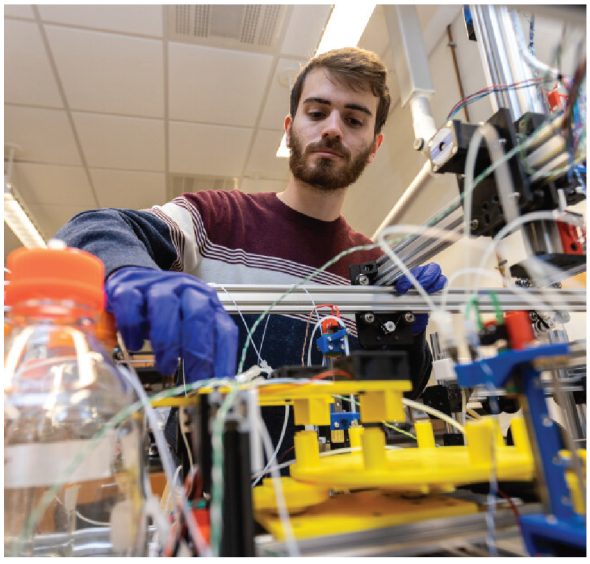
MIZZOU ENGINEERING



2023 Annual Report

Contents

DEAR FRIENDS,

As you will see in this report, it's an exciting time for Mizzou Engineering! Our researchers this past year tackled tough challenges around energy, health care, public infrastructure, sustainability and more, making innovative discoveries that will advance real-world solutions. Our students gained valuable engineering and leadership skills through research, organizations and internship experiences. And, we grew in terms of student enrollment, faculty numbers and research expenditures.

In the coming years, we will expand our physical footprint on campus, adding a new Center for Energy Innovation in partnership with the College of Arts & Science and the College of Agriculture, Food & Natural Resources. This building will allow experts from across campus to solve society's most complex problems through interdisciplinary collaborations.

The key to our success is a wholehearted focus on our people, and we provide faculty and students with unparalleled opportunities. We aim to inspire every Mizzou Engineer to be leaders in their fields, which is evident in the numerous faculty, student and alumni awards we celebrated this year.

It takes all of us working together to engineer a better world. Thank you for your continued friendship and partnership.

Praveen Edara

Praveen Edara
Interim Dean
College of Engineering

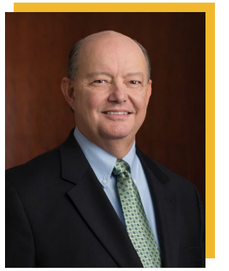
Dean's Advisory Council

The Dean's Advisory Council (DAC) is a group that serves as champions for the University of Missouri College of Engineering. It is comprised of several of the College of Engineering's most prominent alumni.

Co-Chair
Jim Fitterling
Dow Inc., Chair & CEO
B.S. ME '83

Co-Chair
Chih-Hsiang (Thompson) Lin
Applied Optoelectronics Inc. (AOI), Founder, Chairman & CEO
B.S. ME '83, M.S. EE '90, Ph.D. EE '93 (B.S. from National Tsing Hua University – Taiwan)

Mike Brown
Euronet Worldwide, Chairman, President & CEO
B.S. EE '79 (M.S. from UMKC '97)



Steve Edwards
Black & Veatch, CEO (Ret.)
B.S. EE '78

Brian Howard
North Fulton Plastic Surgery, President, Owner (Ret.) M.D.
B.A. Bio Sci '86 (M.D. from University of Rochester, M.B.A. from Emory University)

Kelly King
AT&T, Executive Vice President
B.S. ME '90 (M.B.A. from SLU)

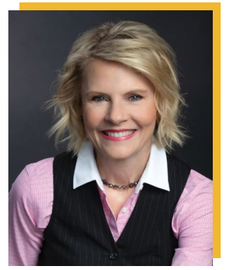
Ray Kowalik
Burns & McDonnell, CEO
B.S. CiE '85, M.S. CiE '99

Sharon Langenbeck
NASA Jet Propulsion Lab, Project Element Manager (Ret.)
B.S. ME '74, M.S. ME '76, Ph.D. ME '79

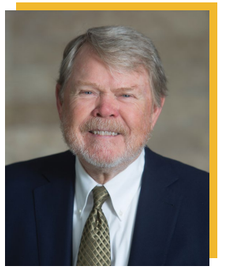
Michael Melton
MEM Enterprises Group Founder and President and CEO
B.S. EE '81, J.D. '84

Jim O'Neill
Boeing, President, Boeing Defense Space & Security Development & St. Louis Sr. Executive (Ret.)
B.S. Civil '81, M.S. Civil '82

David Payne
PayneCrest Electric and Communications, CEO
B.S. EE '83



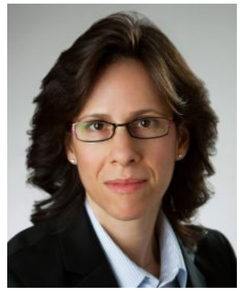
Christine Pierson
CEO of LTA Manufacturing
B.S. IE '85 (M.B.A. from Rockhurst University)



Ron Wood
Black & Veatch, President & CEO (Ret.)
B&V Energy
B.S. EE '64

ENGINEERING LEADERSHIP

Roger Fales
Associate Dean of Student Services and Academic Programs



Roseanna N. Zia
Associate Dean for Research
Dave Wollersheim Professor of Mechanical & Aeropspace Engineering

Kevin Gillis
Chair
Chemical & Biomedical Engineering (ChBME)

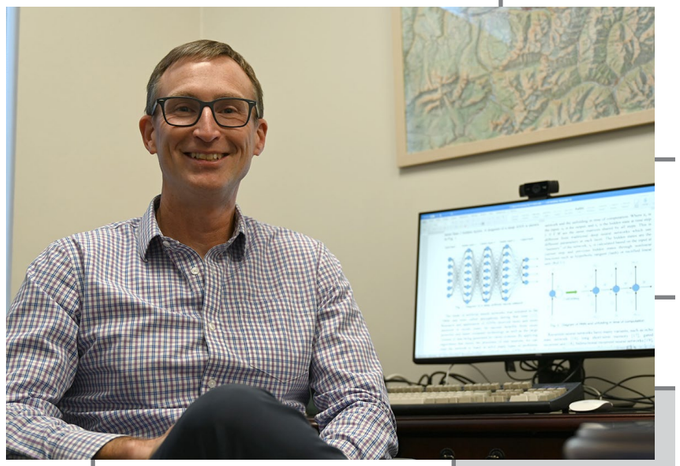
Praveen Edara
Chair
Civil & Environmental Engineering (CEE)

Syed “Kamrul” Islam
Chair
Electrical Engineering & Computer Science (EECS)

Hani Salim
Interim Chair
Engineering & Information Technology (EIT)

James Noble
Chair
Industrial & Systems Engineering (ISE)

Hongbin “Bill” Ma
Chair
Mechanical & Aerospace Engineering (MAE)

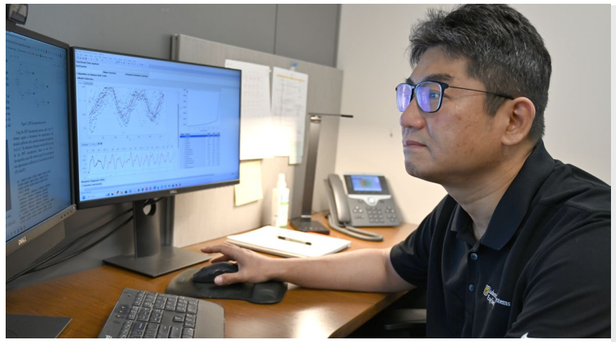


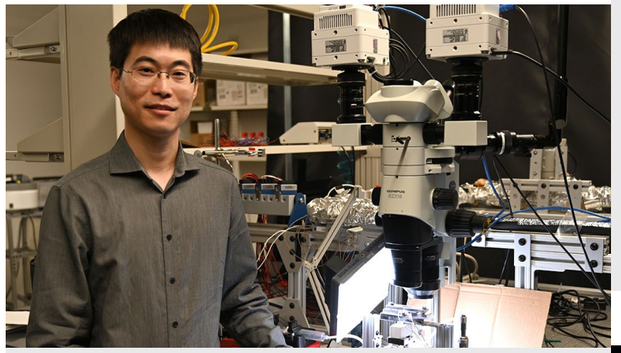
MEET ROGER FALES | Roger Fales serves as associate dean of student services and academic programs.
Fales specializes in dynamic systems and control, especially as it applies to medical devices. His work has included groundbreaking models of the response of premature infants to oxygen therapy, automation of oxygen control in respiratory support, and algorithms designed to predict blood oxygen saturation levels for babies in respiratory distress. He and collaborators are developing a device that automatically adjusts oxygen levels for extremely premature babies. The project, which includes a clinical trial, is funded by the National Institutes of Health, and Fales is part of a company that has optioned to license the technology.
Fales was named associate dean in 2021. On his watch, the College appointed three Inclusivity, Diversity and Equity Fellows and formed an IDE Alumni Advisory Council. He’s also implemented numerous student initiatives such as a new first year engineering program that includes peer mentoring.

MEET ROSEANNA N. ZIA | Roseanna N. Zia joined Mizzou Engineering as Associate Dean for Research and the inaugural Dave Wollersheim Professor of Mechanical and Aerospace Engineering in January.
Zia graduated from Mizzou Engineering in 1995 and spent several years in leadership roles in the automotive industry before returning to academia. She earned a Ph.D. at CalTech and worked at Cornell before earning tenure at Stanford.
In her role as ADR, Zia aims to grow the research ecosystem of Mizzou Engineering, including expanding research in Energy & Sustainability, Geospatial Technology & Cybersecurity, Advanced Materials, BioTechnology, AI/Autonomous Systems, and On & Off Planet Structures, Machines and Systems.
Zia researches colloidal gels, glasses and suspensions. The Zia Lab was the first to accurately model a spherically confined colloidal suspension using large-scale modeling. This past year, she received funding from the Alfred P. Sloan Foundation’s Matter-to-Life Program to expand upon that work.

EXPLORING THE FUTURE OF ENERGY

COOLING THE PUMPS | ISE A Mizzou Engineering team has devised a technique to allow nuclear power plants to monitor reactor coolant pumps more closely, allowing plant operators to flag abnormalities before they become problems.
Assistant Professor Kangwon Seo and Benjamin Oguejiofor, a Ph.D. student, hope the method provides a blueprint that power plants can ultimately implement to better safeguard reactor pumps. The novelty of the technique is that it utilizes wavelets to decompose vibration signals the reactor coolant pumps produce. Those individual wavelets then separate and are analyzed for abnormal vibration patterns and peaks. This allows plants to ensure their pumps and other rotating equipment are working properly within their specific environments.
“If a plant has safety issues, it could also impact communities and states,” Seo said. “So it’s very important to monitor what’s happening in a nuclear power facility.”





MEETING ENERGY DEMANDS | MAE
Since joining Mizzou Engineering last fall, Assistant Professor Yue Jin has become director of the Advanced Flow and Heat Transfer Lab, where his team works to advance technology to solve climate challenges and meet growing clean energy demands. He’s studying fluid flow and heat transfer behavior spanning different scales and alternatives to water, such as liquid metals and molten salts, that can be used as cooling agents in power generation and energy conversion systems.
This past semester, Jin received two grants for his work. With funding from MU’s Research Council, he is developing an innovative model that combines physics-based principles and data-driven techniques to predict crucial heat flux (CHF).
A separate grant from the Nuclear Regulatory Commission, through Penn State, focuses on the study of droplet dynamics and two-phase flow heat transfer in the 7-by-7 rod assembly found in nuclear power plants using a specialized laser imaging test facility.

SUPERCRITICAL CO2 | MAE
In the atmosphere, carbon dioxide (CO2) is a gas known for its negative impact on the environment. But bring it to an unusual fluid state above critical pressure and temperature points, and this supercritical carbon dioxide allows energy and cooling systems to operate at very efficient conditions.
With funding from the U.S. Army, Associate Professor Chanwoo Park will extend research on unmanned aerial vehicle thermal management and advanced cooling systems for larger drones. The idea is to use supercritical CO2 to create lightweight and compact cooling systems that can dissipate the waste heat from UAVs more efficiently. Park’s device would be ideal for other aerospace applications, too, such as more efficient and compact cooling systems found on aircraft.

LED LIGHTING | EECS
Assistant Professor Peifen Zhu has found a way to improve light-emitting diodes (LEDs), reducing the harsh blue hue associated with LED light fixtures. Supported with a Faculty Early Career Development (CAREER) Award from the National Science Foundation, Zhu develops materials that can be used to replace incandescent light bulbs, which are inefficient, and florescent lights that use mercury.
In a recent paper, published in Advanced Functional Materials, Zhu and colleagues used computational and experimental methods to study the property of semiconductors to improve LED performance. They found that the compound perovskite nanostructures can be used to enhance the color quality, shifting the blue toward green hues, and to improve the stability of emissions. Ultimately, she hopes the research will lead to efficient, environmentally friendly lighting technologies that are also affordable to manufacture.

SECURING A SUSTAINABLE FUTURE

BREAKING DOWN PFAS | CEE In a recent study, Associate Professor Feng "Frank" Xiao and colleagues demonstrated an innovative method using thermal induction heating to rapidly break down PFAS left on the surface of granular activated carbon and anion exchange resins after these materials have been used to filter PFAS from municipal water systems. The team's goal is to clean the materials before they are properly disposed.

