



Research, Innovation & Impact
University of Missouri

20
23

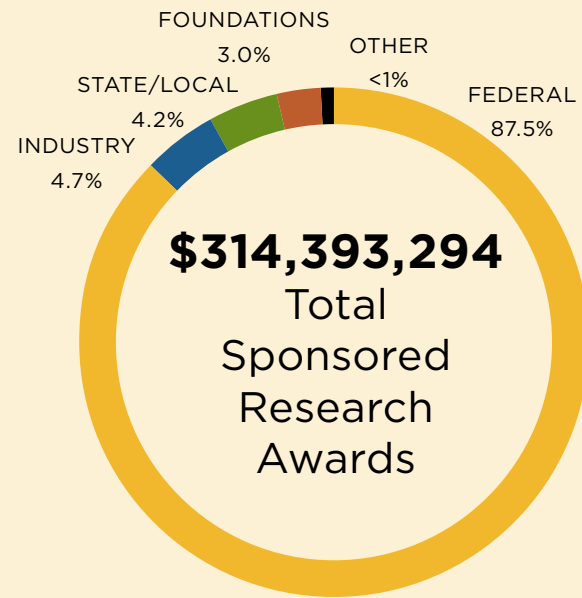
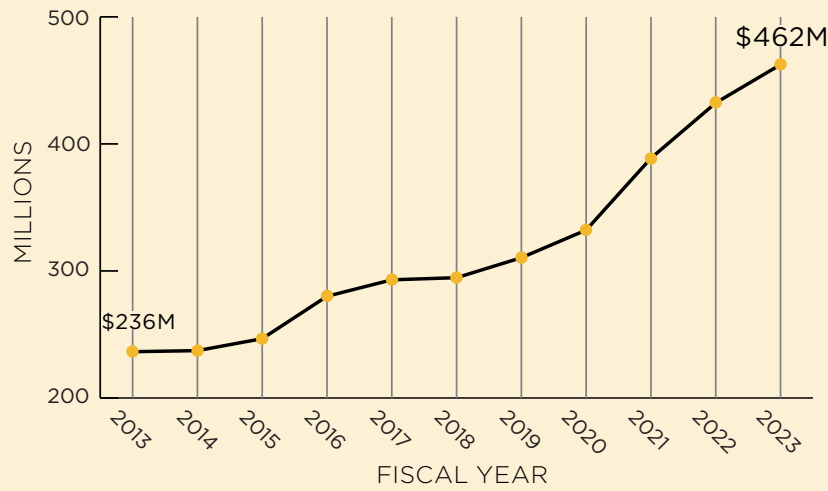


YEAR IN REVIEW



\$462M

Total FY 2023 Research Expenditures



1,392

Distinct awards received

123

New inventions disclosed

1,010

Distinct investigators received awards

19

U.S. patents issued

101

Distinct awards of \$1M+

91

Technologies licensed and optioned by commercial partners

Dear Colleagues,

It was a banner year for the University of Missouri’s research and creative achievements. Faculty, staff and students improved our quality of life, expanded the horizons of what is achievable and added to the university’s 185-year legacy of pioneering work.

MU investigators and scholars generated new knowledge and provided students with hands-on experiences to prepare them to be scientific leaders. They also made significant advances in health, agriculture, engineering, the humanities, veterinary medicine, education and many other areas. This work was supported by hundreds of awards, most in the form of highly competitive grants from federal agencies like the National Institutes of Health and the National Science Foundation. Even more impressive, however, is that the MU community set a record for research expenditures of more than \$462 million in fiscal year 2023, marking our 10th consecutive year of growth.

The Division of Research continues making strategic investments to help investigators increase their research productivity, including new professional development opportunities and state-of-the-art instruments for MU’s advanced technology core facilities. Teams from the Strategic Proposal Development Service, Research Analytics and The Connector worked with hundreds of faculty throughout the year to increase the quantity and quality of grant proposals. A highlight was our inaugural Accelerate Your Research Week, which offered workshops and one-on-one consultations with federal funding agency program officers.

Thank you for your unparalleled achievements and unwavering commitment to excellence. I have no doubt they will propel us to an even brighter future.

Tom Spencer
Vice Chancellor for Research
Curators’ Distinguished Professor



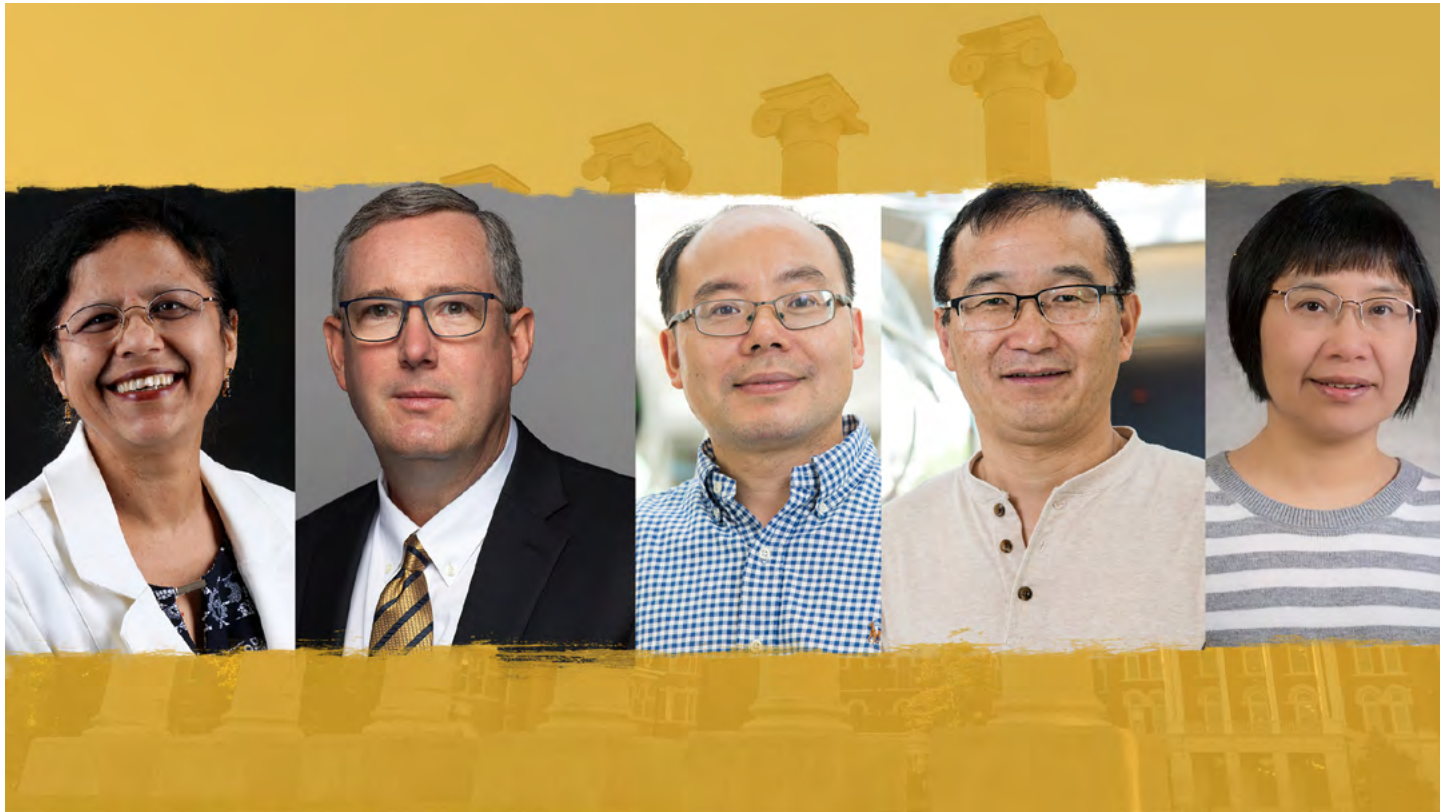
On the front cover

NSF Director Sethuraman Panchanathan visits MU

2023 Columbia Young Scientists Expo

MU’s iconic columns and Jesse Hall

All analytical data is for FY 2023



2022 AAAS Fellows—Shubhra Gangopadhyay, Chris Lorson, Xiu-Feng “Henry” Wan, Bing Yang and Xiaoqin Zou.

FIVE FACULTY NAMED 2022 AAAS FELLOWS

Five professors were named American Association for the Advancement of Science 2022 Fellows for their distinguished efforts in advancing various fields of science.

