



Microbiology & Molecular Genetics

MSU College of Natural Science | Newsletter for Alumni and Friends



Special handling:

BioSafety Level-3 labs vital to infectious disease research

6

CHECK OUT OUR ONLINE VIDEO



Microbiologists Andrew Olive (left) and Sean Crosson are taking advantage of MSU's enhanced containment facilities to further their vaccine development research for tuberculosis and brucellosis, respectively.

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DEPARTMENT OF MICROBIOLOGY & MOLECULAR GENETICS

MMG is a remarkable, dynamic academic community. We have been fortunate to bring new faculty into this community over the past couple of years, while some colleagues have moved on to other opportunities in their lives and careers. We wish them the very best; they remain MMG Spartans in our hearts! You can read more about our new and departing faculty in this newsletter (page 4) and about a wonderful program of peer-mentoring—GRIT—that was created by MMG students and has expanded to include many other departments and programs (page 12).

Our faculty give MMG its excellent reputation, so we hear a lot about them and that makes sense. But they are supported by an outstanding professional staff who work in essential—but often unsung—ways. Led by Coreena Spitzley, who has a campus-wide reputation for her deep knowledge of the MSU administrative machinery, our staff includes Roseann Bills (graduate administrator), Katie Conley (executive assistant to the chair) and Christine VanDeuren (human resources and development). These wonderful professionals routinely jump in to solve problems and address issues beyond the scope of their titles to keep our research, teaching and mentoring missions humming along. Our facilities and operations team of “the Jessicas”—Jessica Bentley and Jessica Spitzley—oversee the complex operations of our home, the Biomedical and Physical Sciences Building, with masterly skill, grace and patience. We are also lucky to have as our academic advisor Jeannine Scott, who manages to schedule several hundred hours of meetings and guidance with our undergraduates each year, and who oversees our growing B.S./M.S. dual

degree program. Jeannine is putting the final touches on a new B.S./M.S. program that will be jointly run with Bennett College in North Carolina. We view this as an opportunity to expand inclusive excellence and diversity in our undergraduate and graduate programs.

We do much work in MMG on pathogens that require enhanced containment conditions. The overall structure of this containment and the practices used to work within it are defined as BioSafety Level 3 (BSL-3), which includes laboratories with high efficiency air-handling capacity and extra levels of safety gear. BSL-3 research facilities are used to study human and animal pathogens such as *Mycobacterium tuberculosis*, *Brucella abortus* and SARS-CoV-2. MSU has three extraordinary researchers—Robert Abramovitch, Sean

Crosson, and Andrew Olive—doing cutting-edge work on the biology, pathogenicity and immunology of different pathogens. Our BioSafety Level-3 lab capacity at MSU is currently

limited, and we are working with leadership across campus to expand such laboratory space, enabling us to hire more faculty who carry out this type of research. You can read more about the important BSL-3 research being done by some of our MMG faculty on page 6.

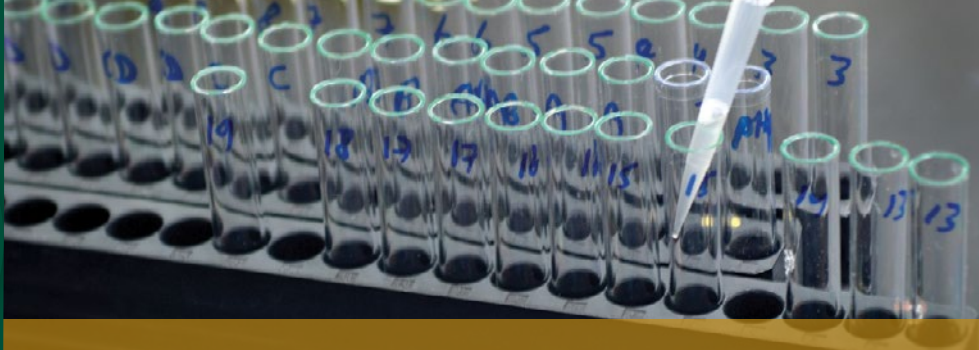
I end on a sorrowful note, but any message to our friends and supporters in 2023 would be deficient in not acknowledging the horrific murders of three MSU students and the injury of several others on February 13. Our campus—from Interim President Teresa Woodruff down—came together with compassion and determination, declaring our Spartan strength and deep support of each other as we mourn our loss. Rest in peace Alexandria, Arielle and Brian. 🍀



“Our faculty give MMG its excellent reputation . . . but they are supported by an outstanding professional staff who work in essential—but often unsung—ways.”



Victor DiRita, Ph.D., Chair
Department of Microbiology & Molecular Genetics
diritavi@msu.edu



Dr. Brandon A. West, microbiology, '82, is celebrating 36 years in practice as a podiatric practitioner, with offices in Novi and Detroit, Mich. He also graduated as an attorney from The Detroit College of Law (MSU Law) in 1991.

David Westenberg, microbiology, '82, was named Curators Distinguished Teaching Professor at Missouri University of Science and Technology.

Scott Giraud, microbiology, '91, has been working in medical device sterilization for 31 years—with the past 26 years at Medtronic. He has been leading a team updating international standards for medical sterilization, allowing him to use his knowledge and experience to help shape the future of medical device sterilization.

