

Arkansas Engineer

The Alumni Magazine
of the University of Arkansas
College of Engineering

Fall 2023

COVER STORY PAGE 28

RESEARCH COLLABORATIVE OFFERS HOPE FOR KIDNEY PATIENTS

**Chemical engineering researchers
join with UCLA physician in quest to
develop artificial kidney that could
give patients freedom from dialysis**



**UNIVERSITY OF
ARKANSAS**

College of Engineering

While it may be a cliché, it's also often true: Time flies! It's been three years since I was named dean of the College of Engineering, yet it's gone by in a flash. I'm proud of what we've been able to accomplish during this time, but I also feel a sense of urgency to do so much more in service to our students, our campus and our state.



I'm grateful for the visionary leadership of Chancellor Charles Robinson, who hit the ground running after his appointment last fall. In working on a strategic plan for the college, Vision 2035, we have aligned our goals closely with those the chancellor has outlined:

- Initiate lifelong student success.
- Generate transformational and relevant knowledge.
- Become the destination of choice.

In short, our mission is to create an entrepreneurial engineering platform that provides a holistic educational experience and grows the STEM workforce for Arkansas and the world.

For well over a year, we have worked diligently to meet and listen to stakeholders, from the college's

advisory councils and campus leadership to entrepreneurs and industries statewide. They've told us in no uncertain terms that we must produce more engineers, computer scientists and data scientists to supply the highly skilled workforce needed to drive economic growth and fuel innovation.

We continue our efforts to refine Vision 2035, and I look forward to sharing its details with you in the coming months. Please know that we see YOU in this plan, and quite frankly we can't do it without you!

My best,

Kim LaScola Needy
Dean
College of Engineering

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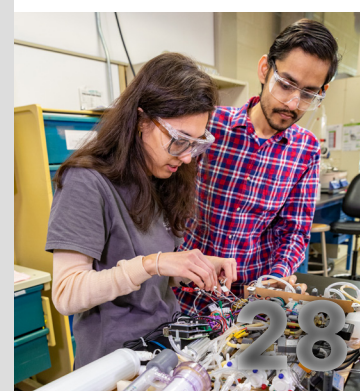
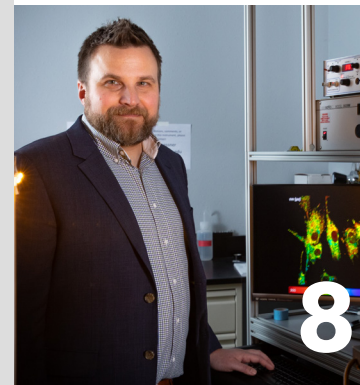
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Researchers Receive \$1 Million Grant to Develop Robotic System to Assist Poultry Processing

By **Brittaney Mann**

Assistant Professor Dongyi Wang

The COVID-19 pandemic strained many poultry processing plants as employees became ill and missed work. With the help of a \$1 million grant, Arkansas Agricultural Experiment Station researchers will design robotics to help alleviate that potential strain.

The project is funded through a joint proposal between the National Science Foundation's National Robotics Initiative 3.0 and the United States Department of Agriculture's National Institute of Food and Agriculture.

Dongyi Wang, assistant professor of biological and agricultural engineering, is the principal investigator on the project. Wang conducts research for the experiment station, the research arm of the U of A System Division of Agriculture. He also has a research appointment with the Food Science

Department and a teaching appointment with the College of Engineering.

A major focus in Wang's lab is to understand what jobs robotic and automated systems can accomplish.

"We are trying to explore the opportunities and to see how automation can help the agriculture industry and the food industry," Wang said.

This four-year project will lead to the development of a robotic system that can hang raw chicken in the same way human workers do to meet the long-term needs of the poultry industry.

Poultry Processing Plants

In 2021, the U.S. produced 59.2 billion pounds of broiler chickens, according to the USDA. Arkansas ranked No. 3 in the nation, producing

1 billion broilers — 7.46 billion pounds of meat worth \$3.97 billion — in 2021, according to the 2022 Arkansas Agriculture Profile.

Many of the steps to process chicken are already automated in processing plants, Wang said. Slaughtering and evisceration do not rely heavily on people. Rehanging the raw chicken is one of the major steps that relies on human work. Workers on the processing line hang the birds on conveyor lines that continue to the deboning, wing-cutting and packing steps.

Lending a Hand

Besides Wang, the team includes co-principal investigators Wan Shou, assistant professor of mechanical engineering at the U of A, and Yu She, assistant professor of industrial engineering at Purdue University. Casey Owens, Novus International professor of poultry science, and Philip Crandall, professor of food science, both with the Arkansas Agricultural Experiment Station, will also be involved.

To create the automation system, the researchers will customize tactile sensory grippers and develop a high-resolution and high-speed 3D imaging system, Wang said. The 3D imaging system will allow the robotic arms to differentiate between the topmost chicken and the rest of the pile and will indicate the predetermined key points for chicken grasping. A key challenge is developing a gripper that reliably grasps the chicken without damaging the meat.

Shou will design the tactile sensors and She will design the robotic hand. By integrating these developments, robots will be enabled to adjust their grip to ensure the bird is secure.

"Rather than buying an expensive robotic hand, we are going to design and fabricate a robotic hand with lower cost with the assistance of 3D printing," Shou said.

Wang's focus for this project is programming the two robots to work as human hands and complete the task of hanging the chicken without issues such as the arms hitting one another.

Center to Study Adaptation of AI to Meat Processing

Researchers Dongyi Wang and Yanbin Li, Distinguished Professor of biological and agricultural engineering, are part of a \$5 million grant from the USDA's National Institute of Food and Agriculture that will establish the Center for Scalable and Intelligent Automation in Poultry Processing. Led by the University of Arkansas System Division of Agriculture, the center brings together researchers from five institutions in three states for efforts to adapt robotic automation to chicken meat processing. U of A researchers will receive \$2.2 million from the grant primarily to focus on food safety automation for poultry processing plants.

They will test the robotics in the experiment station's pilot chicken processing plant, with Owens overseeing the quality of meat handled by the robotic arms. The team will also use this project for opportunities in education and, with the help of Crandall, extension activities that target poultry and broader food industries.

Wang visualizes this project benefitting the scientific areas of tactile sensing, 3D imaging, dual robotic control and algorithms. He also sees it benefitting the poultry industry itself.

"It is very, very exciting that this kind of technology, even maybe not right now, but potentially, can help the local economic development and the local industry," Wang said. 🌱



From left: Michele Reba, research hydrologist for the USDA-Agriculture Research Service in Jonesboro; Tom Vilsack, U.S. Secretary of Agriculture; Deacue Fields, vice president for agriculture, U of A System; and Ben Runkle, associate professor of biological and agricultural engineering.

Report Provides Scientific Plan for Nature-Based Climate Solutions

By **Matt McGowan**

Agricultural engineering Associate Professor Ben Runkle has co-authored a report by leading ecosystem scientists and policy experts calling for a scientific approach to nature-based climate solutions in the United States.

The report is the result of dozens of scientists and policy experts gathering in Washington, D.C., to confront the consequences of climate change and ensure scientific footing for nature-based climate solutions.

The report reviews the current knowledge in the field and offers a multidisciplinary plan for the science, tools and technologies needed to support a policy that will mitigate the effects of climate change.

The researchers are calling for a roughly \$1 billion investment in science and infrastructure development to ensure nature-based climate solutions are robust and credible, that ground-based experiments and monitoring inform rigorously benchmarked maps, model predictions and protocol evaluations.

“Although the investment necessary to generate this information is not small, it is a fraction of the amount already allocated to implement nature-based solutions,” Runkle said. “Investing in sound science to predict, monitor and verify the benefits of these strategies is fundamental to ensuring their success.”

Nature-based climate solutions include reforestation, as well as climate-smart agriculture and wetland restoration. They harness natural processes to reduce greenhouse gas concentrations in the atmosphere and slow climate change.

These approaches have substantial and growing support from bipartisan lawmakers, the private sector and conservation-minded organizations, but the scientific evidence to support their effectiveness is not fully developed.

The authors identify critical gaps in the science needed to support large-scale implementations of nature-based climate solutions and chart a research agenda to address these gaps. They also provide a set of principles to guide future assessments of the effectiveness and viability of nature-based climate solutions.

Among the numerous strategies for achieving the overall goal, Runkle’s research group focuses on ecosystem-scale measurement. They use micrometeorological flux towers to measure basic atmospheric conditions. The measurements will enable the team to enhance and expand ground-based monitoring networks and distributed experiments.

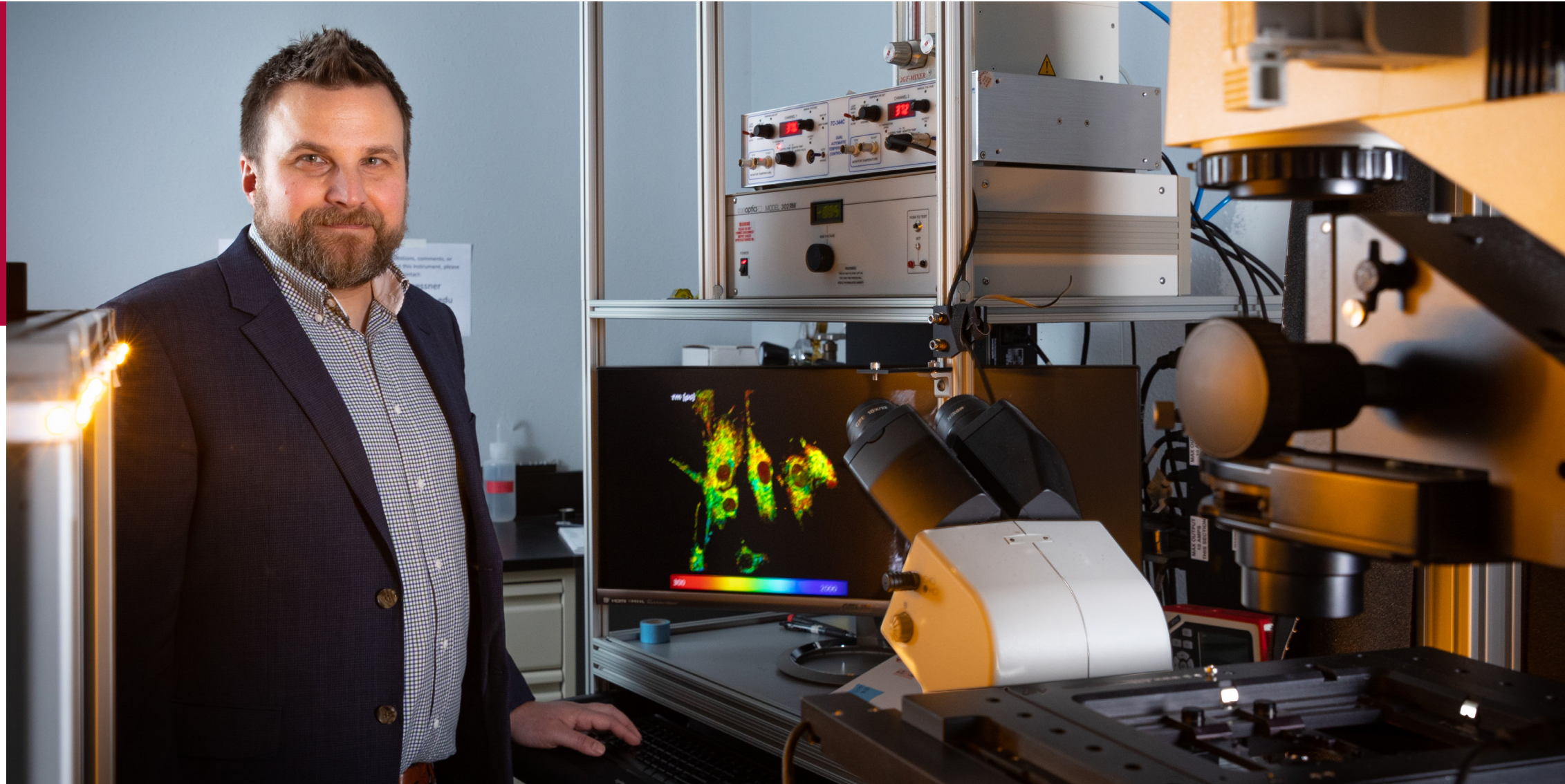
“Essentially we can use the many agricultural fields of Arkansas as test-beds for research under real-world management conditions,” Runkle said. “This provides a quicker and more thorough understanding of how field and farm management can be used to boost sustainability outcomes — quicker because we don’t have to work first in a greenhouse and then an experimental farm.”