PFAS is a group of synthetic chemicals found in household and industrial products such as firefighting foam, food packaging and nonstick cookware. Xiao was one of the first to warn that PFAS, or "forever chemicals," can cause health problems. While they can be filtered using adsorbents, the disposal of those adsorbents creates other contamination in the environment. Xiao's method produced 98% degradation of PFAS on the surface of absorbents after just 20 seconds, which makes this process highly energy efficient and much faster than conventional methods.

PUTTING THE BRAKES ON POLLUTION | CEE Plastic pollution can become a vehicle that transports toxic metals into our water. Assistant Professor Maryam Salehi is investigating the mechanisms behind this relationship in hopes of mitigating harmful effects.

Salehi brings to Mizzou a National Science Foundation Early Career Development (CAREER) Award for work around plastic pollutant fate and heavy metal transport. One specific area of her research is whether plastic pipes are truly a sustainable option. While they don't corrode, they can be problematic in that they become a resting site for metals from connecting lines.

Salehi also studies how plastic pollution transports contaminants. Once researchers understand the mechanics of the process, they can come up with mitigation plans to combat pollution.

HEAT-RESISTANT PLANTS | EECS
An inter-institutional research team is using the power of computational analysis to pinpoint which plant genes confer resilience against rising temperatures that threaten global food supplies in the coming decades.

Curators' Distinguished Professor Jianlin "Jack" Cheng is using deep learning to predict protein structures, collaborating with Dr. Ru Zhang, a plant scientist at the Danforth Plant Science Center in St. Louis, in the study of plant genes. Knowing how proteins in plants behave is critical to Zhang's ultimate goal of designing plants that can survive climate change.

In a recent joint paper, published in Plant, Cell & Environment, Cheng and Zhang, along with lead author Erin Mattoon, provide targets for engineering heat-tolerant plants. Using a type of green algae called Chlamydomonas, the team determined which genes are required for plants to grow under high temperatures.

MISSOURI WATER CENTER | CEE Now in its second year, the Missouri Water Center brings together researchers from engineering, agriculture, food and natural resources, along with community and industry partners and government agencies, to ensure water resources are managed with the shared goal of protecting our most valuable natural resource.

"Society has become complex, and technological solutions alone aren't enough," said Baolin Deng, professor and center co-director. "We want to bridge the gap so we can all address issues that are important to health and the environment and to ensure we have a sustainable society in which everyone benefits."

Because water issues are broad and complex, Deng, along with members of an advisory committee, have spent the past year prioritizing research focus areas. Initial priorities include developing new technologies to monitor water levels and predict changes; analyzing economic impacts such as flood damages to crops, farms and infrastructure; water quality monitoring and mitigation; improving communication with local communities; and training students to work on water-related issues. The Water Center received a $5 million federal appropriation this year to address these priorities.

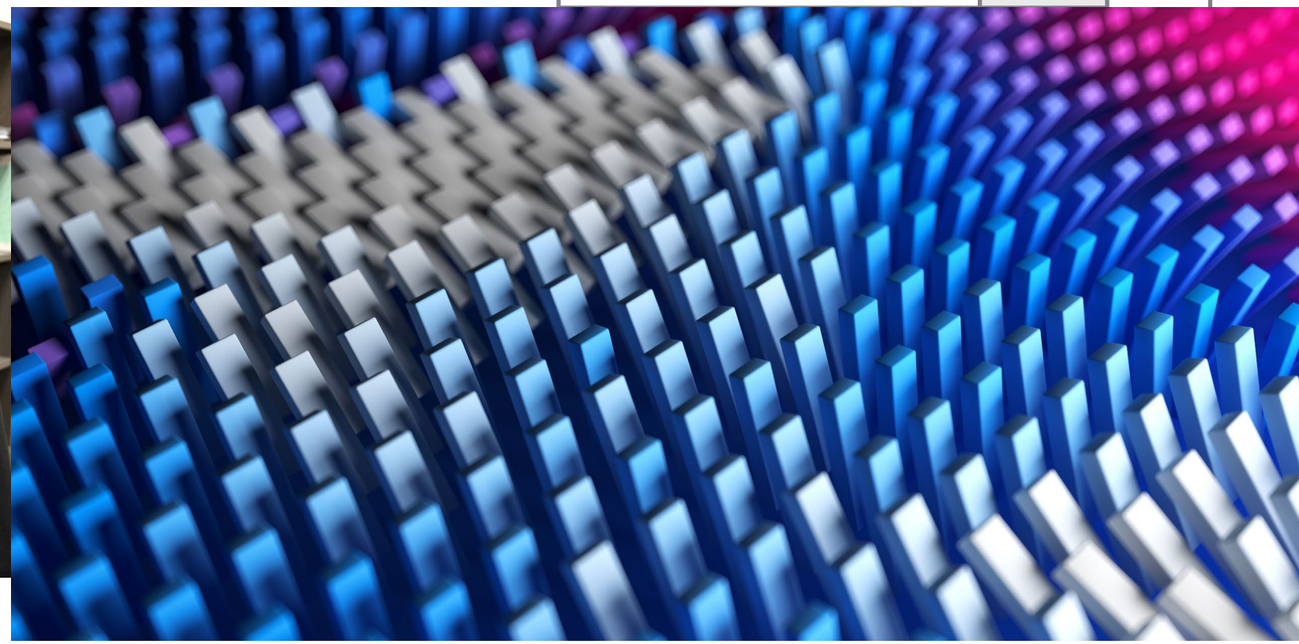
ADVANCING MATERIALS

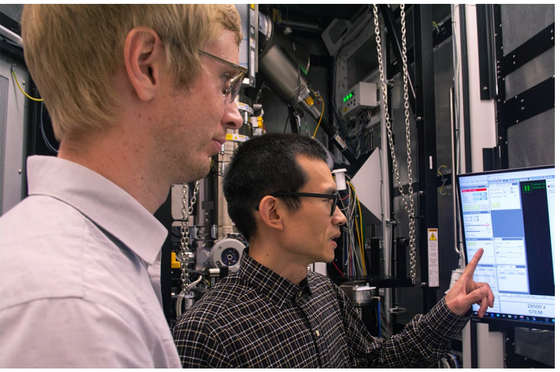
REVOLUTIONIZING HEATING AND COOLING | MAE A pioneer in oscillating heat pipe technology, Curators' Distinguished Professor Hongbin "Bill" Ma is turning his attention to making industrial and household appliances more energy efficient. At the heart of the work is a patent-pending condenser that could revolutionize heating and cooling systems. The condenser recovers moisture from vapor and recycles it within a system, ensuring heat stays where it should.

One such application is a new type of dryer that keeps heat inside the drum rather than exhausting it out of a vent. The heat is vaporized and reused, resulting in zero-loss energy. Ma envisions manufacturing industrial-sized dryers used for products such as cereals and grains, wood and coffee beans.

He's also using those same principles to design more efficient air conditioning units.

This summer, Ma was recognized with the Donald Q. Kern Award from the American Society of Mechanical Engineers (ASME) and American Institute of Chemical Engineers (AIChE) for his contributions to the field.





BUILDING BETTER BATTERIES | ChBME Assistant Professor Matthias J. Young received a $500,000 grant from the National Science Foundation to explore a key technical challenge preventing lithium-ion batteries from achieving optimal energy performance.

While solid-state lithium-ion batteries are considered to be the next big advancement in battery technology, these batteries continue to suffer from performance issues. The team believes the origin of this issue may occur at a key connection point on the battery.

The team will use thin film polymer coatings and a specialized electron microscope to introduce an engineering interface that will prevent undesired reactions while ensuring the battery charges and discharges quickly.

CHALLENGING NEWTON'S LAWS | MAE In a new study published in the Proceedings of the National Academy of Sciences (PNAS), Professor Guoliang Huang and colleagues developed a prototype metamaterial that uses electrical signals to control both the direction and intensity of energy waves passing through a solid material.

Potential applications of his innovative design include military and commercial uses, such as controlling radar waves by directing them to scan a specific area for objects or managing vibration created by air turbulence from an aircraft in flight.

"This metamaterial has odd mass density," Huang said. "So, the force and acceleration are not going in the same direction, thereby providing us with an unconventional way to customize the design of an object's structural dynamics, or properties to challenge Newton's second law."

This is the first physical realization of odd mass density, Huang said.

"For instance, this metamaterial could be beneficial to monitor the health of civil structures such as bridges and pipelines as active transducers by helping identify any potential damage that might be hard to see with the human eye."

SEMICONDUCTORS | ChBME, MAE

Mizzou Engineers have come up with a novel technique to design semiconductors. Matthias Young and Matt Maschmann outlined a proof of concept for their technique in Nano Select and have filed an application to patent the work. Now, they're hoping to scale up and optimize the process to make it viable in industry.

Rather than the traditional method—which allows liquid to fill specific areas similar to stencils—Young and Maschmann are using an electron beam as a "pencil" to write the patterns exactly where they want them. And they're doing that work in a low-pressure water vapor, dissociating water molecules in collisions with the electron beam. One byproduct of the reaction is hydroxyl molecular groups, the initial layer of chemical functionalization needed for atomic layer deposition.

CONTROLLING CNTS | EECS, MAE

Mizzou Engineering researchers are closer to controlling the properties of carbon nanotubes growing in mass quantities. Carbon nanotubes (CNTs) are nanoscale cylindrical carbon molecules that have unique electric, mechanical and thermal properties, making them flexible, lightweight and strong.

While optimal CNT properties are readily observed for an isolated CNT, properties are significantly degraded when they are synthesized en masse. Simultaneously growing CNT forests interact and entangle in ways that are not fully understood with the net effect of modulating their collective properties.

In a recent paper, Associate Professor Matt Maschmann and co-authors outlined a deep learning technique to segment carbon nanotube forests in scanning electron microscopy (SEM) images. This technique allows them to detect individual CNTs within a forest which can help eventually characterize their properties.

TINY EXPLOSIONS, BIG POSSIBILITIES | EECS, MAE

A Mizzou Engineering team has provided direct evidence of a localized explosion of an aluminum nanoparticle, a mechanism first theorized in 2006.

"This reaction mechanism has been proposed for over a decade but hasn't been clearly observed experimentally until now," Associate Professor Matt Maschmann said. Maschmann and Professor Shubhra Gangopadhyay outlined their observation of spallation of isolated aluminum nanoparticles by rapid heating in the journal of Applied Materials & Interfaces.

In short, this nanoscopic explosion means researchers can control the release of a large amount of energy in a small, localized area. That energy could be used in applications such as biomedical treatment, material processing and energy storage.

"The energy contained in this material amounts to more than traditional explosives like TNT," Gangopadhyay said. "There's a lot of interest in this so-called nano thermite."

BETTER PARTICLE ACCELERATORS | EECS, MAE

If Mizzou Engineers are successful, the price tag of particle accelerators could drop dramatically. Furthermore, smaller particle accelerators could be more easily manufactured for medical and commercial applications.

Professor Scott Kovaleski and Associate Professor Matt Maschmann, believe carbon nanotubes could provide an affordable alternative to conventional radiofrequency generation.

"If we can move to carbon nanotubes, the manufacturing process starts to look like it does for semiconductors and computers, which obviously have gotten cheaper over time," Kovaleski said.

Kovaleski will test Maschmann's CNT samples in an experimental environment to identify the parameters that best perform. Then, partners at Stanford Linear Accelerator Center will test them in the field.

MUMSEI | MAE

Since opening a year ago, the MU Materials Science & Engineering Institute (MUMSEI) has had a lot of tangible successes. New research teams have formed to study semiconductor design, water purification, next-generation computing and other topics critical for the advancement of society.