The recipients were:

Shubhra Gangopadhyay

Professor Emeritus of Electrical Engineering and Computer Science.

Chris Lorson

Associate vice chancellor for research in the Division of Research, associate dean for research and graduate studies in the College of Veterinary Medicine, Curators’ Distinguished Professor of Veterinary Pathobiology and principal investigator in Bond Life Sciences Center.

Xiu-Feng “Henry” Wan

Director of the NextGen Center for Influenza and Emerging Infectious Diseases, principal

investigator in Bond Life Sciences Center and Curators’ Distinguished Professor of Molecular Microbiology and Immunology.

Bing Yang

Professor of plant science and technology, principal investigator in Bond Life Sciences Center and principal investigator in the Donald Danforth Plant Science Center.

Xiaoqin Zou

Professor of physics and of biochemistry, principal investigator in the Dalton Cardiovascular Research Center and core faculty member in the Institute for Data Science and Informatics.



George P. Smith

SMITH HONORED WITH INAUGURAL MIZZOU MEDAL OF DISTINCTION

The first recipient of the Mizzou Medal of Distinction was Nobel Laureate George P. Smith, Curators’ Distinguished Professor Emeritus of Biological Sciences, who was awarded the 2018 Nobel Prize in chemistry for his development of phage display, which allows a virus that infects bacteria to evolve new proteins. The medal is among the University of Missouri’s most prestigious service awards designed to recognize its honorees for serving their community through a sense of accomplishment and vision.



Guang Bian

BIAN SELECTED AS A GORDON AND BETTY MOORE FOUNDATION EXPERIMENTAL PHYSICS INVESTIGATOR

Guang Bian, an associate professor of physics and astronomy, was selected as a 2023 Gordon and Betty Moore Foundation Experimental Physics Investigator, which included a five-year, \$1.25 million grant. The foundation’s funding allows physicists to concentrate on their research and build collaborative relationships that enable innovative discoveries during some of their most creative years. Bian conducts experimental and theoretical research in condensed matter physics.



Wendy Reinke

REINKE HONORED WITH SEC AWARD

Wendy Reinke, a Curators’ Distinguished Professor in the Department of Educational, School and Counseling Psychology in the College of Education and Human Development, was honored by the Southeastern Conference (SEC) with the 2023 Faculty Achievement Award. The recognition is given annually to one professor from each university within the SEC. Reinke’s research focuses on preventing social-emotional behavior problems in youth — especially children in school — and her work is evident in K-12 classrooms across Boone County, which includes Columbia, and beyond.



Robert Sharp

SHARP RECEIVED THOMAS JEFFERSON AWARD

Robert Sharp, Curators’ Distinguished Professor and Chancellor’s Professor of Plant Science and Technology in the College of Agriculture, Food and Natural Resources, received the UM System President’s Thomas Jefferson Award for his research. The award recognizes one outstanding faculty member annually who has been nationally or internationally recognized for and demonstrated clear distinction in research, scholarship, teaching and public service.



Carol Ward

WARD ELECTED TO AMERICAN ACADEMY OF ARTS AND SCIENCES

Carol Ward, a Curators’ Distinguished Professor of Pathology and Anatomical Sciences in the School of Medicine, was elected to the American Academy of Arts and Sciences in recognition of her contributions to the field of anthropology. Ward is an international expert in human evolution.



James van Dyke

VAN DYKE AWARDED NATIONAL GALLERY OF ART VISITING SENIOR FELLOWSHIP

James van Dyke, an associate professor and director of graduate studies for the School of Visual Studies, was awarded a Visiting Senior Fellowship from the Center for Advanced Study in the Visual Arts at the National Gallery of Art in Washington, D.C. During his residence, he will explore the Shell Oil company’s use of art and architecture in Europe and the Americas during the 1930s.

CONCANNON RECEIVED NATIONAL LIBRARY AWARD

Marie Concannon, head of government information for the MU Libraries, was awarded the 2023 American Library Association Catharine J. Reynolds Award from the Government Documents Round Table for her project “Prices and Wages by Decade,” which points to retail prices and average wages in primary source materials, mainly government documents. The award provides funding for research that contributes to document librarianship.



Marie Concannon

SHYU NAMED A FELLOW OF THE AMERICAN COLLEGE OF MEDICAL INFORMATICS

Chi-Ren Shyu was named a Fellow of the American College of Medical Informatics for representing excellence from academia, government and industry. Inductees are the best and brightest stars in the field demonstrating thought leadership, stellar experience and established scholarship. Shyu is the Paul K. and Dianne Shumaker Professor in Electrical Engineering and Computer Science and serves as the director of the MU Institute for Data Science and Informatics.



Chi-Ren Shyu

LIU RECEIVED GEORGE P. WOOLLARD AWARD

The Geological Society of America awarded Mian Liu with the 2023 George P. Woollard Award. Liu, the William H. Byler Distinguished Chair and Curators’ Distinguished Professor of Geological Sciences, was honored for his outstanding contributions to geology. Liu’s research focuses on the geophysics and geodynamics of the solid Earth. He and his students combine numerical modeling with geophysical and geological data analyses to study mantle flow, lithospheric deformation, mountain building and basin formation, faulting and earthquakes.



Mian Liu

MARTINEZ-LEMUS RECEIVED BENJAMIN W. ZWEIFACH AWARD

Luis Martinez-Lemus, James O. Davis Distinguished Professorship in Cardiovascular Research and professor of medical pharmacology and physiology, and NextGen Precision Health principal investigator, was honored with the prestigious Benjamin W. Zweifach Award from the Microcirculatory Society. The global scientific society, dedicated to promoting research and teaching in the field of microcirculation, grants the award in recognition of outstanding contributions to advancing knowledge of microcirculation.



Luis Martinez-Lemus



Haval Shirwan

NATIONAL ACADEMY OF INVENTORS NAMED SHIRWAN AS 2023 FELLOW

Haval Shirwan, a professor of pediatrics and molecular microbiology and immunology and NextGen Precision Health principal investigator, was elected to the rank of National Academy of Inventors Fellow, where he joins an elite group of academic inventors recognized for their research and intellectual property contributions. Along with his colleague and wife, Esma Yolcu, Shirwan developed a proprietary platform technology known as ProtEx™ that allows the generation of novel biologics and their use to train the immune system not to self-destruct, with the aim of preventing cancer development and infections as well as protecting transplants from rejection.



David Grant

GRANT NAMED NATIONAL ACADEMY OF INVENTORS SENIOR MEMBER

David Grant, executive director of the MU Midwest BioAccelerator, was elected a National Academy of Inventors senior member. Grant, who also is a research design engineer in the College of Engineering, joined the ranks of an elite group of inventors recognized for their contributions to society. Grant’s research primarily involves designing medical devices and products.