Runkle has already started. He received \$1 million from the USDA Climate Smart Agriculture Initiative, a project led by USA Rice and Ducks Unlimited. The award was part of \$80 million in funding from U.S. Department of Agriculture to reduce greenhouse gas emission associated with rice production.

Runkle’s research was featured in a *New York Times* article highlighting how scientists are addressing the effects of climate change. Runkle found that rice farmers could reduce methane emissions more than 60% by cycling between wet and dry fields rather than keeping them flooded. A staple grain for an estimated three billion people, rice accounts for an estimated 8% of all global methane emissions.

The grant was one of 70 totaling a \$2.8 billion investment in the creation of Partnerships for Climate Smart Commodities by the USDA.

U.S. Secretary of Agriculture Tom Vilsack visited Isbell Farms in central Arkansas in fall 2022 to highlight the project. Runkle has collaborated with the Isbells for several years, focusing on making rice production more sustainable and climate friendly. 🌱



Non-healing wounds can be dangerous for those who are elderly or diabetic. Professor Kyle Quinn wants to help the healing of these wounds through his research on cell metabolism.

Helping the Healing

By **Matt McGowan**

Mitochondria are the powerhouse of cells, and Kyle Quinn, professor of biomedical engineering, wants to use microscopy to understand how their function can change with age.

“Aging affects us all in different ways,” he said. “And, consequently, the function of our cells can change in different ways.”

Quinn focuses on monitoring cell metabolism over time, using a microscopy technique that

detects the natural fluorescence of molecules in our mitochondria. This allows him to investigate the role mitochondria play in age-related diseases like Alzheimer’s, cardiovascular disorders, cancer, diabetes and obesity without bothering or damaging our cells.

One of the applications of Quinn’s research is on non-healing wounds, which disproportionately affect people in Arkansas. The microscopy techniques he utilizes have been applied to cancer research for decades, but very little work has centered on its use in wound healing. So, he’s set out to change that.

A Complicated and Expensive Problem

Skin wounds, particularly for those who are elderly or diabetic, can quickly turn into a challenging and expensive problem. Tens of billions of dollars are spent on wound care each year, but the medical profession lacks the necessary tools to diagnose and treat non-healing wounds. That’s in part due to the scientific community’s incomplete understanding about why wounds don’t heal. They’re typically found on the lower extremities – often as diabetic foot ulcers or venous stasis ulcers – but can also occur in other locations when blood flow is restricted due to prolonged pressure on the skin.

“There aren’t a lot of ways to evaluate why wounds aren’t healing, which makes it difficult to treat,” Quinn said. “These are ticking time bombs in some ways, because if an infection takes hold, that’s when things get complicated. Amputation or death are common consequences, and the mortality rate for someone with a diabetic foot ulcer is higher than most cancers.”

Quinn started researching wound healing because he saw it as an underdeveloped area in biomedical engineering that wasn’t getting much attention. During his postdoctoral research at Tufts University, he utilized the natural fluorescence of mitochondria to monitor stem cell differentiation and the development of engineered tissues. He realized some of these techniques could be transferred to monitor skin wound healing and wrote a grant proposal that resulted in a National Institutes of Health Pathway to Independence Award, which took him from his postdoctoral work to a full-time faculty position at the U of A.

“What appealed to me about the U of A was that it was a small department at the time, and everyone seemed very collegial and collaborative,” he said. “I could tell there were potential opportunities to collaborate and explore other applications for our fluorescence imaging techniques.”

Mapping Metabolism

To tackle the problem of non-healing wounds, it's important to understand how the healing process normally works.

Quinn explained that skin wound healing is a coordinated dance with many different cell types. Inflammatory cells come in to clean up the wound, and then additional cells arrive to deposit collagen and reform the mechanical scaffold that holds the skin together. The cells that make up blood vessels grow into the wound and provide oxygen and nutrients to the area. Then, when the environment is right, keratinocytes "crawl over" and form a protective barrier.

Quinn explained that imaging techniques like MRI and CT scans don't have great resolution, making it impossible to visualize individual cells, so he and his team instead have turned to multiphoton microscopy, a powerful imaging system capable of viewing biological tissue in three dimensions at the cellular level. The system allows him to generate 3D maps of wound metabolism based on the natural fluorescence of mitochondria.

"When someone comments that your skin is glowing, it actually does glow," Quinn said. "Our cells have a couple of naturally fluorescent molecules in them – much like what you would see when turning on a black light. They are primarily localized in mitochondria and are useful in understanding cell metabolism, which is the process through which our cells turn food into energy."

When cells break down glucose and convert it into energy, they use a network of enzymatic reactions that produce adenosine triphosphate, more commonly referred to as ATP. Quinn explained that there are molecules that assist enzymes and connect the breakdown of sugar to the production of ATP, and they carry and release electrons. Whether they're carrying an electron or not is something that can be detected. One molecule is fluorescent when it's carrying electrons and one is fluorescent when it's not carrying electrons.

These molecules are related to metabolism and can provide a sense for whether the cells are breaking down sugar to produce ATP or for other reasons. A ratio of these two fluorescence molecules can give researchers an idea about what the cell is doing – either growing and dividing or starting to "crawl" across the wound.

"At the edge of a wound, our cells metabolically act like a tumor. They pick up on the fact that there's a lot of inflammation from the wound, and they're going to grow and divide like an aggressive tumor," Quinn said. "As the wound inflammation subsides, they'll stop proliferating at the edge of the wound and crawl between the scab and wound bed and reform the outer layer of skin."

For many older adults, the cells don't grow and divide quickly enough at the beginning of the healing process. And with many diabetic patients, the cells remain at the wound edge and keep growing quickly but don't crawl into the wound. Quinn's imaging approach can detect these different responses between age-related delays and diabetic-related delays.

"If we can identify the cause of impaired healing on a case-by-case basis, we can learn to treat these wounds better," he said.

A Rising Star in Research

Since Quinn joined the U of A in 2015, he has accumulated a multitude of research funding to support his work. Three of these awards are particularly notable.

In 2019, Quinn earned \$500,000 to support his research and teaching through the NSF's Faculty Early Career Development program, known as a CAREER award. It's considered one of the most prestigious awards in support of early-career faculty. One of the areas funded by the grant is outreach activities in Arkansas, including summer camps offered by the Department of Biomedical Engineering that are designed to expose K-12 students to science – particularly from groups that are underrepresented in engineering.

Then, in 2021, he received a four-year, \$1.6 million grant from the National Institutes of Health to develop non-invasive, real-time "optical biopsies" of chronic skin wounds. He is combining multiphoton microscopy and "deep learning," an artificial intelligence-based approach to analysis, with the goal of training a computer algorithm to delineate wound regions accurately and quickly.

Also in 2021, the NIH announced a \$10.8 million grant to establish a center of biomedical research excellence that will enable an interdisciplinary team of researchers at the U of A and the University of Arkansas for Medical Sciences to address the role of cell and tissue metabolism in diseases such as cancer, diabetes and obesity. Quinn serves as director of the Arkansas Integrative Metabolic Research Center, which supports three research cores focused on providing complementary, state-of-the-art research tools to aid researchers in studying cell and tissue metabolism.

Because of these grants, Quinn can also fund the work of graduate students in his lab, who contribute to the research.

"I really enjoy training the next generation of scientists," he said. "It's one of the most rewarding aspects of the job. I am here because of the supportive and collaborative environment, and it has motivated me to help grow biomedical research on campus through our new center."

Alan Woessner, originally from the Northeast Arkansas town of Manila, came to the U of A as an undergraduate and has continued to work in Quinn's lab since. He earned his doctorate from the university in 2022 and is the imaging and spectroscopy core manager for the Arkansas Integrative Metabolic Research Center.

"I like being on the cutting edge of this research," he said. "Kyle is a good mentor. He pushes you to learn new things but also ensures you understand the bigger picture of what you're doing and the primary goal." 🌟

Innovative Prosthetic Hand System Developed by I³R Researchers Implanted in First Arkansan

By **David Robinson**

The first Arkansan, and only the second person in the world, has received an innovative prosthetic hand developed by researchers at the Institute for Integrative and Innovative Research that restores a meaningful sense of touch and grip force following surgery at the University of Arkansas for Medical Sciences.

The lengthy and detailed operation was led by neurosurgeon Erika Petersen, M.D., with co-leading roles for orthopedic hand and nerve specialists John Bracey, M.D., and Mark Tait, M.D.

“The surgery went really well,” said Petersen, also a pioneer in the implantation of nerve stimulators for pain and movement disorders. “It’s a great achievement for UAMS, the University of Arkansas and our state. It’s also an exciting promise of what’s to come for people with amputations around the globe.”

The neural-enhanced prosthetic was invented and developed with funding from the National Institutes of Health by an engineering team led by Ranu Jung, Ph.D., and James Abbas, Ph.D., from the U of A Institute for Integrative and Innovative Research, I³R, while serving as faculty researchers at Florida International University and Arizona State University. It has received FDA investigational device exemption status, an effort led by Sathyakumar Kuntaegowdanahalli, Ph.D. The leading-edge device was also used in the first surgery of its kind performed in Florida.

As part of the Arkansas collaboration, the step-by-step implant procedure developed by the I³R team was displayed on a large screen during the surgery, and the team was on hand to provide clarification as needed.

The clinical trial participant, whose identity remains confidential in accordance with clinical trial guidelines, has been learning to use the neural-enabled prosthesis with the I³R team since recovering from the January 2023 surgery.

The prosthesis technology significantly advances the ability to harness the power of the human nervous system, said Petersen, a professor and director of the Section of Functional and Restorative Neurosurgery in the College of Medicine Department of Neurosurgery.

“Drs. Jung and Abbas and their team have opened the door to a new era of augmenting people’s ability to function in the world,” she said. “We are grateful they chose us as collaborators.”

Abbas, a biomedical engineering professor who holds a joint appointment with UAMS in the Department of Neurosurgery, led discussions that brought the team of UAMS surgeons, Snell Prosthetics and Orthotics and health technology companies together with I³R’s Adaptive Neural Systems Group.

“As researchers pioneering innovations to make a positive societal impact, we need academic and industry partners who are on the leading edge with us,” Abbas said. “Our collaboration with UAMS and Snell is an example of the



PHOTO BY Evan Lewis

From left: Orthopedic hand and nerve specialists Mark Tait, M.D., and John Bracey, M.D., use a surgical microscope as they implant tiny filament wires into the patient’s nerves.

type of innovative work that is happening in Arkansas.”

Petersen, Bracey and Tait used their complementary expertise to implant 15 microelectrodes and other components that are part of the Jung-Abbas device and which enable communication between the brain and the prosthesis through the arm’s median and ulnar nerves.

As the expert in neuromodulation, Petersen ensured that the neurostimulator portion of the device was placed appropriately. The neurostimulator receives commands from the prosthesis-mounted components and produces electrical pulses that get conveyed to the patient’s nervous system, enabling the sense of touch.

“From my perspective, the surgery went very smoothly, and I was impressed with the level of teamwork and collaboration by everyone involved,” said Jung, executive director and endowed chair of I³R and a Distinguished Professor of biomedical engineering. “I’m pleased that with this second successful surgery, we’re taking another step forward toward broad deployment of this life-improving technology.”

Bracey and Tait work with many individuals with amputations, and they have dreamed about such a breakthrough.

“The idea of enabling someone to feel with their prosthesis is pretty meaningful, and we’re excited to be part of this groundbreaking project with Drs. Jung and Abbas and the I³R team,” Tait said. 🌟

Information for this article was contributed by **Delia Garcia**, I³R director of strategic communications and engagement.



Alumnus Michael Mourot speaks during the dedication and ribbon-cutting for the Jim L. Turpin Student Advising Center in Bell Engineering Center

Advising Center Dedicated in Honor of “Transformational” Mentor Jim Turpin

By **Michael McAllister**

The Ralph E. Martin Department of Chemical Engineering has opened the Dr. Jim L. Turpin Student Advising Center, made possible with a gift from the Mourot family, and formally dedicated in April.