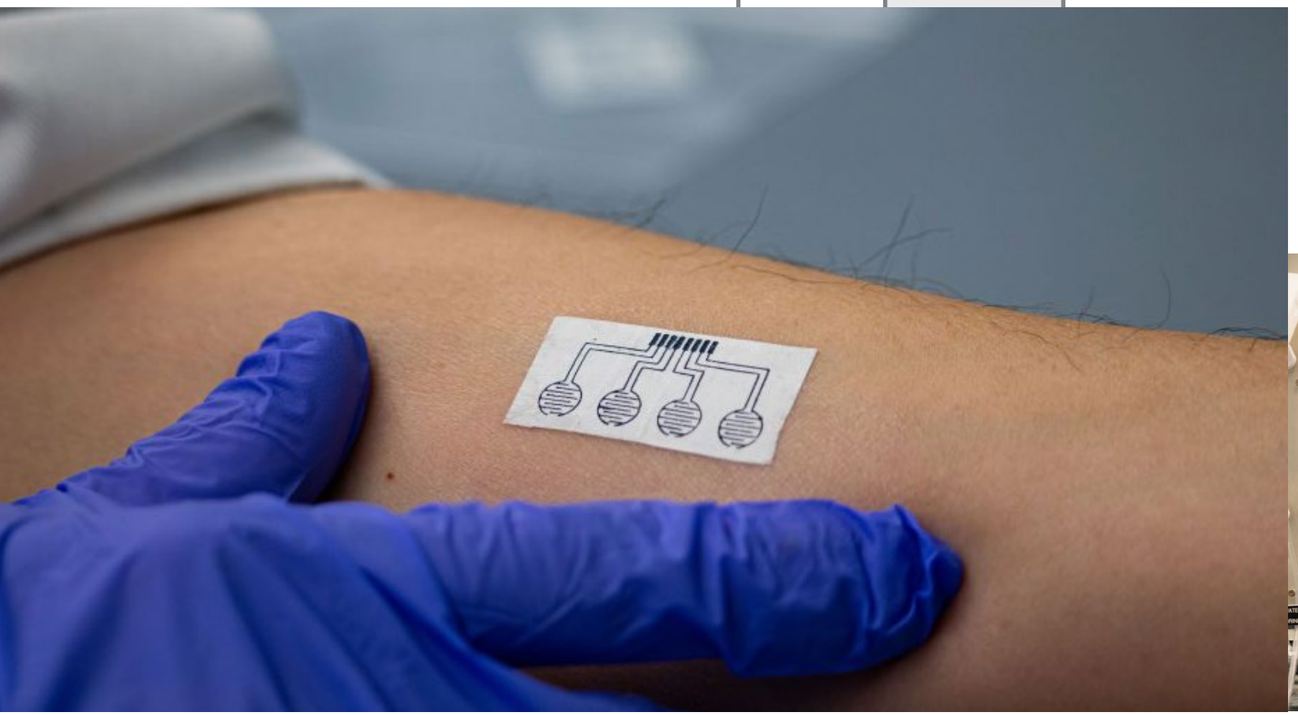
Highly sophisticated in-situ transmission electron microscope tools have been secured as part of a National Science Foundation MRI grant. There's even anecdotal evidence that new faculty hires have come to Mizzou, in part, because of the institute's interdisciplinary opportunities.

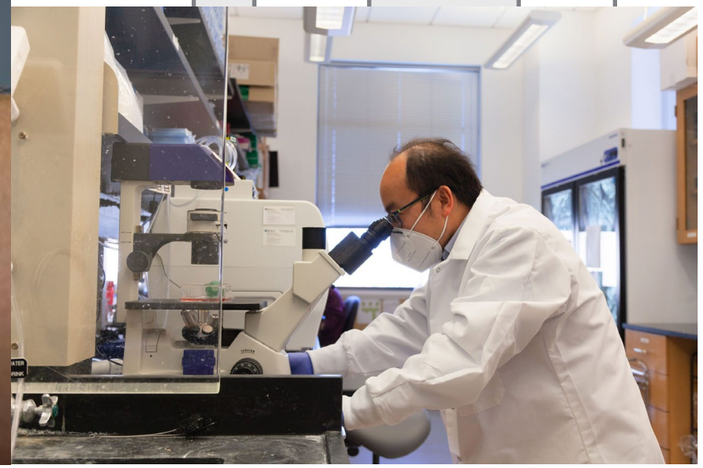
MUMSEI is a shared resource, a partnership between Mizzou Engineering and the College of Arts & Science. Affiliated faculty represent all aspects of engineering, as well as physics and astronomy, chemistry, geological sciences, medicine and anthropology.

"We're bringing people together with complementary expertise so we can tackle tougher problems and have more impact," said Associate Professor Matt Maschmann, who co-directs the institute with Curators' Distinguished Professor Tommy Sewell. "We're tackling problems we couldn't have taken on otherwise because they require multi-pronged solutions that go beyond any one individual's capacity."

So far, MUMSEI has provided seed grants to six projects, including research on ice lithography and quantum materials that support faster and smarter computer systems.

CHANGING LIVES

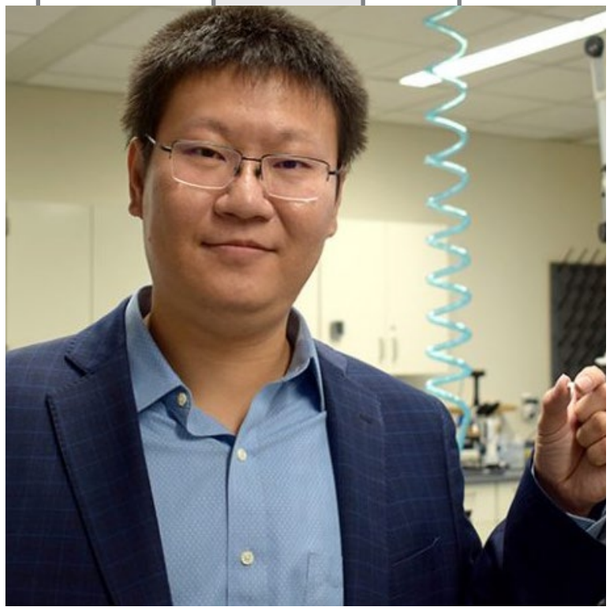




TRACKING COVID | EECS
Curators' Distinguished Professor Xiu-Feng "Henry" Wan has received a $5 million grant from the U.S. Department of Agriculture to investigate how SARS-CoV-2 impacts various species of animals and whether those animals might send new variants of the virus back to us.
Wan is director of the NextGen Center for Influenza and Emerging Infectious Diseases with joint appointments in engineering, medicine and veterinary medicine and is a primary investigator at the Bond Life Sciences Center.
With the three-year USDA grant, Wan and his team will take a closer look at how SARS-CoV-2 affects certain species of wildlife, especially those with potential interactions with humans, such as deer, elk, large cats, swine, birds and rodents.

WEAR AND FORGET | ChBME, MAE Associate Professor Zheng Yan has created an ultrasoft "skin-like" material — that's both breathable and stretchable — for use in the development of an on-skin, wearable bioelectronic device capable of simultaneously tracking multiple vital signs such as blood pressure, electrical heart activity and skin hydration.
"Our overall goal is to help improve the long-term biocompatibility and the long-lasting accuracy of wearable bioelectronics through the innovation of this fundamental porous material which has many novel properties," Yan said.
Made from a liquid-metal elastomer composite, the material's key feature is its skin-like soft properties.
"It is ultrasoft and ultra-stretchable, so when the device is worn on the human body, it will be mechanically imperceptible to the user," Yan said. "You cannot feel it, and you will likely forget about it. This is because people can feel about 20 kilopascals or more of pressure when something is stretched on their skin, and this material creates less pressure than that."

LONG COVID | EECS In a new study, a team of University of Missouri researchers made an unexpected discovery: people experiencing long-lasting effects from COVID-19 are susceptible to developing only seven health symptoms for up to a year following the infection. They are: fast-beating heart, hair loss, fatigue, chest pain, shortness of breath, joint pain and obesity.
To develop their findings, the team reviewed real-world data from electronic medical records containing de-identified information for medical research purposes.
"Despite an overwhelming number of long COVID symptoms previously reported by other studies, we only found a few symptoms specifically related to an infection from SARS-CoV-2, the virus that causes COVID-19," Professor Chi-Ren Shyu said. "Before we examined the data, I thought we would find an ample amount of the symptoms to be specifically associated with long COVID, but that wasn't the case."



PROBING BRAIN ACTIVITY | ISE

Assistant Professor Yi Wang is working with collaborators to fabricate and provide neuro microelectrodes that can be used to further research around brain activity.

Wang is using hybrid manufacturing, including 3D printing and MEMS [micro-electro-mechanical systems] technology to fabricate high-resolution neuro microelectrodes. 3D printing allows researchers to save time and money while customizing electrodes for different neuroscience studies. In the coming years, his research focus will be on fabrication of multifunctional neuro microelectrodes to record neural activities and detect neural chemicals and transmitters.

Ultimately, these studies can lead to improvements in medical treatments, as well as brain-machine interactions.

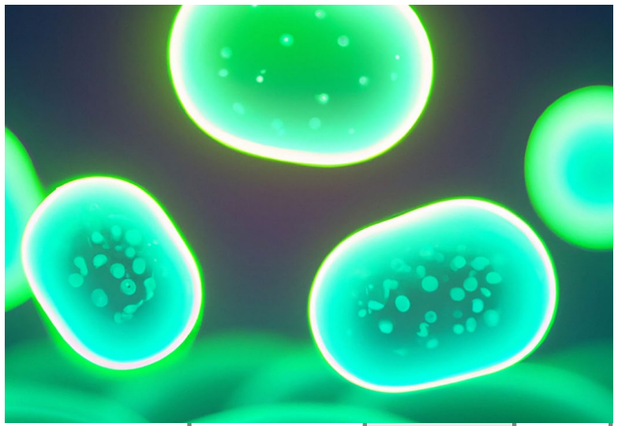
FLUORESCENT BIOMARKERS | ChBME

A Mizzou research team is devising a new tool to find what happens at the molecular level during adrenaline rushes.

Kevin Gillis, chair of the Department of Chemical and Biomedical Engineering, is working with Professor Tim Glass from the Department of Chemistry on the research, which is funded with a grant from the National Science Foundation.

Specifically, they're developing a method to follow biological activity using fluorescent molecules. These specialized molecules are similar to green fluorescent proteins in that they serve as biomarkers, however they're advantageous in that they are smaller and less intrusive than proteins.

Glass, an organic chemist, makes the molecules in his lab. Gillis then uses them to study secretion from cells of adrenal glands.



DRUG DELIVERY INNOVATIONS | ChBME

Professor Raghuraman Kannan and collaborators received a $2.35 million grant from the National Cancer Institute (NCI) to generate preclinical data based on their existing research investigating why lung cancer patients develop a resistance to drug therapy.

Kannan said their approach combines a biological process called RNA interference (RNAi) with protein-based nanoparticles. The nanoparticles will help safely deliver the RNA to the cancer tumor and cause the resistance to stop. This, in turn, will allow the cancer to be more responsive to the efforts of the original drug therapy.

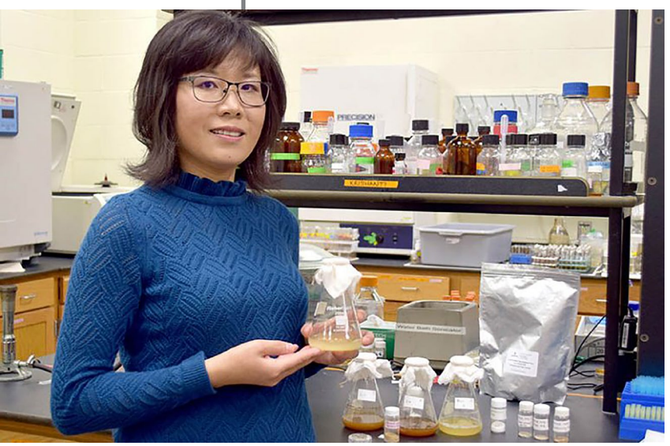
Kannan has created similar nanoparticle-based drug delivery methods to develop treatments for ovarian, breast, pancreatic and liver cancers. He has written more than 55 papers and holds seven patents. He said his ultimate goal is to make his work more accessible, so doctors can use it to help more patients.

C2SHIP | EECS

Mizzou has become the fifth university to join the Center to Stream Healthcare in Place (C2SHIP), a National Science Foundation (NSF) consortium focused on helping patients monitor and manage their health at home.

Marjorie Skubic, a Curators' Distinguished Professor Emerita in Electrical Engineering and Computer Science, and co-principal investigators, were awarded NSF funding to lead the effort. Skubic and her team develop sensors that can detect fall risks, bed sensors that monitor vital signs and other devices that allow patients to track health issues while aging in place. Her goal is to make innovative Care-in-Place technology available by working with industry partners to accelerate commercialization.

ADDRESSING FOOD AND WASTE



BIODEGRADABLE PLASTIC | ChBME A Mizzou Engineer is helping researchers at Virginia Tech develop a process to convert food wastes into biodegradable plastics.

Associate Professor Caixia "Ellen" Wan is part of a team that received a $2.4 million grant from the U.S. Department of Agriculture (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.

Wan will convert different categories of food wastes, such as vegetables, bread and meat, using microorganisms that can process various substrates into polyester biopolymers for plastic materials.

ZERO HUNGER | ChBME Assistant Professor Kiruba Krishnaswamy is an ambassador of multipronged approaches for a Zero Hunger World, one of 17 Sustainable Development Goals set forth by the United Nations.

Current projects in her Food Engineering and Sustainable Technologies (FEAST) Lab include extracting vitamins and minerals from acid whey. She's also looking at food loss prevention of ancient seed grains like millets and adding value to native fruits.

This past spring, she was invited to be part of the AAAS Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics, hosted by the American Association for the Advancement of Science and the National Science Foundation. More than 2,000 students from around the world attended the conference in Washington, D.C.

FOOD SAFETY | EECS Associate Professor Mahmoud Almasri and collaborators received a $750,000 award from the National Science Foundation to develop new techniques that will detect foodborne pathogens with a goal of improving food safety. It's part of the NSF's Convergence Accelerator program's food and nutrition security track.

The team is developing a sensor-enabled food supply chain decision-support system to assess and mitigate Salmonella risks and multidimensional threats to the food supply chain to improve health equity. The sensing technologies are unique in that they can identify and detect low concentrations of Salmonella within a 30-minute time span. By combining results from samples throughout the food supply chain and integrating national population-level data, the system will populate a centralized database to assess, visualize and predict risks.