Christopher Pierson, M.D., Ph.D., microbiology, '93, was promoted

to professor-clinical of pathology and anatomy at the Ohio State University College of Medicine and was also recognized with the college's highest teaching award, "Professor of the Year."

Erica Montessor, microbiology, '04, I was named a 2021 preceptor for the Informatics/Data Analytics Technical Career Field (TCF), a program through the U.S. Department of Veterans Affairs.

Noel Decker, microbiology, '09, was promoted to vice president and head of science and development project management and business operations at Emergent BioSolutions, a company that focuses on vaccines and therapeutics that protect against public health threats. Decker began at Emergent in 2009 as a microbiologist and over the past 13 years has worked in various roles of increasing complexity. Decker now leads the PM and Business Ops function for integrated and global science and development business.

Laurie Pohutsky, microbiology, '10, was officially elected speaker pro tempore of the Michigan House of Representatives in January and named chair of the House Committee on Natural Resources, Environment, Tourism and Outdoor Recreation.

Chelsey Spriggs, microbiology, '10, started as an assistant professor in the Department of Cell & Developmental Biology and the Department of Microbiology & Immunology, and as a research assistant professor, at the Life Sciences Institute at the University of Michigan. Spriggs now has an independent lab studying the nuclear entry of DNA viruses.

Brooke Boger, microbiology and molecular genetics, '21, was accepted into MSU's veterinary school and their dual degree Ph.D. program—which is a very prestigious position, as they accept only one or two people per class to this program.

Contact Us

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Send correspondence to:
MSU College of Natural Science
Advancement Office
288 Farm Lane, Room 5
East Lansing, MI 48824
(517) 432-4561 | natsci4u@msu.edu

Contributing writers: Vic DiRita, Marguerite Halversen, Mollie Newman, Val Osowski and Laura Seeley.

Photographs courtesy of: Harley J. Seeley (cover, pages 6, 11), Department of Microbiology and Molecular Genetics (pages 2, 3, 4, 5); Becky Jo Farrington (page 7); Hausinger lab (page 8, top); Reguera lab (page 8, middle); Andrew Olive (page 8, bottom); WMrapids/Wikimedia Commons (page 9); CDC Public Health (page 10, top); Chris Waters lab (page 10, bottom); and GRIT (page 12).



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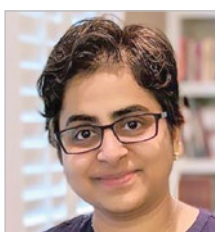
Departures



Shade

Ashley Shade, associate professor, moved to France in October 2022 to join Le Centre national de la Recherche Scientifique as director of research at the Institute of Ecology and the Environment. Best known for her work in microbial

ecology and plant-microbe interactions, Shade is working on how to increase the resilience of agricultural systems, including crops and soils, by maintaining microbial functions despite changing environmental conditions.



Ravi

Janani Ravi, assistant professor, became an assistant professor of biomedical informatics at the University of Colorado School of Medicine in August 2022. In addition to her research studying the molecular basis of

pathogenesis and intervention of infectious diseases using protein sequence-structure-function relationships, comparative genomics, and drug repurposing, Ravi worked to increase the participation of underrepresented minorities in data science and R programming, founding R-Ladies East Lansing Women+ Data Science AsiaR.



Dufour

Yann Dufour, assistant professor, examines how external signals influence individual cell behavior among bacterial communities. His work is groundbreaking, combining mathematical modeling with wet-lab experimental approaches

to uncover knowledge of how diverse single-cell behaviors emerge within clonal bacterial populations. This research has implications for understanding bacterial evolution, signal recognition and sensory transduction, and microbial pathogenesis. Yann recently left MMG, moving to Lyon, France with his family, and we wish him success in this new phase of his and their lives!

New Faculty



Heath-Heckman

Elizabeth Heath-Heckman joined MMG as assistant professor in 2020, after completing her postdoc at UCLA. Her research specializes in the mechanisms underlying host-microbe interactions. She is currently exploring the cellular, molecular and genetic basis of bacterial-animal mutualisms with a focus on the host, specifically the interaction between

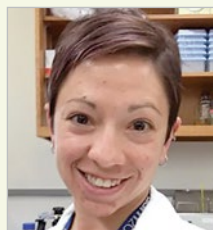
the Hawaiian bobtail squid and its luminescent bacterial symbiont, *Vibrio fischeri*, to discover the mechanisms by which animals establish and maintain their bacterial symbionts.



O'Halloran

Thomas O'Halloran joined MMG in 2020 as an MSU Foundation Professor. For 30 years, his research group has investigated how fluctuations in metal ions inside cells influence key cellular decisions. Using genetic, chemical, structural, mechanistic and biological imaging methods, the group has uncovered new types of metal receptors and tied their function to a

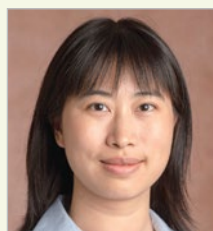
number of disease-related physiological processes, including diabetes, fungal infections, malaria and cancer.



