MCKELVEY ENGINEERING
Momentum
Across Disciplines. Across the World® // **WINTER 2022**

Innovation *never stops*

McKelvey Engineering faculty look to solve problems with their technical expertise

Washington University in St. Louis

Snapshot

James M. McKelvey, Sr. Hall, the new home of the Department of Computer Science & Engineering, was dedicated Oct. 15, 2021. The building, which honors the late longtime dean James M. McKelvey Sr., is located at the northeast corner of the Danforth Campus and houses research laboratories, specialized facilities and student collaboration space. It opened in January 2021.

WASHU PHOTO

From the dean

WASHU PHOTO

"Our research creates new ideas; our innovation creates impact. In McKelvey Engineering, our mission is to achieve both."

The Engineering advantage

To the casual observer of universities — or even someone with an undergraduate degree — it seems clear what we do: educate students. For most of my academic career, when I sat down in an airplane and struck up a conversation with a neighboring passenger, it would eventually come out that I was a professor. And the response was *always* the same: "Really? What do you teach?"

Of course, if you are a regular reader of our *Momentum* magazine — or even if this is your first time skimming through its pages — you are well aware that McKelvey Engineering at WashU has two distinct, yet related, missions: education and research. We arm students with the knowledge derived from decades — actually centuries — of exploration, and we also produce new knowledge. In this issue, you will read about a new degree program in data science for our undergraduates, as well as a story about our instructors teaching basic computer science to people in prison. On the research front, you can read about a new grant to support advances in designing microbes to mitigate water pollution or about inventing new hydrogels to treat wounds. And you will read about our junior faculty winning prestigious CAREER Awards from the National Science Foundation — these awards are celebrated nationally and validate that these are rising stars who are advancing their fields in fundamental ways.

But as an engineering school, there is another mission. And that is *innovation.* A perhaps trite but useful saying is that "Research turns money into ideas; innovation turns ideas into money." Research is typically about exploring the unknown — creating knowledge that provides insight as to how something in nature works or how it might be possible to intervene. Research tends to be "curiosity-driven" — there is a phenomenon to be understood or a new capability to be developed. When embarking on research, we don't really know how it will turn out. That is what makes it compelling and, frankly, fun.

Innovation, on the other hand, is almost always problem-driven. The challenge is to take fundamental knowledge of phenomena and capabilities and solve a problem whose solution will have an impact on the world. And while all scientists are researchers, engineers have the capacity to be innovators. We discover new ways to achieve an effect, and we can apply that capability to solve previously intractable problems. In this issue, you will read about a collection of McKelvey Engineering faculty — all of whom are successful researchers — taking on the role of innovator. They have learned along the way that being successful in innovation is no easier — in fact, it is often harder — than being a successful researcher. The myriad constraints that determine whether a particular idea is successful in the world and, especially, in the marketplace, stretch our faculty beyond the domains of pure science and engineering. Our research creates new ideas; our innovation creates impact. In McKelvey Engineering, our mission is to achieve both.

And if there is money made, I know a great institution they can now support!

Aaron F. Bobick
Dean & James M. McKelvey Professor
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In this issue

WINTER 2022

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THE BUZZ

*Engineering students (from left) **Pryce Adade Yebesi, Kelechi Achilefu** and **Whitney Omoruyi** talk with **Jim McKelvey Jr.** (right) on Oct. 15 at the James M. McKelvey, Sr. Hall dedication ceremony.*

Opened January 2021

McKelvey Hall dedicated Oct. 15

James M. McKelvey, Sr. Hall, located south of Preston M. Green Hall, houses the Department of Computer Science & Engineering and supports Washington University's data science efforts. Jim McKelvey Jr., an alumnus and son of the late James M. McKelvey Sr., made a $15 million lead gift for the building. He attended the Oct. 15 dedication with his family.

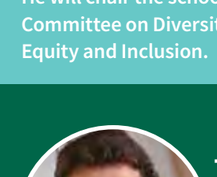
PHOTOS BY JOE ANGELES

*Student speaker **Emma McMillian**, a junior majoring in computer science + mathematics.*

***Judith McKelvey, MD**, widow of James M. McKelvey Sr.*

Foston to lead diversity initiatives in McKelvey School of Engineering

He will chair the school's Committee on Diversity, Equity and Inclusion.



The National Academy of Inventors has elected bioengineer Daniel Moran to its 2021 cohort of fellows

The NAI fellowship is the highest professional distinction reserved solely for academic inventors.

New Master of Science in Imaging Science

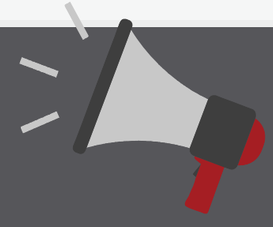
The McKelvey School of Engineering offers a unique interdisciplinary master of science in imaging science program that prepares graduates for success in industry or to advance to doctoral studies.

Students will be taught and mentored by faculty from departments and programs throughout Washington University in St. Louis, including Biomedical Engineering, Electrical & Systems Engineering, Computer Science & Engineering, Mechanical Engineering & Materials Science and the School of Medicine.

IMSE acquires new facility for fabricating nanomaterials

In August, Washington University installed a new instrument capable of creating nano-scale patterns with features 10,000 times smaller — just 10 nanometers wide. The new electron beam lithography system, the Elionix ELS-S50EX, is housed in the Institute of Materials Science & Engineering (IMSE). Scientists across the university will use the new facility to conduct research where micron-and nanometer-sized circuits or patterns in semiconductors and metals are employed to explore and control electronic and optical properties of materials. Applications include producing circuit elements for quantum information science, creating photonic circuits based on light, controlling the nano-scale flow of heat, and more. By taking advantage of the unique properties of materials at very small scales, researchers are poised to explore fundamental questions about electronic structures and quantum phenomena. The facility will be available for shared use by all IMSE members.

Apoorva Pandey, who earned a doctorate in energy, environmental & chemical engineering from the McKelvey School of Engineering in 2019, received the 2021 Sheldon K. Friedlander Award during the American Association for Aerosol Research (AAAR) annual conference. The Friedlander award recognizes an outstanding dissertation by a recent doctoral graduate in the fields of aerosol science and technology.



Student news

Senior Kuziez named Marshall Scholar

Washington University in St. Louis senior **Abdullah Kuziez,** 21, has received the prestigious Marshall Scholarship, which provides American students the opportunity to earn an advanced degree in the United Kingdom. Kuziez plans to earn a master's degree in biomedical engineering at the University of Oxford as part of his ongoing search for cancer treatments that are both effective and accessible. The Marshall Scholarship is among the most selective in academia. Every year, approximately 1,000 endorsed applicants compete for an average of 45 slots. Kuziez is Washington University's seventh Marshall Scholar. Kuziez, of Ballwin, Mo., is majoring in biophysics and biochemistry in Arts & Sciences and minoring in computer science at the McKelvey School of Engineering.

New bachelor's degree in data science offered

The McKelvey School of Engineering and the College of Arts & Sciences at Washington University in St. Louis are now offering a bachelor's degree in data science. The program is a collaboration between the Department of Computer Science & Engineering in McKelvey Engineering and the Department of Mathematics and Statistics in Arts & Sciences.

Data science is an interdisciplinary field that uses data processing, analytics, predictive modeling, statistical hypothesis testing and deep learning to extract meaning from data and use it to solve problems.

Students interested in the bachelor's degree program will apply to and be admitted through either Arts & Sciences or McKelvey Engineering, respective to the intent to earn a bachelor of arts (AB) in data science from Arts & Sciences or a bachelor's of science in data science (BSDS) from McKelvey Engineering. Students from any school may study data science as a second major offered through McKelvey Engineering or Arts & Sciences.

Engineering students, alumni win paper, design awards at SB3C

Three students from the McKelvey School of Engineering won awards at the 2021 Summer Biomechanics, Bioengineering and Biotransport Conference (SB3C). The annual meeting, hosted in conjunction with the Bioengineering Division of the American Society of Mechanical Engineers (ASME), provides students with an opportunity to network among their peers and present their research in a casual, informal environment.

Alexandra Davis, a doctoral student in the Department of Biomedical Engineering, won first place in the master-level Student Paper Competition with her paper titled "Size-dependent solute diffusivity in synovial explants parallels solute transport following intra-articular delivery in vivo." Davis is a student in the lab of **Lori Setton**, the Lucy & Stanley Lopata Distinguished Professor of Biomedical Engineering and department chair.

Chase Hartquist, who earned bachelor's and master's degrees in mechanical engineering in 2021, was named runner-up in the bachelor-level of the Student Paper Competition with his paper titled "Quantification of the Flexural Rigidity of Peripheral Arterial Endovascular Catheters and Sheaths." Hartquist was a student in the lab of **Guy Genin**, the Harold and Kathleen Faught Professor of Mechanical Engineering.

Hartquist also was a member of the team that won second place in the meeting's Student Design Competition. He was joined by **Vinay Chandrasekaran**, a senior majoring in computer science; **Halle Lowe**, who earned bachelor's and master's degrees in mechanical engineering in 2021; and **Mohamed Zayed, MD, PhD**, associate professor of surgery and of radiology at the School of Medicine.

Student team wins first place at NASA research, design competition

A student from the McKelvey School of Engineering and his team members recently won first place at the University Student Design Challenge, an annual competition hosted by NASA's Glenn Research Center, located in Cleveland.

Xavier Salcido, a senior majoring in electrical engineering, was a member of Team Aurora, which included Delano Campos, a student at University of California, Los Angeles; Benjamin Harte, a student at Saint Mary's College of California; Skye Rummer, a student at University of California, Merced; and Nicole Swatton, a student at Arizona State University.

For the competition, the team developed a universal chassis, a load-bearing framework for a rover, with plug-and-play science instruments and mobility capabilities that could streamline robotic exploration across the solar system.

Roell selected for DOE research program

McKelvey School of Engineering graduate student **Garrett Roell** has been accepted into the Office of Science Graduate Student Research (SCGSR) program, a prestigious research opportunity funded by the U.S. Department of Energy's Office of Science. The program will allow Roell, a PhD student in the lab of **Yinjie Tang**, professor of energy, environmental & chemical engineering at Washington University in St. Louis, to conduct a portion of his doctoral thesis research at the Lawrence Berkeley National Laboratory in California. There, Roell will pursue research focused on understanding metabolic regulation for efficient biofuel production from nonfood crops. The program, which is intended to advance participants' doctoral theses, provides travel support and a monthly living stipend. Roell is one of 65 graduate students in this cohort.

Doctoral student named to inaugural cohort of CRE2 graduate fellows

Ivy Smith, a first-year doctoral student in the Division of Computational & Data Science (DCDS), has been named a Graduate Fellow of the Center for the Study of Race, Ethnicity & Equity (CRE2). The brand new fellowship program offers students up to $1,000 of annual support, as well as access to exclusive CRE2 programming and professional development opportunities, such as poster sessions, graduate workshops and center-funded awards. Smith, who earned bachelor's of science degrees in mathematics and computer science from Tougaloo College in Mississippi, said she was drawn to the interdisciplinary nature of WashU's computational and data science program. She hopes to use data science and machine learning to study health disparities in African-American communities. She has a special interest in the community of Canton, Mississippi, the city in which she grew up. Smith is working in the lab of **Sheretta Butler-Barnes**, associate professor in the Brown School at Washington University in St. Louis, on a new project funded by the National Science Foundation.