OPTIMIZING OUR WORLD

LAST MILE DELIVERY | ISE When you order something online, shipping fees can be hefty as companies try to recoup the cost of delivering the product to your doorstep. To help offset some of those so-called "last-mile" expenses, a Mizzou Engineering team is developing a tool that will allow delivery companies to best optimize routes using electric vehicles and drones.

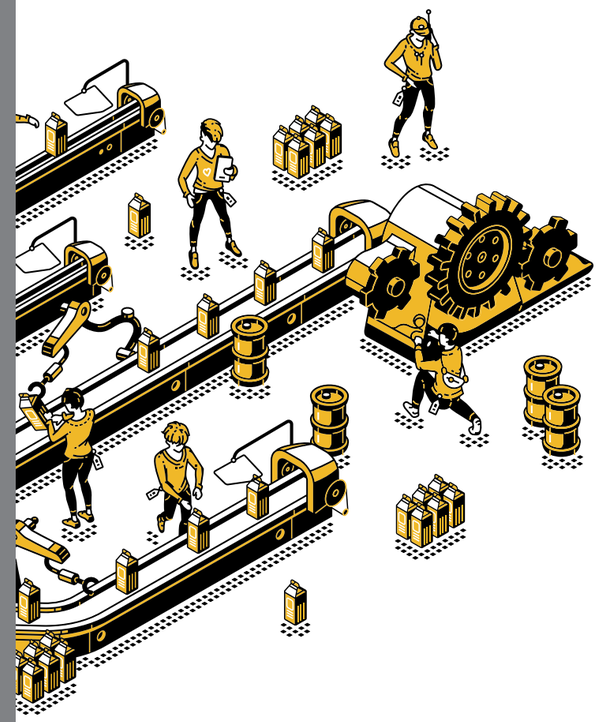
The demand for last-mile delivery is expected to grow over 75% by 2030 and is mostly driven by e-commerce growth. Without intervention, such growth is expected to increase traffic congestion and greenhouse gas emissions by 30%, Assistant Professor Sharan Srinivas said.

Srinivas and Arash Alizadeh, a Ph.D. student, are moving forward with plans to commercialize their system with help from the National Science Foundation's I-Corps.

As part of I-Corps, the team interviewed more than 100 truck drivers, logistic managers, drone operators and executives from companies such as Amazon, Workhorse, FedEx and UPS to ensure their proposed technology will meet industry needs.

Srinivas said one of the main questions was to explore the customer pain points with respect to existing route optimization platforms. While current platforms work well for gasoline-powered vehicles, they were not designed to consider factors related to electric vehicles and drones.

The new platform, called RoutePEARL, takes into consideration factors unique to emerging delivery fleets while also prioritizing safety. First, the platform considers whether a truck will drop an item off at its destination or if it would be more efficient to assign a drone to make the last-mile stop. RoutePEARL also considers the order in which trucks and drones should make stops. Third, it determines the sequence that drones should be deployed to avoid a potential collision. Finally, because drones must be able to communicate back to drivers, RoutePEARL optimizes routes that ensure network connectivity.



BLOOD SUPPLY CHAINS | ISE

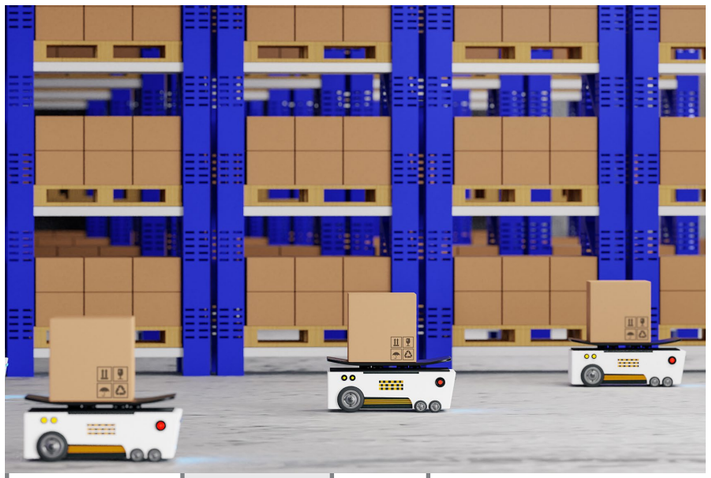
Blood supply chains can be complicated. On one hand, healthcare providers must make sure they have enough to meet demands, which can be unexpected. On the other hand, roughly 20 million donated platelets are discarded each year because they expire before they're needed.

Suchi Rajendran, an assistant professor of industrial and systems engineering, has been working on this problem for more than a decade.

In her latest paper, published in Healthcare Analytics, she's devised a system that could customize solutions based on optimizing multiple criteria. The goal of the paper is to take conflicting factors into consideration to provide the best compromised solution.

Rajendran's analytics also take into consideration the cost of transporting blood units from blood banks to hospitals and other providers.

It's believed to be one of the first papers to consider multiple objectives in the blood supply chain.



MAKING ROBOTS SMARTER | ISE Assistant Professor Sharan Srinivas is working to speed up the online delivery process by developing a software model designed to make "transport" robots smarter. The goal is to better utilize existing technology through efficient planning.

"To do this, we're asking questions like 'given a list of items to pick, how do you optimize the route plan for the human pickers and robots?' or 'how many items should a robot pick in a given tour?' or 'in what order should the items be collected for a given robot tour?' " Srinivas said. "Likewise, we have a similar set of questions for the human worker."

The proposed model will help create faster fulfillment of customer orders by optimizing the key decisions or questions pertaining to collaborative order picking, Srinivas said.

TRANSPORTATION INNOVATION

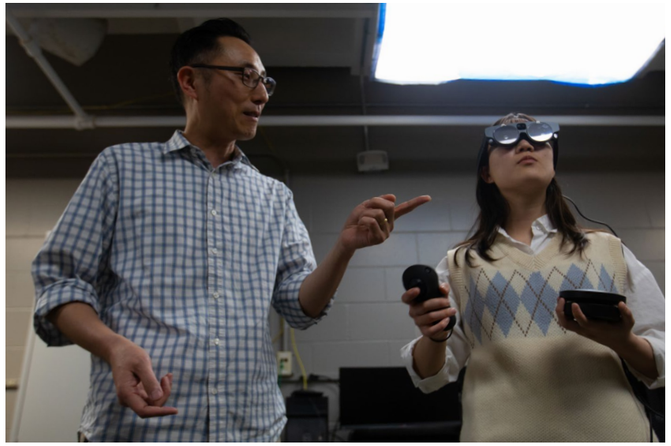
RECYCLED ROADS | CEE Mizzou Engineers are using recyclables as a sustainable solution to fix America's fracturing road system.
In partnership with the Missouri Department of Transportation (MoDOT), researchers from the Mizzou Asphalt Pavement and Innovation Lab (MAPIL) created a real-world test road using recycled materials such as scrap tires and plastic waste along a portion of Interstate 155 in Missouri. By increasing the sustainability of asphalt mixes, this innovative method can help reduce the number of items going into landfills or leaking into the environment, said Bill Buttlar, director of MAPIL and Glen Barton Chair in Flexible Pavements.
The I-155 project will evaluate the real-world effectiveness of nine different types of recycled materials in the creation of asphalt pavement.

WORK ZONE SAFETY | CEE Using a self-driving truck to follow a manned vehicle has the potential to reduce worker injuries in mobile work zones, a Mizzou Engineering team has concluded.
Moving work zones such as pavement striping typically involve a series of vehicles, with the last truck at most risk of being in a wreck.
Research engineer Henry Brown's goal is to eliminate worker injury by eliminating the need for a driver in the last vehicle, instead pairing the two trucks so that the second vehicle can follow GPS crumbs from the vehicle in front of it.
In an unrelated study, Assistant Professor Yaw Adu-Gyamfi developed an alert system that warns drivers when they're in danger of colliding with a mobile work zone vehicle. By utilizing both a mounted camera and lidar, the alert system automatically assesses a vehicle's speed and distance. If the system detects risky behavior, it automatically triggers flashing lights to warn the driver. If corrective action is not taken, a horn will sound.

CRASH DATA | CEE Praveen Edara, interim dean and chair of civil and environmental engineering, and collaborators have developed realistic artificial data sets (RAD) that can be used to train machines to predict the factors that cause wrecks. These data sets are now available through the U.S. Department of Transportation. The three-year $1.1 million project was supported by the U.S. DOT's Exploratory Advanced Research Program.
The RAD data sets provide a baseline of crash data that can be used to develop algorithms to predict crashes. The datasets were created based on actual crash data and literature, identifying factors contributing to crashes from various data sources and the impact of each contributing factor on crash frequency.
In addition, researchers also developed virtual reality simulation test beds that use videos of real crashes captured by in-vehicle and external cameras. By analyzing these videos, researchers created virtual data sets that offer insights into crash events.

EXPLORING EMERGING TECHNOLOGIES

WEATHER IN VR | EIT Meteorology students were able to step inside 3D virtual reality (VR) models of weather systems this past year, thanks to a collaboration with Mizzou Engineering.
Associate Teaching Professor Fang Wang (pictured left) worked with cross-campus faculty to provide the immersive experience through the CAVE. Located in the Cyber Education, Research and Infrastructure Center at Mizzou, the CAVE consists of adjustable walls and motion sensors that track movement to provide an immersive VR environment. It was funded by the National Science Foundation.
Wang and Mizzou faculty Eric Aldrich and Xinhao Xu combined their expertise in meteorology, virtual and augmented reality and mixed-reality-based learning environments to help students gain a deeper understanding of mid-latitude cyclones, which are complicated systems that help drive most of the stormy and severe weather in the continental United States.
“This has been the perfect partnership,” said Aldrich, an assistant teaching professor in the College of Agriculture, Food & Natural Resources. “This technology is a game changer for our program.”



BRINGING CLASS TO LIFE | ISE Associate Professor Jung Hyup Kim is exploring how best to incorporate augmented reality (AR) technology into engineering curriculum. He’s the Principal Investigator on a National Science Foundation grant that is allowing him to design and test AR lessons in a new lab.
Specifically, Kim is researching the use of real-time tracking and eye-tracking technologies for integrating AR into undergraduate engineering labs.
The first objective is to integrate real-time 3D motion and location tracking systems to improve student engagement. The GPS-based system would have the ability to determine where a student is and respond based on the student’s posture. This will ensure students see appropriate images in the right spots so they can understand the context of the digital assets. Another objective is to track eye movements and metacognition to determine whether a student is grasping the concepts.

DETECTING CYBERSICKNESS | EECS
Assistant Professor Khaza Anuarul Hoque is working to develop a personalized approach to identifying cybersickness by focusing on the root causes, which can be different for every person.
“Cybersickness is not generic,” he said. “For instance, one simulation could trigger cybersickness in me while the same simulation may not cause cybersickness for someone else.”
He’s using explainable artificial intelligence (AI) to not only make predictions and decisions to mitigate cybersickness but also explain why the machine came to those conclusions.
Hoque said explainable AI can also help software developers identify the most important features needed to optimize the model for teaching the AI how to identify someone experiencing cybersickness. This is especially important for users wearing stand-alone VR headsets.

UNDERSTANDING AI | EECS

Generative artificial intelligence (AI) systems haven't been built with the capacity to explain why they provide the answers they give. This is why large language models have produced fabricated reports. Professor Derek Anderson believes one solution will be to ensure that future AI systems explain themselves. He has created algorithms to do that, spitting out chains of numeric, text and graphical explanations about the data and decision-making process. He's now working to make those explanations something anyone can understand. In a recent paper, his team outlined a way to generate succinct natural language explanations of black box AI models, with associated uncertainty.

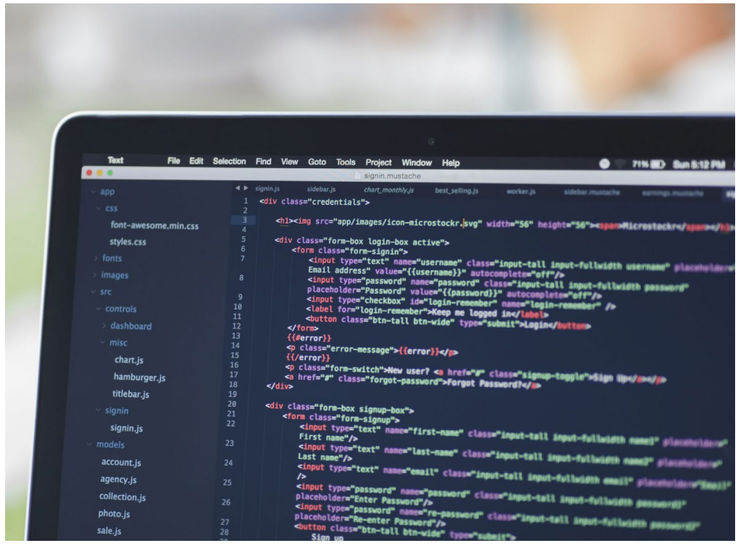
The researchers can tailor their linguistic summarizations, which increases their usefulness across different types of users and criteria. This approach can also be used to identify model weaknesses and data biases.