Shames

Stephanie Shames joined MMG as associate professor in 2022. She previously worked as an assistant professor at Kansas State University. Her research focuses on uncovering the mechanisms by which intracellular bacterial pathogens interact with their hosts, using *Legionella pneumophila* as a model. To replicate within phagocytic cells, *L. pneumophila* uses translocated virulence factors (effector

proteins). Shames leverages biochemical, immunological, cell biological and in vivo approaches to explore how these effectors contribute to the host response to bacterial infection and how regulatory effectors contribute to bacterial pathogenicity.



Zhang

Yu Zhang, assistant professor, joined MMG in 2022, having completed a postdoc through Harvard Medical School. Her research explores abnormal antibody diversification and its link to diseases ranging from immunodeficiency to autoimmunity and its contribution to oncogenic translocations in various leukemias and lymphomas. Zhang's lab works to identify mechanisms that

promote antibody diversification and suppress associated oncogenic lesions in B lymphocytes, particularly how 3D genome organization and chromatin status collaboratively contribute to antibody generation, gene regulation and genome integrity.

Faculty Honors

Sarah Evans, associate professor, was one of 22 leading sustainability scientists named to the 2022 North American cohort of the Earth Leadership Program (ELP). The ELP provides outstanding academic researchers with the skills, approaches, and theoretical frameworks for catalyzing change to address the world's most pressing sustainability challenges, emphasizing new forms of individual and collective leadership. The program enables scientists to work collaboratively with diverse stakeholders and become agents of change within and beyond their universities.

James Tiedje, Distinguished Professor Emeritus, was awarded the 2023 Lifetime Achievement Award by the American Society of Microbiology to honor his sustained contributions to research, education, clinical laboratories, service and scientific diversity in the microbiological sciences. Tiedje's major contributions include his foundational discovery of the microbial ecology of the nitrogen cycle; a paradigm-shifting discovery of microbes that dechlorinate pollutants; and his findings surrounding the use of genomics and metagenomics to understand microbial speciation, community structure and ecological functions. Tiedje is also among one of three NatSci faculty named to the 2022 Highly Cited Researchers List compiled by Clarivate Analytics.

MMG faculty members recognized with MSU All-University Awards

Three Michigan State University Department of Microbiology and Molecular Biology faculty members received 2022 All-University Awards in recognition of their outstanding contributions to education and research.



DiRita

Victor DiRita, department chair and Rudolph Hugh Endowed Chair, received the Simmons Chivukula Award for Academic Leadership for exemplary work as department chair, school director, and assistant and associate dean. DiRita is recognized for supporting everyone without exception, treating all faculty, staff and students as equals.



Reguera

Gemma Reguera, professor, received a William J. Beal Outstanding Faculty Award in recognition of her pioneering work on electromicrobiology and the discovery that that *Geobacter sulfurreducens* – a gram-negative metal and sulphur-reducing proteobacterium – made nanowires, which are used for long-distance electron transfer. Reguera was also appointed NatSci associate dean for faculty affairs and development to oversee faculty-related policies, processes and initiatives in August 2022.



Waters

Christopher Waters, professor, received a William J. Beal Outstanding Faculty Award in recognition of his research, which ranges from increasing understanding of bacterial chemical signaling to developing novel technologies for biomedical applications and new strategies to control bacterial disease.

Student Honors



Bowcutt

Two microbiology and molecular genetics juniors—**Bailey Bowcutt** and **Calista Busch**—were recipients of the nationally competitive Goldwater Scholarship for 2022. Both are also Honors College students.

The scholarship is awarded each year to students committed to a career in science, mathematics or engineering who display intellectual intensity and the potential for significant future contribution in their chosen field. Recipients receive funding for undergraduate tuition and living expenses.

Bowcutt, majoring in microbiology, is a research assistant for Professor Shannon Manning, examining how antibiotic treatment leads to antibiotic resistant microbes in dairy cattle gut microbiome. She is president of MSU's MMG Club and the 3D printing team lead in association with the Resource Center for Persons with Disabilities.

Busch, majoring in genomics and molecular genetics, is a research assistant for Professor Richard Schwartz, studying the effect of diet and oxybenzone on the proliferation of breast cancer. She is an also undergraduate learning assistant in Lyman Briggs College and group leader for the Spartan Support Network.



Busch

Special handling: BioSafety labs vital to infectious disease research

There's an unassuming, nondescript building on campus where only a handful of people are allowed inside. And for good reason: Researchers at Michigan State University's Biological Safety Level 3 (BSL-3) facility are experimenting with microbes that need special handling.

Microbiologists Sean Crosson and Andrew Olive, two faculty members in the Department of Microbiology and Molecular Genetics, are conducting research in MSU's BSL-3 facility in an effort to eradicate the infectious diseases brucellosis and tuberculosis, respectively.

BSL-3 labs are required for work on microbes that can cause serious or potentially lethal diseases. They are built and run in accordance with strict USDA and Center for Disease Control safety protocols that include the use of personal protective equipment, or PPE (e.g., goggles, gloves, wraparound gowns and respirators), controlled entry, and airflow control, with all air exiting the facility being highly filtered.

Brucellosis is an infectious disease caused by bacteria of the genus *Brucella*. Cattle brucellosis can cause abortion, infertility and sterility, resulting in economic loss to the producer. The organism also causes brucellosis in wildlife, including bison, elk, and swine in select regions of the United States. People can become infected by direct contact with infected animals or by ingesting contaminated dairy products.