Across two generations, there are four University of Arkansas chemical engineering graduates in the Mourot family, all of whom graduated while Turpin taught at the university. At the dedication, the department thanked Michael (B.S.Ch.E. '76, M.S.Ch.E. '77) and Janet Mourot; Joshua (B.S.Ch.E. '03) and Rebecca Buckmaster Mourot (B.S.Ch.E. '03); Jordan (B.S.Ch.E. '05) and Valerie Varner Mourot; and Alex and Mallory Mourot Garcia; for their generous support and remembrance of Jim Turpin.

Turpin received his B.S and M.S. degrees in chemical engineering from the University of Arkansas in 1960 and 1961. He received his Ph.D. from the University of Oklahoma in 1966. He married Joyce in 1963, and upon his graduation, they made their home in Fayetteville, where Jim taught chemical engineering at the U of A until his retirement in 2009.

At the heart of the center is Turpin's legacy of mentorship. Remembered by the Mourot family as a “transformational mentor,” Turpin provided guidance tailored to his students because of his ability to get to know each one personally.

Turpin was recognized for his ability to connect with students throughout his career with numerous accolades. Those include the UA Alumni Association Outstanding Teaching Award in 1982, the American Institute of Chemical Engineers' National Outstanding Student Chapter Advisor Award in 1988, the Catalyst Award for Excellence in Teaching by the Chemical Manufacturer's Association in 1991, the Carnegie Foundation Arkansas Professor of the Year in 1996, and the College of Engineering Outstanding Service to Students Award in 2003.

The dedication was attended by members of the Turpin and Mourot families as well as former students of Jim Turpin. Speakers at the dedication included Professor Keisha B. Walters, department head for chemical engineering; Professor Bob Beitle, who holds the Jim L. Turpin Professorship in Chemical Engineering; Michael Mourot; and Terry Turpin, Jim Turpin's son.

Jim Turpin was a member of the inaugural class of the Arkansas Academy of Chemical Engineers in 2005. He was also a founding member of the UA Teaching Academy and a co-director of the Wally Cordes Teaching and Faculty Support Center.



From left: Kirsty Turpin, Terry Turpin, Michael Mourot and Janet Mourot prepare to cut a ribbon at a ceremony to dedicate the Jim L. Turpin Student Advising Center.

“Dr. Jim Turpin served the university well, as a distinguished alumnus but most memorably as a wonderful professor and student advisor,” Walters said. “When remembering Dr. Turpin, our former students routinely talk about the extra time, attention and advice he gave each and every student who came to him with a question, concern or need. I cannot think of a more fitting remembrance of him than dedicating space for student advising in his honor.”

Turpin passed away in 2019 and is survived by his wife, Joyce Turpin; two sons, Tracy Turpin and wife Amy; and Terry Turpin and wife Kirsty; five grandchildren and two great-grandchildren. 🌸



From left: Michael Mourot, Janet Mourot, Kirsty Turpin and Terry Turpin at the dedication of the Jim L. Turpin Student Advising Center.

Revolutionizing Construction: A \$3.5 Million Grant Fuels Cutting-Edge 3D Printing Research

By **Mike Emery**



PHOTO BY University Relations

From left: Associate Professor Michelle Barry and Associate Professor Wenchao Zhou in the AMBOTS lab, in front of a robotic 3D printing platform.

Appplied Research Associates, a research and engineering firm headquartered in New Mexico, awarded nearly \$3.5 million to College of Engineering faculty members to fund a groundbreaking two-year study that aims to revolutionize construction through advanced 3D printing technology.

At the heart of the research lies a critical focus: exploring the most efficient methods of 3D printing to provide horizontal mission

structures for the U.S. military. Led by an interdisciplinary faculty team, the study will explore optimal design patterns and locally sourced materials suitable for these construction projects. This includes creating essential structures like culverts, T-walls and Jersey barriers. Moreover, the team seeks to develop precise printing instructions for mobile robots, enabling swift and efficient on-site deployment, thus enhancing construction capabilities.

Leading this research is Michelle Barry, associate professor of civil engineering, who serves as the principal investigator. Assisting her as co-principal investigators are Wenchao Zhou, associate professor of mechanical engineering, and Cameron Murray, associate professor of civil engineering.

Barry's responsibilities include exploring innovative material structures and geometric configurations to optimize performance and efficiency. The study will also delve into biomimetic structures, drawing inspiration from nature's designs, such as honeycomb patterns, to reduce material usage while increasing structural strength.

In addition, Barry will catalogue and assess various local soils, evaluating their potential for incorporation into printable concrete. This will enable use of indigenous materials in horizontal construction, mitigating the need for transporting cement and aggregates over long distances. Instead, the team will develop concrete recipes tailored to local conditions, facilitating efficient 3D printing on-site using robotic systems.

Murray, with his expertise in concrete, will analyze the composition of the concrete and conduct large-scale tests on experimental forms.

Overseeing the conversion of CAD models into precise machine instructions is Zhou, director of the Advanced Manufacturing, Modeling and Materials Lab at the U of A, and co-founder of AMBOTS. This involves establishing printing paths for various materials and designs while integrating construction robots.

AMBOTS, a cutting-edge local startup company specializing in "swarm manufacturing technology," will lead the software development for the 3D printing robots. These advanced robots will adapt to different material mixes for precise, large-scale printing. Moreover, AMBOTS will focus on developing a mobile platform, allowing versatile deployment in diverse environments and optimizing the overall system's power and efficiency.

The project will involve graduate students from Zhou's lab and employees from AMBOTS.

With an ambitious two-year timeline for developing a prototype, Barry plans to mobilize up to 18 graduate students, postdoctoral students, research technicians and additional faculty members. The funding from the award will support the acquisition of a large format 3D printer and additional equipment to advance the team's capabilities to evaluate soil and concrete.

Barry's interest in using indigenous soils stems from their significantly lower environmental impact. Embracing 3D printing with these materials offers exciting possibilities, she said.

"We can build structures or roads in disaster relief areas where you're just bringing in a piece of equipment because you might not be able to bring in other construction materials," she said. "If the local soils will work, you print with them for the time being, people are sheltered and then once it's not needed, it dissolves back to the original landscape."

This project provides an exceptional opportunity for AMBOTS to demonstrate its expertise and capabilities. Zhou expressed great enthusiasm for collaborating with Applied Research Associates, leveraging its industry knowledge and experience to drive innovations in swarm 3D printing technology, with far-reaching implications for the future of construction and other industries.

The primary impetus behind the project is to bolster military readiness, emphasizing rapid deployment and cost-effectiveness. However, like many groundbreaking innovations, the technology has potential to help local governments and the private sector in responding to both natural and man-made disasters. This concept could prove invaluable to swiftly build culverts, conduct bridge repairs, address road damages and enhance infrastructure. The versatility and efficiency of this technology opens a wide array of applications with far-reaching benefits.

The \$3.5 million subaward is part of a larger \$12 million contract the United States Army Engineer Research and Development Center awarded to Applied Research Associates. 🌟

Two Engineering Faculty Land Early Career Research Awards

By **Tamara O. Ellenbecker** and **Dani Jackson**

Two engineering faculty members landed prestigious early career development awards from the U.S. Department of Energy and National Science Foundation.

Jacob Monroe

Jacob Monroe, assistant professor in the Ralph E. Martin Department of Chemical Engineering, received an Early Career Award from the Department of Energy through a program designed to support researchers at the outset of their careers, when many scientists carry out some of their most formative work.

Monroe and his project, which focuses on creating multiscale models, were selected for funding by the department's Office of Basic Energy Sciences. According to a news release, the award, totaling around \$875,000, was the only one in Arkansas in 2023. Monroe is the fifth U of A faculty member to receive the department's Early Career Award since it was created in 2010. Monroe is the first recipient in the College of Engineering.

Chemical Engineering Department head Keisha Bishop Walters said she was pleased but not surprised.

"Jacob Monroe is extremely talented. This award will allow him to find solutions for a fundamental problem in the field of computational modeling and make a significant impact on the scientific community while training students to join the workforce with cutting-edge knowledge and skills," she said.

The award comes from the department's Early Career Research Program. Research topics must meet the scope of one of the department's eight major program areas.

"This is a fantastic opportunity coming at a critical time. I am extremely excited about this project. I hope it will not only provide new tools for researchers but also contribute unique perspectives concerning the incorporation of machine learning into molecular simulation," Monroe said.

Monroe's research involves computational models. His methods allow researchers to switch to and from two different resolutions of models of multiscale materials, including proteins and polymers.

Monroe joined the Chemical Engineering Department in January 2023. He earned his Ph.D. from the University of California, Santa Barbara, in 2019, and conducted a National Research Council postdoctoral fellowship at the National Institute of Standards and Technology in Maryland. He leads the Monroe Molecular Simulation Group.



Jacob Monroe

Alexander Nelson

Associate Professor Alexander Nelson received the CAREER award from the National Science Foundation's Division of Information and Intelligent Systems' Human-Centered Computing program. This is the most prestigious award presented by the foundation to support junior faculty who display the most effective integration of research and education in the context of the U of A's mission.

His project, titled "Enhancing Ambient Capacitive Sensing Through Improved Resolution and Multi-Modal Sensor Fusion," will contribute to the advancement of medical technologies for physical and occupational rehabilitation patients.

Physical therapists, occupational therapists and physicians are only able to see their patients for a brief period on any given day. Some health factors rely on a high number of motions to re-learn how to do them, teaching the brain how to make the neurological connections needed to move the body properly. The problem this project seeks to address is that there is not enough time in the average rehabilitation appointment for doctors to supervise the patient's movements completely and with the highest accuracy.

The most common solution would be to use cameras to track the motions of the patient, but that presents issues related to privacy and potential connection problems if coverage is unstable. Instead, Nelson's project will use wearable capacitive sensors to perform real-time motion analysis.

"The cool thing about this project is that it is human-centered," Nelson said. "A lot of people think computer science is just about building faster, more powerful technology — and it is — but they don't think about how technology can improve the human experience through interaction."

The Chancellor's Innovation Fund in support of faculty research at the U of A helped Nelson and students complete a project using some of the tools that will be used in the project.

In addition, the college's Engineering Research and Innovation Seed Funding Program helped Nelson and his students work with capacitive sensor arrays for smart robots, the same technology that will be used in this project.

"Internal funding mechanisms produced the pilot work that led to the hypotheses and research questions that we want to address with this project," Nelson said.

Jia Di, head of the Department of Electrical Engineering and Computer Science, is excited to see junior faculty in the department being awarded for their hard work.

"It is an honor to have Dr. Nelson on our team, and we are proud to see his work recognized by the National Science Foundation with this prestigious award," Di said. "This grant will help Dr. Nelson create impactful work in both computer science and health fields." 🌟



Alexander Nelson





U of A Well Positioned to be a National Leader in Semiconductors

By **Andy Albertson**

A researcher holds up and looks through a silicon carbide wafer.

PHOTO BY Russell Cothren

The U of A is well positioned to be a leader in the United States' semiconductor economy. Semiconductors, such as silicon, are essential materials in most electronic devices and advance performance in fields such as health care, the military, computing and transportation.

In the last two years, researchers at the U of A, primarily in electrical engineering and physics, have been awarded in excess of \$45 million in funding to create a multi-user silicon carbide research and fabrication facility, a center dedicated to investigating the formation of atomic orders in semiconductor alloys and their effects on various physical properties, and, in collaboration with Montana State University, a Quantum Foundry to accelerate the development of quantum materials and devices.

Building on this expertise, the university has launched a major new initiative to increase investment in semiconductor research and awareness of what is already happening.

The U of A's existing research foundation means it's uniquely positioned to take advantage of the recent CHIPS (Creating Helpful Incentives to Produce Semiconductors) and Science Act, which is providing approximately \$280 billion in funding to stimulate domestic research and manufacturing of semiconductors.

As a result of manufacturing and production shortages of essential computer chips during the pandemic, which are overwhelmingly manufactured overseas, the federal government has prioritized the onshoring of this critical technology.

Alan Mantooth, a Distinguished Professor of electrical engineering, noted that the semiconductor isn't just important, "it's foundational. A lot of things get built off semiconductors."

Mantooth added, "I think it's important to recognize that this region and Arkansas particularly, and this university, are very well positioned because we have that entire value chain. From the foundational work to the new fabrication going in, to backend processes that allow us to build all the way to the application, and the people that we work with, like John Deere, Caterpillar, Ford, G.M., Toyota... I think there is an opportunity to attract businesses to this state and region that we haven't had before as a result of investment through the CHIPS Act and raised awareness of what's here."

U of A Chancellor Charles Robinson noted that there isn't currently a semiconductor chip plant in Arkansas, and creating one is essential to retaining talent.