BME internship program supports students, startups in St. Louis

The Department of Biomedical Engineering in the McKelvey School of Engineering launched the St. Louis Internship Program for Biomedical Engineers in the summer of 2020 under the direction of **Joseph Klaesner**, instructor of biomedical engineering.

While the department has offered internships in the past, 2020 marked the first time it managed its own program. Previously, it partnered with the Skandalaris Center for Interdisciplinary Innovation and Entrepreneurship to match students with organizations.

"We partnered with Skandalaris in the first year to learn from their experience supporting students in meaningful entrepreneurial opportunities in St. Louis," said **Lori Setton**, the Lucy & Stanley Lopata Distinguished Professor and chair of the Department of Biomedical Engineering. "The company demand for engineers from BME and other departments quickly grew beyond what we expected, so we created a distinct internship program largely modeled on the Skandalaris program."

In the summer of 2021, the program placed eight students with five different companies throughout St. Louis. Many of the companies were recruited into the program by Klaesner, who has deep connections to the St. Louis startup community through his role as instructor of the department's capstone design course.

Warning system predicts patient deterioration

Written by **BETH MILLER**

About 9% of cancer patients experience complications while hospitalized that lead to a deterioration in their condition, a transfer to the intensive care unit or even death.

A multidisciplinary team of researchers at Washington University in St. Louis is developing a machine-learning-based early warning system model to predict this deterioration and improve patient outcomes.

Chenyang Lu, the Fullgraf Professor in the McKelvey School of Engineering, with collaborators including **Marin Kollef, MD**, the Golman Professor of Medicine and director of the medical intensive care unit and respiratory care services at Barnes-Jewish Hospital, and **Patrick Lyons, MD**, instructor in medicine in the School of Medicine, recently developed a new predictive model for hospitalized cancer patients that integrates heterogeneous data available in electronic health records (EHR). Results of their work were presented at the Association for Computing Machinery (ACM) Conference on Information and Knowledge Management (CIKM) on Nov. 3, 2021.

Lockdown drove pollution changes between – even within – cities

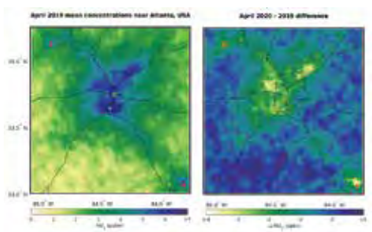
Researchers from Washington University in St. Louis developed a method using satellite measurements that allowed them to determine levels of nitrogen dioxide — NO2 — on a scale never before accessible — even in areas where there are no monitoring capabilities on the ground. NO2 is a key contributor to the smog associated with bad traffic or areas of intense industry.

Developed in the lab of **Randall Martin**, the Raymond R. Tucker Distinguished Professor in the Department of Energy, Environmental & Chemical Engineering, the method allows researchers to infer levels of NO2 in regions as small as a neighborhood.

When they used it to compare levels of NO2 before and during COVID-19-related lockdowns across the globe, they found that, although there was a significant decrease in NO2 worldwide in areas under lockdown, there were also striking discrepancies on smaller scales.

"We can determine differences, not just from city to city, but within cities we were seeing interesting differences in levels of NO2," said **Matt Cooper**, first author of the study. "Changes within cities weren't uniform; some areas saw a larger decrease than others."

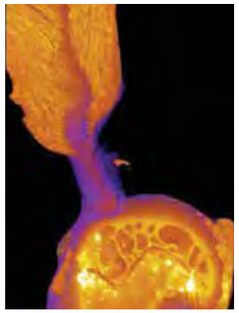
The results were published Jan. 19 in the journal Nature.



April 2019 and 2020-2019 difference of inferred ground-level NO2 mixing ratio near Atlanta. The green circle represents downtown Atlanta, the red diamonds represent coal-burning power plants with capacities > 2000 MW. The blue x represents Hartsfield-Jackson International Airport. The black lines indicate major highways.

PHOTO COURTESY OF MARTIN LAB

Using nature to inspire new materials and designs



A discovery by a multi-institutional team of researchers and engineers about how tendon and bone attach in the shoulder joint has uncovered previously unsuspected engineering strategies for attaching dissimilar materials. The discovery also sheds new light on how the rotator cuff functions and on why rotator cuff repairs fail so frequently.

Guy Genin, the Harold and Kathleen Faught Professor of Mechanical Engineering in the McKelvey School of Engineering at Washington University in St. Louis, and **Stavros Thomopoulos**, the Robert E. Carroll and Jane Chace Carroll Professor of Orthopaedic Surgery at Columbia University, led a team that discovered a previously unknown fibrous architecture between the rotator cuff tendons and their bony attachments in the shoulder.

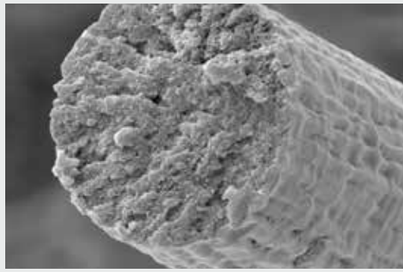
Results of the work were published in Science Advances Nov. 26.

NSF CAREER AWARD

Parker's CAREER Award focuses on pesticides that use double-stranded RNA as active agent

Kimberly Parker, assistant professor of energy, environmental & chemical engineering in the McKelvey School of Engineering, will study the environmental fate of pesticides that use double-stranded RNA (dsRNA) as their active agent with a five-year, $500,480 CAREER Award from the National Science Foundation. The NSF CAREER awards support junior faculty who model the role of teacher-scholar through outstanding research, excellence in education and the integration of education and research within the context of the mission of their organization. One-third of current McKelvey Engineering faculty have received the award.

Specifically, she will identify the physical processes that degrade dsRNA pesticides in the environment, including in soils, surface water and on the surfaces of leaves. By identifying these processes, the work will advance knowledge on the environmental fate and persistence of nucleic acids, including microbial genetic markers.



Synthetic biology enables microbes to build synthetic muscle

Written by Brandie Jefferson

Researchers at the McKelvey School of Engineering at Washington University in St. Louis have developed a synthetic chemistry approach to polymerize proteins inside of engineered microbes. This enabled the microbes to produce the high molecular weight muscle protein, titin, which was then spun into fibers.

"Its production can be cheap and scalable. It may enable many applications that people had previously thought about, but with natural muscle fibers," said **Fuzhong Zhang**, professor in the Department of Energy, Environmental & Chemical Engineering. Now, these applications may come to fruition without the need for actual animal tissues.

The synthetic muscle protein produced in Zhang's lab is titin, one of the three major protein components of muscle tissue. Critical to its mechanical properties is the large molecular size of titin. "It's the largest known protein in nature," said **Cameron Sargent**, a PhD student in the Division of Biological and Biomedical Sciences and a first author on the paper along with **Christopher Bowen**, a recent PhD graduate of the Department of Energy, Environmental & Chemical Engineering.

Their research was published Aug. 30 in the journal Nature Communications.

Environmental injustice, population density and the spread of COVID-19 in minority communities

Written by Brandie Jefferson

During the "first wave" of COVID-19 in the United States, **Rajan Chakrabarty**, the Harold D. Jolley Career Development Associate Professor at Washington University in St. Louis, learned that African Americans made up 47% of the population in St. Louis, but nearly three-quarters of COVID-19 cases.

2 FACTORS
Population density and long-term exposure to air pollution disproportionately affect communities with more minority residents.

That fact was from an article in the Boston Review, written by **Jason Purnell**, associate professor at Washington University's Brown School. In it, Purnell noted that in St. Louis, African Americans were 12 times more likely than white residents to live in conditions with higher environmental risks, including poor air quality.

And as it turned out, aerosol science had much to say about the matter.

New research from Chakrabarty's lab analyzed disparities in socioeconomic, environmental and lung health factors to determine how they contributed to R0 — the rapidity at which COVID-19 spread — through 12 metropolitan areas. Researchers found just two factors had an overwhelming influence on R0: population density and long-term exposure to air pollution.

Results were published in the journal Environmental Research Letters.


PHOTO BY DEVON HILL

Henry Luce Foundation awards $300,000 in support of McKelvey School of Engineering

Two women doctoral students in computer science & engineering will receive two-year Clare Boothe Luce graduate fellowships thanks to a $300,000 grant in support of the McKelvey School of Engineering at Washington University in St. Louis from the Henry Luce Foundation's Clare Boothe Luce Program for Women in STEM.

The funds will enable outstanding women computer science or computer engineering students to participate in the McKelvey School of Engineering's rigorous doctoral program, preparing them to excel in a science or engineering career. The fellowship supports the first two years of the students' doctoral studies and offers travel funds.

EPA funds Moon's biotech, containment research

Written by Brandie Jefferson

The U.S. Environmental Protection Agency awarded a $744,262 grant to **Tae Seok Moon**, associate professor of energy, environmental & chemical engineering at the McKelvey School of Engineering, for cutting-edge biotechnology research.

Moon will be leading the project, which aims to expand the possibilities for use of genetically engineered bacteria and ensure the safety of their use. He will work with **Kimberly Parker**, assistant professor, who will investigate the behavior of the bacteria in real soil and surface water samples.

In addition to developing the technology, the EPA's award will also support design of a system that allows researchers to safely study these microorganisms in the lab in conditions that match those out in the world.

Engineering various sources of loss provides new features for perfect light absorption

Natural and manmade physical structures all lose energy, and scientists work hard to eliminate that loss or compensate for it. Optical and photonic devices lose energy through light scattering, radiation or material absorption. In some situations, however, intentionally yet carefully designing loss in open optical devices and systems can lead to unconventional physical phenomena that inspire novel methods for optical control and engineering.

Lan Yang, the Edwin H. & Florence G. Skinner Professor in Electrical & Systems Engineering in the McKelvey School of Engineering at Washington University in St. Louis, and a team that includes A. Douglas Stone, the Carl A. Morse Professor of Applied Physics and Physics at Yale University, and his lab uncovered new approaches to manipulating light absorption in optical resonators by different types of optical losses. They achieved a degeneracy of two coherent perfect absorbing modes, which leads to an unconventionally broadened absorption spectrum and the capability to switch between weak and strong absorption over a broad frequency band.

The work was published Sept. 9 in Science.


PHOTO BY WHITNEY CURTIS

NSF CAREER AWARD

Ling receives NSF CAREER Award

Written by Brandie Jefferson

The National Science Foundation has awarded a Faculty Early Career Development (CAREER) Award to **Fangqiong Ling**, assistant professor of energy, environmental & chemical engineering and principal investigator of the Environmental Genomics and Microbiology Lab.