"There's been really successful *Brucella* eradication programs here in the United States, but in other regions of the world, brucellosis is still a major problem," said Crosson, who is working with the USDA to eliminate the disease from wildlife and livestock.

Crosson's lab studies how *Brucella* bacteria infect, colonize, and survive



Kayla Conner (left), a microbiology postdoc, and Andrew Olive discuss immune cells growing in the flask in preparation for a new experiment at the BSL-3 facility.

“These infectious diseases are not going away, so thinking about investments in the BSL-3 infrastructure is important.”

CONTAIN

inside animal hosts. Recently, the team identified molecules that are potential anti-brucella molecules that could be used to treat infection.

"While this is a cool finding," Crosson explained, "if you really want to assess these molecules as possible antimicrobials, you need safe, contained facilities to investigate them working with the actual bug that causes the disease. You can't do this work without the facility."

Andrew Olive has always been interested in how pathogens cause

disease. Born in Kuwait, he watched his father work for the World Health Organization in the Middle East. Now, his lab is studying the pathogen *Mycobacterium tuberculosis*, which is becoming highly resistant to antibiotics and has no effective vaccine for adults. Endemic in areas lacking strong public health infrastructure, it is responsible for more than 10 million new infections and over 1.5 million deaths each year.

"The BSL-3 facility is required to study how *M. tuberculosis* evades the immune response and causes disease" Olive said. "This research enables us to make new discoveries that can be used to develop effective vaccines and new therapies."

Because of their research importance and increasing numbers of faculty members in need of these facilities, feasibility studies are being conducted to explore ways to expand and centralize BSL-3 facilities at MSU.

"These infectious diseases are not going away, so thinking about investments in the BSL-3 infrastructure is important," Olive said. "MSU is looking to position itself in a strategic way to ensure that we can keep doing this critically important research." 🌱

Van Frank Summer Research Institute “pays it forward”

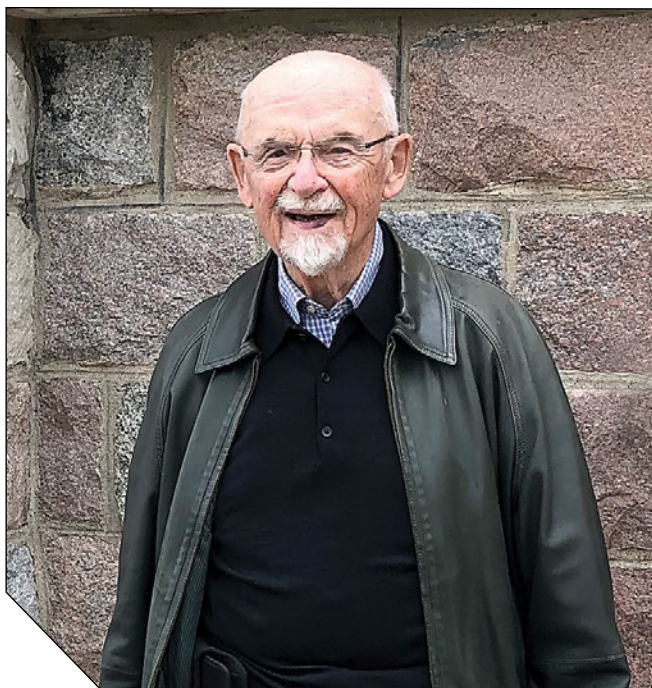
The inaugural Richard and Susan Van Frank Summer Research Institute hosted 14 undergraduate students on campus during the summer of 2022.

Richard Van Frank (B.S., micro-biology and public health, '51) established funding for the annual program in 2019; his wife, Susan, passed away in 2018.

An undergraduate research experience at MSU planted the seed for a lifelong career in research for Van Frank, which prompted him to “pay it forward” in the form of an endowment that will fund undergraduate research programs in the MMG department.

“When I was a student at MSU, I took advantage of an undergraduate research program. I learned how to make my own decisions and do a lot of work that I otherwise would not have had the opportunity to do. It was a good start for my research career,” said Van Frank, who earned an M.S. degree in microbiology and histology in 1956 after completing his service in the U.S. Navy Reserve. Van Frank retired from Lilly Research Lab in 1990 after 33 years of service. He then launched Van Frank Associates, in Indianapolis, Ind., which consulted on methodology for protein purification.

Phillip Delekta, instructor for the summer course (formally known as MMG 494L), coordinated several laboratory experiences designed to bring students to a much deeper



Richard Van Frank

level of understanding of various research approaches. He seeks to train students to think like scientists, so they understand the underlying basis of methods they use in the lab and gain intuition about how these methods can be applied to answering new questions in microbiology. Some

of the endowment funds were also used to purchase a plate reader, essential for a number of the experiments carried out in the Institute.

This summer program offered an opportunity for students to get out of the cookbook approach of many other lab courses, giving them a greater sense of enthusiasm for the work.

“This class has been one of the best learning “non-cook-book-science” opportunities I have had to date; I thank you for that,” one of the students said.

“... the biggest area of improvement I have witnessed within myself and my ability centers around researching/writing protocols based on scientific literature,” said another student who attended the summer program. “This is a skill that I have never been tasked with in my academic tenure, and honestly, I cannot believe this is the first time I have been tasked with writing protocols like this.”