In 2023, MU researchers were featured or were sources in thousands of media stories. Some highlights include:

NATIONAL HEADLINES

THE MOST ANCIENT GALAXIES IN THE UNIVERSE ARE COMING INTO VIEW

—National Geographic

SPECIAL HUMAN-CAT BOND MAY HAVE STARTED 10,000 YEARS AGO

—U.S. News & World Report

‘PLASTIC ROADS’ ARE PAVED WITH GOOD INTENTION

—Yahoo! News

EYE-TRACKING TOOL MAY HELP DIAGNOSE AUTISM MORE QUICKLY AND ACCURATELY, NEW STUDIES SUGGEST

—CNN

ANCIENT FARMING PRACTICE MAKES A COMEBACK AS CLIMATE CHANGE PUTS PRESSURE ON CROPS

—USA Today

TEACHERS WHO STRUGGLE WITH STRESS AT WORKPLACE REPORT LESS JOB SATISFACTION: STUDY

—MSN

HOW FORESTS BEHAVE IN A DROUGHT

—Inside Higher Ed

CORONAVIRUS PROBABLY SPREAD WIDELY IN DEER AND PERHAPS BACK TO PEOPLE, U.S.D.A. SAYS

—The New York Times



Better slogans can make a more significant impact for business brands.

[BETTER TO BE LIKED OR REMEMBERED?](#)

Brady Hodges, assistant professor of marketing, showed that businesses can significantly impact their brand by making changes to their slogans. His research provides business owners and managers with a novel, more precise framework of best practices, guidelines and linguistic recipes for likable and memorable slogans.

[REDEFINING MODERN CONTRACTS](#)

The complexity of consumer contracts has increased thanks largely to the internet's rise. Consumers might encounter these company-controlled agreements, often called "terms and conditions," when shopping online, subscribing to a service or joining a gym. In a study published in the "Denver Law Review," **Andrea Boyack**, Floyd R. Gibson Endowed Professor of Law, advocated for changes to modern contract law that would offer more consumer protections.

[AI NEWS COVERAGE AFFECTS INVESTMENTS](#)

After sifting through 3 million newspaper articles and tracking company stock prices, Professor of Finance **Kuntara Pukthuanthong** and her team identified a correlation between news coverage of artificial intelligence (AI) and stock prices of firms known to use AI. Their research found that people can acquire gains by buying stock once AI begins trending in the news.

[NEW MODEL PREDICTS U.S. RECESSIONS](#)

U.S. publicly traded companies are required to report their financial performance, whether good or bad, to the public. However, a study conducted by **Matthew Glendening** and **Ken Shaw**, both accounting faculty, suggests that when businesses submit misleading statements, it can be an early warning sign of a looming recession or slowdown in GDP growth. Their new model helps predict the status of the economy based on financial misreporting.

An MU Journalism study explored the attitudes and environmental awareness of people in the Mississippi River Basin.

[NIH GRANT SUPPORTS RESEARCH ON CANNABIS RISKS](#)

Zachary Massey secured an \$800,000 grant from the National Institutes of Health (NIH) to explore how to effectively warn recreational users about the health effects of cannabis. Messaging on cannabis products varies widely from state to state, and public polling has shown that people often overestimate the drug's therapeutic effects and underestimate its negative effects.

[COMMUNITY ACTIVISM AS PUBLIC RELATIONS](#)

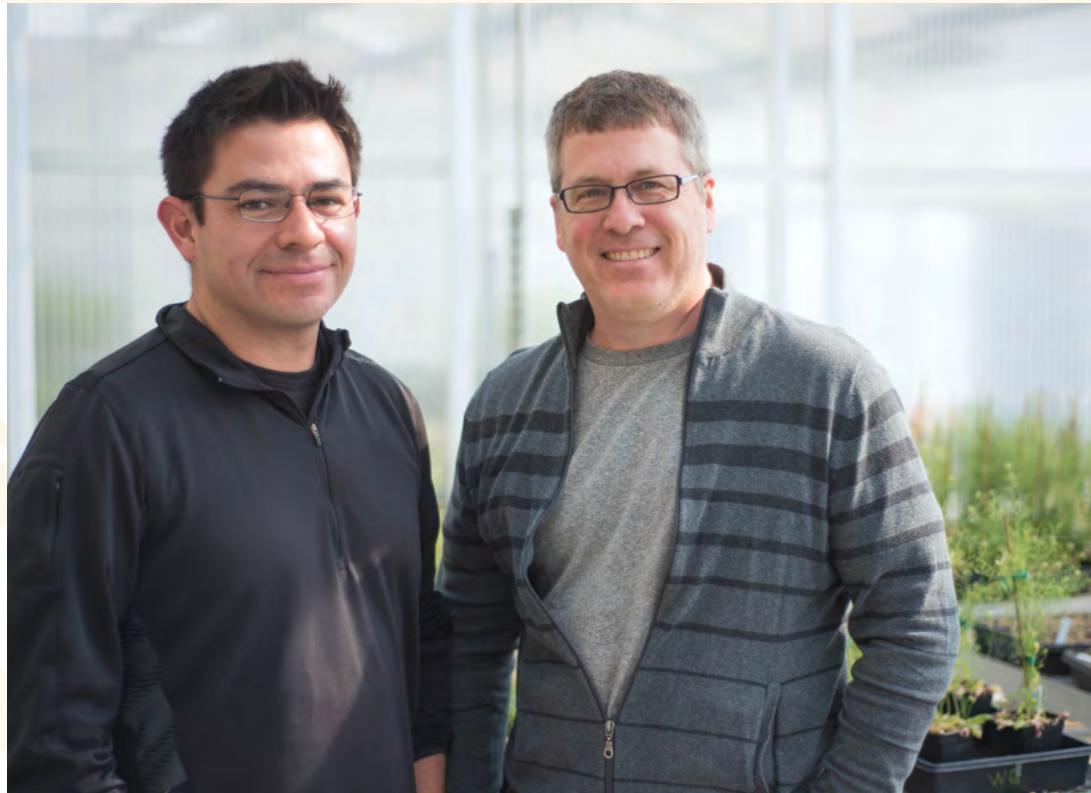
A study from **Luke Capizzo**, assistant professor of strategic communication, challenged the notion that public relations is solely a corporate communication practice. He found that community activism has used PR strategies and tactics for years to bring about societal change and argues that a more inclusive understanding of PR could attract more diverse practitioners.

[INVESTIGATING NEWS DESERTS](#)

A partnership between the School of Journalism and the Institute for Data Science and Informatics received a grant from the Inasmuch Foundation to develop a more accurate method of analyzing news deserts — communities with limited access to local news. **Damon Kiesow**, Knight Chair in Journalism Innovation, and **Chi-Ren Shyu**, an engineering professor and institute director, are investigating how to address gaps in current methodology and improve large-scale analyses of the local news ecosystem.

[REPORT HIGHLIGHTS ATTITUDES TOWARD ENVIRONMENT](#)

The School of Journalism released first-of-its-kind research on the attitudes and environmental awareness of people in the Mississippi River Basin. The study was led by Assistant Professor **Kate Rose** in collaboration with the Mississippi River Basin Ag & Water Desk, a network of journalists supported by a \$2.47 million grant from the Walton Family Foundation.



David Mendoza-Cózatl, associate professor of plant science and technology, and Scott Peck, professor of biochemistry.

NEW FACES

New questions are being asked within Bond LSC with three [MizzouForward](#) hires joining the center. [Roman Ganta](#), McKee Endowed Professor of Veterinary Pathobiology, focuses on tick-borne diseases and how pathogens survive in ticks and animals. He aims to develop molecular strategies and vaccines to prevent parasitic disease. [Marc Libault](#), professor of plant science and technology, explores single cell plant biology, working to reveal unique molecular features and mechanisms so scientists can better understand the functions of different genes. [Paul de Figueiredo](#), NextGen Precision Health Endowed Professor of Molecular Microbiology and Immunology, has broad expertise in host-pathogen interactions and biotechnology.