The five-year, $500,000 award will fund Ling's research to advance the science of wastewater-based epidemiology — tracking the spread of infectious disease using microbial biomarkers in wastewater. To do this, Ling will develop a new computational framework to model urban populations from microbiomes in wastewater; and develop and validate tools to better use wastewater surveillance data. The research can improve wastewater-based epidemiology sampling programs and data interpretation. One of the project's educational programs will involve collaboration with the mySci program at the university's Institute for School Partnership.

Stretchy, bendy, flexible LEDs

Written by Brandie Jefferson

Sure, you could attach two screens with a hinge and call a cell phone "foldable," but what if you could roll it up and put it in your wallet? Or stretch it around your wrist to wear it as a watch?

The next step in digital displays being developed at the McKelvey School of Engineering at Washington University in St. Louis could make that a reality.

First, there were light-emitting diodes, or LEDs. Then, organic LEDs, or OLEDs. Now, researchers in the lab of **Chuan Wang**, assistant professor in the Preston M. Green Department of Electrical & Systems Engineering, have developed a new material that has the best of both technologies and a novel way to fabricate it — using an inkjet printer.

Organic LEDs, made with organic small molecules or polymer materials, are cheap and flexible. "You can bend or stretch them — but they have relatively low performance and short lifetime," Wang said. "Inorganic LEDs such as microLEDs are high performing, super bright and very reliable, but not flexible and very expensive. What we have made is an organic-inorganic compound. It has the best of both worlds."

The research was published in October in the journal Advanced Materials.

> "What we have made is an organic-inorganic compound. It has the best of both worlds."
>
> — CHUAN WANG
> *Assistant Professor in the Preston M. Green Department of Electrical & Systems Engineering*

NSF CAREER AWARD

Investigating the immunological effects of chiral supramolecular nanomaterials

Written by Beth Miller

Jai Rudra, assistant professor of biomedical engineering, will study chirality in nanomaterials with a five-year, $639,361 CAREER Award from the National Science Foundation. The NSF CAREER awards support junior faculty who model the role of teacher-scholar through outstanding research, excellence in education and the integration of education and research within the context of the mission of their organization. One-third of current McKelvey Engineering faculty have received the award.

In the new work, Rudra will use natural and chiral versions, or mirror images, of self-assembling peptides to understand how sentinel immune cells, which have evolved to protect humans from external and internal threats, interact and process chiral peptide-based nanomaterials. The project will use natural and chiral variants of peptide building blocks that instinctively self-organize into supramolecular 3D nanomaterials and ultimately will allow for the creation of right-handed nanomaterials that will have a range of applications in biotechnology, Rudra said.

Oxygen-delivering hydrogel accelerates diabetic wound healing

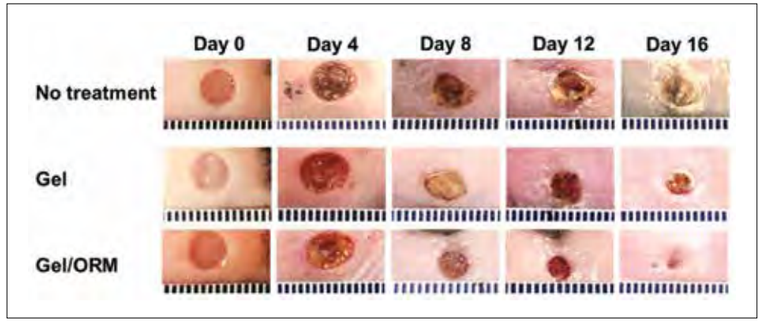
Written by Beth Miller

About one-fourth of people with diabetes develop painful foot ulcers, which are slow to heal due to low oxygen in the wound from impaired blood vessels and increased inflammation. These wounds can become chronic, leading to poor quality of life and potential amputation.

Jianjun Guan, a professor of mechanical engineering & materials science in the McKelvey School of Engineering, has developed a hydrogel that delivers oxygen to a wound, which decreases inflammation, helps remodel tissue and accelerates healing. **Ya Guan**, a doctoral student, and **Hong Niu**, a postdoctoral research associate, both in Guan's lab, are co-first authors.

Tissues in the body require oxygen to survive and need even more when tissue is injured.

Guan's hydrogel delivers oxygen to the wound using microspheres that gradually release oxygen to interact with the cells through an enzyme on their surface that converts what is inside of the microsphere into oxygen. The oxygen is delivered to the wound over about a two-week period, and inflammation and swelling decrease, which promotes healing.



Representative images of the wounds treated with or without gel and oxygen-release microspheres for 16 days.

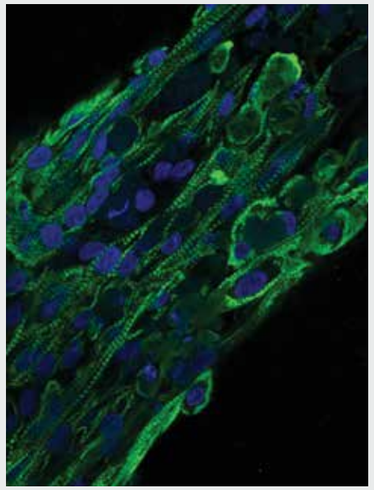
Results of the work, which were in a mouse model, were published Aug. 28 in Science Advances.

Potential mechanical triggers behind inherited heart disease focus of new study

Written by Beth Miller

Hypertrophic cardiomyopathy is caused by genetic mutations in the sarcomere, a protein apparatus that cardiomyocytes use to contract as the heart pumps blood. However, not all individuals with sarcomere mutations develop hypertrophic cardiomyopathy, even if they harbor similar mutations. This suggests that non-genetic factors may trigger the disease in patients who have genetic mutations.

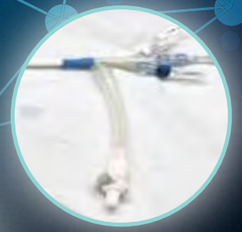
Nathaniel Huebsch, assistant professor of biomedical engineering in the McKelvey School of Engineering, will research the role that blood pressure plays in triggering symptoms in patients with hypertrophic cardiomyopathy with a five-year, nearly $2 million grant from the National Institutes of Health. He and his team will use a heart tissue model engineered from human induced pluripotent stem cells (iPSCs) to identify molecular mechanisms that sensitize heart muscle to the mechanical load imparted by hypertension.



Innovation *never stops*

McKelvey Engineering faculty look to solve problems with their technical expertise

Written by **BETH MILLER**



CLOCKWISE FROM TOP: ***Eric Leuthardt, MD**, demonstrates the IpsiHand device developed by Neurolutions; the underside of the Mackinac Bridge in Michigan where Infratico sensors are in use; a prototype of the device developed by CaeliVascular; **Jennifer Silva, MD**, using the holographic cardiac ablation guidance system developed by SentiAR; and **Shantanu Chakrabartty** (left), talking with a coworker on the Mackinac Bridge.*

COURTESY PHOTOS

The startup culture in St. Louis has been strong since the early 2000s, particularly at Washington University in St. Louis, where many successful startups began or have an association, including Square, GiftAMeal, Varsity Tutors, Answers.com, Cardialen and Exegy. And it hasn't slowed down: the venture capital firm M25 recently named St. Louis the fifth-best Midwest city for startups; St. Louis-based Arch Grants awarded 35 new startups with awards; and T-Rex awarded five $100,000 grants through its GeoSeed Grant Program. In 2020, St. Louis venture capital firm BioGenerator funded 22 startups in health care and agriculture.

Worldwide, investors poured nearly $25 billion into artificial intelligence startups, according to Statista, despite the ominous statistic that 90% of startup businesses fail.

Over the past several years, faculty members in the McKelvey School of Engineering at Washington University have made numerous technological advances in their labs based on years of painstaking research.

In fact, the goals in the school's 2018 strategic plan include increasing the number of faculty actively starting companies and commercializing technology from 10% to 20%, guaranteeing that students have the opportunities for entrepreneurial experience, appointing professors of the practice with entrepreneurial experience, and creating an Entrepreneurs in Residence program within the school. With assistance from the Office of Technology Management, as well as funding from various sources, these advances have been used to launch startup companies that offer solutions to existing problems.

THE FOLLOWING HIGHLIGHTS ONLY A FEW OF THE MANY STARTUP COMPANIES OUR FACULTY HAVE FOUNDED OR COFOUNDED IN THE PAST SEVERAL YEARS.

Infratico's roadside unit for collecting test data.

PHOTO COURTESY OF INFRATICO

Infratico

SHANTANU CHAKRABARTTY, professor of electrical & systems engineering and of computer science & engineering

Shantanu Chakrabartty and **Kenji Aono**, his former master's and doctoral student and postdoctoral researcher, launched Infratico (Infrastructure Analytics Co.) in 2020 with Nizar Lajnef, associate professor of civil and environmental engineering at Michigan State University. The company builds sensors and systems to monitor infrastructure, such as roads, to gather various types of data, including road conditions and traffic patterns. By embedding the sensors in the pavement, it also can determine structural integrity, such as cracks, before they become visible.

"The beauty of these sensors is that they collect these proprietary features that are very unique based on the mechanical properties, such as vibration," Chakrabartty said. "The sensors take that data and compress it right away and store in the cloud, so we don't need to send raw data over a wireless network. Then machine learning comes in to interpret and make sense of the data. Using AI techniques, we can make a prediction that something will happen."

The work stemmed from Aono's doctoral research at WashU, which he completed in 2018. For the past several years, the team has had its sensors deployed on the 5-mile-long Mackinac Bridge, which connects Michigan's upper and lower peninsulas and is the largest suspension bridge in the western hemisphere. The team first installed sensors in 2016 in work funded by the National Science Foundation (NSF). Five years later, in August 2021, Infratico received Phase I Small Business Innovation Research (SBIR) funding from the NSF to further develop its technology.

"We want to make smarter cities and smarter infrastructure," said Aono, who works out of a co-working space in Philadelphia. "Everyone's talking about autonomous vehicles. You can put laser radar cameras on your car to make it super smart, but the infrastructure is still dumb. What we want to do is take built environments, such as roadways, and give them some sense of smartness during Phase I. We're working on finding a way to change the radio communication between autonomous vehicles and the infrastructure."

In addition to bridges and roads, Chakrabartty said Infratico's sensors could be used to monitor the structural integrity of buildings, such as the Champlain Towers South Condominium tower in Surfside, Florida, that collapsed in June 2021.

"These sensors can monitor a huge bridge or building, and we want to determine what type of long-term maintenance or critical maintenance you need to do," Chakrabartty said. "They can last for 20 years before needing to be replaced."

DeepSight

LAN YANG, Edwin H. & Florence G. Skinner Professor in the Department of Electrical & Systems Engineering

Ultrasound technology has been used in medical diagnostics for decades. While it is a safe method of imaging to use, it does have limitations. **Lan Yang** and a team of researchers, including **Nader Sadrzadeh** and **Anand Chandrasekher**, have partnered to launch DeepSight designed to incorporate hardware, software and artificial intelligence technologies that will improve image quality and extend the depth that ultrasound can penetrate the body. DeepSight has more than 20 patents granted, exclusively licensed or in process.