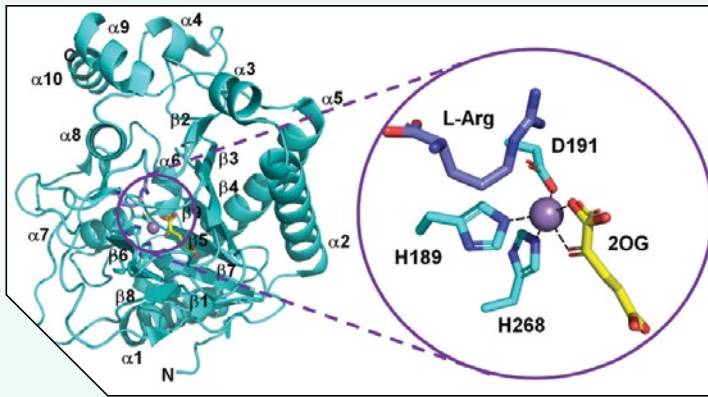
“A key process that the students began to appreciate and even master to some degree was that of ‘fail, think, and try again,’ which is essential to becoming an independent scientist and, of course, important for any endeavor they may take on in life,” said Victor DiRita, MMG department chair.

“This program will also improve our other laboratory courses, so the impact will be felt across our curriculum,” DiRita added. 🍀

“This class has been one of the best learning “non-cook-book-science” opportunities I have had to date; I thank you for that.”

~Summer research institute participant

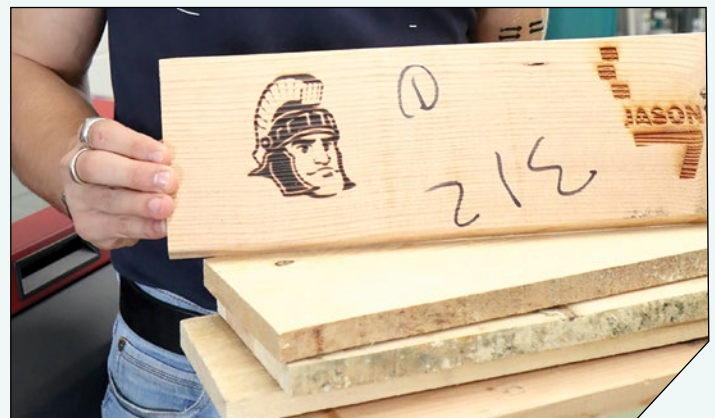
LEARNING



The protein structure of the ethylene-forming enzyme (left), with a blow-up of the active site (right).

Robert Hausinger will use a three-year, \$356,255 NSF grant to investigate how the ethylene-forming enzyme (EFE) from bacteria and fungi catalyzes dual reactions to form ethylene or guanidine (ethylene is a potential biofuel and guanidine is a nitrogen-rich fertilizer). In collaboration with MSU structural biologist Jian Hu and Michigan Tech computational chemist Christo Christov, the Hausinger laboratory has revealed new insights into how the enzyme catalyzes these remarkable reactions and is now building on that work to engineer new versions of the protein to enhance its ability to generate the desired bioproducts.

Gemma Reguera received a nearly \$1 million grant from the DOE’s Advanced Research Projects Agency-Energy to develop “living” wood, which has three components—the wood itself, along with microbes in the form of both bacteria and fungi. In collaboration with Purdue University, Reguera will lead a team of researchers to introduce microbes into the wood’s porous network, which will improve its mechanical strength and flame resistance. The process itself consumes carbon dioxide, leading to a reduction in greenhouse gas emissions while making stronger wood. The end goal is the creation of a new building material that will be stronger than steel and have the power to heal itself.



Researchers are working to create a new type of strong, sustainable, self-healing timber infused with microbes.

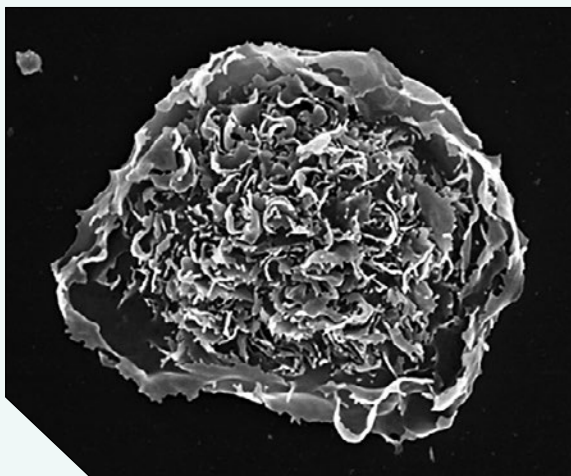


Image of an alveolar macrophage, which are tissue-resident cells found in the lungs.

Andrew Olive has received two NIH grants. The first is a 59-month, \$1.9 million award that will use a new model of alveolar macrophages to understand how tissue specific inflammation is regulated in the lungs and how alveolar macrophages control lung homeostasis. Distinct macrophage populations play unique roles in these processes, with long-lived tissue resident macrophages (TRMs) maintaining homeostasis in the absence of infections. Questions remain, however, regarding how TRMs are maintained and contribute to regulating the local environment. Olive’s research will identify new signaling pathways, transcriptional networks and functional mechanisms required for TRMs to maintain tissue homeostasis.