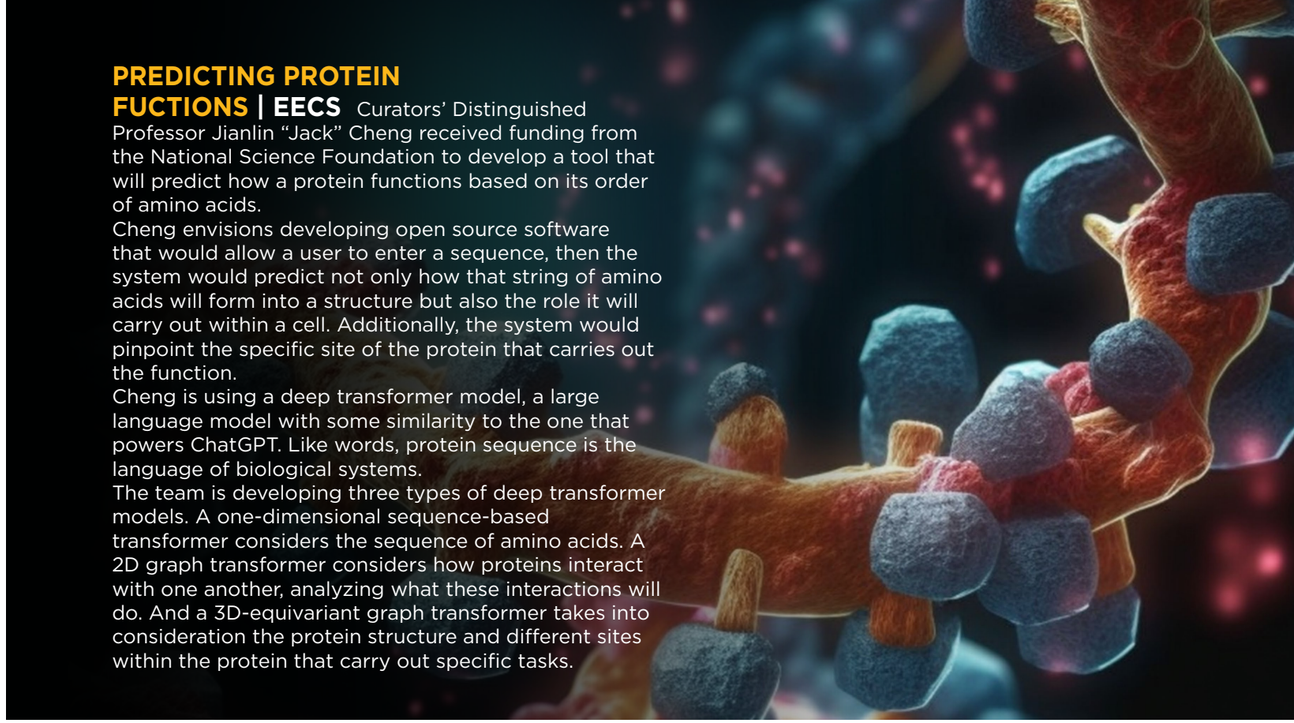
SUPPORTING OSS | EECS

Professor Sean Goggins and collaborators received a three-year, $1.6 million grant from the Alfred P. Sloan Foundation to make the tools and metrics they've already developed for open source software — through their work on a Linux Foundation project called CHAOSS — more accessible and understandable to a wider range of people and tech companies. The grant will help them develop better tools, software and methods to measure the long-term viability of OSS and help developers and tech companies alike identify what OSS projects are good to invest in for commercialization.

"This grant is a testament to the importance of open source software and the need to support its development and sustainability," Goggins said. "It shows MU is committed to continuing its work in this area, and we look forward to the continued engagement with the Alfred P. Sloan Foundation and other generous organizations that have supported this work."

Matt Germonprez at the University of Nebraska-Omaha is a co-principal investigator on the project.





PREDICTING PROTEIN FUCTIONS | EECS

Curators' Distinguished Professor Jianlin "Jack" Cheng received funding from the National Science Foundation to develop a tool that will predict how a protein functions based on its order of amino acids.

Cheng envisions developing open source software that would allow a user to enter a sequence, then the system would predict not only how that string of amino acids will form into a structure but also the role it will carry out within a cell. Additionally, the system would pinpoint the specific site of the protein that carries out the function.

Cheng is using a deep transformer model, a large language model with some similarity to the one that powers ChatGPT. Like words, protein sequence is the language of biological systems.

The team is developing three types of deep transformer models. A one-dimensional sequence-based transformer considers the sequence of amino acids. A 2D graph transformer considers how proteins interact with one another, analyzing what these interactions will do. And a 3D-equivariant graph transformer takes into consideration the protein structure and different sites within the protein that carry out specific tasks.

A ROADMAP FOR DISCOVERY | EECS

Curators' Distinguished Professor Dong Xu and colleagues updated their protein localization prediction model, MULocDeep, with the ability to provide more targeted predictions, including specific models for animals, humans and plants. Xu and a collaborator created the model 10 years ago to originally study proteins in mitochondria.

By harnessing the power of machine learning, the model can help researchers who are studying the mechanisms associated with irregular locations of proteins, known as "mislocalization," or where a protein goes to a different place than it's supposed to. This abnormality is often associated with diseases such as metabolic disorders, cancers and neurological disorders.

Another application of the team's predictive model is assisting with drug design by targeting an improperly located protein and moving it to the correct location, Xu said.

The work is currently supported by the National Science Foundation.

FACULTY AWARDS

Xiu-Feng "Henry" Wan

Curators' Distinguished Professor | Electrical Engineering & Computer Science

American Association for the Advancement of Science Fellow

Wan is director of the NextGen Center for Influenza and Emerging Infectious Diseases. He was recognized for his "distinguished contributions to the fields of virology, systems biology, and engineering, particularly for studies of highly pathogenic influenza with a focus on transmission, ecology, diversity and vaccine development."

Shubhra Gangopadhyay

Professor Emeritus | Electrical Engineering & Computer Science

American Association for the Advancement of Science Fellow

Gangopadhyay was recognized for her "distinguished contributions in bioengineering for the development of plasmonic gratings and nanoelectronic device-based biosensor systems for ultrasensitive detection of biomarkers."

Matthias J. Young

Assistant Professor | Chemical & Biomedical Engineering

National Science Foundation Early Career Development (CAREER) Award

Young's CAREER award is exploring how to make polymers (plastics) that conduct electricity and can charge and discharge to make metal-free batteries. The polymers are made by linking small molecules or monomers together into long chains.

Guoliang Huang

Huber and Helen Croft Chair in Engineering | Mechanical & Aerospace Engineering

SPIE Fellow

Huang's research focuses on addressing challenges in development of passive and active metamaterials for wave propagation and noise control, mechanical topological insulator, vibration and sound mitigation, energy harvesting, bio-sensing and more. He is widely recognized for his pioneering contributions to active metamaterials.

Praveen Rao

Associate Professor | Electrical Engineering & Computer Science

PLOS One Long Service Award

Rao was recognized for having been an academic editor of the journal's editorial board for more than five years.

Vellore Gopalaratnam

Professor | Civil & Environmental Engineering

American Society of Civil Engineers Fellow

Gopalaratnam has been active in ASCE for more than 30 years, serving on various technical committees, journal boards and conference organizing committees.

2023 CURATORS' DISTINGUISHED PROFESSORS

Three engineering faculty were named Curators' Distinguished Professors, the highest honor bestowed by the University of Missouri System, and one received Curators' Distinguished Professor Emerita status this fall.

Jianlin "Jack" Cheng

William and Nancy Thompson Distinguished Professor | Electrical Engineering & Computer Science

Cheng was recognized for his groundbreaking work around artificial intelligence (AI)-based protein structure prediction.

Zhiqiang Hu

William Andrew Davidson Professor | Civil & Environmental Engineering

Hu was honored for his outstanding research around water and wastewater engineering.

Xiu-Feng "Henry" Wan

Professor | Joint appointments in Engineering, Medicine, Veterinary Medicine

Wan, director of the NextGen Center for Influenza and Emerging Infectious Diseases, was recognized for his pioneering work around spread of infectious diseases.

Marjorie Skubic

Curators' Distinguished Professor Emerita | Electrical Engineering & Computer Science

Skubic, director of the Center to Stream Healthcare in Place, was named Curators' Distinguished Professor in 2021.

A NEW HUB FOR COLLABORATION

Rendering: PGAV + LMN

CENTER FOR ENERGY INNOVATION | Mizzou Engineering, in partnership with the MU College of Arts & Science and the College of Agriculture, Food & Natural Resources, is in the planning stages of a new building on the University of Missouri campus. Through the Center for Energy Innovation, researchers will focus on solving serious challenges around rising energy demands and the rapid growth in artificial intelligence. We're committed to addressing these issues head-on, bringing experts from across campus together to drive solutions-oriented research from our laboratories into the real world through practical policies. The four-story, 180,000-square-foot building is expected to open in late 2026.

Read more here!

*Photo Illustration

STUDENT OPPORTUNITIES

STUDENT SUCCESS At Mizzou Engineering, we know that exploration expands students' perspectives. So we don't let anything stagnate our curiosity. That's why this past year, Roger Fales—associate dean of student services and academic programs—ramped up efforts to ensure students make the most of their Mizzou education, such as increasing the number of students who conduct undergraduate research, participate in internships and co-ops and study abroad. Additionally, more and more students are gaining hands-on experience during the school year through student clubs, competition teams and identity-based organizations.

"There's no substitute for learning through experience because that's how we create the space to pursue truth, free expression and world-changing ideas," Fales said. "It's a practice called the Missouri Method, and it allows students to explore boundless possibilities."

Fales has also overseen the creation of special events around student success, including a Graduate Research Open House to showcase graduate school opportunities to undergraduate students. This past year, he launched a weekend-long program for admitted graduate students, giving them an opportunity to explore the College, campus and everything the Columbia community has to offer.

SUMMER AT MIZZOU ENGINEERING

The College of Engineering was abuzz this summer with special programming for elementary, middle and high school students.

The Summer Bridge Program allowed 12 newly enrolled engineering students to get acclimated to college life, both academically and socially. The eight-week session included core course offerings in math, chemistry and algorithm design and programming alongside tutoring and coaching. Students also attended workshops to become more familiar with campus resources to succeed their first year of college.

Throughout the summer, youth from grades 3-12 attended camps around sustainability, robotics, neural science and game development.

"We're committed to introducing younger students to STEM and to ensuring they're successful once they decide to pursue an engineering degree," said Roger Fales, associate dean of student services and academic programs. "It was great to see so many elementary, middle and high school students on campus learning about the power of engineering."

FELLOWSHIPS AND ACCOLADES

Lucas Kuehnel

B.S. ChE '23

National Science Foundation Graduate Research Fellowship

Lucas Kuehnel is using funding from the prestigious NSF Graduate Research Fellowship to transition into a Ph.D. program at Mizzou, where he will conduct research under the mentorship of Professor Patrick Pinhero around terahertz energy using photonic crystals.

"There are few in the country who have worked so extensively in this area, and Dr. Pinhero is one of them," Kuehnel said.

Brooke Runge

B.S. ME '21, M.S. EE '23

National Science Foundation Graduate Research Fellowship

After graduation, Brooke Runge accepted a job in industry with the option of using the NSF Graduate Research Fellowship to pursue a Ph.D. within the next five years. Because of her Mizzou education, she's prepared for whatever comes next.

"The research here is incredible with the medical school, veterinary school, law school — there are so many opportunities for interdisciplinary collaboration," she said.