"We want to help revolutionize the technology for medical imaging," said Yang, a co-founder and chief technology officer of DeepSight. "There are some emerging physics that we can make use of to better enhance the sensitivity of the current ultrasound system. When you reinvent the physics, then the data will look different, so naturally, we have to redo the software."

DeepSight's technology would allow ultrasound to see deeper inside a patient, providing better data for diagnostics in a variety of areas, including general radiology, cardiology, women's health, oncology and at the point of care in emergency rooms.

"In addition to enhancing the current performance, we can make the current medical diagnosis better by providing better imaging quality but also enhance the capability that would allow us to deal with some difficult cases that cannot be solved by ultrasound and have to be referred to more expensive diagnostic equipment," she said.

Yang said startup companies are important to the economy because they are able to take the risks needed to grow and develop technology.

"I can see the reasons why there are startups – they are resilient, flexible and can change direction based on market needs," she said. "Naturally, as a professor, I appreciate doing innovative research. Now I have a better understanding of engineering. When you address an innovation challenge, that's engineering."

Neurolutions

ERIC LEUTHARDT, MD, professor of neurosurgery at Washington University School of Medicine and of biomedical engineering

DAN MORAN, professor of biomedical engineering

Eric Leuthardt and **Dan Moran** have developed a first-of-its-kind device to help those disabled by stroke regain control over their arm and hand function by using their minds. The device, the IpsiHand Upper Extremity Rehabilitation System, was developed by their startup, Neurolutions, formed in 2007. It received Breakthrough Designation in May 2020 and market authorization from the Food and Drug Administration in April 2021. The product uses a non-invasive brain-computer interface technology licensed from Washington University. In the fall of 2021, it was awarded Product of the Year for California Life Sciences' Pantheon Awards, which recognize excellence and celebrate the contributions and achievements of leading life sciences innovators representing therapeutic, diagnostic, medical device and industrial biotechnology companies.

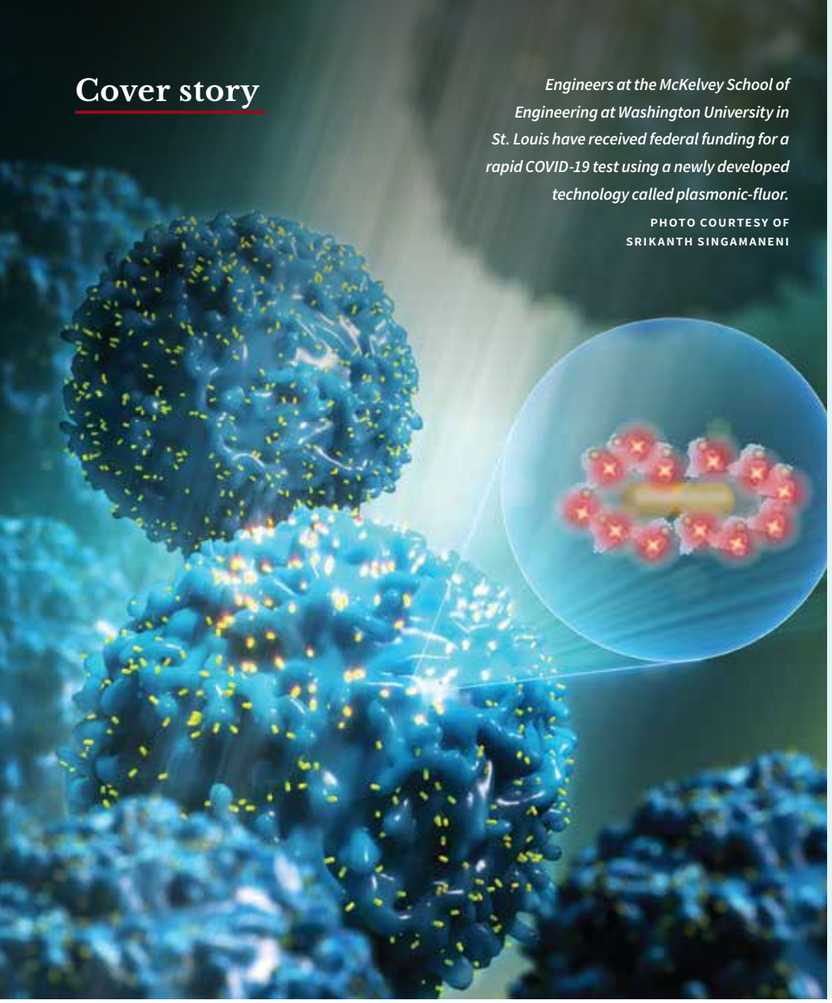
While not yet available to patients, Neurolutions is preparing to bring the device to market. IpsiHand is intended for stroke survivors who have difficulty in moving or controlling an arm and hand. Most patients recover some movement in the first few weeks after a stroke, but improvement generally wanes by six months, leading to stalls in progress.

Patients who have used the device so far have shown meaningful improvement in recovering some movement in their upper extremities when they weren't expected to see any improvement. The key is the use of a non-invasive, wearable brain-computer interface.

Early St. Louis-based investors included BioGenerator and Ascension Ventures. The company is now led by CEO Leo Petrossian and Fred Khosravi, chairman of the board.

A wireless EEG electrode device worn on the head and used to measure the patient's brain signals; these signals are analyzed by the system to determine the patient's intent to move their affected hand, and translates the signals into motor movement of the robotic skeleton, resulting in opening and closing of the impaired hand.

PHOTO COURTESY OF NEUROLUTIONS



Engineers at the McKelvey School of Engineering at Washington University in St. Louis have received federal funding for a rapid COVID-19 test using a newly developed technology called plasmonic-fluor.

PHOTO COURTESY OF SRIKANTH SINGAMANENI

Auragent Bioscience

SRIKANTH SINGAMANENI, professor of mechanical engineering & materials science

Since he joined the Engineering faculty in 2010, **Srikanth Singamaneni** has been developing novel gold and silver nanoparticles and platforms for biosensing. In 2018, his lab invented an ultrabright fluorescent nanoparticle called the plasmonic fluor, which can be used to create extremely sensitive tests for determining the concentrations of biological markers. These tests have higher performance and are simpler and cost less than what is used in both biomedical research and clinical diagnostics. In 2018, Singamaneni co-founded the company Auragent Bioscience, derived from the Latin words for gold (aurum) and silver (argentum). Auragent licensed the intellectual property rights to bring this technology to market.

Since its launch in 2018, Auragent has not only scaled up the manufacturing process of the plasmonic fluors, but also developed its own fluorescence reader, assay kits and antibodies to offer an entire biodetection platform initially targeted to biomedical researchers.

Auragent has received about $2.5 million in funding through two Phase I and one Phase II Small Business Innovation Research grants from the National Institutes of Health. They plan to have their products available to the commercial market in Summer 2022.

Singamaneni is joined by CEO **Shaker Sadasivam**, former president and CEO of SunEdison Semiconductor Ltd. and an alumnus of Olin Business School's executive MBA program; and **Scott Crick**, who earned a bachelor's degree and a doctorate in biomedical engineering from WashU Engineering in 2005 and 2011, respectively, and is now director of research and development for Auragent. Several former students and postdoctoral trainees from Singamaneni's lab are also working there, bringing the total number of employees to about 10.

Singamaneni said that he never expected that his research would take this direction.

"Although I do like a lot of work in the lab, the tech translation from the lab to market is a very, very different ballgame," he said. "If not for the team, I don't think I could actually think about how to approach this. I used to think about it very, very differently, and now I know that I was completely naive."

However, he said it is very rewarding to see his research culminate this way.

"This is the best way to make an impact," he said. "There is a lot of satisfaction in training students and sending them out, but these technologies coming out of your lab, if they can go into someone else's lab and answer research questions, is very rewarding."

OpenCell Technologies

J. MARK MEACHAM, assistant professor of mechanical engineering & materials science

J. Mark Meacham started OpenCell Technologies, an early-stage company developing intracellular nanomaterial delivery tools for life-sciences researchers, based on the research he did for his doctoral dissertation at Georgia Tech. The company makes ultrasonic droplet generators, which take fluid and turn it into small droplets for a variety of applications, including vaccine aerosolization, electrospray interface and mass spectrometry. The company received Phase I and Phase II grants from SBIR before going into silent mode before Meacham moved to St. Louis and got connected with BioGenerator Ventures.

Since then, OpenCell Technologies has pivoted to focus on using the device for the emerging gene therapy market and has recently received additional Phase II SBIR funding and venture capital.

"We've been around for a long time, but we still call it a startup company, though we have never sold a product," Meacham said.

Now, **Michael Binkley**, who was a student in Meacham's lab and earned a master's in biostatistics in 2015 and a doctorate in mechanical engineering in 2019, is joining the company as the principal investigator on the new SBIR grant, which will fund scaling up the device for gene therapy applications.

"Students who joined my lab often expressed interest in entrepreneurial activities and translation of their work into a product," Meacham said. "Michael and I were talking about starting a company based on his research, and the opportunity with OpenCell accelerates his development."

SentiAR

JONATHAN SILVA, the Dennis & Barbara Kessler Career Development Associate Professor of biomedical engineering and computer science & engineering

JENNIFER SILVA, MD, professor of pediatrics at Washington University School of Medicine

SentiAR, which developed visualization technologies for surgical applications, was co-founded by **Jonathan Silva** and **Jennifer Silva**, a pediatric cardiologist at St. Louis Children's Hospital. The company's first product, the CommandEP system, receives imaging data from the electro-anatomic mapping systems and creates a 3D holographic image via its proprietary data flow and visualization algorithms. The patented system presents a 3D image of the patient's heart showing in real-time the position of the catheters via a wearable headset. The system demonstrated up to 50% improvement in point navigation accuracy in clinical studies.

Jon Silva and his team of engineers created software for the headset that converts the data from the catheters fed into the patient's heart into a geometrical holographic image that hovers over the patient. The headset, which weighs roughly a pound, allows the physician to take control of the procedure by using his or her gaze to guide the controls and to keep hands free and sterile. Their system provides a 3D digital image of the patient's electroanatomic maps that provide a picture of the inside of the heart, which they can measure and manipulate during the procedure. The U.S. Food & Drug Administration cleared the CommandEP system as the first holographic guidance system to be used during invasive cardiac procedures.

In April 2021, SentiAR raised $5.1 million in Series A funding. Its investors include TechWald Holding; BioGenerator, the investment arm of BioSTL; Cultivation Capital; VCapital; Neue Fund; QRM Capital and Keiretsu Forum. It also has funding from the National Institutes of Health and an Arch Grant. The Silvas licensed their technology to SentiAR, which is further developing the augmented reality software. They have been working with the university's Office of Technology Management to bring the technology to market.

CaeliVascular Inc.