The second is a five-year, \$2.6 million award that will be used to determine the role of the kinase GSK3 in regulating cytokine interferon γ (IFN γ) responses and immunity to *Mycobacterium tuberculosis* (TB) infection. Infections with *M. tuberculosis* remain a worldwide public health concern causing over 1.5 million deaths annually. Current therapy requires at least six months of treatment and there is no effective vaccine that prevents

pulmonary disease. Unfortunately, there is a lack of fundamental understanding of the host immune pathways that protect against TB. Olive’s lab will use genetic approaches combined with in vivo models to dissect the role of GSK3a/b-mediated control of IFN γ responses and TB. These mechanisms can then be leveraged to develop new therapies that may shorten treatment times and prevent TB disease progression.

Discovering a blueprint for nature’s ‘high-end machinery’

Working with tiny bacteria, Professor Lee Kroos and his team revealed a new way nature can inhibit or switch off intramembrane proteases.

Their research, using a model organism of the ubiquitous microbe *Bacillus subtilis*, shows the first example of regulating an intramembrane protease with natural inhibitor proteins, providing some ideas on how scientists might be able to use and mimic it.

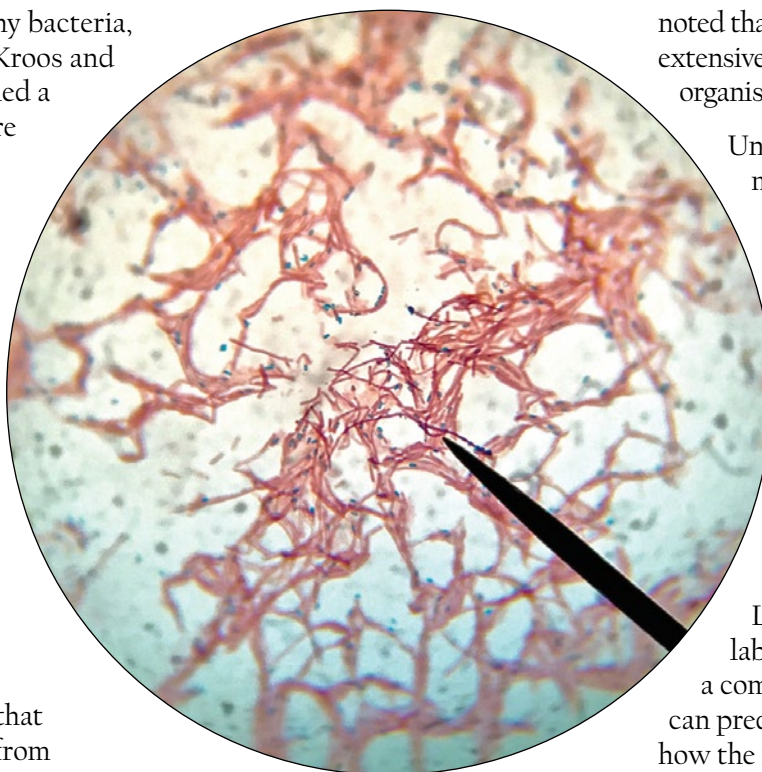
Bacillus subtilis is a type of protein found in organisms that span the kingdoms of life—from single-celled bacteria to people. The first intramembrane protease was discovered in humans in 1997. And perhaps the best-known member of this family—gamma secretase—is implicated in Alzheimer’s disease.

Although Kroos explained that using this information to design drugs to treat Alzheimer’s will take years, the team’s findings could have more immediate impacts in fighting particularly nasty and stubborn bacterial pathogens—such as *Bacillus anthracis*, the bacteria behind anthrax infection, as well as other bacteria responsible for tetanus, botulism and food poisoning.

“Many, many bacteria have intramembrane proteases that are pretty closely related to the one we studied,” Kroos said. “Figuring those out could reveal how to make bacteria less stress-resistant and more treatable with antibiotics.”

Beyond that, it helps paint a more complete picture of how life works.

The protease studied by the team is part of the biological system that *B. subtilis* uses to make spores when food is scarce.



A microscope image shows stained, rodlike *Bacillus subtilis* cells in red, with spores (stained green) dotting the image.

noted that this system has evolved extensively compared to related organisms.

Understanding the high-end machinery of intramembrane proteases required extensive genetic and biochemical testing, which Kroos’s doctoral student, Sandra Olenic, led. Kroos and Olenic also consulted Michael Feig, a BMB professor, to bring in computer modeling to help complete the expansive puzzle.

Lim Heo, a postdoc in Feig’s lab, also provided expertise in a computational technique that can predict protein structures and how the intramembrane protease worked before such tools were widely accessible.

The team’s findings imply that this *B. subtilis* intramembrane protease is kept inactive with help from two other proteins, with one of these inhibitor proteins working like a clamp, keeping the second protein lodged in the scissor enzyme’s active site.

The researchers theorize that the bacteria can then activate the protease by releasing the clamp, letting the blocking protein slip out and allowing the target protein in.