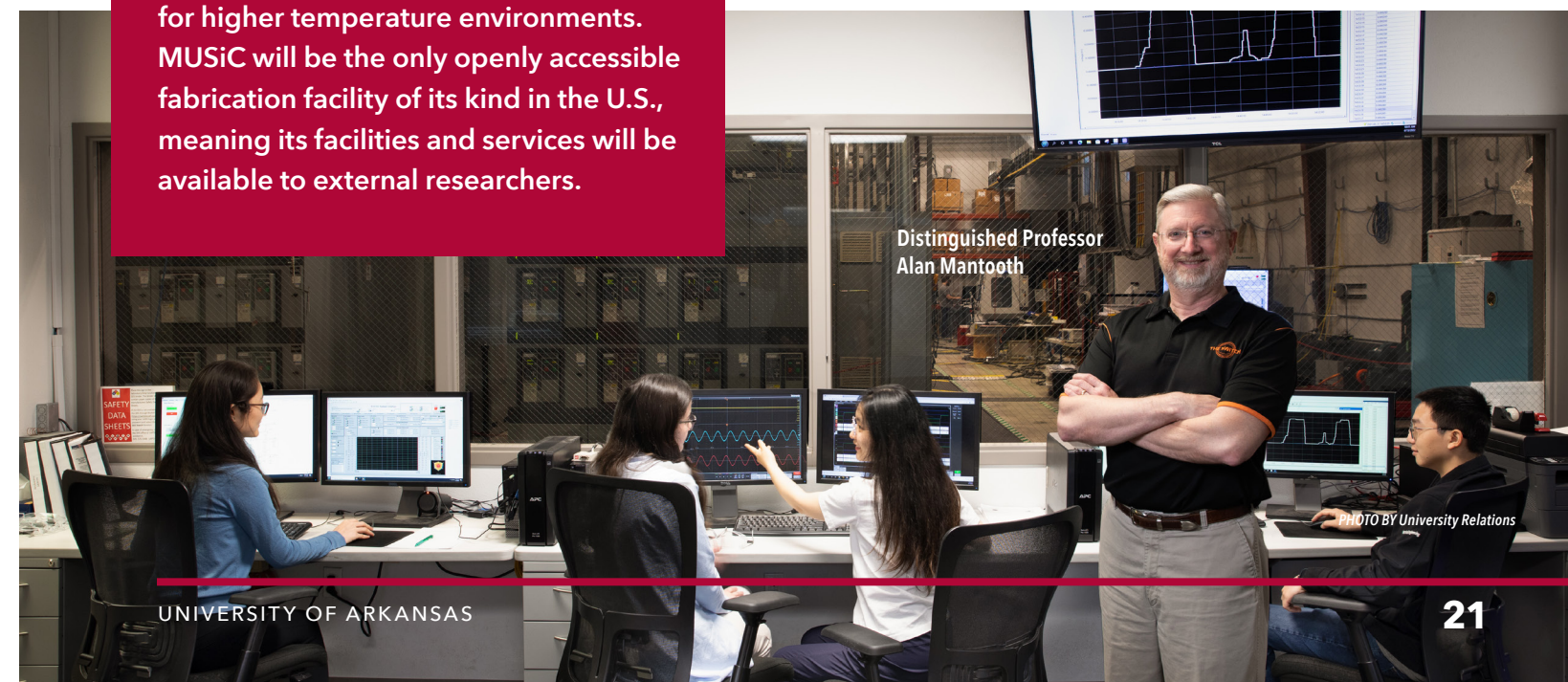
"Historically, our graduates who want to work in this field have had to leave the area. Greater investment in and awareness about what is happening here will not only create opportunities to keep our graduates here but incentivize even more talented people to come here. We're at an inflection point where the university can step forward to maximize its potential in this field."

"The university and state of Arkansas have a golden opportunity to help drive the United States' semiconductor industry and transform the heartland of the nation in the process," said Mike Malone, vice chancellor for economic development. "Through workforce development, talent attraction and retention, unmatched facilities and partnerships with global industry leaders, we are ready to take the lead."

The research team working to develop the MUSiC facility crossed an important milestone in January when it commissioned Deposition Technology to build a high-volume manufacturing tool critical to the silicon carbide chip-making process. The tool will be remanufactured to match the unique specifications U of A researchers need.

In 2020-21, the team received nearly \$18 million from the National Science Foundation and \$5.4 million from the Army Research Laboratory. 🌟

U of A broke ground for the Multi-User Silicon Carbide Research and Fabrication Facility, often known as MUSiC, on Aug. 18 at a site on Cato Springs Road in Fayetteville. The facility is expected to fill a void in U.S. production of integrated circuits made with silicon carbide, a powerful semiconductor well-suited for higher temperature environments. MUSiC will be the only openly accessible fabrication facility of its kind in the U.S., meaning its facilities and services will be available to external researchers.



Distinguished Professor Alan Mantooth

PHOTO BY University Relations

Electrical Engineering Professor Pioneers Imaging Techniques to Improve Breast Cancer Treatment

By **Matt McGowan**

Breast cancer is the second most common cancer for women in the U.S., and many women find themselves facing recurrence of the disease over time. Magda El-Shenawee is working to reduce this threat through new imaging technologies that help surgeons make more precise decisions about cancerous tissue during lumpectomies.

“When the surgeon takes the tumor out, what remains?” El-Shenawee asked. “It’s hard to determine where the cancer ends, and healthy tissue begins. If the surgeon doesn’t remove enough, the cancer comes back. And if too much healthy tissue is removed, the patient risks having a mastectomy. Preventing it from metastasizing is the key, and the margins we examine help ensure the correct amount is being removed.”

Using a new imaging technique involving terahertz frequencies – a frequency range found between microwaves and infrared waves – El-Shenawee and her team can help surgeons more accurately determine the appropriate amount of cancerous tissue to remove by making it easier for them to clearly see tumor margins during lumpectomies.

El-Shenawee notes that the percentage of second surgeries is nearly 25%, adding stress



PHOTO BY Russell Cothren

Electrical engineering Professor Magda El-Shenawee is fighting breast cancer using terahertz technology

to an already highly charged emotional experience. Imagine being a woman who has just undergone an initial surgery only to find out that the cancer has returned, and another operation must be scheduled, she said.

It’s a problem she’s not tackling alone; in fact, there are researchers across the country and the world who are trying to combat the disease. And El-Shenawee realizes that what she contributes to the research is an important part of the solution.

“It’s amazing the amount of work being done nationwide,” she said. “And yet, one out of eight women still gets breast cancer.”

Tissue, Tumors and Terahertz Technology

El-Shenawee’s new research centers on diversifying the way signals are sent and received through cancerous tumors – called

wave polarization – and the different results they yield. She and her team produce many different images using the terahertz technology and layer them to get a better, fuller picture of the composition of a tumor.

Their biggest breakthroughs come from imaging freshly excised tumors and comparing those results to the findings from a pathologist, who helps interpret the images. All this simulates what could eventually be done in an operating room, given the appropriate equipment, training and time.

Currently, more than 50% of the freshly excised tumor tissue examined can be differentiated, but El-Shenawee wants that total to increase to at least 90%.

“It’s exciting to get meaningful results,” she said. “We’re not doing this research to satisfy ourselves. We want to publish it and help other researchers.”

From Intrigue to Inspiration to Implementation

El-Shenawee was introduced to terahertz technology at a workshop and was immediately intrigued, though she had no equipment available for her research. Various grants have allowed her to purchase equipment and set up her own lab, working with her U of A students and collaborating with fellow faculty members along the way. The students who work in El-Shenawee’s lab are right by her side, gaining first-hand knowledge about problem solving and critical-thinking skills.

“The good students are everything,” she said. “I have the ideas, but they implement them. It takes some time to train them, and they have to

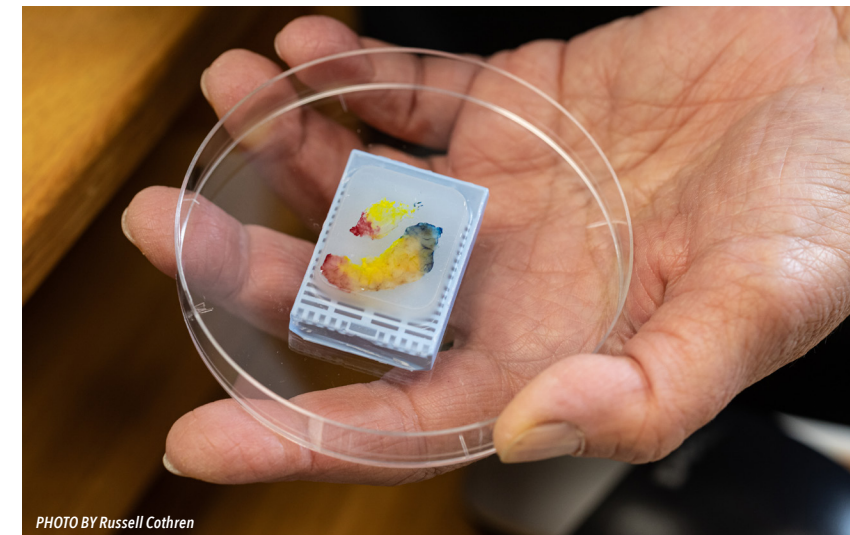


PHOTO BY Russell Cothren

One of El-Shenawee’s laboratory samples.

be self-motivated, but they have all found very good jobs in national labs, U.S. companies, or with other universities after they have moved on. They inspire me, and if they don’t, I inspire them.”

The terahertz technology used by El-Shenawee and her team is housed in a couple pieces of equipment: one that is designed to scan tumors and smaller cancer samples and another used for bigger applications. Grants provided the funding for her research instrumentation, and she continues to finesse its capabilities by determining what it is picking up on the scans and what it is not. It’s a continual process of trying, tweaking, and trying again.

“I tell students all the time that we don’t make jumps in research – we take small steps,” she said. 🌱

A Selection of Grants Garnered by El-Shenawee:

- **\$424,545** from the National Institutes of Health, announced in October 2021.
- **\$456,070** from the National Science Foundation for El-Shenawee to research high-frequency antennas in April 2020.
- **\$16,502** from the University of Arkansas Women’s Giving Circle in January 2021.
- **\$424,081** from the National Cancer Institute, part of the National Institutes of Health, in March 2017.
- **\$388,913** from the National Science Foundation in May 2014.

NSF Grant Administered by I³R to Empower Small Farmers

Industrial engineering department head, assistant professor of computer science part of team

By **Andy Albertson**

Led by the Institute for Integrative and Innovative Research at the U of A, a cross-disciplinary team of university researchers, consultants and startup companies has been awarded a National Science Foundation Convergence Accelerator grant for a project designed to connect regional farmers with institutional buyers and ultimately expand access to healthy and nutritious food.

NSF's Convergence Accelerator was launched in 2019 to build upon basic research and accelerate solutions toward societal impact through convergence — the integration of ideas and approaches across research sectors.

The project, "Data-driven Agriculture to Bridge Small Farms to Regional Food Supply Chains," brings together researchers from the U of A, University of Arkansas at Pine Bluff, University of Arkansas System Division of Agriculture and University of Florida with two startups, Cureate and Junction AI Inc., and a team of consultants. The team was one of 16 multidisciplinary teams awarded under the NSF Convergence grant to tackle challenges such as food insecurity while offering novel business solutions.

"We're excited to bring this team of experts and innovators together to empower regional food producers with data insights that could enable access to new markets," said the project's

principal investigator, Meredith Adkins, an assistant research professor at I³R. "By leveraging our collective expertise and engaging in an extensive planning and user discovery process to deeply understand the needs of producers, buyers and other stakeholders, we have the opportunity to make both a positive societal and economic impact, particularly here in Arkansas."

The overall objective of the project is to empower regional food producers to understand the economic value of specialty crop assortment and food animals on their farms in comparison to market demand for institutional sales and intervening factors such as food safety considerations. The project team ultimately will create a scalable technology platform that provides market insights to small farmers via the convergence of multiple scientific research fields and modern technological innovations such as robotics, artificial intelligence and machine learning.

"This is a unique convergence of the public and private sectors, and exactly the kind of project we envisioned I³R driving," said Mike Malone, vice chancellor for economic development. "The team's diverse research and business experience will yield novel solutions that we can take to the marketplace to spur regional economic development."