GUY GENIN, the Harold and Kathleen Faught Professor of Mechanical Engineering

ERIC LEUTHARDT, MD, professor of neurological surgery and of biomedical engineering

MOHAMED ZAYED, MD, PHD, professor of surgery, of radiology and of biomedical engineering

CaeliVascular Inc., co-founded by **Guy Genin**, the Harold and Kathleen Faught Professor of Mechanical Engineering, developed a device to treat large volume deep vein thrombosis (DVT). It is the first device to overcome the limits of previous-generation devices which have caused complications and death in patients with DVT. CaeliVascular has received a Phase II Small Business Technology Transfer (STTR) grant from the National Institutes of Health for its Hydra Catheter thrombectomy system.

Genin is chief technical officer; co-founder **Mohamed Zayed, MD, PhD**, is chief medical officer; and co-founder **Eric Leuthardt, MD**, is chief scientific officer. The company's employees include McKelvey Engineering alumni **Roger Rowe**, who earned bachelor's, master's and doctoral degrees from WashU in 2007, 2015 and 2018, respectively; **Julian Elson**, who earned an MEng in mechanical engineering in 2015; and **Usama Ismail**, who earned bachelor's and master's degrees in mechanical engineering in 2018 and 2019, respectively.

Other McKelvey Engineering startups, past or present

Observable Networks, started in 2011 by PATRICK CROWLEY, professor of computer science & engineering, was sold to Cisco Systems in 2017.

IAN BOGOST, professor of computer science & engineering, is founding partner at **Persuasive Games LLC**, an independent game studio.

Cardialen, founded by former faculty member IGOR EFIMOV, now at George Washington University. On Nov. 17, 2021, the company received FDA approval for an investigational device exemption to begin a clinical trial of its MultiPulse™ Therapy to treat paroxysmal and persistent atrial fibrillation.

CardioInsight, which was sold to Medtronic in 2015. YORAM RUDY, Fred Saigh Distinguished Professor of Engineering, was principal inventor.

Challenges CONQUERED

Written by **BETH MILLER**

Students in the Prison Education Project learn computer science the WashU way

***Jennifer Hudson**, former lecturer in political theory, Department of Political Science, in a 2017 photo.*

PHOTO BY JOE ANGELES

The omnipresence of computers in our lives makes Introduction to Computer Science (CSE 131) offered by the McKelvey School of Engineering's Department of Computer Science & Engineering the most popular undergraduate course at the university that is taken by students in all majors. While it requires no previous programming experience, it assumes that students have had high school algebra and geometry.

Most of today's undergraduate students have been using computers throughout their education and may even have had some coding or programming experience before entering Washington University in St. Louis. But a group of WashU undergraduate students who recently took Introduction to Computer Science had little, if any, computer experience, which made the class even more valuable to their education.

Students in a 2017 Prison Education Project class.

PHOTOS BY JOE ANGELES

Doug Shook, senior lecturer in computer science & engineering, took Introduction to Computer Science to the Missouri Eastern Correctional Center (MECC) in Pacific, Missouri, for students in University College's Prison Education Project (PEP) in Fall 2019 and made some follow-up visits in Spring 2020 before the pandemic. Students in PEP are enrolled in the same undergraduate courses taught on the Danforth Campus as they work toward an associate's or bachelor's degree. While the PEP students all have earned a high school diploma or a GED, it may have been years — or even decades — since they studied basic algebra or other math classes that would prepare them for the curriculum in a computer programming course. In addition, there is no access to computers inside the correctional center for those not in an educational program.

Intro to Computer Science teaches students how to solve problems, introduces processes and algorithms, procedural and data abstraction, encapsulation and object-oriented programming, and requires homework outside of the lecture periods. On the Danforth Campus, the class is taught through a "flipped classroom" approach, in which students view lectures online before going to class, allowing class time for discussion, questions and hands-on learning. Since there was a shortage of computers at the correctional center, Shook delivered the lectures during the weekly three-hour class period.

Shook, who has taught CSE 131 for seven years, planned to teach as much of the original curriculum as possible at MECC. But when he arrived there, he found a different situation.

> ***"I walked in expecting to teach a class the same way I always had, but it was a completely different experience . . . For the first month, I taught a computer science class without computers. We did the best we could with a whiteboard and a pencil and paper."***
>
> — **DOUG SHOOK,** *Senior lecturer in computer science & engineering*

After the computers arrived, Shook had to make some adjustments to the software, and the projector Shook needed to show his computer screen to the class took yet another month to arrive.

Despite these challenges, Shook and the students were determined to make the class a success.

"The students were extremely dedicated," Shook said. "It was quite painful to see that they wanted to work on more outside of class, but they were only allowed to be in the classroom for three hours in the morning and three hours in the afternoon, and sometimes there was another class in there, so it wasn't available to them. It was very difficult to ask students to write code on a sheet of paper and type it into the computer later."

Mariah Yelenick, who earned a bachelor's degree from WashU in computer science in 2020, was the teaching assistant for the course at MECC. She had been the TA for Shook's class for several semesters, so she volunteered for the role. Originally, she went with Shook to be there during the three-hour class period, but they quickly realized it would be more useful to the students if she were there for a different three-hour time period to offer more help.

"I was helping them with their labs, with debugging, with hands-on work while they were working on their homework, and preparing for exams," she said. "The guys in the prison cared so much about this class. They did every single reading we assigned them, they worked in the evenings together, formed study groups and cared so much about learning. For these guys, taking a computer science class made a bigger difference than for a traditional WashU student because they were starting with so much less, so in terms of rate of return on the time spent teaching, it was definitely higher at the prison. It really rejuvenated my desire to teach."

Yelenick continued to go to MECC until mid-March 2020, when the university moved classes online due to the COVID-19 pandemic, and MECC closed to outside visitors. She now works as a data scientist at a nonprofit corporation in the Washington, D.C. area. She also is in graduate school and volunteers with Microsoft's Technology Education and Literacy in Schools (TEALS) program, which helps high school teachers learn to teach computer science.

"My experiences at MECC were overwhelmingly positive," she said. "Teaching people computer science is one of the best things for someone's education, even if they don't pursue it as a career. It changes the way your brain thinks."

THE PRISON EDUCATION PROJECT

Offers **LIBERAL ARTS DEGREES** to people who are incarcerated and to prison staff.

In addition to the degree programs, it offers **TUTORING**, **READING GROUPS**, a **LECTURE SERIES** and a **CHESS CLUB**.

More than **20 STUDENTS** have earned associate's or bachelor's degrees.

*Jerome "JJ" Taylor celebrates his associate's degree with former University College **Dean Mark Rollins** and **Chancellor Emeritus Mark Wrighton**.*

Learning while incarcerated

PEP offers the same liberal arts courses taught by mostly tenured/tenure-track faculty that are offered on the Danforth Campus through the College of Arts & Sciences. Students study social sciences, humanities, math and natural sciences, as well as literature and foreign languages. The computer science course was a recent addition to the curriculum.

Barbara Baumgartner, teaching professor in Women, Gender, and Sexuality Studies and associate director of PEP for five years, said students had expressed interest in learning to code.

"We really wanted them to have a computer science class rather than a coding class," she said. "We reached out to Ron Cytron (professor of computer science & engineering), who thought it was a wonderful idea and introduced us to Doug Shook."

It takes PEP students about three years to earn an associate's degree and about six to earn a bachelor's degree, said **Robert Henke**, who, along with the late Maggie Garb, was co-director for seven years. Students can apply credits from other colleges and universities toward the 60 credits needed for an associate's and 120 credits needed for a bachelor's. They must maintain a minimum 2.7 GPA to enroll in a degree program. If they haven't completed their degree by the time they are released, they may continue seamlessly into University College on the Danforth Campus. Some of those who have completed their bachelor's degrees have continued onto graduate school or are planning to begin.

The Prison Education Project recently received a nearly $1 million innovation grant from the Andrew W. Mellon Foundation to develop a learning management system, similar to the Blackboard or Canvas systems used on the Danforth Campus, to be used at MECC and the Women's Eastern Reception, Diagnostic and Correctional Center in Vandalia, Missouri. It doesn't require an Internet connection and can deliver educational content to anyone in the prisons. By the end of 2022, PEP expects to have computers installed and operational at both facilities.

The grant also includes funding for a reentry program that helps PEP students and alumni find housing, jobs and funding to continue their education after their release from prison. Another organization that provides support for reentry is the St. Louis Reentry Collective, co-founded by **Harvey Galler**, who was a student in Shook's computer science class at MECC before his release in December 2019.

Galler had computer experience before he was incarcerated, so he wasn't as interested in taking the course until his cellmate and some others in PEP convinced him to join them. He said not having computers for the first month and having students with a wide variety of computer knowledge made it difficult, but taking the class was well worth it.

> ***"I did learn a little about programming, more than I already knew, and I did learn about myself, like how to develop patience."***
>
> — HARVEY GALLER
> *University College's Prison Education Project (PEP) student*

Since the students could not remove the laptops from the classroom or study hall area, they had some basic tablets that they could take back to their cells that allowed them to watch the lecture videos that provided basic introductory skills and logic in preparation for learning programming.

Galler took classes on the Danforth Campus in the Winter 2020 semester toward completing a bachelor's degree, but the shift to virtual learning was a difficult one for him. He's proud of his 3.97 GPA and plans to return to in-person classes in the near future. He and the other members of the St. Louis Reentry Collective are working on a documentary series focusing on those impacted by the prison system.

Jerome "JJ" Taylor, another PEP student who took computer science at MECC, is Galler's friend and former cellmate. Taylor said he was excited to take the course to learn about algorithms and felt he had a solid math background going into the class. Although he received a B in the course, he felt as though he had failed.

"I placed extremely high expectations for myself after being homeless with a drug addiction, receiving a conviction and a gunshot wound to the back from the police," Taylor said. "Therefore, anything below the best (in this case an A) was considered a huge failure, because I felt that I failed myself throughout the duration of my existence. I had to learn that just because you might not grasp it, it doesn't make you a slow person. It's one thing to fail, and it's another thing to let the failure consume you."

Taylor said his B grade in the class propelled him to apply to LaunchCode's programming boot camp, which he began in September 2021. When he earned his bachelor's degree in August 2021, he became the first man in his family to do so. Based on his experience in PEP, he has plans to launch a community-based STEM initiative in the future.

Galler, who now runs a resale business in addition to working with the STL Reentry Collective, said he appreciated Shook and his effort to make the most of the class despite the obstacles.

The 2019 graduates with faculty at the Commencement ceremony.

"He was really patient," Galler said. "He wanted to make sure that everyone understood, so we didn't even make it through a quarter of the material."

Taylor said Shook was one of the best things about his experience in the class.

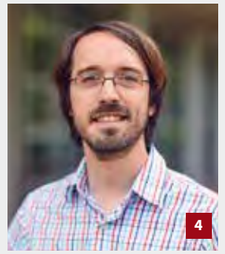
"He didn't give up on us," Taylor said. "He did what he knew to do as a professor with a subject like computer science that is so theoretical, straightforward and unemotional. Here you've got this guy teaching one of the most indifferent disciplines you can teach, and he had so much conviction trying to make sure that we grasped it."