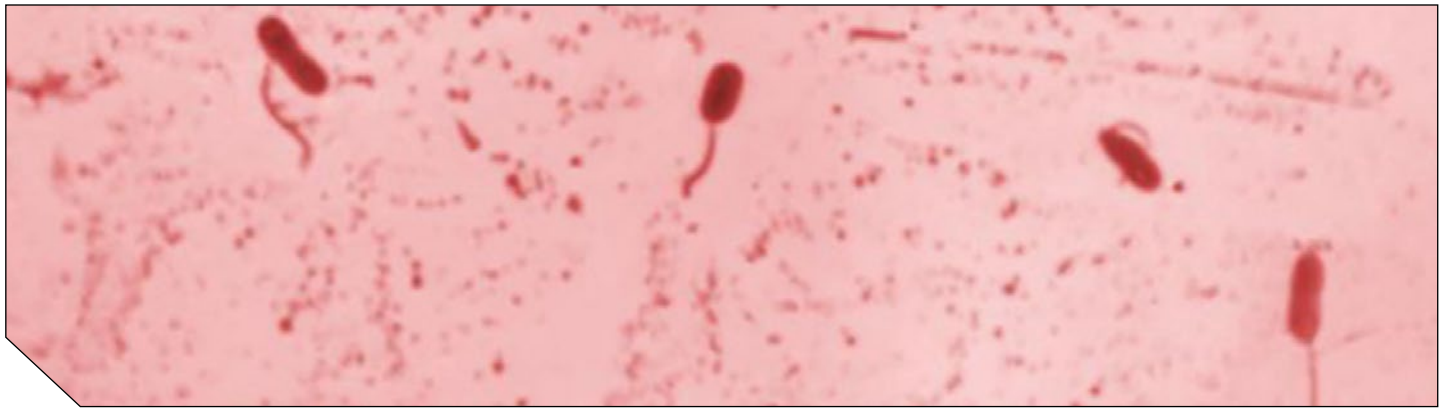
“This was like putting together a 5,000-piece jigsaw puzzle without knowing what it looks like,” Kroos said. Although the puzzle isn’t completely solved, the team has enough data and results to be confident it has a reasonable model of how things look and work.

A better understanding of these proteases could also help develop applications in areas such as agriculture and environmental protection. 🌱

DISCOVERY
“This was like putting together a 5,000-piece jigsaw puzzle without knowing what it looks like.”

Because intramembrane proteases do their work within the confines of a cell membrane, it’s been challenging for researchers to determine exactly how they work. Additionally, the researchers thought their protease might be working in a sophisticated way that had never been documented. Kroos

Bacteria versus viruses



Cholera is a well-known disease caused by intestinal infection with the toxin-producing bacteria, *Vibrio cholerae* (pictured above).

As antibiotic resistance challenges scientists to find new ways to treat bacterial infections, microbiologist Chris Waters and his team have discovered a new way for bacteria to defend themselves against viral infection, or phage, which could lead to better treatments in the future. Their research was recently published in the journal *Nature Microbiology*.

When bacteria are resistant to antibiotics, phage therapy has become an effective way to treat bacterial infections. Phage therapy uses a bacterial phage to infect and kill the bacteria.

While studying the evolution of the cholera-causing bacteria *Vibrio cholerae*, Waters, along with graduate students Brian Hsueh (now an R&D scientist at Meso Scale Diagnostics) and Geoff Severin (now a postdoctoral fellow at the University of Michigan), discovered that bacteria have developed a new defense mechanism against phage infection, which they named AvcD.

“This bacterial defense system is analogous to the viral defense system present in humans to inhibit viruses such as HIV,” Waters said. “By understanding how bacteria prevent phage infection, we can predict and counteract the mechanisms that will allow bacteria to resist emerging phage therapy approaches to treat antibiotic-resistant infections.”

RESISTANCE

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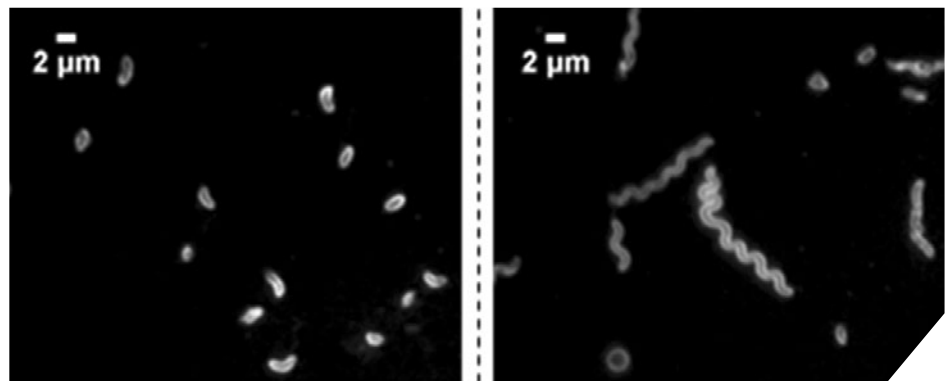
When the enzyme AvcD is turned on, it depletes nucleotides, which are the building blocks of DNA, in the cell. This prevents the cell from growing and replicating more phage that normally would kill the host

bacteria. It also reduces the number of phage that can burst from the cell to infect its neighbors, saving the entire population of bacteria.