The project will engage students, including those underrepresented in fields such as food science and computer engineering, in convergence research and in human-centered design across the three Arkansas land-grant institutions. The investigators will lead outreach with small farmers in Northwest Arkansas, as well as the underserved regions of the central Arkansas Delta and the Cherokee Nation in Oklahoma through the U of A School of Law's Indigenous Food and Agriculture Initiative, a grant collaborator.

The grant totals \$743,651 and will support market research, hiring of graduate assistants, development of the technology platform and other initiatives.

Co-investigators include Chase Rainwater, professor and department head of industrial engineering, U of A; Kristen Gibson, professor

of food science, U of A System Division of Agriculture and U of A; Thi Hoang Ngan Le, assistant professor of computer science and computer engineering, U of A; and Yasser Sanad, assistant professor of food safety, University of Arkansas Pine Bluff.

Multiple distinguished faculty and consultants serve as senior personnel and will advise on the project.

"Access to healthy food is an essential component of our vision for integrative health, and support for the FoodTech and HealthTech ecosystems in Arkansas will contribute to economic development in the region," said Ranu Jung, endowed chair and executive director of I³R, associate vice chancellor and Distinguished Professor of biomedical engineering. "We will create transformative discoveries and deliver them at scale to the benefit of the economy and society." 🌱

Industrial Engineering Professors Honored with IISE Awards

Two professors in the Department of Industrial Engineering received prestigious awards from the Institute of Industrial and Systems Engineers during the group's annual meeting in May.

Professor Chase Rainwater, who also serves as department head, was awarded the title of fellow, which recognizes outstanding leaders of the profession who have made significant, nationally recognized contributions to industrial and systems engineering. A fellow is the highest classification of membership in the institute.

In addition, University Professor Manuel Rossetti received the Albert G. Holzman Distinguished Educator Award, which recognizes educators who contribute significantly to the industrial engineering profession through teaching, research, publication, extension, innovation or administration. The annual award is nomination-based and is judged on evidence of teaching excellence, research accomplishment and innovation in teaching and learning, among other factors.

Together, Rainwater and Rossetti led an innovative change to the computing offerings in the department's undergraduate program. This effort resulted in a two-semester computing sequence designed



Chase Rainwater



Manuel Rossetti

specifically for sophomore-level industrial engineering students. The courses present core programming and computing concepts in the context of fundamental industrial engineering problems. The duo was recognized internationally with the 2021 Innovations in Education Competition from IISE.

Rainwater's research and teaching interests include supply chain logistics, security and food safety. His work has been supported by the National Science Foundation, U.S. Department of Transportation, U.S. Department of Homeland Security and U.S. Department of Education, as well as multiple national labs, nonprofit organizations and companies.

Rossetti's research and teaching interests include the design, analysis and optimization of logistics, manufacturing, health care and transportation systems using computer simulation and operations research techniques. 🌱

Engineering Researchers Use Data in New Ways to Improve Waterways Management

By **Jennifer P. Cook**

Two College of Engineering researchers are exploring how the use of real-time data on vessel movements can help government agencies make better-informed decisions about shipping infrastructure to reduce costs and ultimately improve the nation's supply chains.

Sarah Hernandez, associate professor of civil engineering, and Sandra Eksioglu, professor of industrial engineering and associate dean for research, were awarded \$222,039 for their study by the U.S. Army Corp of Engineers Coastal Hydraulics Laboratory at the U.S. Army Engineering Research and Development Center.

The agencies historically have relied on manually collected surveys of shippers and carriers to support their decisions about operations maintenance and infrastructure needs for waterways and ports. Detailed

information about the movement of goods and vessels is important when scheduling lock and dam repairs, channel dredging and other maintenance, but the way data is processed means it's not available until it's about two years old.

Hernandez and Eksioglu will use anonymized vessel data collected by the U.S. Coast Guard to make predictions about waterway and port traffic, giving the agencies more accurate information on waterborne commerce trends.

"This work is exciting for our team because it fills a critical gap in the type of data that can be available for strategic decision making," said Hernandez, the principal investigator. "Our team works to use existing data sets in new and exciting ways to close data gaps that prevent transportation and other government agencies from making better informed decisions."



Sandra Eksioglu



Sarah Hernandez

The Coast Guard collects mandated Automatic Identification System data for purposes of safety and navigation. Using the data predictively presents a cost-effective way to gain insights into critical freight supply chains, said Eksioglu, co-principal investigator.

"This work will provide near real-time insight into how our inland and coastal waterways function within the freight supply chains in the U.S.," she said.

More efficient management of waterways will make them a more competitive option for shipping, potentially meaning a reduction in the costs for food, building products and other consumable goods, the researchers say.

The research team includes Sanjeev Bhurtyal, Ph.D. candidate in civil engineering, and Hieu Bui, Ph.D. candidate in industrial engineering. 🌟



From left: Professor Christa Hestekin and Professor Jamie Hestekin show a prototype of their waterless artificial kidney device.

Research Collaborative Offers Hope for Kidney Patients

U of A researchers join with UCLA physician in quest to develop artificial kidney that could give patients freedom from dialysis

By **Matt McGowan** Photos by **Chieko Hara**

Every year, more people die of kidney disease than breast cancer. The Centers for Disease Control and Prevention estimates that 37 million people in the United States — 15% of U.S. adults — have some form of chronic kidney disease.

Of this population, about 100,000 people will develop end-stage renal disease. The treatment options for this group — hemodialysis, peritoneal dialysis or kidney transplant — have not changed significantly over the past 50 years.

According to the CDC, patients can survive on dialysis for about seven years, but most patients must wait 10 years to receive a donated kidney. A hundred thousand people die each year on dialysis, many waiting for a kidney transplant.

Kidney disease is also a major public health problem. The U.S. government spends more than \$100 billion in Medicare payments — almost 10% of Medicare’s annual budget of \$1 trillion — to care for patients with kidney disease.

A collaboration between engineering researchers at the University of Arkansas and a kidney doctor in Southern California could change all of this. If successful, their work will revolutionize treatment for kidney disease and offer hope for something better than dialysis or transplantation.

The Power Of Electrodeionization

Several years ago, a decade into his career at the University of Arkansas, chemical engineering Professor Jamie Hestekin received a call from Ira Kurtz, a prominent nephrologist in Southern California. Hestekin’s research did not have medical applications, so the call was unexpected. At the time, Hestekin had no way of knowing that Kurtz’s call would change the direction of his work and eventually dominate his research agenda.

Hestekin specializes in a chemical process called electrodeionization, which is why Kurtz was calling. Used primarily in water treatment, electrodeionization removes or separates ions

(electrically charged molecules) from water by applying an electrical charge to specially designed membranes.

Before Kurtz’s call, Hestekin had used the technology to remove ions from grape juices, cells from biofuels and organic acids from fermentations. More recently, he was doing consulting research for fracking companies, applying the electrodeionization process to the removal of environmentally hazardous particles from wastewater.



Doctoral student Juliana Marcal works with a membrane caster, a machine used for making sheet membranes.

As Distinguished Professor of Medicine and Chief of Nephrology at UCLA Health, Kurtz is a leading researcher on the structural biology and physiology of the human kidney. He focuses on proteins that transport various ions in renal and extrarenal tissues. In the kidney, ion transporters play an important role in helping determine the final chemistry of urine.

US Kidney Research Corporation, had been investigating a new, radical idea.

“I’d been thinking about creating an artificial kidney,” he said. “So, I looked around to see what was out there. There were a few efforts, but I could see they weren’t going to work ultimately. Such a device needed to filter

or a dialyzer, which are currently used to treat patients.

He ultimately landed on electrodeionization as a technology that could potentially transport ions like the human kidney. After looking at several researchers around the country with a background in this process, Kurtz called Hestekin.

The Kidney As a Chemical Computer

Kurtz likes to say that the kidney is more complex than a 747. Weighing in at about a third of a pound, each kidney is located toward the back of the upper abdomen. Its microanatomy is particularly complex, containing roughly a million nephrons, each of which is responsible for filtering and transporting ions and other substances that will end up in the urine. Each nephron contains a filter, called a glomerulus, and a tubular transporting part that is further subdivided anatomically and functionally into about 15 segments that contain different cell types. Kidneys also have nerves, arterial and venous blood vessels, and lymphatics that, along with the nephrons, are configured in a complex three-dimensional structure.

They never stop working. Even though people typically eat and drink three times a day, a process that can significantly affect the chemistry of blood and cells, the kidneys recognize these changes and excrete the exact amount of electrolytes, water and organic compounds to compensate for what is absorbed from the human diet into the bloodstream via the gastrointestinal tract.

Potassium, one of the many important electrolytes the kidneys regulate, plays a role in the electrical properties of all cells in the body, including cardiac — pacemaker cells that control the heart rate. Unfortunately, in patients without kidney function, whatever they eat and drink stays in their bodies. In such patients, nephrologists need to control what the kidneys would normally do by artificially removing the necessary amount of water and electrolytes during dialysis treatments.

Briefcase-Sized Artificial Kidney

Creating an artificial device that performs the functions of the kidney is an immense task. The call from Kurtz led to a fruitful collaboration. In addition to Hestekin and Kurtz, the team also includes Christa Hestekin, professor of chemical engineering, and US Kidney Research Corporation, whose founder/CEO is Roland Ludlow. US Kidney Research Corporation supports the research and plans to market the world’s first tabletop artificial kidney based on a prototype that will ultimately be developed by the Kurtz-Hestekin-Ludlow team.

With \$4 million in funding from the company, the research team, including students in the Hestekin laboratory, are building a prototype device that fits on a desktop. It could be used at work or placed on a bedside table and used while a patient sleeps.

The device has four basic components that simulate the filtering and critical ion transport functions of an individual nephron. There is an ultrafiltration module that filters blood. Proteins and blood cells return to the patient’s blood, while water, ions, urea and some uremic toxins permeate to the next component in the device.

A nanofiltration module helps glucose to return to the blood, while allowing all other substances to permeate. Electrodeionization modules perform the ion transport requirements, and a reverse osmosis module concentrates the synthetic urine and simultaneously controls water excretion, ensuring that the volume of urine approximately matches the patient’s water intake.

Early on, most of the work focused on the electrodeionization module, which selectively removes ions from urine and returns them to the blood. The researchers have successfully tested this technology with several physiologically relevant ions, mimicking the specific control of ion transport by the kidney.

More recently, an “accidental” discovery has given the research team further reason to



From left: Doctoral student Juliana Marcal and postdoctoral fellow Partha Chowdhury work on the prototype of an artificial kidney

Kurtz emphasizes that the human kidney is not a simple filter. Rather, it is more like a computer, sensing the chemistry of our blood and keeping it constant, despite all the chemicals that food and beverages introduce into the blood. How the kidney accomplishes this is a major focus of his research.