FOCUSING ON FIGHTING CANCER

Paul de Figueiredo secured \$20 million to improve cancer treatment with an Advanced Research Projects Agency for Health grant, part of a federal initiative to support biomedical and health breakthroughs. De Figueiredo's project promises to build inexpensive, safe therapeutics using bacteria that regulate tumor-targeting immune cells without side effects.

INTEGRATING APPROACHES

Scott Peck, professor of biochemistry, and **David Mendoza-Cózatl**, associate professor of plant science and technology, began a project funded by the NSF Integrative Research in Biology program. This new federal initiative supports dynamic and diverse interdisciplinary teams. With **Antje Heese**, associate professor in biochemistry, they received \$1.2 million for research on how plants regulate proteins during bacterial infection. Peck studies signaling proteins during plant infection, Mendoza looks at the transport of iron in cells and Heese explores how proteins move through the cell.

TRAINING NEXT GENERATION SCIENTISTS

New funding arrived for graduate and post-doctoral training. [Brian Thomas and Cynthia Tang](#) received F30 fellowships toward their joint MD-Ph.D. degrees. These NIH awards are a first for MU, covering up to six years of research and clinical training costs. Postdoctoral research fellow [Clayton Kranawetter](#) also secured a postdoctoral fellowship from the U.S. Department of Agriculture (USDA) National Institutes of Food and Agriculture Postdoctoral Research to study root border cells. Mizzou was one of 17 institutions that received part of this \$12 million USDA investment in microbiome research.

STUDY LINKS RESPIRATORY AND DIGESTIVE DISEASES

Professor **Carol Reinero** explores the interplay between canine respiratory and digestive system disorders. The director of the Comparative Internal Medicine Laboratory found in a study that 75% of dogs with respiratory disease but no gastrointestinal signs had one or more co-existing digestive tract abnormalities, such as reflux, aspiration and trouble swallowing. Reinero advised closely monitoring dogs with respiratory disease for digestive issues, even if symptoms aren't apparent.

HOW BRUCELLOSIS AFFECTS THE BRAIN

Brucellosis is one of the most common bacterial infections that jumps from animals to humans. NIH-funded research showed how innate parts of the immune system help protect the human brain against the bacteria. **Jerod Skyberg**, associate professor of veterinary pathobiology, laid the foundation for future treatments by showing the power of innate lymphoid cells and interferons in reducing harmful neurological effects caused when the bacteria enter the brain.

LONGHORNED TICK SPREADS IN MISSOURI

Researchers, led by doctoral student **Rosalie Ierardi**,

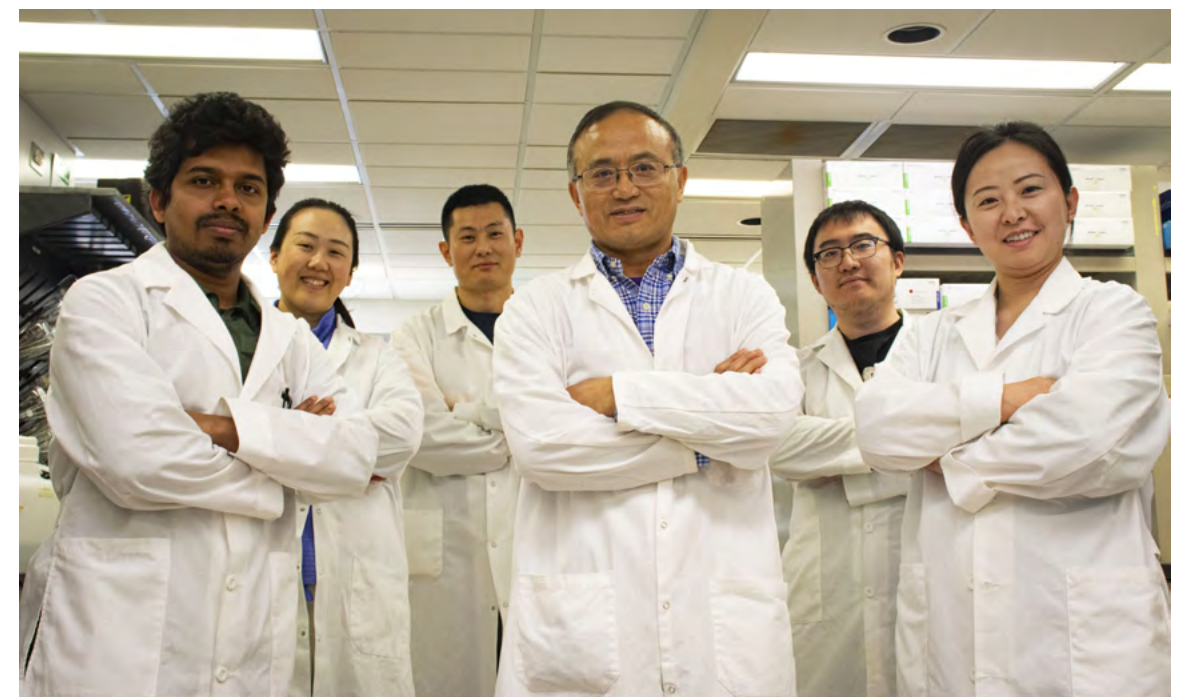
discovered the invasive longhorned tick in Boone County for the first time. The team earlier found the pest in northern Missouri, and they worked to alert cattle ranchers in these areas. This vigilance in monitoring animal health can reduce the parasite's potential to cause major losses in revenue.

TRAINING THE NEXT GENERATION OF INFECTIOUS DISEASE SCIENTISTS

A five-year, \$12 million NIH grant will increase workforce development at the Laboratory for Infectious Disease Research by providing additional training and support to existing employees and helping recruit new employees. By educating and training the next generation of infectious disease scientists, the grant helps support approaches for both the prevention and treatment of infections caused by bacteria, viruses and other pathogens.

OCCLUDIN PROTEIN HELPS COVID-19 SPREAD

Researchers in the College of Veterinary Medicine and the School of Medicine discovered that occludin, a protein inside the human body, plays a critical role in how SARS-CoV-2 spreads from cell to cell after infection. Their research will help scientists better understand COVID-19 and could lead to the development of new antiviral drugs.



Researchers in the College of Veterinary Medicine and the School of Medicine.

UNIVERSITY OF MISSOURI RESEARCH REACTOR (MURR) QUICK FACTS

- Missouri is home to the most important university research reactor in America for producing lifesaving medical isotopes for cancer treatments.
- Last year, more than 1.6 million patients were diagnosed or treated using the radioisotopes that MURR produces.
- MURR is the only U.S. producer of four medical isotopes used in multiple FDA-approved drugs that extend the lives of liver, thyroid, pancreatic and prostate cancer patients.
- MURR is the most reliable supplier of medical isotopes, safely operating 365 days a year and filling production gaps when other research reactors go offline.



Reliably delivering critical medical radioisotopes is a focus of the University of Missouri Research Reactor.



NEXTGEN MURR ANNOUNCED

MU launched an initiative to build a new, state-of-the-art research reactor — NextGen MURR — to expand the university’s critical cancer-fighting research and medical isotope production. NextGen MURR will create an innovation hub for nuclear medicine that will benefit Missourians and beyond for decades to come. Medical isotopes are used in cancer treatments that target tumors without damaging the surrounding cells. The new initiative continues the legacy and work done at MU and MURR, which began operating in 1966.