Amber Spriggs

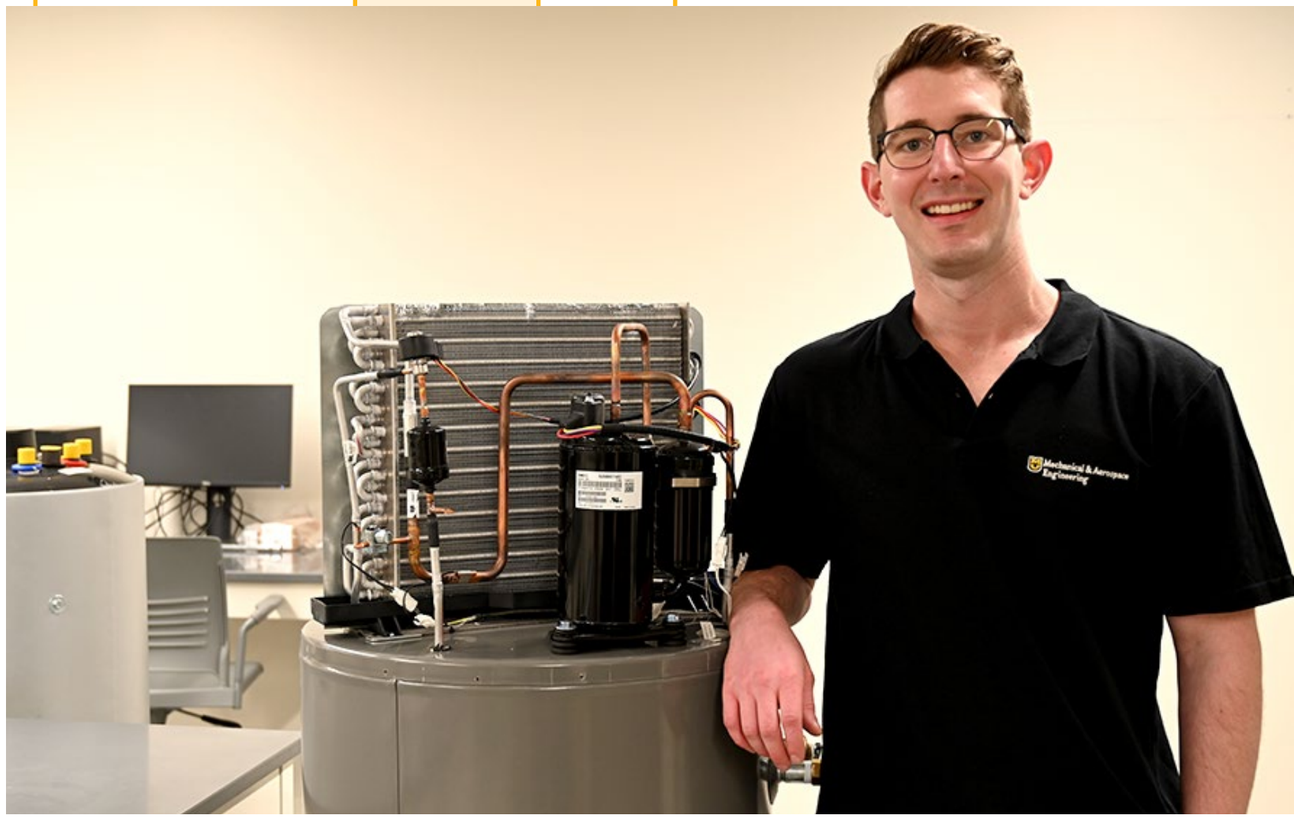
B.S. CiE '21, M.S. CiE '23

Fulbright Research Fellowship

As part of her Fulbright Fellowship, Amber Spriggs is collaborating with Dutch officials and researchers from Delft University of Technology to use GIS and remote sensing technology for flood mitigation measures in the Netherlands. She hopes to develop a methodology to examine how similar infrastructure changes could work along the Missouri and Mississippi rivers. After she completes the fellowship in May 2024, Spriggs plans to pursue an engineering career in the public sector.

GREGORY SCHOLAR | EECS Krutika Deshpande, a master's student in data science, was selected to participate in the Gregory Scholars Program this past year. The program, through the Missouri School of Journalism, allowed students from across campus to couple their areas of interest with applications around strategic communications. Deshpande specifically studied the use of augmented reality (AR) and storytelling by brands, finding that, if done correctly, AR can be an effective tool to engage with consumers.

SUSTAINABILITY FROM SPACE | CEE Jaweed Nazary, a Ph.D. student, participated in NASA's DEVELOP National Program, which trains students to leverage Earth observation data to investigate environmental challenges. "Supporting a small community's resilience in the face of climate change is very important to me," said Nazary, a former water engineer. "We have this amazing technology and science that can be used to help a lot of people." During the program, Nazary spent 10 weeks analyzing sophisticated satellite imagery to see how rising sea levels and melting permafrost are impacting drainage networks in Unalakleet, Alaska. The community is at risk of coastal erosion and sea-level rise. Findings from the work will help determine new locations less at risk.



IBUILD | MAE A Mizzou Engineer has been selected to participate in a U.S. Department of Energy (DOE) research fellowship program designed to support graduate students working on energy-related research. As part of IBUILD: Innovation in Buildings Graduate Research Fellowship, Jeremy Spitzenberger will continue to conduct research around thermal management with additional opportunities for mentorship and training. "This will allow me to get more industry experience, attend networking events and explore future opportunities," Spitzenberger said. "It will expand my circle of collaborators and, if successful, I'll be able to take what I know to release a product or even start a company. It's definitely exciting."
IBUILD is sponsored by the Building Technologies Office of the DOE, Energy Efficiency and Renewable Energy. It's managed by Oak Ridge National Laboratory and administered by Oak Ridge Institute for Science and Education. In addition to training, the program provides tuition and stipend funding.
Spitzenberger is a third-year Ph.D. student in mechanical engineering. He's working with department Chair and Curators' Distinguished Professor Hongbin "Bill" Ma on fluid thermal management applications, specifically looking at ways to improve efficiencies in water heaters.

RISING STAR | EECS
Ph.D. student Omiya Hassan had the opportunity to practice interviewing for jobs in academia during the Rising Stars in EECS career workshop held at the University of Texas at Austin this past year. Rising Stars began in 2012 at MIT as a way to encourage underrepresented students to pursue faculty careers.
During the three-day workshop, Hassan was grouped with chairs, professors and other Rising Star participants from similar fields.
As a Ph.D. student at Mizzou, Hassan worked as a research assistant in the Analog/Mixed-Signal VLSI and Devices Laboratory and as a graduate instructor. Her research focused on the design and development of low-power integrated circuits.

PEOPLE'S CHOICE | MAE
A Ph.D. student has discovered a way to turn unrecyclable plastic into building insulation that is 150% more effective than its untampered state on the market. For his research, Osasu Osaze earned the People's Choice Award at the 3MT® competition sponsored by the University of Missouri Graduate School.
Under the direction of Professor Sanjeev Khanna, Osaze's research focuses on finding solutions to environmental challenges such as combating pollution and promoting energy efficiency.
Osaze used 3D printing to melt the polypropylene down into filaments, then used that to print the insulating materials layer by layer.

GOLDWATER SCHOLAR | ChBME
Emma McDougal was named a 2023 Goldwater Scholar. McDougal is a member of the Biomodulatory Materials Engineering Laboratory, led by Associate Professor Bret Ulery. Specifically, she is part of a project focused on targeted peptide delivery. The group is creating biomodulatory materials capable of therapeutically targeting the immune response to prevent or treat infectious diseases and cancer.
"What I love about research is that it allows me to take what I learn in the classroom and apply it to real-life problems," she said. "Finding those connections between my classes and my projects is neat and very rewarding. It's motivating, too."

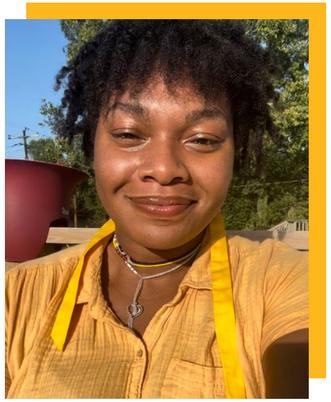
REU | ChBME, EECS, ISE, MAE Mizzou Engineering this year hosted four National Science Foundation Research Experiences for Undergraduates (REU) sites. The sites were:

- REU in Consumer Networking Technologies (pictured) led by Professor Prasad Calyam was focused on technologies such as artificial intelligence (AI), computer vision, cybersecurity and large language models;
- REU in Computational Neuroscience, led by Professor Satish S. Nair, gave students from various disciplines the opportunity to utilize computational resources in their respective fields;
- REU in Materials Science, led by Associate Professors Reginald Rogers and Matt Maschmann, taught students to incorporate creativity in the development of new material solutions; and
- REU in Research on Perspective Analytics for AI-enabled Operations Engineering, led by Assistant Professor Suchi Rajendran, allowed students to study AI models and data analytics.

INTERNSHIP SPOTLIGHT

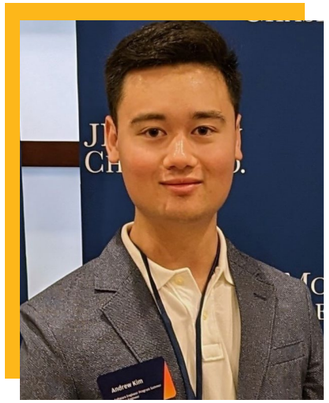
JUDE DIERKER | INDUSTRIAL ENGINEERING | THE CONNOR GROUP

"My official title was Intern Analyst. I have learned that Mizzou has prepared me well for the real world. I have also learned that the education doesn't end when we leave school but that it has only really just begun which is exciting because I enjoy learning how to better my skills."



TAJA HAWKINS | MECHANICAL ENGINEERING | BOEING

"As a child, I knew that I wanted to be in the aerospace field, I want to go on to become an astronaut. So having this experience with Boeing is amazing. One of the things I've really taken away from this internship is that confidence is key... if you're confident in yourself, then others are confident in you."



ANDREW KIM | COMPUTER SCIENCE & INFORMATION TECHNOLOGY | JPMORGAN & CHASE CO.

"At JPMC, I was a Software Engineer intern located in Chicago. I learned so much over the course of the internship. I'd never touched DevOps before, so I ended up gaining a lot of new experience with CI/CD and internal tools within that scope... I also learned a lot from a business perspective."

CRAIG ERICKSON | COMPUTER ENGINEERING | NISC

"My internship at NISC was a fantastic experience. My internship was mostly web development, where my background is mostly related to embedded systems. I've gotten to learn Java, JavaScript, Angular, Databases and many other things like that. Most importantly, I learned how coding in a professional environment works."

ENGINEERING CAREER FAIR Each semester, the College hosts 200-plus employers from top companies and governmental agencies during the Mizzou Engineering Career Fair, a much anticipated event that attracts more than a thousand students. The five-hour fair allows students to not only find internships, co-ops and jobs, but also gives undergraduates the opportunity to explore career paths and network with professionals.

"We encourage students to attend starting their first semester of college, so they can see the breadth of career options available," said Anh Nguyen, career services coordinator. "We have incredibly dedicated companies who attend each semester because they know Mizzou Engineers will be prepared with both foundational knowledge and technical know-how." Prior to the Career Fair, students have the opportunity to participate in mock interviews, resume reviews and panel discussions. Interviews are typically scheduled on campus the following day.

FINDING COMMUNITIES

NSBE

SWE

SASE

SHPE

SACNAS

ENGINEERING IDENTITY

Open to all students, identity-based organizations provide opportunities for students to develop a sense of community as they navigate engineering and science fields. These groups host campus and public events and participate in conferences, allowing students to hone leadership, teamwork and communication skills.

SASE Mizzou's chapter of the Society of Asian Scientists and Engineers wrapped up its first year of being an active organization. The group hosted events such as a Lunar New Year celebration, a dry ice rocket workshop and an egg drop competition. They also brought in a Two Sigma software engineer to discuss professional success.
Mizzou SASE continues providing a space for Asian American students and others who want to connect with the Asian engineering community.

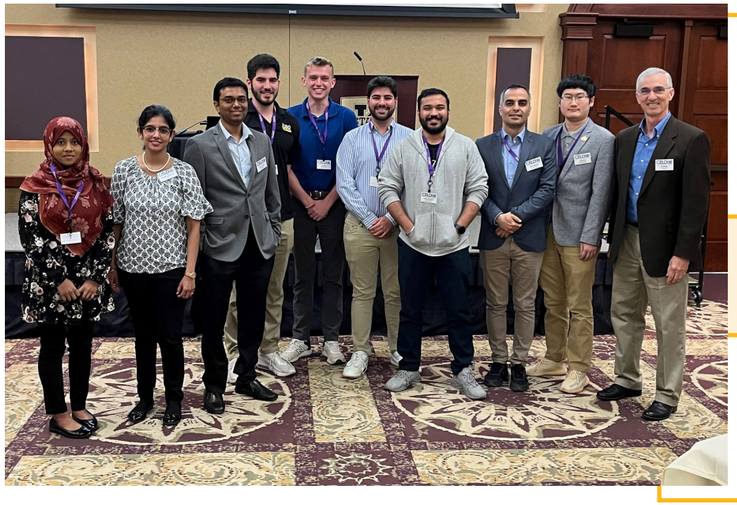
NSBE The National Society of Black Engineers' mission is to increase the number of Black Engineers who excel academically, succeed professional and positively impact the community. Five groups won awards at the NSBE region V conference last fall, including Most Outstanding Collegiate Member, earned by Kyarra Gorham. Mizzou NSBE also hosted a Spring Zone meeting for members from chapters across Missouri and Oklahoma. Two Mizzou students, Awa-Bousso Gueye and Trenton Foster, were recognized at the NSBE national convention in Kansas City.

SHPE Mizzou's Society of Hispanic Professional Engineers strives to provide members with a sense of family.
Nationally, SHPE is the largest association dedicated to fostering leadership in STEM among the Hispanic community.
In addition to regular meetings at Mizzou, SHPE hosts professional development workshops, volunteering events and mentorship opportunities.

SWE Mizzou's chapter of the Society of Women Engineers empowers women in engineering while also inspiring future generations.
This past year, six SWE members travelled to the WE Local conference in Detroit, Michigan. And in March, they organized the Ada Wilson Green Tea Lecture during Engineers' Week. Mizzou SWE also organizes outreach events for the Missouri community, including Daughter Day and Girl Scout Day.

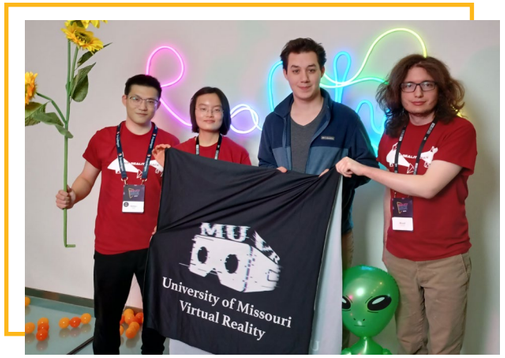
SACNAS The Mizzou chapter of the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science provides resources for students to succeed as they advance their degrees.
SACNAS was created with the goal of increasing Latinx and Native American communities in science. The group brings together students and faculty to provide mentorship and build professional skills and networks.

