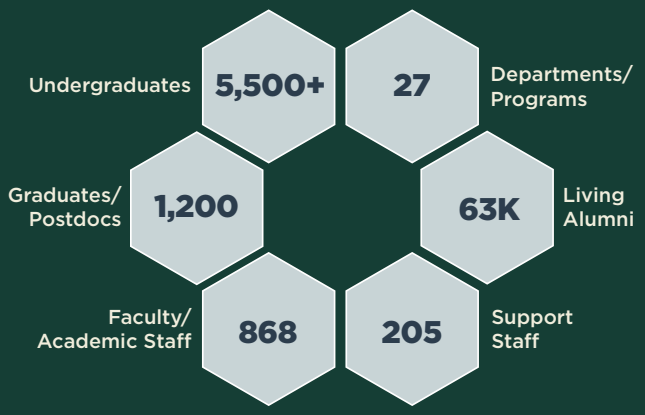
Phillip M. Duxbury

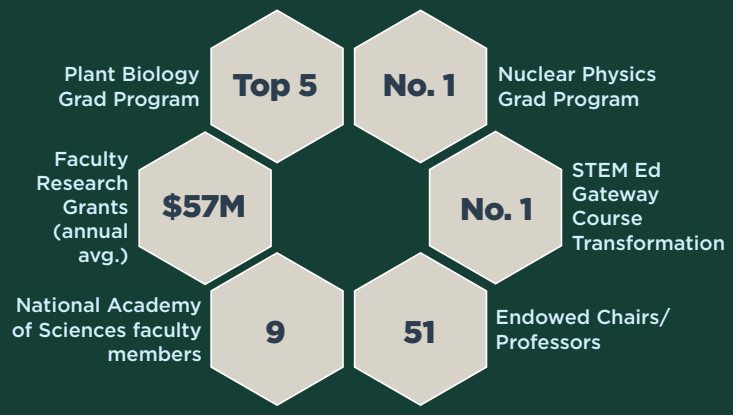
ASSISTANT DEANS

Danielle Flores Lopez (Interim), Diversity, Equity and Inclusion

Cori Fata-Hartley, Fixed-term Faculty and Academic Specialist Development

Heidi Purdy, Academic and Student Affairs





*Multi-college effort

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:

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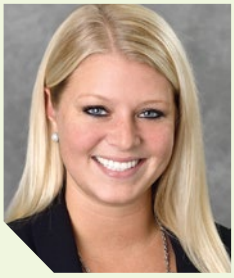

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517-884-0290

Plan for the future: Use your IRA rollover

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

IRA's continue to be a tax smart strategy for making charitable gifts under the new SECURE 2.0 Act of 2022 (Setting Every Community Up for Retirement Enhancement) Act, which was signed into law at the end of 2022. 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 73
- You can still make QCDs at age 70½, up to $100,000 annual limit

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 annually to MSU or NatSci directly from your IRA. For more information on gift planning from your IRA, visit **https://giftplanning.msu.edu/give-from-your-ira** or contact a NatSci development officer (see above).

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.

"Teaming up" *to make the world* a better place

By Corey Palmer
NatSci Senior Director of Development

It is hard to believe another year has come and gone. The College of Natural Science (NatSci) Advancement Team spent the past year focusing its work on continuing to connect with alumni virtually, while also starting to meet with and host alumni and events in person.

I thought I would use this year's article as an opportunity to reintroduce our team and what we do to help support the college.

What is "Advancement?"

Within Michigan State University and NatSci, Advancement is the combined effort of both development and alumni engagement. Development fosters connections with individuals and organizations whose financial support fuels the efforts of students, faculty and staff to make MSU, NatSci and the world a better place. The alumni engagement part of our team is tasked with connecting with NatSci's 63,000 living alumni and helping them stay engaged and connected with MSU and NatSci in ways that are meaningful to them. Engagement means something different for everyone and it's our job to help identify what is meaningful for our alumni—whether that is mentoring students, talking to classes about their Spartan story and sharing their career experiences, attending events and staying up to date on campus happenings, or investing philanthropically and supporting opportunities that are meaningful to them and important to the university.

Throughout the years, we have highlighted different engagement opportunities and fundraising efforts in our magazine. It's important to note there are so many more opportunities to engage with MSU and to give back philanthropically than outlined in this magazine. It is the job of our Advancement Team to explore those opportunities with you.

Who is our Advancement Team?

Karen Wenk, Becky Jo Farrington and I (Corey Palmer) are tasked with fundraising in the college. We all travel across the United States and meet with alumni and friends and help them invest in meaningful opportunities within the college. Sara Ford is our alumni engagement officer. In her role, Sara helps oversee and plan alumni events, outreach and engagement for the college. Liz Chidsey is the development assistant and our "go to" for all things! Our team has more than 40 combined years of experience working in NatSci. We are incredibly proud of that, especially since a big part of our job is building relationships with you and our faculty.

"Our team has more than 40 combined years of experience working in NatSci."
~Corey Palmer

TEAM

I encourage you to contact any of the NatSci Advancement Team if you have any questions. We have a wonderful team that will work with you to find ways to give back or engage that are meaningful to you.

As always, thank you and Go Green!

BRANDIZZI LAB

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UPCOMING NATSCI ALUMNI EVENTS—2023

March 14, 2023—GIVE GREEN DAY
Online fundraising event

April 8, 2023—FALLING TREE COLLECTIVE PERFORMANCE
8 p.m.—Cook Recital Hall, MSU
Tickets to this plant biology/music compostion event are FREE and open to the public.
Registration required—visit https://bit.ly/3l6RhPH

April 21, 2023—NATSCI ALUMNI AWARDS
The Huntington Club, MSU Spartan Stadium

April 22, 2023—CLASSES WITHOUT QUIZZES
https://msunatsci.info/ClassesWithoutQuizzes

June 27–June 29, 2023–GRANDPARENTS UNIVERSITY
alumni.msu.edu/grandparents-university

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

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