In addition to studying the ion transport process in the kidney, Kurtz, along with the

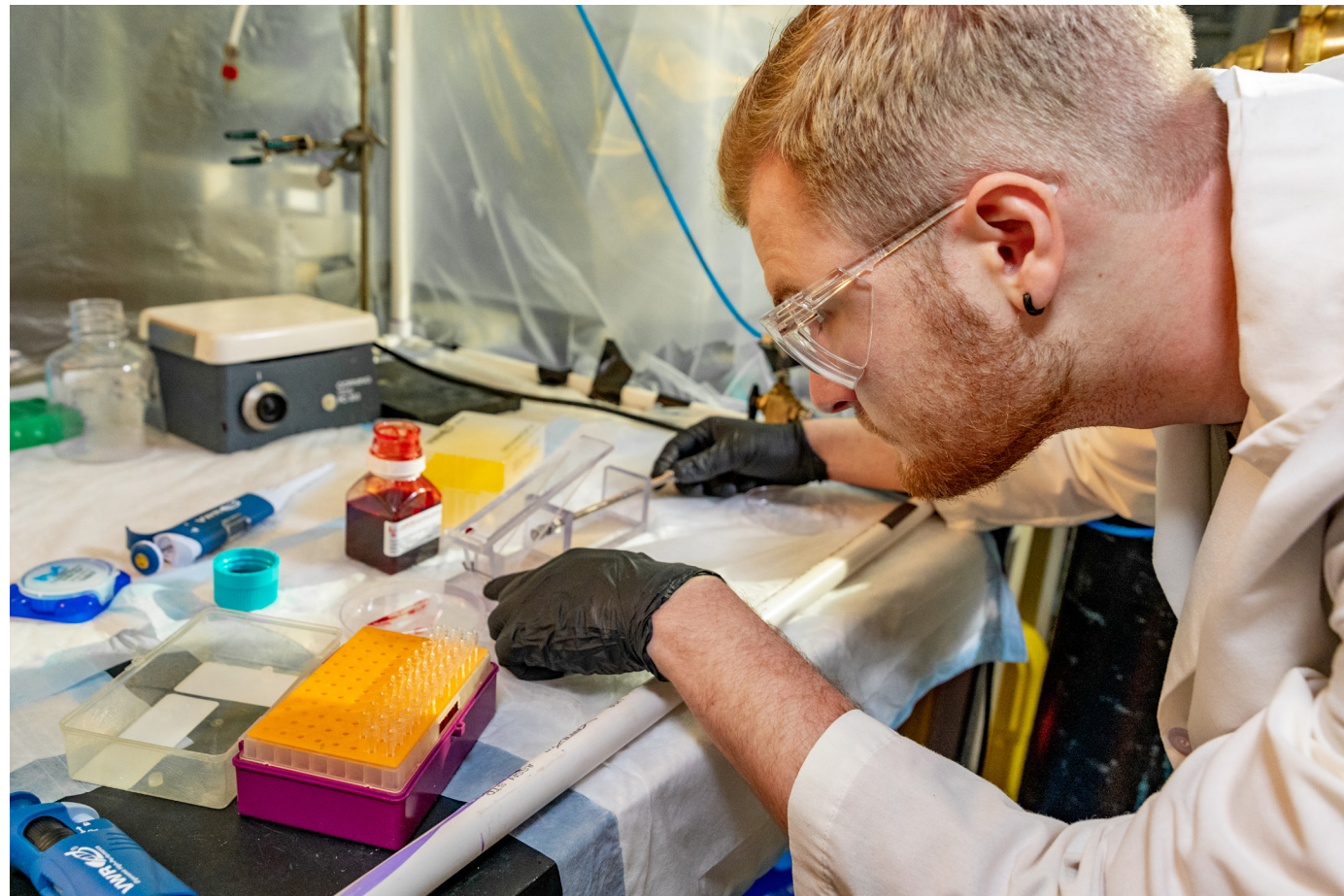
blood, as everyone knew, but compared to the requirement of needing to create a device that could transport ions specifically, the filtration requirement was child’s play.”

Kurtz started exploring techniques that could transport critical ions, such as sodium and potassium, without using dialysis. The device he envisioned would be implantable and therefore couldn’t use water, a dialysate

be excited. Ultrafiltration membranes used in hemodialysis, the primary treatment for people with end-stage kidney disease, have problems. They tend to clot. In recent years, in the effort to develop a better membrane, biomedical researchers have focused on the so-called “middle molecule,” that is, design of a membrane that achieves optimal performance in terms of molecule size and electrical charge, one that filters out uremic toxins without losing critical proteins and ions.

“This membrane looks more like nature,” Jamie Hestekin said. “It mimics the glomerulus and the tiny fibers connected to it better than anything out there. This was kind of an accidental discovery. We’re still not sure why it mimics the glomerulus better.”

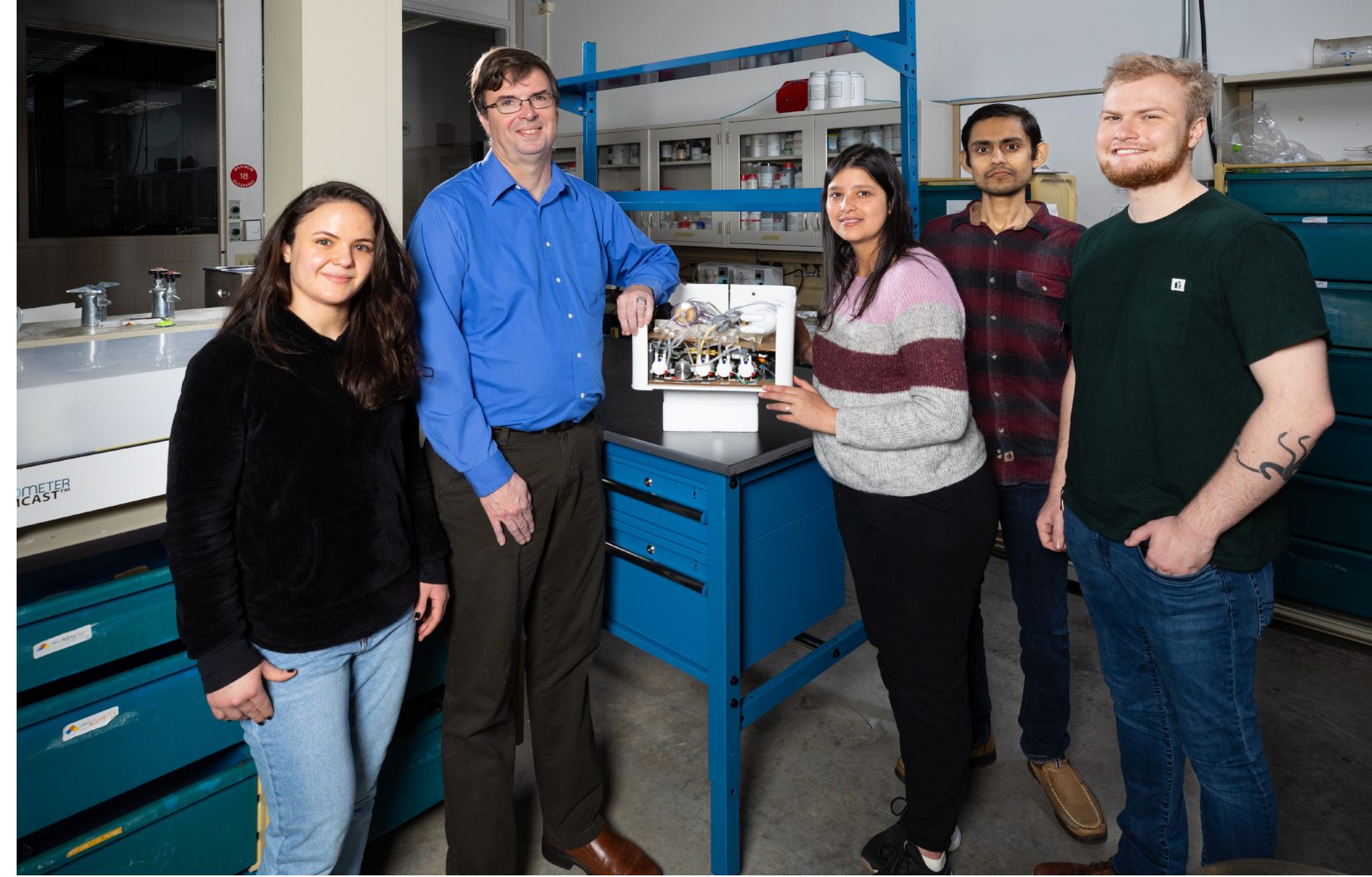
The researchers have used the cellulose membrane in animal studies, but it has not yet been tested as part of the artificial kidney device. The cellulose membrane could



Ph.D. student Eric Walker demonstrates a device used in sliding angle experiments.

As part of a different project, Jamie Hestekin and students in his lab were experimenting with various types of membranes to use as friction material for surface engineering. They were having success with a membrane made of cellulose. Then, a student decided to try it on blood. The results were encouraging.

potentially be used in hemodialysis dialyzers as well. Its filtering performance is superior to those currently in use, Hestekin said. US Kidney Research Corporation has licensed the membrane for this purpose and is exploring potential collaborations.



From left: Doctoral student Leticia Santos de Souza, Professor Jamie Hestekin, post-doctoral research fellow Imen Bousrih, post-doctoral fellow Partha Chowdhury and doctoral student Eric Walker

What It Means

Developing and marketing an artificial kidney could give patients with kidney disease more options and independence, while potentially reducing Medicare expenditures significantly. Patients using the device would no longer need to go to a dialysis clinic three times a week for treatment. Because their treatment would be done daily at home or in the office, with less stress on the cardiovascular system, there likely would be improvements in both patient quality of life and lifespan.

There’s another major benefit — the environment. Billions of gallons of wastewater produced annually by dialysis treatments would no longer enter water treatment facilities. Development of a waterless artificial kidney would significantly reduce the carbon footprint

associated with using and manufacturing water-purification systems, dialysate solutions and dialyzers. This additional advantage of not using water means the system would be optimal in countries where water is scarce.

The team is also trying to scale down components to create a partially or fully implantable device, which would be about the size of two fists. They first need to complete testing the new filtration membrane and make additional refinements to the tabletop device before creating a prototype that can be used in animal trials. The Hestekins and Kurtz estimate this will require an additional \$5 million in research funding, and they hope to begin animal trials for the prototype by the end of 2024. 🌱

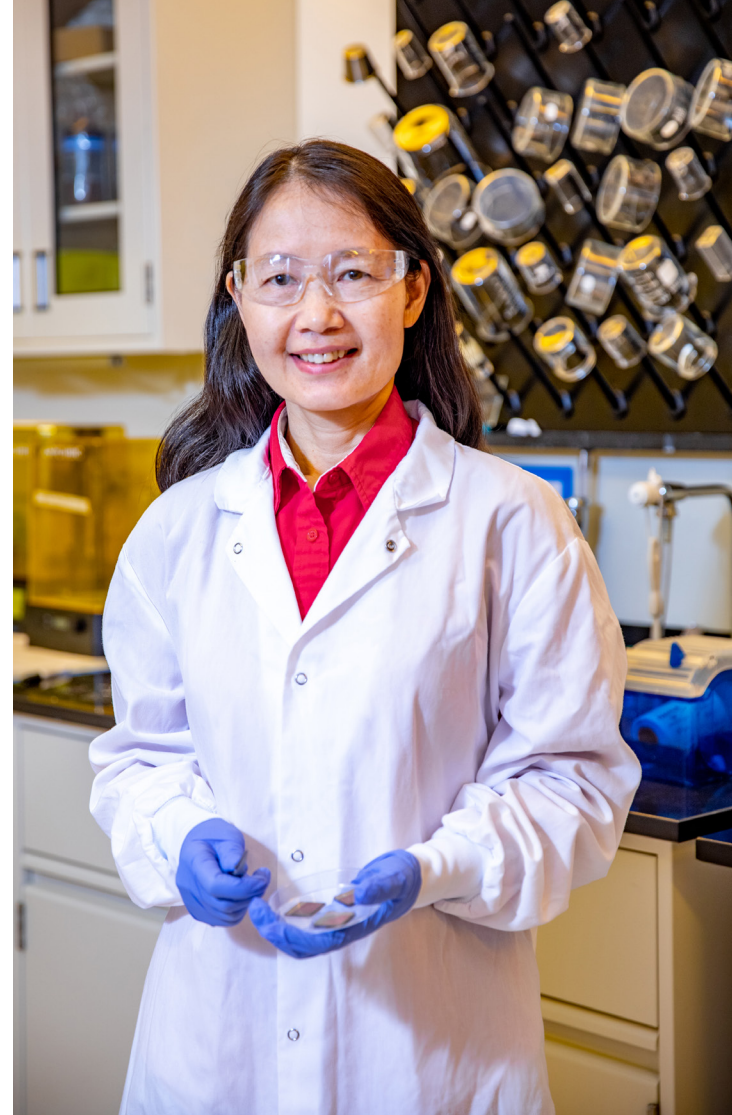
Mechanical Engineering Professor Receives SEC Faculty Achievement Award

By **Lyndsey Bradshaw**

The Southeastern Conference honored Min Zou, Distinguished Professor of mechanical engineering, with the 2023 SEC Faculty Achievement Award for the U of A.

“Dr. Min Zou is a shining example of our amazing faculty in the College of Engineering, from her groundbreaking research in nanomaterials to her outstanding and inspiring work with mechanical engineering students,” said Dean Kim Needy. “We are joyful to see Dr. Zou’s achievements honored in this way, and we are celebrating her award with as much enthusiasm as any SEC win on the field or court.”

Every year, the SEC recognizes faculty with outstanding records in research and scholarship from each of its member universities with SEC Faculty Achievement Awards. The U of A recognized Zou’s achievement at the Provost’s Faculty Reception held in spring 2023 at the Janelle Y. Hembree Alumni House.



Distinguished Professor Min Zou

PHOTO BY Whitt Pruitt

“I owe this award to my mentors, collaborators and talented students who make my career at the University of Arkansas so fun and rewarding,” said Zou, who holds the 21st Century Chair of Materials, Manufacturing and Integrated Systems. “I’m honored and humbled to have been selected by our provost and supported by my department head and Dean Kim Needy for this prestigious award.”