GROUNDBREAKING FOR MURR ADDITION

MU is building a new \$20 million, three-story addition to the existing MURR building to expand the facility’s research and medical isotope production space and offer researchers and their students more resources to explore nuclear science and discover new treatments. The 47,000-square-foot expansion is scheduled for completion in late 2024.

PRODUCING A BREAKTHROUGH RADIOISOTOPE FOR CANCER TREATMENT

In the fall, MURR completed its first commercial shipment of no-carrier-added lutetium-177 (NCA Lu-177) for human use and is providing weekly deliveries to Novartis for cancer treatments. These shipments are a significant milestone in a yearslong development project by researchers at MURR, which is the sole U.S. producer of NCA Lu-177, a highly pure form of the Lu-177 radionuclide. The radioisotope is produced in a new radiochemical processing suite specifically designed for lutetium production.

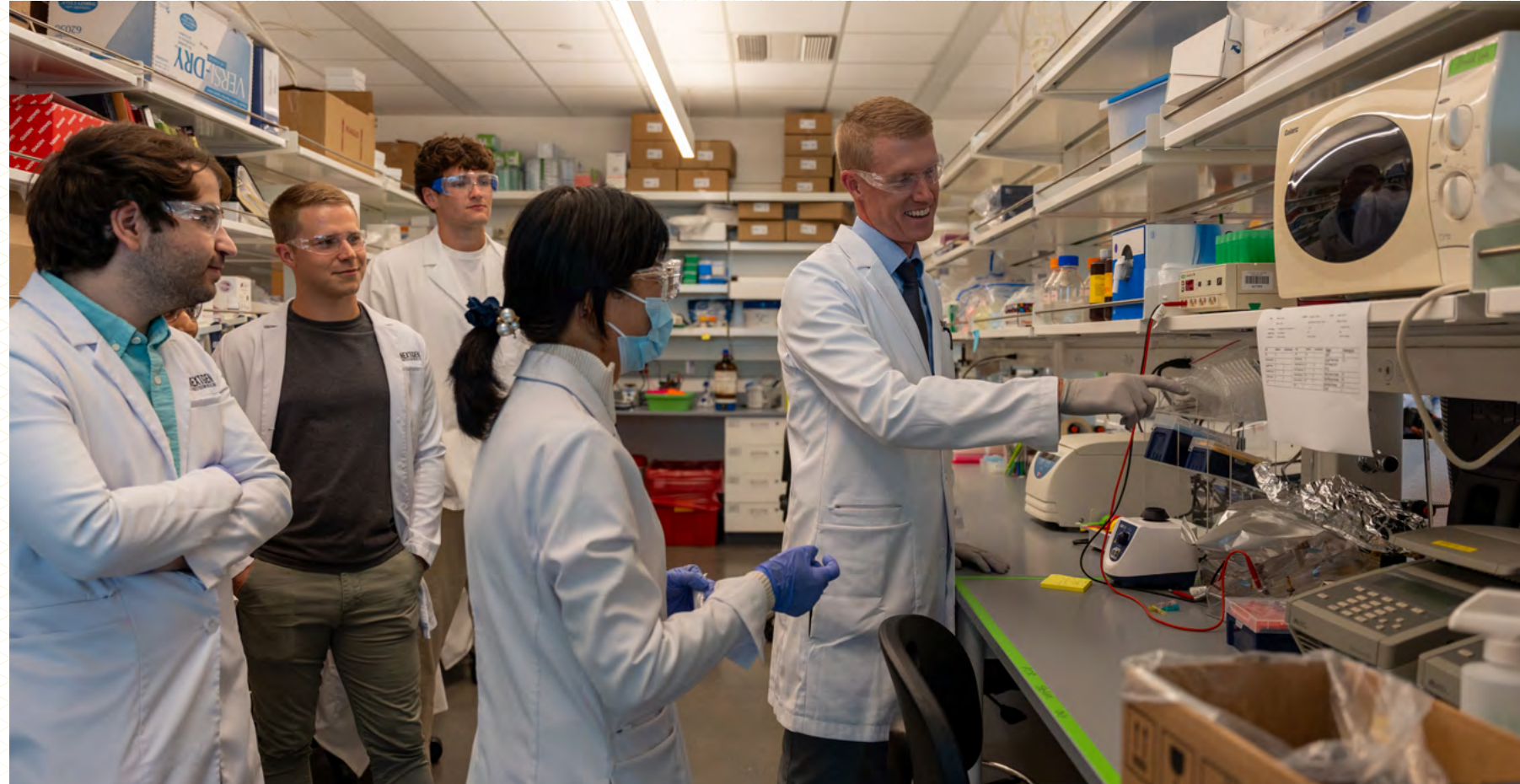
HELPING CREATE A PIONEERING PROSTATE CANCER TREATMENT

MU Health Care initiated its first treatment using an FDA-approved targeted radioactive medicine for advanced metastatic prostate cancer. Pluvicto® is the brand name for the radiopharmaceutical,

which includes no-carrier-added lutetium-177 (NCA Lu-177), a radioisotope only produced at MURR. This treatment shows promise in cases when metastatic prostate cancer has continued to progress after other interventions, such as chemotherapy and hormonal therapy.

MURR CONTINUES TO BOLSTER DOMESTIC SUPPLY CHAIN OF CRITICAL RADIOISOTOPES

MURR began production of iron-59 (Fe-59) and manganese-54 (Mn-54) radioisotopes in support of the Department of Energy’s Isotope Program, meant to bolster under-produced or unavailable isotopes for researchers in the United States. These two radioisotopes are primarily used in biomedical research, including in vitro and in vivo analyses of cell and systemic metabolism.



Arsh Ketabforoush, Nathan Kerr, Peter Moore, Meifang Wang, and W. David Arnold, executive director of the NextGen Precision Health initiative, collaborate in the lab.



MU assistant research professor Kris Kelly is leading one of the first clinical trials to use the CTSU.

[NEXTGEN PRECISION HEALTH BUILDING OPENS DOORS TO CLINICAL TRIALS](#)

The Roy Blunt NextGen Precision Health building's newly opened Clinical and Translational Science Unit (CTSU) is employing state-of-the-art equipment to pursue life-changing precision health advancements to uncover a better future for the health of Missourians and beyond. The 15,700 square-foot hub for clinical and translational research activities supports bench-to-bedside research, including first-in-human clinical testing, physiological assessments, exercise testing, nutrition studies, device studies and Phase 0-IV pharmaceutical clinical trials.

[IMPROVING MOTOR FUNCTION IN OLDER ADULTS](#)

W. David Arnold, executive director of the NextGen Precision Health initiative and School of Medicine professor, received a \$3 million grant from the

National Institute on Aging to examine how motor neuron firing rates influence strength in older adults. Arnold's research focuses on a problem referred to as sarcopenia, which is age-related loss of muscle mass and strength. His goal is to discover new ways to optimize and maintain the function and independence of older adults.

[RESEARCHERS HELP BOOST IMMUNE SYSTEM MEMORY AGAINST INFLUENZA](#)

Emma Teixeira and **Mark A. Daniels**, NextGen Precision Health building researchers and associate professors in the School of Medicine, are helping develop more effective vaccines and therapeutics. A study by them found that manipulating one molecular signaling pathway in T cells helped clear influenza infection in the lungs and can improve the strength and longevity of immunological memory. This amplified immune response could better combat influenza and other respiratory infections.

[RESEARCHERS DISCOVER PARADIGM-SHIFTING APPROACH TO PREVENTING CANCER](#)

A ground-breaking approach explored by two NextGen Precision Health building immunologists shows promising results in preventing lung cancer caused by a carcinogen in cigarettes. In their work, **Haval Shirwan** and **Esmat Yolcu** designed a molecule that can mobilize immune cells and guide them along a pathway that most efficiently attacks cancer cells. The molecule not only reduces the number of nodules on cancerous tumors but also could prevent lung cancer by triggering the immune system to recognize and target cells in the body that could become cancerous.