“If this enzyme was activated in the cell all the time, it would be toxic,” Waters said. “To save neighboring cells, the bacteria make an RNA (called AvcI) which binds to AvcD and prevents it from depleting all the nucleotides in the cell.”

The researchers showed that once bacteria are infected with a phage, the AvcI in the cell breaks down, which activates the AvcD gene to inhibit phage production.

Additional MSU collaborators on the project are J. K. Billman, Jr., M.D., Endowed Research Professor Kristin Parent (BMB) and Assistant Professor Janani Ravi (MMG). 📍



The micrographs above show that activation of AvcD causes normal bacterial cells (left) to form long filaments (right) due to depletion of nucleotides.

Investiture ceremony honors MSU's Sean Crosson as a Rudolph Hugh Endowed Chair

Michigan State University microbiologist Sean Crosson, a professor in the MSU Department of Microbiology and Molecular Genetics (MMG), with joint appointments in the College of Natural Science (NatSci) and the College of Veterinary Medicine (CVM), was honored as a Rudolph Hugh Endowed Chair at an investiture ceremony held March 23 at MSU's Wharton Center.

Crosson, a leading young figure in the field of infectious diseases, specializes in investigating the molecular basis of environmental adaptation in bacteria that inhabit niches ranging from freshwater to soil to the interior of mammalian cells. He received his B.A. in biology from Earlham College in Richmond, Ind., and his Ph.D. in biochemistry and molecular biophysics from the University of Chicago. Following his graduate studies, Crosson served as a National Institutes of Health (NIH) postdoctoral fellow at Stanford University School of Medicine, then joined the University of Chicago as an assistant professor in the Department of Biochemistry and Molecular Biology in 2006, where he remained until he joined MSU in 2019.

"It's a real honor to receive this endowed position and I really appreciate the recognition for the hard work that the people in my group have been doing for many years," Crosson said. "MSU provides a fantastic work environment, and the Rudolph Hugh Endowed Chair gives me a chance to pursue ideas that are a little bit off the beaten path but could end up being really useful down the road. I value the flexibility to follow some of the ideas that I have and the people in my group have to go where the science leads us and not be so constrained by traditional federal funding mechanisms."



Sean Crosson receiving his endowed faculty medallion from MSU Vice President of Research and Innovation Doug Gage following his investiture research presentation.

“It’s a real honor to receive this endowed position and I really appreciate the recognition for the hard work that the people in my group have been doing for many years.”

EDUCATION

Crosson's work in this cutting-edge field has already resulted in more than 100 publications to date, and he has been highly successful in generating substantial and sustained funding support for his research, currently holding several NIH awards including a prestigious MIRA Established Investigator Award.

"The investiture of Dr. Crosson as a Rudolph Hugh Endowed Chair brings to our community his world leading program studying mechanisms that enable bacterial cells to adapt their physiology to changing environments," said Phil Duxbury, NatSci dean. "This area is critical to understanding the effects of changing environments and stressors, such as climate change, on the evolution of ecosystems, microbiomes, and pathogens in wild and domestic hosts."

"Sean's research and scholarship exemplify the academic innovation and excellence that is a cornerstone of MSU, and his thoughtful leadership has been vital to our faculty, staff and students, as well as his colleagues in the field," added CVM's Birgit Puschner. "We are so proud of his accomplishments and excited to see what his future brings."

The endowed chair is named after Rudolph Hugh, who received his B.S. in bacteriology from Michigan State University in 1948, and his Ph.D. in bacteriology from Loyola University Chicago in 1954. Upon his death in 2011, Hugh provided resources to establish this endowed position. 🌱

c/o College of Natural Science
288 Farm Lane, Room 103
East Lansing, MI 48824-1115



Graduate students with GRIT

Retaining graduate students in science, technology, engineering, and mathematics (STEM) can be difficult, especially in traditionally underrepresented minority groups. But Ph.D. student Laurisa Ankley came up with a solution.

In 2020, she founded GRIT at MSU, a graduate student-led initiative to improve the diversity, equity and inclusion of STEM graduate programs. GRIT (Graduate Recruitment Initiative Team) focuses on recruitment, retention and the long-term success of graduate students in MMG and the five other MSU departments that are part of the BioMolecular Science Gateway (BMS) program. First established at the University of Chicago, the GRIT model can be specifically tailored to meet the needs of each university program and the students it serves.

With roughly 60 new students arriving each year and staying an average of five to six years, GRIT caters to students with various requirements, research needs and backgrounds. GRIT's peer mentorship program, led by Jasper Gomez and Jenny Schuster, accommodates the needs of first-year PhD students.

"GRIT is a grassroots student organization. All of our initiatives and funding are the direct result of the hard work of our current and past leadership team," said Kaylee Wilburn, current GRIT director. "As students



GRIT members attending an end-of-year party.

ourselves, we recognize the issues present in STEM, and we can help administrators think about how to be accessible to all."

GRIT's four main programs drive equitable education by providing application feedback, first-year student mentorship and a community for traditionally excluded people in STEM.

With support from MSU, GRIT has grown from \$5,000 in annual funding to more than \$20,000 within three years. The hope is to expand and cover more departments and programs within the College of Natural Science. 🍀