Joining the U of A in 2003, Zou has served in the Department of Mechanical Engineering as an assistant professor, associate professor, professor and Distinguished Professor. Zou is also a faculty member of the Institute for Nanoscale Science and Engineering and the interdisciplinary Microelectronics-photonics Graduate Program at the U of A.

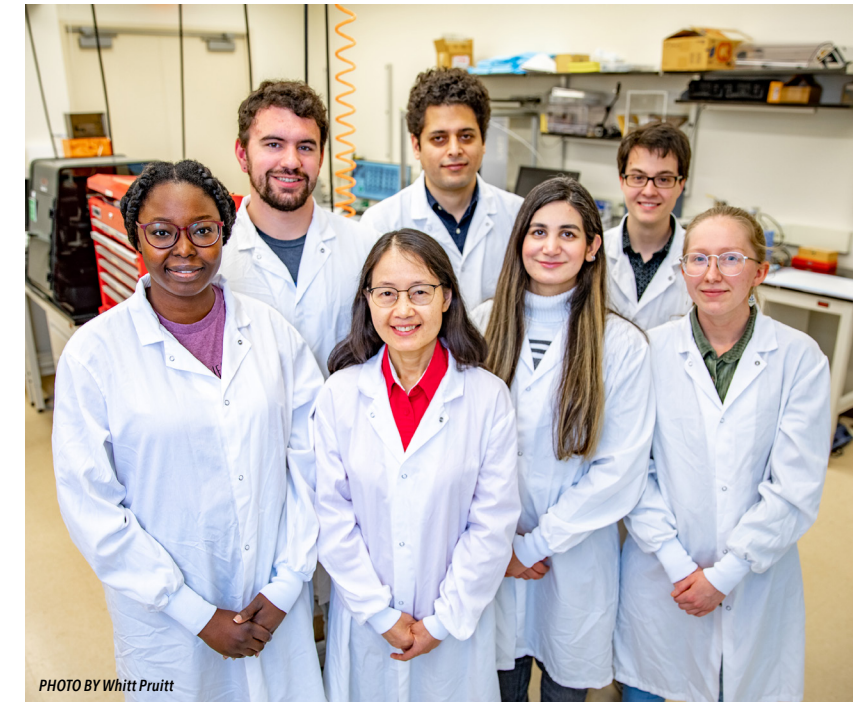
Zou is a leader in the fields of mechanical engineering, materials science and nanotechnology, and she is internationally recognized for her expertise in nanoscale surface engineering, nanomechanics and nanotribology.

She has received numerous awards and honors for her groundbreaking research, including the prestigious National Science Foundation CAREER Award (2007), two AI Sonntag Awards (2021 and 2013), the Edmond E. Bisson Award (2019) and the Walter D. Hodson Award (2001) from the Society of Tribologists and Lubrication Engineers, where she is also a fellow.

She has been recognized by the Arkansas Alumni Association with the Faculty Distinguished Achievement Award for Research (2018) and by the Arkansas Research Alliance, which named her a fellow in 2015. She is also a fellow of the American Society of Mechanical Engineers.

In addition, Zou has led over \$30 million in extramural research funding. Her research has been cited and published in more than 134 peer-reviewed publications, four book chapters, seven granted and four pending patents, and 36 best paper, poster or business competition awards.

The technology developed in Zou’s lab has led to the creation of two startup companies, which have received over \$5 million in support from the National Science Foundation, the Department of Energy and the Arkansas Economic Development Commission. This technology has made a significant impact on many industries and has been used in a wide range of applications including tribology, solar panels and LED lighting.



Distinguished Professor Min Zou (center) with her research team.

Zou received her bachelor’s and master’s degrees in aerospace engineering from Northwestern Polytechnical University, China, and she received her Ph.D. in mechanical engineering from the Georgia Institute of Technology. Prior to joining the U of A, she worked at the Shanghai Aircraft Research Institute and was a senior advisory development engineer and staff engineer at Seagate Technology, where she contributed to developing new technology involving the computer hard drive head-disk interface.

“We applaud Dr. Zou for receiving this great honor,” said Terry Martin, provost and executive vice chancellor for academic affairs. “Dr. Zou is a distinguished professor and well known for her research in nano-surface engineering. She has made tremendous contributions to the research activities of our university, as well as brought cutting-edge technology to the forefront of the engineering field.” 🌟



From left: Benjamin Marlow, Jack Kincannon and Annelise Koster became the first three students to graduate from the Data Science Program in May.

Data Science Program, Launched in 2020, Celebrates First Graduates

By **Lee Shoultz**

The Data Science Program, an interdisciplinary program housed in the College of Engineering, celebrated its inaugural class of three graduates in May: Jack Kincannon, Annelise Koster and Benjamin Marlow.

Kincannon graduated with honors with a concentration in business data analytics and planned to work for Arvest as a portfolio management analyst for its wealth management group. He was also a finalist for College of Engineering senior of the year.

Koster graduated with honors and a concentration in business data analytics. She planned to work as an associate consultant with Mastercard in Rogers.

Marlow graduated with a concentration in data science statistics. He planned to explore job opportunities in the fields of finance, sports analytics or tech consulting.

“Reaching commencement is always meaningful, but to be the first graduates from such a unique program in such an exciting and vital field is especially momentous,” said Kathryn Sloan, interim dean of the Fulbright College of Arts and Sciences.

Launched in 2020 with 14 students, the Data Science Program is a multi-college, interdisciplinary undergraduate degree program between the College of Engineering, Sam M. Walton College of Business and Fulbright College of Arts and Sciences.

The program has grown quickly, from 27 students entering the first year to a total enrollment of approximately 150 students in spring 2023.

“The data science degree program at the University of Arkansas is one of a kind. Very few higher education institutions offer an interdisciplinary collaborative degree such as this,” said Shannon Bedore, CEO of Sightline

Retail, which provides retail analytics and data management services to midsize suppliers. “Graduates of this program are taught to understand broader implications for data management and analytics beyond their specific field of study, giving students a robust professional edge in the real world.”

A key element of the program’s teachings is industry knowledge and experience prior to entering the workforce. The program has worked toward that goal by “collaborating with industry leaders across the state to develop a world-class program that prepares graduates for rewarding careers with some of the nation’s top companies,” said Nelson Peacock, president and CEO of the Northwest Arkansas Council.

Each of the students has endured challenging times, not only in being in the first group of students to enroll in the Data Science Program but also doing so during the COVID-19 pandemic.

“Having started courses virtually in 2020, to hitting the final stretch in 2023, I am appreciative of the process and everything I have learned,” Marlow said. “I am proud to represent the first group of graduates and know this program will only continue to grow and prosper in the future.”

The Data Science Program is at the forefront of the College of Engineering’s push to provide a holistic educational experience, generate transformational and relevant knowledge and grow the STEM workforce for Arkansas and the world, said Kim Needy, dean of the college.

“These first three graduates are a great beginning for this dynamic and important program whose exponential growth demonstrates students’ keen interest and companies’ heavy demand for data scientists,” she said. “We are grateful to this inaugural class, and we wish them much success.” 🌟

Two Long-Serving Department Heads Retire from College

By **Austin Cook** and **Fred Miller**

The College of Engineering said goodbye over the summer to two long-serving department heads — Juan Balda, who was head of electrical engineering for 13 years, and Lalit Verma, who was head of biological and agricultural engineering for 21 years.

Juan Balda

Balda's retirement marks the end of a 34-year career filled with transformative contributions to electrical engineering education and research, said Dean Kim Needy. She praised Balda's leadership and tireless advocacy.

"His legacy will continue to shape the university and inspire future generations of students, faculty and alumni in the years to come," she said. "I will miss the way he can make you laugh, sometimes even during the toughest moments."

Balda's work ethic and unwavering dedication to the program earned him the admiration of peers.

"No one works harder in the college than Dr. Balda," said John English, professor of industrial engineering and former dean of the college. "He is in the office all the time, including many weekends. As department head, he ran the unit faithfully and diligently while carrying a full research and service load."

Balda earned his bachelor's degree in electrical engineering from Universidad Nacional del Sur in Argentina and Ph.D. from University of Natal in South Africa. He worked as a visiting assistant professor at Clemson before joining the U of A College of Engineering in 1989.

Reflecting on his time at the U of A, Balda

expressed pride in the achievements of the electrical engineering undergraduate program.

"Our undergraduate program is among the best within our region, including bordering states and beyond. I am proud of having contributed to this achievement. Our undergraduate



Juan Balda

students have more opportunities beyond the classroom that enrich their educational experiences," Balda said.

Balda's influence has extended beyond the classroom and into research. He was the only faculty member studying his area of power engineering when he joined

the college. Today, power engineering covers traditional power systems but is transitioning to a new energy paradigm relying on renewable energy sources, utility-scale energy storage and new high-voltage power semiconductor devices based on silicon carbide materials — a much broader field that also includes electric propulsion.

"Having been part of this transformation was an excellent professional experience. Today, the UA Power Group is one of the most

important research teams in the United States and, I would say, the world," Balda said.

Balda said leading the department has been rewarding, but it's the people who he will miss.

"On the personal side, I have been blessed to work with individuals committed to undergraduate and graduate education — whether they were staff, faculty or administrators — all enabled me to move the department to a higher level. I will definitely miss working with them," Balda said.

Lalit Verma

Verma served for 21 years as head of the Department of Biological and Agricultural Engineering and two as interim dean of the Dale Bumpers College of Agricultural, Food and Life Sciences. He also served as interim associate vice president for academic programs for the Division of Agriculture from 2008 to 2010.

During his tenure, the department saw critical advancements in research and teaching programs.

"The most gratifying thing in my 23 years here has been creating and implementing the research, teaching and service programs for our citizens," Verma said.

"Recruiting young faculty and facilitating the growth of their individual programs while contributing to the departmental goals has been very rewarding.

"The support and invaluable contributions of our dedicated support staff and faculty have been the reasons for our sustained successes," he said.

The Department of Biological and Agricultural Engineering includes research and extension programs of the U of A System Division of Agriculture and research and academic programs of the College of Engineering.

"Dr. Verma came at a crucial stage when emerging technologies were opening new avenues of research and development for agriculture, the environment, food and human health," said Jean-François Meullenet, senior associate vice president-research for the Division of Agriculture and director of the Arkansas Agricultural Experiment Station. "Under his leadership, research in the Department of Biological and Agricultural Engineering has reached exciting heights of achievement in all these fields that improve the state's agricultural and food industries and made life better for all Arkansans."

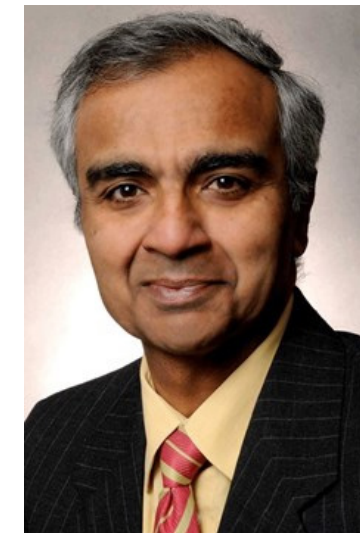
College of Engineering Dean Kim Needy said, "It's hard to imagine the campus without him. We will sorely miss our dear friend and colleague and wish him much happiness in his retirement."

Verma oversaw the advancement of biological research programs, including the design and implementation of the biomedical engineering program. Recruiting talented faculty and promoting interdisciplinary collaboration across multiple departments, including joint faculty appointments across departments and colleges at the U of A, he built a research program focused on advancing health technology.

At the same time, under Verma's leadership, the department continued to focus and advance research and extension programs in the land-grant mission to support Arkansas' agricultural communities and economy.

In particular, Verma said he is proud of faculty hires and program initiatives in sustainable engineering for water, food and energy systems.

Verma earned his Ph.D. in engineering from the University of Nebraska. He joined the U of A in 2000. 🌸



Lalit Verma

Engineering Celebrates Alumni at Awards Banquet

By **Jennifer P. Cook** Photos by **Stephen Ironside**

College of Engineering alumni, faculty, staff and guests gathered April 15 to induct two new members into the college's Hall of Fame and recognize 18 graduates with Distinguished Alumni and Early Career Alumni awards.