Materials from the research project by Carsten Strathausen, Adapting Kafka.

ADAPTING KAFKA

Carsten Strathausen, professor of German and English, collaborated with the MU Libraries' Interlibrary Loan service on his research project Adapting Kafka. Strathausen is cataloging as many adaptations as possible of Franz Kafka's novel, "The Trial," into a searchable database and website with tools for viewing the adaptations. Students, teachers and scholars will be able to use the site for comparative studies.

UNDERSTANDING ADAPTIVE CLOTHING CUSTOMER NEEDS

A study by **Li Zhao**, an associate professor in the Department of Textile and Apparel Management, found that adaptive clothing retailers must change to satisfy an increasingly diverse customer base. The study involved mining online reviews to understand the perspectives of adaptive clothing customers with disabilities. Zhao examined customer experiences with adaptive clothing products and with navigating an e-commerce environment to help provide guidelines for retailers.

THROUGH THE GALAXY'S MAGNIFYING GLASS

An international team of scientists, led by MU's **Haojing Yan**, used NASA's James Webb Space Telescope to discover 14 new transient objects during their time-lapse study of galaxy cluster MACS0416 — located about 4.3 billion light years from Earth — which they've dubbed the "Christmas Tree Galaxy Cluster." Yan, an associate professor in the Department of Physics and Astronomy, and his team employed the advanced technological capabilities of the telescope to explore the galaxy cluster's "flickering lights" or transients that scientists first saw years ago using NASA's Hubble Space Telescope.

A 'TRANSFORMATIVE' EXPERIENCE

Theater professor **David Crespy** applied a Fulbright Program grant to visit Spain and Greece to unite the two separate landscapes in the fictional stories of the Sephardic Jews. During the trip, Crespy wrote a six-play cycle spanning different historical eras critical to understanding the diasporic experiences of ordinary people.



Robert Petrone with his board and his latest book.

EXPLORING EXTRAORDINARY LOVE

Linda Helmick's newest creative work is a series of 12 paintings inspired by the sacrifices of Friedl Dicker-Brandeis, an Austrian artist who taught art classes to about 600 children before being murdered in October 1944 by Nazis at the Auschwitz-Birkenau extermination camp. Using an MU Research Council Grant, Helmick, an assistant professor of art education, visited the Czech Republic to research the life and work of Brandeis, which resulted in her research project, "The pedagogic legacy of Friedl Dicker-Brandeis."

REVOLUTIONIZING RURAL EDUCATION

The College of Education and Human Development is taking aim at teacher shortages in smaller communities across Missouri by launching an education initiative designed to enhance programming and further develop outreach in rural parts of the state. Features of the initiative include applying key aspects of new research projects to support science, technology, engineering and math education in rural areas and MU researchers working with school districts to address adolescent immigrants' needs.

HELPING KEEP SCHOOLS SAFE

Keith Herman, a Curators' Distinguished Professor in the College of Education and Human Development, is exploring school safety through a \$2 million grant from the Department of Justice to help identify and avert threats students or others may make on school grounds involving potential harm to themselves or others. The project involves more than 20 rural school districts throughout Missouri. Herman is co-director of the Missouri Prevention Science Institute, a multidisciplinary MU institute focused on understanding human development; preventing social, behavioral and emotional problems; and designing, evaluating and implementing effective interventions.

DROPPING IN

For **Robert Petrone's** latest book, "Dropping In: What Skateboarders Can Teach Us About Learning, Schooling, and Youth Development," the education and human development associate professor observed skateboarders at a rural skatepark to uncover what could be learned about the human dynamics that take place there and see if any takeaways could be applied to the modern-day classroom.

[PREDICTING PROTEIN FUNCTION](#)

Jianlin “Jack” Cheng — Curators’ Distinguished Professor and William and Nancy Thompson Distinguished Professor of Engineering — received NSF funding to develop software that will predict how a protein functions based on the order of its amino acids. Like words make the basis for spoken language, protein sequences are the basis for the language of biological systems. Cheng uses a large language, deep transformer model with some similarity to the one that powers ChatGPT, the popular artificial intelligence (AI) program that generates text based on user prompts. Because proteins are the building blocks of life, applications span from engineering drought-resistant crops to advanced drug development.



Matt Maschmann, left, and Tommy Sewell examine a piece of equipment in the MU Materials Science & Engineering Institute.

[BUILDING LEADERS IN DATA AND MATERIALS SCIENCE](#)

A five-year, \$3 million grant from the NSF is establishing a doctoral training program to help prepare the next generation of scientists and engineers in the emerging fields of materials science and data science and analytics. The program aims to empower future workers to be proficient in both subjects, a skillset that is highly desirable in today’s global marketplace. In addition to emphasizing the integration of these two disciplines, the program also has a formal creativity training component to help students conceptualize new materials technologies.

[TWO-PRONGED SOLUTION TO ENVIRONMENT ISSUES](#)

Caixia “Ellen” Wan, associate professor of biological and biomedical engineering, is helping researchers at Virginia Tech develop a process to convert food wastes into biodegradable plastics. Wan’s team received a \$2.4 million grant from the USDA to upscale bioplastic production with the goal of replacing petroleum-based plastics while also keeping leftovers out of landfills.

The first-of-its-kind project aims to solve two significant problems. Because bioplastics are made from plant and animal products that naturally degrade, they can replace traditional plastics that have harmful effects on the environment, especially marine life. On the other end, diverting food scraps from landfills can significantly reduce greenhouse gas emissions.

[NEW TOOL PROVIDES GREATER ACCURACY FOR MEDICAL BIOSENSORS](#)

Li-Qun “Andrew” Gu, professor of biological and biomedical engineering and investigator in the Dalton Cardiovascular Research Center, developed a new method using nanopores to help scientists advance their discoveries in neuroscience and other medical applications. Potential applications include studying the structures of DNA and RNA-based diseases such as COVID-19 and certain types of cancers. It promises to help researchers see how drug therapies work and discover new small-molecule drug compounds that can be used in future drug discoveries.



Elizabeth Schrader analyzes a prepared stump sample for fire scars.

[GREAT SCARS OF FIRE](#)

Although fires are often destructive, **Michael Stambaugh** argues that when done correctly, they can be particularly valuable. The associate professor of forest ecology said frequent controlled burning of forests with low-intensity fires can reduce the hazardous buildup of fuels that lead to more frequent, intense wildfires. Stambaugh received approximately \$1.2 million through the Bipartisan Infrastructure Law and U.S. Forest Service to determine how fires of varying severities and frequencies affect forest ecosystems, particularly with hard/yellow pine trees.

[IMPROVING RICE PRODUCTIVITY](#)

In a study partially funded by the USDA, **Bing Yang**, professor of plant science and technology, used a revolutionary gene-editing technique called CRISPR to help identify problematic pathogens present in certain bacteria that lead to prolific infections in rice crops. His research helps scientists understand how these pathogens function and can therefore determine how to guard against widespread infections that destroy crop yields.

[DOUBLING COVER CROP ACREAGE](#)

Rob Myers, director of MU’s Center for Regenerative Agriculture, is leading a new \$10 million grant project from the National Institute of Food and Agriculture, a federal agency within the USDA, to help double the acreage of cover crops in the U.S. Cover crops — plants that are used to protect and improve soil during a time when other crops are not being grown — help reduce soil erosion, improve soil health, smother weeds, control pests and diseases and improve biodiversity.