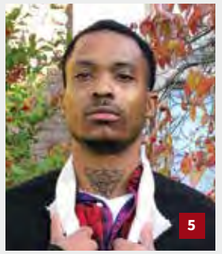
Shook said while the class offered numerous challenges, he feels like he owes it to students at MECC to go back and teach it again.

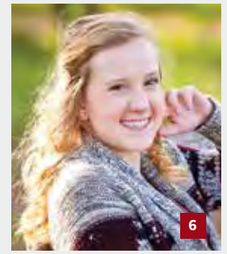
"It drove me to try even harder to get it to where I think it should be," Shook said. "Just seeing how much work there is left to do, I want to go back in there and do it. It's our duty as a university to do that work."

Meet the people involved with the computer science course offered through PEP.

1. **BARBARA BAUMGARTNER** — *Associate Director of PEP for five years*
2. **ROBERT HENKE** — *Co-director of PEP for seven years*
3. **HARVEY GALLER** — *PEP Student*
4. **DOUG SHOOK** — *Lecturer for the course at MECC*
5. **JEROME "JJ" TAYLOR** — *PEP Student*
   PHOTO BY NATASHA NARAYANAN
6. **MARIAH YELENICK** — *Teaching Assistant for the course at MECC*







FOR MORE INFORMATION ABOUT PEP, VISIT **PRISONEDPROJECT.WUSTL.EDU**

Engineering student groups use their ingenuity to provide community during mostly virtual academic year

PERSEVERANCE THROUGH THE PANDEMIC

Written by **BETH MILLER**

Students thrive on connections with each other, and student groups play a big role in that. What happens when all in-person activities are canceled for an entire academic year due to a global pandemic?

Several McKelvey School of Engineering student groups used their innate problem-solving skills and developed creative ways to keep their groups active after the March 2020 campus closure. And while most of the events were over Zoom or a similar platform, students were able to form new friendships and maintain existing ones, even when in different parts of the country and the world.

AGES (Association of Graduate Engineering Students) float trip in September 2021.

"Now that vaccination rates are increasing, we are beginning to promote our in-person events, starting with the monthly happy hour, now held outdoors . . . We went on a float trip on a Saturday in September and had a lot of people participate. Everyone is happy to be able to be together and spend time together off campus."

— **RACHEL BLOW**
AGES coordinator and a dual degree master's student in chemical engineering

OSTEM @ WASHU, which supports the LGBTQ+ community in science, technology, engineering and math, faced an additional challenge: it launched at WashU in fall 2020. Despite few students being on campus, an inaugural group of nine students, from both McKelvey Engineering and Arts & Sciences, gathered to form the organization, write meeting and event plans, and train new members. Its first general board meeting attracted more than 40 students. By the end of the academic year, the group had nearly 100 members and was quickly growing its social media following.

"The fact that we had so many people speaks to the reality that queer reality in STEM is so poor, and there is so much desire to change that," said **David Massey**, external president of oSTEM. "The prospect of being able to have that kind of impact energized a lot of people."

"We wanted to have a fun and interactive experience, and Zoom really helped empower us to do that because not all of these people were in St. Louis."

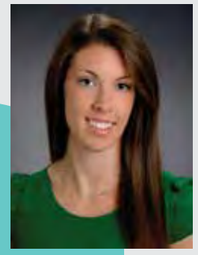
— DAVID MASSEY
Senior majoring in geology in Arts & Sciences

AGES 2020 Holiday party held virtually on Gather.

THE ASSOCIATION OF GRADUATE ENGINEERING STUDENTS (AGES) offers both professional and social activities for graduate students in McKelvey Engineering. While AGES transitioned its general board meetings and a few other events to Zoom, the executive board wanted to maintain a sense of community in this newly transitioned virtual and social-distanced world. In one of the efforts to directly engage graduate students, the group had a running challenge that asked participants to log miles run over a month using the Nike Run Club app.

In addition, the group had various social media challenges that required using different hashtags corresponding to different themes each month. They then held a prize drawing for anyone who posted and tagged AGES. By the time the winter holidays approached, group members were experiencing Zoom fatigue, so AGES moved to the Gather.town platform, which creates a virtual campus that allows students to more realistically recreate the interactions they had when on campus. They used Gather.town to host their virtual holiday party, which they shared with the Graduate Professional Council and Graduate Student Senate. Participants each had an avatar with which they could play games, have an ugly sweater contest and celebrate together without actually being in the same physical place.

For their coordination of the holiday party event, AGES won a Liberman Leadership Award for Interdisciplinary Collaboration from the Liberman Graduate Center.



"It was a way to be boost friendly competition, promote active physical and social lifestyles, and best of all, you could participate from anywhere in the world . . . It went so well that we extended it to cycling the next month."

— MELISSA MCCANN
Communications officer for AGES and a doctoral student in mechanical engineering & materials science

AGES students marked the end of the fall 2021 semester with a happy hour at a nearby bar. All students were vaccinated and were following recommended guidelines at that time.

PHOTO BY TAYLOR BEVIRT

Outdoor AGES happy hour. The group's popular happy hours had to move outdoors for 2021.

THE SOCIETY FOR WOMEN ENGINEERS (SWE) offers social, networking and professional events for women engineering students. The group transitioned its professional events to Zoom calls and had a good turnout, said **Caitlind Walker**, who is president of SWE.

"While it was good for professional development and corporate relations, what was more important to us was having that connection and a community of women engineers that students knew they could go to," Walker said.

Walker and the executive board created a social event for group members every two weeks throughout the 2020-21 academic year. Events included online escape rooms and a cookie decorating event with prizes.

"A few SWE members knew each other from a class they had together, but being in the virtual SWE events allowed them to become friends. That makes me happy to see that SWE helped them form that bond." Walker said.

In addition, some of the first-year students had the opportunity to participate in the virtual national leadership conference, which includes networking opportunities, career skills, resume reviews, and a career and internship fair.

One of SWE's social media cards promoting a virtual event.

Student feature

The **24-MEMBER WU ROCKETRY TEAM** was able to design, manufacture and build a rocket that could reach a height of 1 mile and release a payload during landing, all during the 2020-21 academic year. Since campus buildings were mostly closed, **Caitlind Walker**, founder of the group and a senior majoring in electrical engineering, hand-delivered parts of the rocket to members of the team who were in St. Louis. Each team member or small group of members would build one component, then Walker would pick up the components and add them to the rocket. Since they had limited access to the Spartan Light Metal Products Makerspace, they had to use external manufacturers to fabricate parts for their rocket. The team's participation in the annual NASA Student Launch was possible with support from the McDonnell Center for Space Sciences.

ENCOUNCIL followed a similar model by offering an event every two weeks. Instead of the traditional gathering that offers cookies and milk after physics exams, students could register to pick up their cookies earlier in the day, then gather on Zoom to eat their cookies together virtually and relax after the exam.

To get more people involved, EnCouncil often partnered with other student groups, such as SWE and Alpha Omega Epsilon (AEO), a social and professional sorority for women in STEM. Walker said EnCouncil asked members and participants for feedback throughout the year to improve events as the year went on.

"Those who attended the events really liked them and said they got to know other people in more of a social setting than an academic setting," she said.

Many other student groups, including the National Society of Black Engineers, held virtual events and meetings throughout the year.

"There were a lot of first-year students involved, and they told me they have felt more of a sense of community at WashU in general because of these events."

— CAITLIND WALKER, *President of SWE*

The Society of Women Engineers held a virtual cookie decorating event. They provided kits for each participant, then decorated them together via Zoom. SWE also held a virtual Halloween costume contest and a virtual escape room event.

FOCUS ON EDUCATION

Written by **BETH MILLER**

MCKELVEY SCHOOL OF ENGINEERING

launches Division of Engineering Education to focus on world-class education for students and tools for faculty.

***Shaina Rowell,** assistant director of the Center for Teaching and Learning, presents on effective lesson planning to new STEM faculty.*

PHOTOS BY WHITNEY CURTIS

***Tucker Krone,** lecturer in the Division of Engineering Education, discusses lesson planning with **Athena Tabakhi,** lecturer in computer science & engineering.*

McKelvey School of Engineering has launched a new Division of Engineering Education to facilitate a world-class, well-rounded engineering education for students that stems from excellence in instruction and the art and science of teaching.

Jay Turner has been appointed head of the division by Dean Aaron F. Bobick, dean and the James M. McKelvey Professor. Turner also is vice dean for education, the James McKelvey Professor of Engineering Education and professor of energy, environmental & chemical engineering.

"The creation of this new division is an exciting development for McKelvey's educational enterprise," said **Jennifer R. Smith**, vice provost for educational initiatives and professor of earth and planetary sciences. "Its efforts in developing transformative, cross-cutting experiences for students and in supporting department- and school-wide efforts to create and promote evidence-based pedagogies will help place McKelvey at the forefront of educational innovation."

"This new division was designed to support both our school's departments and instructors and serve as a test bed to develop and adopt innovative approaches to engineering education," Bobick said. "It also will facilitate and coordinate interdisciplinary and collaborative projects among multiple departments."

"The Division of Education will be a key resource for experiential learning and career-development programming within McKelvey and foster multidisciplinary and interdisciplinary design-, problem- and project-based opportunities for students," Turner said.

The Division of Engineering Education will focus on a curriculum that is not specific to any engineering domain with such courses as Engineering Ethics and Sustainability; Amplifying CyberDiversity: Real Humans in Virtual Spaces; Technical Writing; Leadership and Team Building; Conflict Management and Negotiation; and Engineering Math, among others. In addition, it will focus on the 14 Grand Challenges for Engineering put forth by the National Academy of Engineering, which include advancing personalized learning, securing cyberspace, and engineering the tools of the scientific discipline.

The academic-focused division will be the home for experiential learning and project- and problem-based learning within the school, as well as for communications skills and how they apply in the workplace.

"We are discussing with the department chairs on how the division can support, rather than replicate, what they are already doing," Turner said. "We plan to tackle corners of the enterprise that the departments would like to see but aren't planning to stand up themselves."

Teaching fellows who will focus on specific areas of education will join the division. The first teaching fellow will focus on machine learning as it applies to mechanical engineering. In addition, the division will house a new STEM faculty onboarding program, led by **Jason Crandall**, director of Learning Design & Innovation, and **Meghann Pytka**, instructional specialist, that will help McKelvey Engineering faculty who have teaching responsibilities understand the expectations, standards and resources used in STEM courses while providing the tools and techniques needed for high-quality instruction. The onboarding program will include seminars on classroom management, educational technology and faculty development, as well as mentoring, networking and observing classrooms.

Overall, the division will serve as an umbrella organization for a variety of existing offices and academic programs in the school, including the Engineering Communications Center and Instructional Design and Technology. Some full-time lecturers, adjunct faculty, staff and postdoctoral engineering education specialists will be housed within the division.

In addition, the division will coordinate efforts across all departments, including integrating new instructors and offering mentoring, establishing best practices in academic advising, centralizing some of the school's service courses and creating new courses that appeal to students throughout the school. It also will support departments in assessing existing curricula, developing new curricula and program-specific initiatives, and serving as a focal point to engage with university-wide education initiatives. The division will house some student activities, groups and organizations that do not have a departmental home or affiliation.