ENGINEERING ORGANIZATIONS



CELDi | ISE Industrial and systems engineering students took top honors for work around intelligent decision-making systems and optimizing manufacturing processes at the annual Center for Excellence in Logistics and Distribution Research Symposium. Pyam Oveys, a Ph.D. student, received the Outstanding Graduate Student Award. Senior Ray Wood received honorable mention in the Outstanding Undergraduate Student Award category. Both were on teams that tied for second place in the CELDi Research Symposium Poster Competition.

IISE | ISE Industrial Engineering students and faculty traveled to New Orleans in spring to present research projects at the Institute of Industrial and Systems Engineers (IISE) annual conference. Four students, Matt Deay, Madeline Easley, Joshua Freeman and Garret Robison, presented work on subjects such as optimal surgical center operations, learning through augmented reality and personalized design.

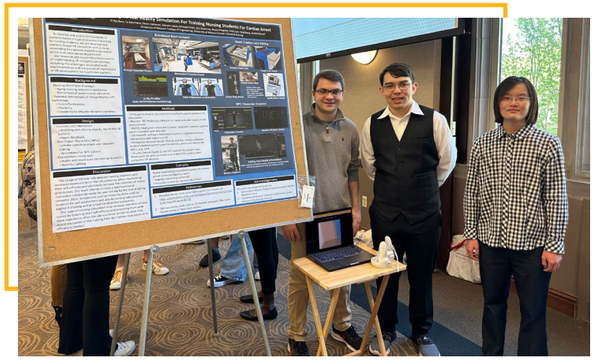


REALITY HACK | EECS, EIT Four Mizzou Engineers participated in MIT's Reality Hack. Weiyu Feng, B.S. CS '21, and his team won Best Use of Spatial Audio for an app that turns your office space into a fantasy setting. Stuart Aldrich and Erika Zhou built a game in AR using Oculus Quest 2. Jacob Woods' team developed an interactive application that teaches students about waveforms.

AIChE | ChBME Chemical Engineering students earned honors at the 2023 American Institute of Chemical Engineers Regional Student Conference, hosted at Mizzou. This year's event attracted 281 students, faculty and industry representatives, setting an attendance record for the Mid-America Region. Mizzou Chemical Engineering senior Katrina Brathwaite placed third in the Student Poster Competition, and Mizzou's Chem-E Car Team placed second in the Chem-E Car Poster Competition.

MSP | MAE Mizzou Space Program made history this year at the Spaceport America Cup when it launched Mizzou's first rocket flown with a student researched and developed (SRAD) motor. The team earned fourth place in the 10,000 feet SRAD category and 22nd overall.

REASEARCH AT THE CAPITOL | CEE, ISE, MAE Graham Bond, Elli Castonguay and Madeline Easley were selected to participate in Undergraduate Research Day at the Missouri State Capitol, an annual event that showcases innovations taking place at Mizzou. Students presented their research on 4D printing, water quality and augmented reality to legislators and state agencies.



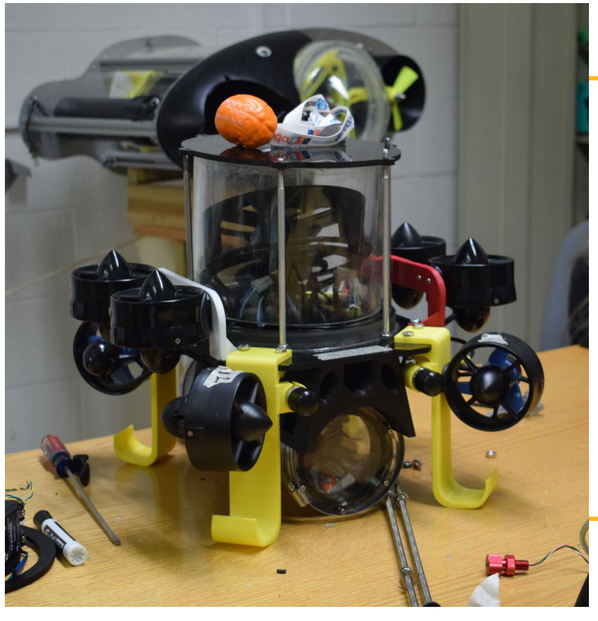
SHOW ME RESEARCH This spring, Mizzou Engineers demonstrated how engineering impacts all areas of society during presentations at Show Me Research Week. More than 55 engineering students participated in the campus-wide event.

AEROTIGERS | MAE Mizzou AeroTigers participated in the American Institute of Aeronautics and Astronautics (AIAA) “Design, Build, Fly” competition this spring. This was the first year for the aviation-focused club at Mizzou, although some of the members previously competed in the competition as part of the Mizzou chapter of the American Society of Mechanical Engineers.

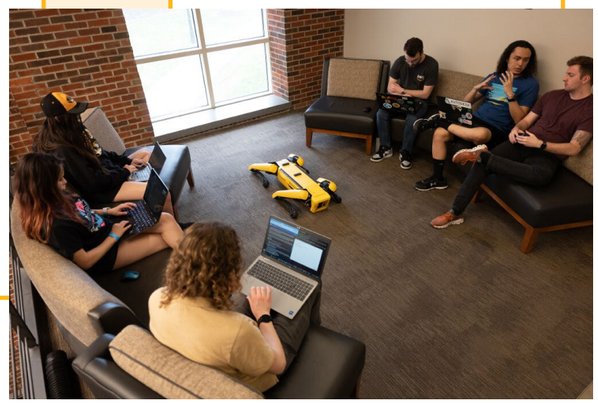
ASCE | CEE Mizzou civil engineering students won awards at the 2023 American Society of Civil Engineers Mid-America Student Conference. The Steel Bridge and Concrete Canoe teams competed against other colleges from the Mid-America region. The Steel Bridge team placed 2nd in construction speed, 2nd in economy, 3rd in overall lightness and tied for 3rd place in aesthetics. Concrete Canoe placed 6th out of 12 teams.

MIZZOU RACING | MAE Tigers in fast cars competed this spring in the Formula SAE (FSAE) competition at Michigan International Speedway, bringing home awards and beginning a new era of racing at Mizzou.
Mizzou Racing, which builds a quarter-scale formula car, competed in May, placing 17 out of 120 teams and 2nd in the Skidpad event. Mizzou Electric Racing, which builds a quarter-scale electric formula car, competed for the first time June, passing all except the brakes safety test.

TORQ’N TIGERS | ChBME, MAE The Torq’N Tigers Quarter Scale Tractor Pulling Team earned honors at the American Society of Agricultural and Biological Engineers (ASABE) International Quarter Scale Student Design Competition. The A-Team, which built a new tractor, won both heavy pulling events and earned 5th in the overall competition. The X-Team, which redesigned last year’s tractor, placed 2nd overall and won the pulling performance competition.



UNDERWATER ROBOT Members of the Mizzou Underwater Robotics Foundation, or Mizzou SURF, built Jelly, an underwater submarine programmed to go through a gate, tracking lines with a camera or shooting a torpedo through a hoop. Founded in 2018, SURF and Jelly compete annually in an underwater obstacle course at the RoboSub Competition.



ROBOTICS FOR ALL MU Robotics is an umbrella organization that brings together all-things robotics at the University of Missouri. The group’s goal is to make robotics accessible across disciplines. This past year, MU Robotics worked in nine areas such as autonomy, navigation, drones and machine learning/ artificial intelligence.

THE COLLEGE TOUR

ENGINEERING OPPORTUNITIES | EIT
As an information technology major and student videographer, Cedric “Cj” Harris is used to being behind the camera. This past year, he stepped into the spotlight to star in the University of Missouri’s episode of The College Tour.

In the episode, Harris discusses his undergraduate experience as a Mizzou Engineer, including how he has incorporated extracurricular activities into his degree. You can see him operating Spot, the robotic dog from Boston Dynamics, with Assistant Professional Practice Professor Kristofferson Culmer and taking photos between The Columns on the Francis Quadrangle.

“I feel that it provided me a great opportunity to showcase how special and unique a student’s experience could be here at Mizzou,” Harris said. “Coming into college, I didn’t know the things I’ve accomplished were possible. I’ve genuinely enjoyed every minute of my time as a Tiger, and I want other students and especially potential students to know that Mizzou and college in general is so much more than classes, homework and dressing up your dorm room. There are real opportunities to grow as a person and prepare yourself for whatever type of life and career you want.”

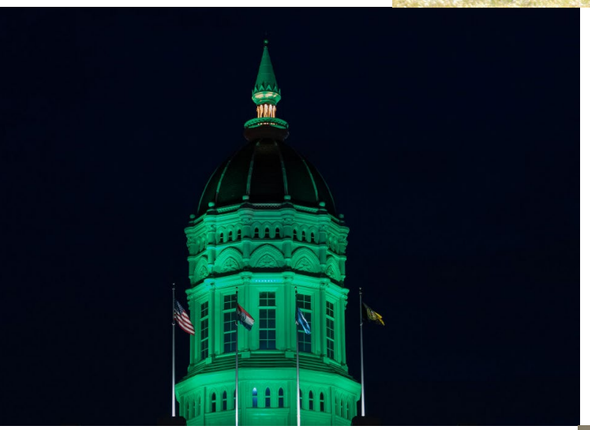
Watch the College Tour here!

ENGINEERING A PARADE

MARCHING MIZZOU Members of Marching Mizzou — many of them Mizzou Engineers — spent this past Thanksgiving in the Big Apple performing at the Macy’s Thanksgiving Day Parade. Marching Mizzou is comprised of students from across campus. In fact, 84% of members are majoring in programs outside of music, and engineering is consistently in the top five colleges represented within the organization said Amy Knopps, associate director of bands and director of athletic bands. “Engineering students are drawn to what we do because they’re analytical,” she said. “And they’re used to doing several things at once.”
On the field, engineering skillsets come in handy, students agree. Chase Bridger, an electrical engineering major, says he’s systematic about how he learns music and drills as one of the Alto Saxophone Section Leaders. And mathematics comes into play when figuring out rhythms and beats, added Serenity Mallon, a mechanical engineering student. “When we learn new drills — the formations we create during our pre-game and half-time performances — I find it easier to think of as just plotting points (marchers) onto a graph (field),” Mallon said. An estimated 27.7 million viewers watched NBC’s telecast of the parade.

ENGINEERS' WEEK 2023

KNIGHTING CEREMONY
Every year during E-Week, St. Patrick makes his annual trek to campus to "knight" senior engineering students and honorary guests, recognizing them for their hard work and accomplishments. The Knighting Ceremony and Grand Kowtow are traditions dating back to the early 1900s.



120 YEARS OF E-WEEK Engineers' Week, or E-Week, is one of the longest-standing traditions at Mizzou, predating the first homecoming. The week commemorates March 17, 1903, when Mizzou Engineers first proclaimed that St. Patrick was an engineer, and today is a celebration of all-things engineering. This year marked the 120th anniversary of the proclamation.
Throughout E-Week, students, faculty, staff and alumni across the College come together at events. E-Week is organized by St. Pat's Board, which was chaired this year by Lane Atchison and Kate Sherard.

E-WEEK EVENTS Among the most visible Engineers' Week celebration at Mizzou is the Dome Lighting Ceremony when the Jesse Hall dome is lit green. Students, alumni, faculty and friends gather at Francis Quadrangle to witness the lighting ceremony, which began in the late 1980s as a student stunt. Today, the dome remains green for the entire duration of E-Week. Other notable E-Week events include Lab Exhibits, during which engineering students showcase research to the community; the Ada Wilson Green Tea Lecture and a 5K/10K Walk, Run, Roll.

E-WEEK ROYALTY Throughout the celebration, 10 students selected by student clubs and organization make up Engineers' Week Royalty, representing the College at all events and activities. The delegation also travels to Jefferson City each year to receive an E-Week proclamation from the governor. E-Week wraps up with St. Patrick's Ball, featuring the crowning of the King and Queen. This year, Trenton Foster and Kyarra Gorham received the royal titles.

ADVISOR OF THE YEAR Steve Borgelt was honored this year with the University of Missouri's Advisor of the Year Award for his more than decade of service as advisor of the Engineers' Club and St. Patrick's Board at Mizzou Engineering.
"I was surprised," said Borgelt, associate professor emeritus of chemical and biomedical engineering. "It means a lot. It's hard to explain how much it means."
Borgelt is the glue that the holds the club together and keeps the oldest tradition at Mizzou alive, said Jordan Hayes, B.S. CiE '23, who was a member of Engineers' Club and past president of MU Engineering Student Council. "He truly is something special, and I can't imagine anyone more deserving of this award."

ALUMNI HAPPY HOUR Engineers' Week kicks off with a Cheers to Engineers Alumni Happy Hour at The Heidelberg in Columbia.
The event brings together multiple generations of Mizzou Engineering alumni and students, along with family members and friends. After the event, attendees walk to Francis Quadrangle to watch the Dome Lighting Ceremony. This year, Dave Wollersheim, a beloved longtime engineering professor, was an honored guest as he was on campus to celebrate the fully funded Wollersheim Professorship in Mechanical and Aerospace Engineering.