[DIVING DEEP INTO THE HEALTH OF NORTH AMERICA’S LAKES](#)

Supported by a new five-year, \$2.5 million NSF grant, **Rebecca North**, associate professor of water quality, will examine how rapidly warming temperatures can influence the growth and toxicity of lake algae. North and her collaborators will use predictive modeling to forecast future outcomes on samples taken from more than 30 lakes across the country to measure the impact of shorter winters. North also hopes this research will be helpful for water treatment plant operators.

[INCREASING PHYSICIANS IN RURAL MISSOURI](#)

The School of Medicine received a new federal award of \$16 million from the Health Resources and Services Administration (HRSA) to expand programming aimed to address a shortage of physicians in rural Missouri. The funding will support the Rural Scholars Program, which exposes students to different rural medicine opportunities, highlights the social and community aspects of rural life and embeds medical students in clinical sites in rural areas.

[STUDYING HOW GUT HEALTH CAN AFFECT ALZHEIMER'S PROGRESSION](#)

Alzheimer's disease, the most prevalent form of dementia, currently lacks an effective treatment to slow or stop its progression. Now, **Ai-Ling Lin**, professor of radiology and biological sciences, is using \$1.6 million from NIH to lead groundbreaking research about how bacteria in our gut from the foods we eat can influence the onset and progression of Alzheimer's. The research will involve Missouri's most powerful magnetic resonance imaging (MRI) scanner.

[PRESERVING FERTILITY FOR ENDOMETRIAL CANCER PATIENTS](#)

Often the only certain cure for endometrial hyperplasia — the thickening of the lining of the uterus that can lead to endometrial and uterine cancer — is surgical removal of the uterus. For reproductive-age women hoping to achieve pregnancy, this approach can be devastating. Now, **Tae Hoon Kim**, assistant professor of obstetrics, gynecology and women's health, has



School of Medicine third-year student Brittney Marshall (right) works with Dr. Misty Todd as part of a \$16 million HRSA grant.

been awarded a \$2.26 million NIH grant to study treatments for the preservation of fertility in women of reproductive age with the condition.

[EXPLORING NEW TREATMENTS FOR COMBAT WOUND INFECTIONS](#)

Hongmin Sun, associate professor of cardiovascular medicine, was awarded a nearly \$1.2 million grant from the U.S. Army to study non-intravenous, topical and localized antibiotic treatments for drug-resistant bacterial infections. Sun's team is researching an optimal dosing regimen for use with innovative micro-infusion devices that can deliver antibiotics to deep, difficult-to-reach regions of wounds without causing other adverse effects such as kidney damage that are frequently caused by potent antibiotics. These small portable devices were originally designed to apply skin care products, but Sun believes they have the potential for application as antibiotic treatment devices because they can deliver medicine in mist form deep into tissue.

[PUBLIC HEALTH RESEARCHER'S GRANT ADDRESSES OPIOID EPIDEMIC](#)

Childhood trauma is a key risk factor for future substance use disorder, overdose and suicide. This is particularly problematic in rural areas where children experience higher rates of adverse childhood experiences (ACEs), such as physical and emotional abuse and neglect. **Julie Kapp**, associate professor of public health, received a grant from the USDA to train health care workers on topics including what ACEs are, the prevalence of ACEs in rural areas and strategies to implement to support families. Kapp's online training module will target five high-risk rural Missouri counties with the goal of reducing opioid overdoses and suicides.

[ENHANCING QUALITY OF LIFE FOR PRISON RESIDENTS](#)

Kelli Canada, associate professor of social work, is using her expertise to make a difference in Missouri's prisons using a grant from the Urban Institute. In collaboration with prison residents and staff members at the Moberly Correctional Center, Canada and her team have focused on getting fresh fruits and vegetables in the prison canteen, developed more programming on re-entry and created opportunities for family contact within the institution.

[IMPROVING HOSPITAL DISCHARGE PROCESS](#)

Patients who are discharged after vascular surgery are far more likely to be readmitted to the hospital than those recovering from other types of surgery, due to coexisting medical conditions such as diabetes or high blood pressure, which can negatively impact wound healing. **Elizabeth Doss**, a doctoral nursing student, worked with a team led by **Todd Vogel**, an associate professor and chief of vascular surgery at MU Health Care, to conduct a study in which nurses, physicians, patients and health care staff were interviewed about the obstacles they faced during the discharge process to examine factors that can be improved to reduce hospital readmission, such as clarifying who to contact with follow-up questions, simplifying processes related to filling prescriptions and more.

[MU GRANT EASES NURSING WORKFORCE SHORTAGE](#)

An \$800,000 grant from the Missouri Department of Economic Development will help train hundreds of MU students to become part-time nurse assistants at MU Health Care. The three-year grant creates an elective course within the Sinclair School of Nursing to help nearly 100 MU students each year earn paid, part-time positions within MU Health Care as nurse assistants.



MU research is making a difference in Missouri's prisons.

ASH SCHOLARS PROGRAM PROMOTES RESEARCH IN ARTS, SOCIAL SCIENCES AND HUMANITIES

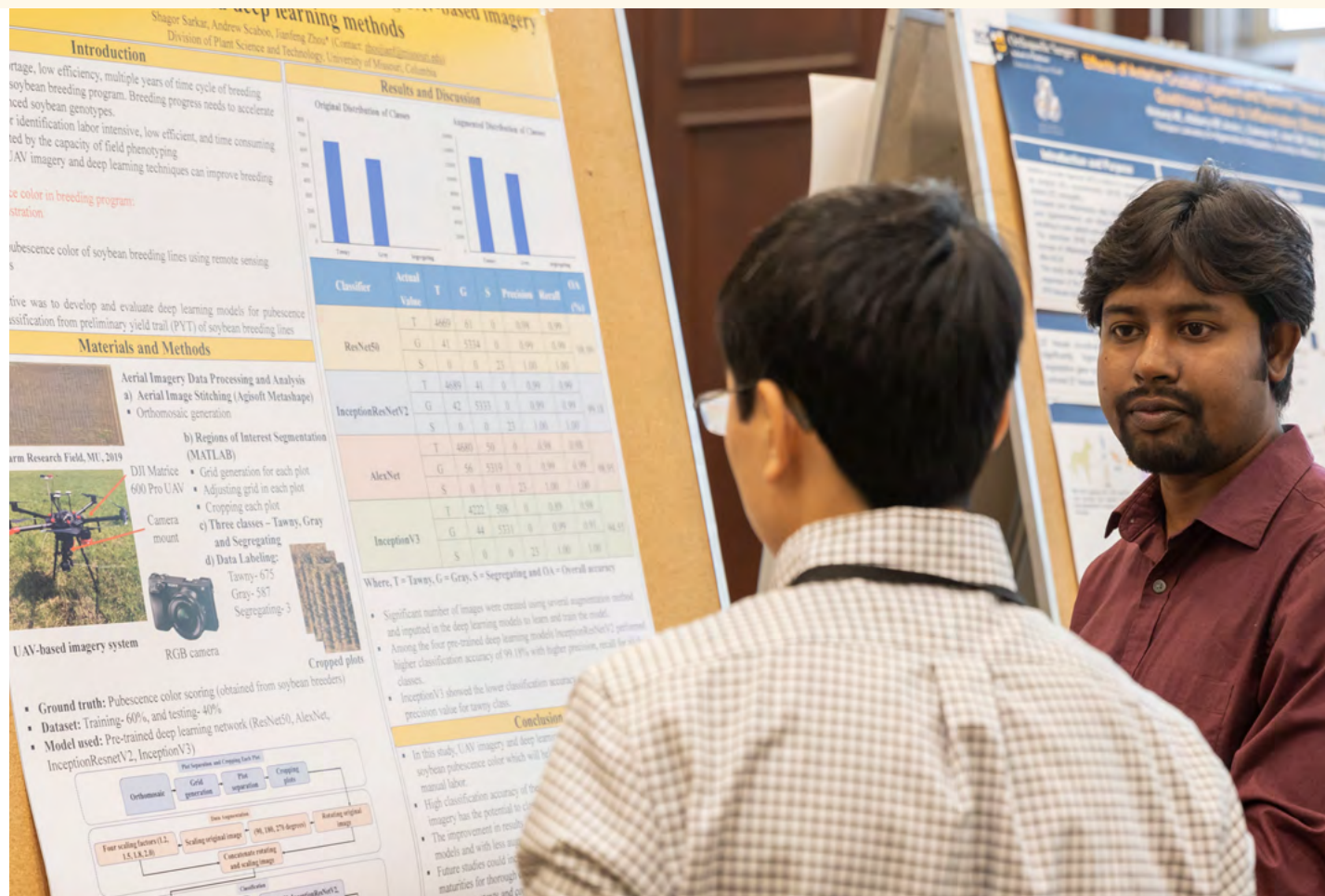
A collaboration between the Office of Undergraduate Research and the Honors College has created an ongoing research opportunity for undergraduate students involved in the arts, social sciences and humanities (ASH) disciplines. The ASH Scholars Program began in 2016 and has continued to grow, including a new cohort of five teams of eight to 12 undergraduate students working closely with faculty mentors on an established research project.