JAY TURNER
Head of the new Division of Engineering Education

JASON CRANDALL
Director of Learning Design & Innovation

MEGHANN PYTKA
Instructional Specialist

***Alexandra Rutz,** assistant professor of biomedical engineering, discusses lesson planning with **Neha Singh,** lecturer in computer science & engineering, at a seminar on effective lesson planning for STEM faculty.*

Two WUSEF, McKelvey Engineering grads earn research awards

Written by DANIELLE LACEY

Kyle Thomas and Jonathan Smith, who both took part in undergraduate research programs at the McKelvey School of Engineering, have earned the prestigious Graduate Research Fellowships from the National Science Foundation (NSF).

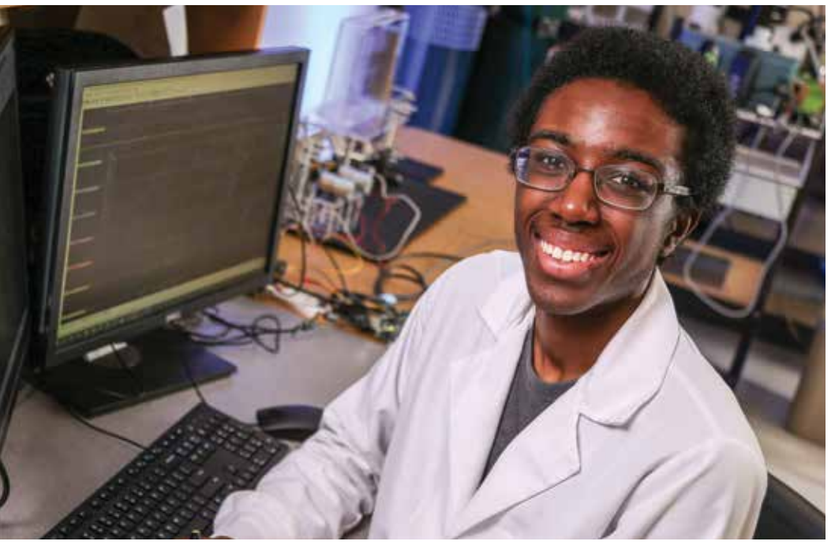
As well as being alumni of McKelvey Engineering, Thomas and Smith are also alumni of the Washington University Summer Engineering Fellowship (WUSEF).

Each summer, WUSEF hosts a cohort of exceptional students from backgrounds underrepresented in the STEM fields as they work in university labs and learn more about academic research. The goal is to prepare students with the experiences and resources they'll need to continue in research.

"I started the WUSEF program in 2015 with support from the Engineering school and the Office of the Provost," said **Phil Bayly**, the Lee Hunter Distinguished Professor and chair of the Department of Mechanical Engineering & Materials Science. "I built on the examples of the successful summer research programs at the medical school that increased the numbers of students from under-represented groups who applied to medical school at WashU."

Kyle Thomas took part in the program in 2018 and worked in Bayly's lab. **Jonathan Smith** also participated in 2018, performing research in the lab of **Kathy Flores**, professor of mechanical engineering & materials science and interim chair of the Department of Energy, Environmental & Chemical Engineering.

"Diversity of people encourages diversity of thought," Smith said. "If there were more diversity in STEM, you probably wouldn't see so many biases making their way into people's work. People often don't think that gender or racial bias get into their work, but it does more than they think."



***Kyle Thomas**, who earned a bachelor's degree in biomedical engineering in 2019, is a doctoral student studying biomedical engineering at the Georgia Institute of Technology and Emory University, and focusing on understanding how the nervous system allows for motor skill development.*

PHOTO BY CAROLINE JOE

***Jonathan Smith**, who earned a bachelor's degree in mechanical engineering in 2020, is a doctoral student studying aerospace engineering and mechanics at the University of Minnesota. His work will apply mathematical concepts from control systems theories to high-speed turbulence for use in aerospace and high-speed vehicles.*

PHOTO BY CRAIG LASSIG

Fellowship Experience

Graduate Research Fellowships provide students with three years of financial support, which includes a stipend and academic scholarship.

Thomas credits his undergraduate research experience with helping him succeed in applying for his fellowship. His experience in the lab led to a publication that he was able to use to strengthen his proposal.

"When you're doing research during the year, you can only give a couple hours a week," Thomas said. "When you're working full-time in the summer, you get a lot more done. You get to interact with the graduate students, build off each other's energy and accomplish more because of that."

Students are only allowed to apply for a Graduate Research Fellowship twice: once as an undergraduate and once as a graduate student. Both Thomas and Smith applied as graduate students, but Thomas says he regrets not applying sooner.

"I didn't feel that I was ready, and I didn't have a project in mind," he said. "In hindsight that was the wrong way to think about it. I should have submitted something and gotten feedback. Later, I had a chance to present my project idea and get a lot of feedback. I realized I did have all the pieces I needed."

Smith had already received a fellowship for his first year of study, which provided him with an opportunity to work closely with an adviser to research and draft a proposal.

"Every week, the research I was doing was reading papers and getting a better understanding of the topics so I could talk about them better in the application," Smith said.

Smith even had Thomas look through a draft of his application before submitting it.

"I had Kyle look over it for me because I know there's no guarantee from the NSF that the reviewers will be in your specific area," he said. "I find it better to be safe than sorry."

Both Thomas and Smith say they're grateful for the fellowship, as they won't have to worry about tuition or funding their research.

"With this support, I can branch out and work on personal goals," Thomas said. "I want to teach. I could take a semester to design a class or work with high school students. My interest is neuroethics, and I think that's a good topic to introduce to people before they are involved in the study."

What advice do they have for students hoping to follow their lead?

"Failing happens, and it's happened to me a lot of times. It's important to keep track of when failures happen and why, partly so they don't happen again and because they can lead to other interesting findings."

— KYLE THOMAS

"Research is very different from most of the things you're taught in engineering. It's much more open. You have to figure things out for the sake of figuring things out more so than you'd be expected to in other environments like the classroom."

— JONATHAN SMITH

Ling among *Popular Science*'s 'Brilliant 10'

Fangqiong Ling's lab studies microbial ecosystems to improve water supply safety and public health.

Popular Science magazine has named **Fangqiong Ling**, assistant professor at the McKelvey School of Engineering at Washington University in St. Louis, one of its "Brilliant 10."

After a five-year hiatus, the magazine's signature awards program has returned to highlight early-career scientists and engineers who are working to make positive change in the world.

Ling came to Washington University in 2018 from the Massachusetts Institute of Technology, where she was a postdoctoral fellow supported by the Alfred P. Sloan Foundation Microbiology of the Built Environment program. Her research aims to tell the story of microbes in water — drinking water and wastewater — and to use what she learns from the microbial systems to guide development of tools to improve everything from public health to quality of life.

Dahlheimer, Matteucci to receive Emerson Excellence in Teaching awards

Seema Dahlheimer and **Sandra Matteucci** were among the seven recipients at Washington University who received the 2021 Emerson Excellence in Teaching Awards in mid-November. They are among more than 80 teachers in the St. Louis area who are recognized this year for their outstanding commitment to educational excellence.

Dahlheimer is assistant director of the Engineering Communication Center and a senior lecturer of technical writing. She teaches Technical Writing, Engineering Leadership & Team Building, Engineers in the Community, and Reflective Writing in Medicine and Healthcare. She has been with McKelvey Engineering for 13 years but has been with WashU since she was an undergraduate student in the late 1990s and early 2000s.

Matteucci is director of the Engineering Communication Center and a senior lecturer. With funding from the Gephardt Institute, she piloted a class entitled Destination Ferguson that has evolved into the present course, Engineers in the Community. Matteucci teaches Technical Writing and Engineering Ethics and Sustainability. In her role as director of the Engineering Communication Center, she recently expanded offerings to include graduate courses in Communication Tools, Publication Writing and Presentation Skills.

Seema Dahlheimer

Sandra Matteucci

Ramani named vice provost for graduate education

Vijay Ramani, the Roma B. and Raymond H. Wittcoff Distinguished University Professor of Environment and Energy at Washington University in St. Louis, has been named vice provost for graduate education, announced Provost **Beverly Wendland**. His three-year appointment was effective Jan. 1. In his new role, Ramani, who also is a professor and director of graduate studies in the Department of Energy, Environmental & Chemical Engineering in the McKelvey School of Engineering, will serve as a key member of the provost's core leadership team, advising the provost on graduate education trends, programming and policy and acting as a collaborative partner with the schools. He is a member of the Faculty Senate Council, serving as chair in 2020-21, and is also a member of the strategic planning coordinating committee.

McKelvey Engineering has three of world's most 'highly cited researchers'

Randall Martin

Rohit Pappu

Lan Yang

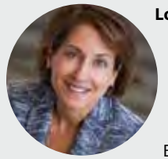
The Institute for Scientific Information has named **Randall Martin**, **Rohit Pappu** and **Lan Yang**, all professors in the McKelvey School of Engineering at Washington University in St. Louis, among the most highly-cited researchers in the sciences in 2021.

The annual list identifies 6,600 researchers from more than 70 countries and regions who demonstrated significant influence in their chosen field or fields through the publication of multiple highly cited papers during the last decade. Their names are drawn from the publications that rank in the top 1% by citations for field and publication year in the Web of Science citation index.

University-wide, 45 researchers made the 2021 list.

LISSNER AWARD

Setton receives 2022 Lissner award from ASME



Lori Setton, the Lucy & Stanley Lopata Distinguished Professor and chair of the Department of Biomedical Engineering at the McKelvey School of Engineering, has been named the recipient of the 2022 H.R. Lissner Medal by the American Society of Mechanical Engineers (ASME).

The prestigious Lissner Medal recognizes outstanding achievements in the field of bioengineering. Setton received the honor for her mechanobiology research related to degenerative cartilage disease, significant contributions leading to a better understanding of osteoarthritis and intervertebral disc disorders and for internationally recognized leadership in the bioengineering community.

Setton is the second woman to win this award since it was established in 1977.

2021-2022 Faculty news

New faculty join McKelvey School of Engineering

By **BETH MILLER**

The new faculty bring a wide range of expertise to bolster teaching, research

BIOMEDICAL ENGINEERING

CHRISTINE M. O'BRIEN

Assistant Professor

- PhD, Vanderbilt University, biomedical engineering, 2017
- BS: University of Missouri, biological engineering, 2010

Christine O'Brien joins McKelvey School of Engineering from Washington University School of Medicine, where she has been an instructor in the Mallinckrodt Institute of Radiology since spring 2021. During her postdoctoral research, she received a W.M. Keck Postdoctoral Fellowship to develop focal dynamic thermal imaging for point-of-care cancer detection. She plans to join McKelvey Engineering on July 1, 2022.