MIZZOU ENGINEERING ALUMNI MAKE THEIR MARK

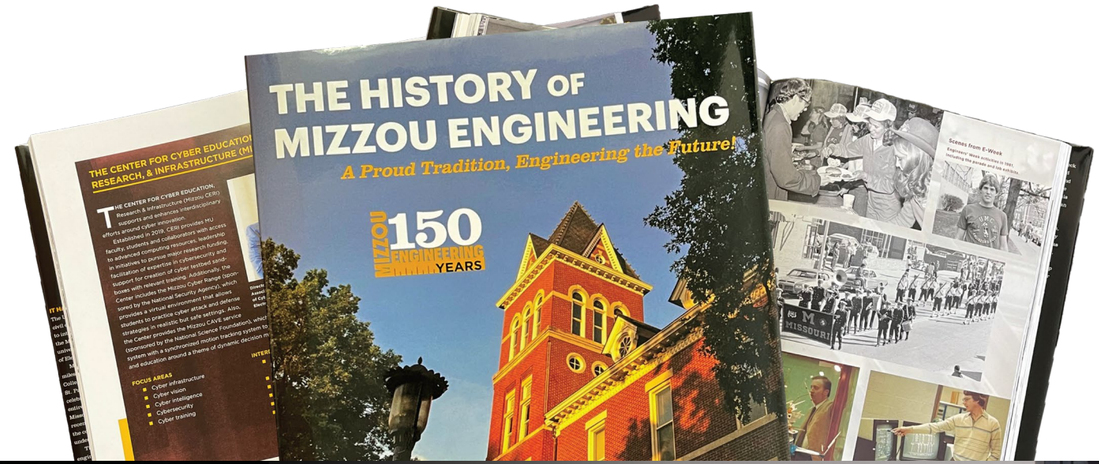
MAKING A DIFFERENCE | CEE Shishi Chen, B.S. CiE '18, M.S. CiE '20, was among the 2023 class of American Society of Civil Engineers (ASCE) New Faces of Civil Engineering Professionals. Honorees represent inspiring young engineers already making a difference, according to ASCE.
Chen is a civil engineer at HVJ Associates and works on state highways, city streets and airports projects in Austin, Texas.

GIVING BACK | EECS, EIT
Erica Martin, B.S. CS/IT '08, celebrated the fifth anniversary of her business this past year, during which Pixel Jam Digital was also named a Columbia Area Chamber of Commerce Small Business of the Year finalist. Additionally, Martin recently launched Help Radar, a site that connects users to resources such as food, legal assistance, mental health services and more.
Despite her jam-packed schedule, Martin jumped at the opportunity to join the Department of Engineering and Information Technology Industrial Advisory Council. For her, it was a way to use the skills she honed at Mizzou Engineering to give back.
"I like to joke that I want to save the world through web design," she said. "But what I mean is that I want to use my knowledge to build tools that end up helping people."

ELIMINATING RISKS | EECS As a senior security engineer on the Chrome offensive security team, Brendon Tiszka, B.S. CS '16, spends his days making sure users stay safe while browsing the internet by scouring lines of code for flaws.
Since graduating from Mizzou Engineering, Tiszka has worked at eBay, Facebook and Google as a cybersecurity researcher. In his current role, he has discovered bugs that would have allowed hackers to bypass browser security restrictions and plant spyware on devices.

HOMECOMING Mizzou Engineering celebrated its 150th anniversary of incorporation at the Mizzou Homecoming Parade in October. One of the first celebrations of its kind, Homecoming at MU is a community-wide event that brings in alumni and visitors from across the country. In addition to student organizations, engineering faculty and staff prepared a float in the 2022 parade to honor 150 years of engineering excellence.

A PROUD TRADITION, ENGINEERING THE FUTURE!



150TH BOOK As part of its anniversary celebration, the College released a commemorative book showcasing the history of engineering at Mizzou. While Mizzou Engineering just celebrated 150 years of incorporation, the College's history dates back to 1849 when Mizzou offered the first engineering course west of the Mississippi. The book includes historical timelines, profiles of College leadership and notable alumni through the years. It's available for sale at the Mizzou Bookstore on campus and online.

MIZZOU R.A.H.

Three engineering alumni received 2023 Mizzou R.A.H. awards for showing exceptional professional achievement along with a demonstrated record of volunteerism on campus and in their communities. The R.A.H. (Recent Alumni Honorees) award aims to shed light on incredible things young alumni are doing across the globe.

Kate Doetsch

B.S. ChE '13
Technical Integrator/Project Engineer — Boeing
St Louis, MO

"I recently celebrated my ten-year anniversary with Boeing. I spent the first nine years working in the Materials & Process Engineering organization, turning my love of electrochemistry and kinetics into designing aircraft parts and assemblies on commercial and defense aircraft, while also supporting aircraft paint and assembly operations. Today, I'm working on legacy F/A-18 Hornet fighter jet spares for multiple customers which has been incredibly challenging so far, but also very rewarding."

Sean Earl

B.S. EE '18
Manager, Enterprise Production Engineering Integration and Advanced Products — Boeing
Philadelphia, PA

"In my current role at Boeing, I am responsible for leading a team of enterprise production engineers to integrate best practices, functional excellence, and advanced tools throughout Boeing commercial, defense, space and services products. Prior to this role, I served as a systems engineer and engineering performance leader for the Space Launch System (SLS) program within Boeing Defense, Space and Security."

Ryan Mathewson

B.S. ME '17
Aerospace Systems Engineer — NASA
Huntsville, AL

"After graduating, I accepted a position as an engineer with NASA's Marshall Space Flight Center. In my 5+ years with NASA, I have had increasingly larger responsibilities including Propulsion Lead for Jettison Motor, Redesign Lead for a sounding rocket program, Propulsion Test engineer with Redstone Test Center, Solid Propulsion Lead for the SLS Launch Abort System, and currently I am transitioning into Solid Propulsion Subsystem Manager for NASA's Commercial Crew Program."

MIZZOU HALL OF FAME

Rodger O. Riney

Mizzou Hall of Fame

Rodger Riney, B.S. CiE '68, has been inducted into the 2023 Mizzou Hall of Fame. Riney founded Scottrade, Inc., in 1980 to compete in the new business of discount stockbrokerage. Under his leadership, the firm expanded to three million client accounts and $170 billion in assets under management, with over 500 branch offices in 48 states.

In 2015, Riney was diagnosed with multiple myeloma and made the difficult decision to sell the firm to TD Ameritrade in 2017. Three years later, Schwab acquired TD Ameritrade as the industry continued to consolidate.

Riney graduated from the College of Engineering in 1968 before earning an M.B.A. from the Robert J. Trulaske, Sr. College of Business in 1969. He and his wife lead the Paula and Rodger Riney Foundation, which supports research into uncovering a cure for multiple myeloma and related cancers – a cause close to his heart as a cancer survivor. The Foundation also has supported research into neurodegenerative diseases such as Alzheimer's and Parkinson's. Riney is a life member of the Mizzou Alumni Association and member of Traditions Circle.

Jim Fitterling

Mizzou Hall of Fame

Jim Fitterling, B.S. ME '83, was inducted into the 2022 Mizzou Hall of Fame. Fitterling is the chair and chief executive officer of Dow, a global materials company.

He has played a key role in the Company's transformation, from lower-margin, commodity businesses to one more deeply focused on higher-growth, consumer demand-driven markets that value innovation – with the goal of creating the most innovative, customer-centric, inclusive and sustainable materials science company in the world. He is also a cancer survivor, an experience that has influenced his commitment to transforming health care.

Fitterling is co-chair of the Dean's Advisory Council at Mizzou Engineering.

MIZZOU ENGINEERING ALUMNI AWARDS

Sharon Langenbeck
Faculty Alumni Award

Sharon Lagenbeck, B.S. ME ‘74, M.S. ‘76, Ph.D. ‘79, was honored with a 2022 Mizzou Alumni Association Faculty Alumni Award. Langenbeck is retired from NASA Jet Propulsion Laboratory, where she served in a number of roles including as the mechanical engineering project manager for developing a replacement instrument to correct a defect in the Hubble Space Telescope’s mirror following its launch in 1990. For this work, she was awarded the NASA Exceptional Service Medal in 1993.
As a Mizzou Ph.D. student, Langenbeck won the Amelia Earhart Fellowship awarded by Zonta International. She remained involved with the organization throughout her career, and, after holding various leadership positions, she was named President and CEO in 2020.
Langenbeck and her husband, Loren Lemmerman, are members of Mizzou’s Legacy Society, Jefferson Club and Shamrock Society. She is also a member of the Dean’s Advisory Council.

Jerry Jost
Missouri Honor Award

Jerry L. Jost, B.S. ChE ’70, is the Founder and President of Jost Chemical Company. Jost serves on the Chemical Engineering Industrial Board and in 2021 established the Jerry L. Jost Endowed Chair in Chemical Engineering. He also provided equipment for a chemical operations laboratory in Lafferre Hall, which the College dedicated with a ribbon cutting ceremony this spring.

Chih-Hsiang “Thompson” Lin
Missouri Honor Award

Chih-Hsiang (Thompson) Lin, B.S. ’83, M.S. EE ’90, Ph.D. EE ’93, is Founder, President and Chief Executive Officer of Applied Optoelectronics, Inc. (AOI). He is a member of the University of Missouri’s Chancellor’s Advisory Group and currently serves as co-chair of the Dean’s Advisory Council. He also established the Professor Jon M. Meese, Ph.D./AOI Endowed Fellowship in Engineering at Mizzou.

The Missouri Innovation Center
Missouri Honor Award

MIC is a non-profit organization launched in 1984 as part of a state initiative to create economic development support systems in partnership with the University of Missouri System. MIC selects businesses well-suited for the program, leases space and provides mentorship throughout the process of commercialization.

Karen Hamilton
James E. “Bud” Moulder Distinguished Alumni Award

Karen Hamilton, B.S. IE ’87, is semi-retired following a long career at Schneider Electric, Invensys and Motorola. This past year, she was president of the ISE Hall of Fame. She is also president of the Rocky Mountain Tigers alumni organization in Colorado.

Andre Logan
MUEAO Citation of Merit Award

Andre Logan, B.S. IE ’01, is the Director of Strategic Initiatives at the University of Missouri-Kansas City. Logan is a member of Mizzou’s Industrial and Systems Engineering Hall of Fame and a member of Mizzou Engineering’s Inclusion, Diversity and Equity Alumni Advisory Council.

WELCOME NEW FACULTY

Bio-inspired materials, sustainable energy, autonomic computing and advanced manufacturing are just a few of the areas of expertise new faculty members are bringing to Mizzou Engineering.

These outstanding researchers and educators are poised to help the College usher in a new era of scholarship, discovery and innovation.

Spring 2023:

Punyaslok Rath
Assistant Research Professor
Civil and Environmental Engineering

Feng "Frank" Xiao
Associate Professor
Civil and Environmental Engineering

Hessam Yazdani
Associate Professor
Civil and Environmental Engineering

Roseanna N. Zia
Associate Dean for Research & Wollersheim Professor
Mechanical and Aerospace Engineering

Fall 2023:

James Ogechi Kereri
Assistant Teaching Professor
Civil and Environmental Engineering

Mike Klote
Associate Teaching Professor
Joint Appointments:
Engineering and Information Technology
&
Industrial and Systems Engineering

Xiaohua Liu
Professor
Chemical and Biomedical Engineering

Hyeong Suk Na
Assistant Professor
Industrial and Systems Engineering

Abdelnasser Ouda
Teaching Professor
Electrical Engineering and Computer Science

Travis Sippel
Associate Professor
Mechanical and Aerospace Engineering

Scott Thompson
Associate Professor
Mechanical and Aerospace Engineering

Yingchao Yang
Associate Professor
Mechanical and Aerospace Engineering

DEGREE PROGRAMS

10 undergraduate
9 master's
7 doctoral

Only public Research 1 university in Missouri

CURRENT FACULTY

103 TT
29 Ranked NTT

$29M
Research Expenditure by Shared Credit

95.3% successful career outcomes post graduation

$9 Million
in scholarships and aid awarded to Engineering Students

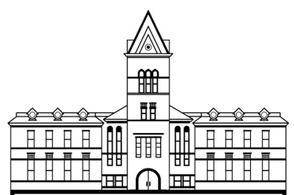
BEST GRAD SCHOOLS
U.S.News & WORLD REPORT
ENGINEERING
2023-2024

CURRENT STUDENTS

2,800+ undergraduate
450+ graduate

Median Starting Salary of Graduates

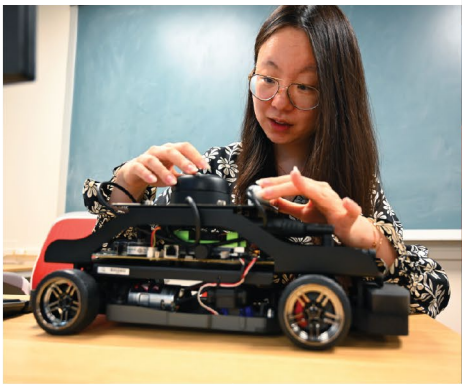
$70,000



1 of 7
Public universities with engineering, veterinary medicine, medicine and law on a single campus

College of Engineering
University of Missouri

416 S 6th Street
Columbia, MO
65211



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