SISTERS IN SCIENCE

Olivia and Mya Burken came of age with the Science Channel and National Geographic while their friends grew up watching shows on Nickelodeon. Now, the MU students assist with clinical trials related to cardiovascular disease and improving vascular function at the NextGen Precision Health building. In their time at NextGen, the Burken sisters have learned how to label, process and inventory specimens, interacted with pharmacists and assisted with study recruitment activities and data collection.



Sisters in science: Olivia and Mya Burken.



Students present at Show Me Research Week.

SHOW ME RESEARCH WEEK

From April 17-21, nearly 500 students and postdoctoral fellows presented their research and creative activity at the inaugural Show Me Research Week. A collaboration between Bond Life Sciences Center and the Office of Undergraduate Research, the week celebrated MU students as creators, innovators, problem solvers and thinkers through professional development sessions, a visual arts and design showcase, keynote speakers, the Spring Research and Creative Achievements Forum, student presentations and more.

UNDERGRADUATE RESEARCH STARS

Forty-three MU students received MizzouForward Undergraduate Research Training Grants for independent research investigations in STEM and NSF-supported fields. The one-year grants include up to \$5,000 per year in salary support for the students to enhance their graduate school applications. The grants are funded as part of

the MizzouForward initiative, which includes increased support for undergraduate research.

FULBRIGHT AWARD WINNERS

Five students — **Maya Ganapathy**, **Caitlin Kelleher**, **Roselena Kristine Rodriguez**, **Amber Spriggs** and **Olivia Watson** — earned Fulbright scholarships. The Fulbright U.S. Student Program provides funding for recent graduates, graduate students and young professionals to undertake research, study or teach abroad. The prestigious program aims to promote cross-cultural exchange and mutual understanding between the U.S. and other countries.

UNRAVELING THE SECRETS OF COLORECTAL CANCER

Kameron Hahn spent three months in Germany researching colorectal cancer through the DAAD RISE Germany scholars award program. A junior biological sciences major and Honors College student, his project focused on the role of PDGF — a growth factor protein — in colorectal cell

invasion. These findings can potentially help develop new treatments to slow the cancer's spread. His daily lab responsibilities included culturing and collecting cells for protein and RNA extraction, running Western blots for protein analysis and analyzing gene expression.

KICKSTARTING BRIGHT IDEAS

Three graduate students won Mizzou's annual Entrepreneur Quest competition. The program helps students develop their business ideas into viable companies, and winners receive up to \$15,000 to take their ventures to the next level. Parker's Brick Builds won first place. Created by **Parker Owens**, a third-year law student, his business uses LEGO-style blocks to create customized build kits. **Lauren Compton**, a nursing doctoral candidate, came in second for her freeze-dried breast milk service, and **Jia Wu**, a textile and apparel management doctoral student, placed third for her business creating sustainable period underwear for people with disabilities.



A choir from the MU College of Arts and Science performs during the Center for the Humanities launch.

ADVANCING HUMANITIES RESEARCH AND COLLABORATION

The College of Arts and Science launched its new Center for the Humanities to advance humanities research, collaboration across disciplines and public scholarship. Generating more interdisciplinary research among humanists, artists and scientists is a major focus of the center, along with deepening the intellectual exchange of scholars and students who study art, history, identity, literature, culture and other humanities. Another priority for the center is connecting with the public through community outreach and research.

NEW INSTITUTE TEACHES STEWARDSHIP OF FRAGILE ECOSYSTEMS

MU, in collaboration with the Missouri Conservation Heritage Foundation and the Missouri Department of Conservation, established the Johnny Morris Institute of Fisheries, Wetlands and Aquatic Systems within the College of Agriculture, Food and Natural Resources. The new institute will train the next generation of environmental scientists, researchers and conservationists and serve as a national center of research, knowledge and best management practices impacting fisheries, wildlife, wetlands and aquatic systems.

Strategic Proposal Development Service

- 91 proposals submitted to federal sponsors, including DOD, DOE, EPA, NIH, NIST, NSF and USDA.
- \$100+ million awarded as of Dec. 31, 2023.

Information Technology Research Support Solutions

- Hellbender, a high-performance computing and data storage environment.
- Arculus, a cybersecurity tool for Controlled Unclassified Information.

The Connector and Professional Development

- 153 people received one-on-one consultations.
- 143 participated in programs that provided sustained support and training.
- 413 attended 11 how-to workshops.

Accelerate Your Research Week

- 175+ attended.
- 20 workshops and panels.
- 10 federal funding agency program officers.

Community engagement

- 803 people attended 12 Extra Credit films with researcher panel discussions.
- 600+ for Columbia Young Scientist Expo.
- 65 explored fossils at Mizzou Rocks day camp.

2023 HIGHLIGHTS

THE DIVISION OF RESEARCH OFFERS SEVERAL RESOURCES TO SUPPORT MU RESEARCHERS AND SCHOLARS IN THEIR ENDEAVORS.

SPURRING AND SHARING DISCOVERIES

The [Connector](#) team provides programming, resources and professional development to help researchers increase their skills and productivity, show how their work benefits society and engage the public.

ACCELERATE YOUR RESEARCH WEEK

The inaugural event offered 20 workshops and panels, including one-on-one consultations and presentations led by 10 federal funding agency program officers, to help MU researchers and scholars charge their endeavors and develop the quality of their proposals and submissions.

ELEVATING FUNDING SUCCESS

The [Strategic Proposal Development Service](#) team provided researchers with a wide range of support, including grant proposal management, narrative development, editing, budgeting and illustrations.

SUPERCOMPUTING EMPOWERS RESEARCHERS TO GO FURTHER, FASTER

The [Information Technology Research Support Solutions](#) team (ITRSS) continued developing next-generation solutions for investigators. ITRSS is part of the Mizzou Forward initiative and an associated \$7 million investment to develop computing resources and strengthen the university's research data ecosystem.

On the back cover

Christmas Tree Galaxy Cluster—credit: NASA, ESA, CSA, STScI, Jose M. Diego (IFCA), Jordan C. J. D'Silva (UWA), Anton M. Koekemoer (STScI), Jake Summers (ASU), Rogier Windhorst (ASU), Haojing Yan (University of Missouri)

Love is at the root of everything—all learning, all relationships painting by Linda Helmick



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