O'Brien's research involves a wearable multimodal optical sensor for early detection of postpartum hemorrhage, which is funded by a nearly $1 million Pathway to Independence Award from the National Institute of Child Health and Human Development and a Washington University Women's Health Technologies Collaboration Initiation Grant.

MICHELLE OYEN

Associate Professor

- PhD, University of Minnesota, 2005
- MS, Michigan State University, 1998
- BS, Michigan State University, 1996

Michelle Oyen joins BME from East Carolina University, where she has been an associate professor in the Department of Engineering. Prior to her time at East Carolina University, Oyen was a Reader (senior academic position similar to full professor) at Cambridge University, where she established a successful and independent research lab studying soft tissue mechanics and other biomaterials.

Oyen's research interests include bioengineering approaches to the study of pregnancy and childbirth, mechanical properties of hydrogel and hydrogel composite materials, and biomimetic materials referencing both hard and soft natural tissues.

COMPUTER SCIENCE & ENGINEERING

IAN BOGOST

Professor

- PhD, MA: University of California, Los Angeles, comparative literature, 2004 and 2001, respectively
- BA: University of Southern California, philosophy & comparative literature, 1998

Ian Bogost joins McKelvey School of Engineering from Georgia Institute of Technology, where he was the Ivan Allen College Distinguished Chair in Media Studies, professor of interactive computing, of architecture, and in the Scheller College of Business. In addition, he was affiliate faculty with the Graphics Visualization and Usability Center; the Center for 21st Century Universities; and for the Center for the Development and Application of Internet of Things Technologies. He also has an adjunct professorship at Brock University in St. Catherine's, Ontario, Canada, in the Centre for Digital Humanities. He is a founding partner of and chief designer at Persuasive Games LLC, an independent video game developer, and a contributing editor for *The Atlantic*. He joined the faculty July 1, 2021.

Bogost is internationally recognized for his writing on video games and media studies. He is the author of 11 books, several book series, many book chapters and journal articles. His research approaches media studies from the perspective of both a critic and a practitioner. While in graduate school, Bogost also worked for tech companies in the digital media space. He will bring that technical humanist experience to Arts & Sciences. Bogost will boost the university's growing expertise in video games and new media through his primary appointment in Arts & Sciences and secondary appointment in Engineering.

NEHA SINGH

Lecturer

- PhD: University of Maryland, Baltimore County, 2022
- MTech: Jawaharlal Nehru University, 2014
- BTech: Hindustan College of Science & Technology, 2011

Neha Singh's research area is artificial intelligence and applying machine learning and natural language processing methods to solve the interdisciplinary problems of disaster management. The goal of her work is to build efficient predictive models which can extract crucial relevant insights and information regarding the disaster in real-time.

ATHENA TABAKHI

Lecturer

- PhD: Washington University in St. Louis, 2021
- MS: New Mexico State University, 2014
- BEng: Azad University of Tehran, 2009

As a doctoral student, **Athena Tabakhi** researched modeling and solving the elicitation and scheduling problem of home automation systems. The algorithms for solving the home automation scheduling problems focus on obtaining homeowners' preferences and constraints regarding their use of smart devices.

MECHANICAL ENGINEERING & MATERIALS SCIENCE

CHIAMAKA ASINUGO

Lecturer

- BS/MS: Washington University in St. Louis, mechanical engineering, 2016

Chiamaka Asinugo was promoted to lecturer from lab & design course specialist in mechanical engineering & materials science. Since then, she has run courses in design and vibrations, and also is an adjunct instructor for the UMSL/WashU Joint Undergraduate Engineering Program and runs a College Prep summer course.

ELECTRICAL & SYSTEMS ENGINEERING

IOANNIS (YIANNIS) KANTAROS

Assistant Professor

- PhD, MS: Duke University, mechanical engineering and materials science, 2018 and 2017, respectively
- Diploma (MS): University of Patras, Greece, electrical and computer engineering, 2012

Yiannis Kantaros joins the McKelvey School of Engineering from the University of Pennsylvania, where he is a postdoctoral researcher.

His research was focused on enabling safe, robust and distributed autonomy for robotic systems, such as drones and autonomous cars. His work seeks to understand how teams of robots need to coordinate and use their heterogeneous sensing capabilities to safely accomplish complex missions in unknown environments in the presence of sensing and perceptual uncertainty. He has designed safe reinforcement learning algorithms and perception-based control frameworks that constitute the first formal bridge between Simultaneous Localization and Mapping (SLAM).

ARAVIND NAGULU

Assistant Professor

- PhD: Columbia University, electrical engineering, 2021
- MTech: Indian Institute of Technology Madras, microelectronics & VLSI, 2016
- BTech: Indian Institute of Technology Madras, electrical engineering

Aravind Nagulu joined the McKelvey School of Engineering in January 2022 from Columbia University, where he earned a doctorate in electrical engineering.

Nagulu's research interests lie in the intersection of integrated circuits and systems, electromagnetic, communications, biomedical systems, and quantum computing systems. He has been a pioneer in the area of novel wave propagation based on time-variance and has explored the use of time-variance to achieve non-magnetic non-reciprocity and wave propagation beyond the delay-bandwidth limit. His doctoral research dealt with the breaking of Lorentz reciprocity without the use of magnetic materials and the implementation of high-performance components in commercial CMOS processes for emerging applications including full-duplex wireless, full-duplex MRI, and quantum computing.

Five new tenured/tenure-track faculty will join the McKelvey School of Engineering for the 2021-2022 academic year, bringing the total number of faculty to 99 and further bolstering the school's research and academic strengths.

"We are excited to welcome these new faculty members to the McKelvey School of Engineering who bring new areas of expertise as well as other new areas of research that will further strengthen our robust research and education for our students."

— AARON F. BOBICK, *Dean & James M. McKelvey Professor*

McKELVEY ENGINEERING AWARDS

MARK BARTEAU

Alumni Achievement Award

Mark Barteau has been widely recognized for his scientific and professional leadership in the fields of chemistry and chemical engineering. As vice president for research at Texas A&M University and professor in the department of chemistry, his research focuses on chemical reactions at solid surfaces and their applications in various catalysis and energy processes.

Barteau is a member of the National Academy of Engineering, an elected fellow of the American Association for the Advancement of Science and a fellow of the National Academy of Inventors. He earned a bachelor's degree in chemical engineering from Washington University in 1976 and a master of science degree and a doctorate in chemical engineering from Stanford University.

TONY NOCCHIERO

Alumni Achievement Award

Tony Nocchiero began his career as a financial analyst with Amoco Corp. in 1975. Over the next 23 years, he was a member of the senior leadership team filling a variety of financial and management roles. After Amoco's 1998 merger with BP, Nocchiero became the chief financial officer at BP Chemicals and guided the accounting services team. He later served as chief financial officer of Merisant Worldwide, and in 2007 joined CF Industries Inc. as senior vice president and chief financial officer. Since retiring in 2010, Nocchiero has served on the board of directors for Callon Petroleum.

Nocchiero earned a bachelor's degree in chemical engineering from Washington University in 1973. He also holds a master of business administration from Northwestern University.

LOUIS GRIESEMER

Alumni Achievement Award

With the founding of Griesemer Stone Co. in 1946, **Louis Griesemer** entered the family business as a safety director and mine planner providing crushed limestone to the construction and agricultural markets. In 1994, the company merged to become Springfield Underground. For the next 23 years, Griesemer served as president and CEO, until he retired in 2017 and passed the company to a third-generation family member. Griesemer is now chairman of the board for Erlen Group, a corporate umbrella for Springfield Underground and other real estate investments.

Griesemer earned a bachelor's degree in applied mathematics and computer science from Washington University in 1977.

NANCY PENDLETON

Alumni Achievement Award

As the vice president of mission systems for Boeing Defense, Space & Security Engineering, **Nancy Pendleton** is responsible to execute and develop processes and performance metrics on Boeing platforms. As the senior chief engineer for mission systems, payloads and sensors, she also ensures the technical integrity of all Boeing mission systems. She has been with Boeing since 1988.

In 2019, she was inducted into the Academy of Electrical and Computer Engineering, which recognized her outstanding contribution to the profession, leadership and involvement with Missouri University of Science & Technology.

Pendleton earned two master of science degrees in management of technology and engineering management from Washington University in 1993. She earned a bachelor's degree in electrical and electronics engineering from Missouri University of Science & Technology.

TO SEE VIDEOS OF EACH OF THE RECIPIENTS:

bit.ly/35IBMWN

BLAKE MARGGRAFF

JOE MCDONALD

Engineering Entrepreneurship Award

As change-makers, thought leaders and visionaries — **Blake Marggraff** and **Joe McDonald** knew that their entrepreneurial partnership and complementary approach would make a significant impact.

CareSignal, founded in 2015, is a deviceless remote patient monitoring platform that reduces hospitalizations and improves care for patients with chronic conditions and serves dozens of large health systems and physician groups across the United States.

As CEO, Blake Marggraff guides the AI strategy, leveraging vertically integrated data collection and downstream solution implementation to deliver engagement, outcomes, and returns as CareSignal grows. With an analytical approach to innovation and strategy as president, Joe McDonald creates disruptive business models to improve quality and reduce costs.

Marggraff earned a bachelor's degree in biology from Washington University in 2015. McDonald earned a bachelor's degree in biomedical engineering and master of business administration from Washington University in 2015.

GARY WENDLANDT

Dean's Award

In 1972, **Gary Wendlandt** worked as an actuarial student at Massachusetts Mutual Life Insurance Company. In 1980, Wendlandt was tapped as the first actuary at MassMutual to join the firm's investment department to solve new problems. Three years later, he was named head of securities investments.

Over the next three decades, Wendlandt grew with MassMutual, eventually serving as chief investment officer before moving to New York Life Insurance Co., to lead the firm's investment activities through New York Life Investment Management. In 2010, he retired as vice chairman of the board.

Wendlandt earned a bachelor's degree in applied mathematics and computer science from Washington University in 1972.

rehabilitation

def. the action of restoring someone to health or normal life through training and therapy after imprisonment, addiction, or illness

Written by **DOUG SHOOK**

It is hard for me to imagine a situation that would end up with me going to prison. Yet there I was, walking through the airlock onto the prison grounds, surrounded by people who were sentenced to spend precious moments of their lives, or perhaps even their entire lives, behind these walls.

Some of them would be able to leave once their sentences were served, but what then? Some of my students had not used a computer much, if at all, since the 1990s. They knew about the internet but were not allowed to be on it. What would life be like for them once they were released? Would they have the skills to get a job to support themselves? How were they supposed to prepare when they had very few resources available to them inside the prison?

Statistics show that half or more of all prisoners will be reincarcerated within three years of release, in large part due to their unpreparedness to reenter society.

We cannot eliminate this recidivism without helping these people through rehabilitation. We must provide tools to all those who wish to better themselves, and I can think of no better tool for bettering oneself than education. That is why the work of the Prison Education Program is so important. When we help those in our society who need it most, we all benefit.

Washington University in St. Louis
James McKelvey School of Engineering

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Snapshot

The May 2021 Commencement was held on Francis Olympic Field to allow for social distancing.