The formal event featured dinner and an awards ceremony led by Dean Kim Needy and co-hosts Pam McGinnis and Becca Leonard, with remarks by Terry Martin, provost and executive vice chancellor for academics, at the Fayetteville Public Library Event Center. McGinnis is chair of the college's Dean's Advisory Council and Leonard is chair of the Early Career Advisory Council.

"We wish the very best for all of our students when they leave the University of Arkansas, and it's so rewarding to celebrate the success of our outstanding alumni," Needy said.

The two new inductees to the Hall of Fame were Sam Alley (B.S.C.E. '79), chairman of VCC, a Little Rock-based contractor, and Pam McGinnis (B.S.I.E. '90), retired vice president of global sales, marketing and retail operations at Phillips 66.



Dean Kim Needy welcomes attendees to the 2023 Alumni Banquet.



Hall of Fame inductees receive the College of Engineering medal.



From left: Hall of Fame inductees Sam Alley and Pam McGinnis with Dean Kim Needy.

Alley was recognized as a distinguished alumnus in 2015, while McGinnis received that honor in 2017.

Alley moved with his family from a small town north of Jerusalem to Rose City in North Little Rock at age 14. Inspired by mentors, he found a passion for engineering. He graduated in 1979 with a bachelor's degree in civil engineering.

He co-founded VCC in 1987 on his 31st birthday after working as a project manager for a Little Rock construction firm. Alley is recognized as one of the top engineering and construction professionals in the United States, and VCC is consistently listed in the top 100 contractors by the Engineering News Record and recognized as the largest retail contractor in the nation.

Together with his wife, Janet, Sam Alley established the master's degree in construction management at the U of A. He also served on the steering committee for Campaign Arkansas and is a member of the Arkansas Academy of Civil Engineering.



Brian Gene Ballew shakes hands with Becca Leonard while accepting his Early Career Award.



Pam McGinnis shows her son her Hall of Fame medal.



From left: Joel Jewell, Distinguished Alumni Award honoree Karen Jewell and Hall of Fame member Bob Davidson share a laugh.

McGinnis is the second woman to be inducted into the college's Hall of Fame. A native of Springdale, she earned a Bachelor of Science in industrial engineering in 1990. She worked for more than 31 years in the oil and gas industry. Prior to assuming her role as vice president at Phillips 66, she was chief procurement officer and held a variety of leadership positions across the company, including commercial supply and trading, marine shipping and truck and rail transportation.

Prior to her retirement, she served on the boards of the National Action Council for Minorities in Engineering and the Fuels Institute. She was a member of the executive Inclusion and Diversity Council and served as a global sponsor for the Phillips 66 Hispanic Network. McGinnis also served as chair of the board for the Houston Area Habitat for Humanity. 🌸



The Fayetteville Public Library Event Center was the site for the 2023 Alumni Banquet.

2023 Distinguished Alumni Awards

- Steven J. Austin Sr. (B.S.C.S. '01)
- Indrajeet Chaubey (M.S.B.A.E '94)
- Jeff Fackler (M.S.O.M. '13)
- C. Denese Bracy Jackson (B.S.Ch.E. '90)
- Karen Jewell (B.S.I.E. '00)
- Mike Linstrom (B.S.Cmp.E. '85)
- Herbert J. "Bert" Parker (B.S.C.E. 1977, M.S.C.E. '78)
- E. Lamar Pettus (B.S.M.E. '68)
- Rajesh Calicut Subramaniam (M.S.E.E. '01)

2023 Early Career Alumni Awards

- Christopher Adkins (B.S.I.E. '12)
- Brian Gene Ballew (B.S.M.E. '12, M.S.M.E. '15)
- Teni Rane Butler (B.S.Ch.E. '16)
- Stephanie G. Cone (B.S.Bm.E. '14)
- Emmanuel Decrossas (Ph.D.E.E. '12)
- Wiwat Leebhaisomboon (B.S.Cmp.E. '09, M.S.Cmp.E. '11)
- Michael Keith May (B.S.B.E. '10, M.S.Bm.E. '14)
- Christopher P. Velardi (M.S.O.M. '19)
- Adam White (B.S.C.E. '08)



From left: Early Career Award honorees Brian Gene Ballew, Christopher Adkins, Stephanie G. Cone, Emmanuel Decrossas, Teni Rane Butler, Adam White and Michael Keith May.



From left: Distinguished Alumni Award honorees Herbert J. (Bert) Parker, C. Denese Bracy Jackson, Mike Linstrom, E. Lamar Pettus, Indrajeet Chaubey, Jeff Fackler, Steven J. Austin Sr., Rajesh Calicut Subramaniam and Karen Jewell.

'Alternative Spring Break' Gives Companies, Engineering Students Chance to Meet

By **Jennifer P. Cook**



College of Engineering students and staff stop for a group photo at Phillips Medisize in Maumelle.

Job opportunities are plentiful, and engineering graduates are in high demand, but it's still important for students to investigate companies that will be the best fit for their personalities and aspirations. These are just a couple of reasons the College of Engineering created Alternative Spring Break, a three-day, all-expense-paid tour of employers held in the spring since 2014.

The tour helps companies with recruitment and helps students explore possible careers, said Kelsey Lavigne, the college's director of employer relations.

"Alternative Spring Break is great program because it helps us show students great things companies are doing, and it helps us show employers our amazing students, whose skills and training make them exceptional hires," she said.

The spring 2023 tour, March 20-22, took 16 students and three staff members to visit six employers: Southwest Power Pool, McClelland Consulting Engineers, Dassault Falcon Jet, Little Rock Port Authority, Dillard's and Phillips Medisize, all in the Little Rock area.

The tour organizers get great feedback from both sides, Lavigne said.

Honors computer science student Pranav Mahesh said the trip was one of the best experiences he's had through the College of Engineering.

"We had a lot of fun going to different companies and getting to see how each one of them relied on engineers and their tools to function on a daily basis, even though most of them aren't really an engineering-based company," he said. "Along with that, the feeling of going to different places with a bunch of other engineering students was really new to me, and personally I loved getting to know them."

Donna Graham, director of Central Arkansas Industry and Community Engagement, said the trip provided a great insider perspective on Arkansas employers.

"It was unbelievable to see the massive industry operations taking place right here in Arkansas," she said. "We have everything from jet construction to medical manufacturing to fashion retailing taking place in central Arkansas. Our students are fortunate to have a wide range of thriving businesses eager to hire engineers."

The 2023 Alternative Spring Break trip was the first since 2019 because of cancellations during the pandemic. ❁

Gaines Named Inaugural Director of Newly Created Engineering One-Stop

By **Jennifer P. Cook**

A proven campus leader with 14 years of success in academic advising was named inaugural director of the College of Engineering's new Engineering One-Stop, which aims to improve retention and graduation rates by providing intensive, robust support to all undergraduate students.

Adrienne Gaines, who most recently served as associate director of student services for the First-Year Engineering Program, began her new duties in fall 2022.

Established through a 2014 gift by the late Robert H. Biggadike, a 1958 mechanical engineering alumnus, Engineering One-Stop will centralize student success initiatives, academic advising, coaching, mentoring and other services for engineering and computer science students.

Gaines extended thanks to Richard Cassady, director of the First-Year Engineering Program, for his leadership the past 10 years.

"He trusted me to develop programming initiatives to provide both proactive and reactive support for students," she said. "I am excited to build on the support that we have provided first-year students through our peer mentoring and academic coaching programs to support all students in the college under the leadership of Dr. Bryan Hill."

Gaines got to work quickly to recruit and hire her team, which includes an assistant director, three academic advisers, a senior study abroad adviser and a financial aid/scholarship adviser. A student services specialist and academic coaches integrated from the First-Year Engineering Program will round out the team of 12.

Since October 2012, Gaines has led the Student Services team that provides proactive support for all new freshmen entering the College of Engineering. The Peer Mentoring Program is a major component to help students transition successfully from high school into the College of Engineering.



Adrienne Gaines

Gaines serves as the advising director for the College of Engineering on campuswide Academic Advising Council. She has led all academic advising activities for the 800-plus first-year engineering students, including coordinating new student orientation. Gaines advocated to create the first college-specific academic coaching program in Spring 2019. It expanded to two full-time staff and two graduate assistants.

Hill, associate dean for student success, praised Gaines' strong record not only for serving students but also collaborating with faculty and staff.

"Adrienne is the perfect inaugural director of Engineering One-Stop as the College of Engineering aims to increase our retention and graduation rates," Hill said. "Adrienne is highly respected both inside the college and across the university campus in supporting students through innovative programming, data-driven decisions and quality advising."

Dean Kim Needy said Gaines has done a great job building out her team to support engineering and computer science students.

"Adrienne is the right person for this important position, one that will help to fundamentally transform undergraduate student support in the College of Engineering," she said.

Gaines has a Bachelor of Arts in management information systems from the University of Northern Iowa and a Master of Education in workforce development education from the U of A. ❁



From left: Dean Kim Needy, Sharon Booth McGee and Chad McGee.

New Endowment Creates Scholarship for First-Year Engineering Students

Special to *Arkansas Engineer*

Sharon and Chad McGee of Sapphire, North Carolina, are giving more Arkansas students the financial assistance they need to attend the U of A, thanks to a new scholarship.

The Sharon D. Booth McGee and Chad C. McGee Endowed Scholarship was created with a \$50,000 endowment, and the couple will make additional gifts over time to increase the number of scholarships awarded.

Sharon, who grew up in Ashdown, and Chad, who grew up in Gepp, both hold undergraduate and graduate degrees from the U of A. Sharon earned a Bachelor and Master of Science in chemical engineering from the College of Engineering, and Chad earned a Bachelor of Arts in political science and Master of Public Administration with a focus on information systems.

“I believe in education,” Sharon Booth McGee said. “When combined with hard work, it provides a leg up in this world, especially for students who study STEM-based degrees where starting salaries provide a tangible reward for the tuition and the blood, sweat and tears needed to earn the degree. University of Arkansas is an excellent choice for students.”

Chad McGee said, “We want to help students from our hometowns experience the same opportunities we did. We want to help these young adults who will lead and improve our world through the knowledge that an engineering education provides. We’re very excited about this scholarship, and it’s very important to us.”

The Sharon D. Booth McGee and Chad C. McGee Endowed Scholarships are intended to recruit talented graduates from Ashdown High School or Viola High School who choose to major in the College of Engineering at the U of A in Fayetteville and to supplement other awards to bridge funding gaps.

The couple met while attending the U of A in Fayetteville and have fond memories of their experiences. They recognize the importance of education, as well as the barriers that students sometimes face in pursuing their degrees.

Dean Kim Needy thanked the McGees for their generosity and for Sharon Booth McGee’s service on the Dean’s Advisory Council.

“Sharon and Chad both epitomize how higher education and hard work can give someone a world of opportunity.”

“Sharon and Chad are longtime friends of the college, and both epitomize how higher education and hard work can give someone a world of opportunity,” she said.

Sharon Booth McGee was inducted into the Arkansas Academy of Chemical Engineers in 2012, received the Distinguished Alumni Award in 2015 and is a member of the Dean’s Advisory Council. She and Chad are members of the Chancellor’s Society at the U of A for their consistent giving to the university. They are also both members of the Arkansas Alumni Association. 🌸

For information about how to create a scholarship endowment, contact Bill Lansden at blansden@uark.edu.

Faculty and Research Highlights

Needy Named to List of "Top 100 Women of Impact in Arkansas"

College of Engineering Dean Kim Needy was among three U of A staff members named among the Top 100 Women of Impact in Arkansas, a prestigious list that includes business executives, educators and civic leaders from across the state.

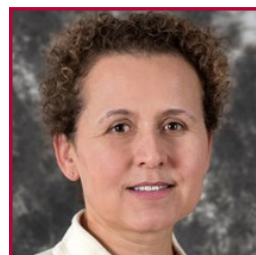


Needy, first female dean of the college, said she was honored to be recognized "alongside these outstanding leaders at U of A and across the state."

In addition to Needy, the list included Sarah Goforth, executive director of U of A's Office of Entrepreneurship and Innovation, and Denise Thomas, CEO of the World Trade Center Arkansas.

Narrowed from more than 600 submissions, the list revived a publication from the 1990s highlighting the top 100 women in Arkansas, said Mitch Bettis, whose company, Arkansas Business Publishing Group, assisted in compiling the top 100 alongside the Women's Foundation of Arkansas.

Little Rock Soirée magazine, which also aided with the selections, highlighted the honorees with a special publication in September.



College Welcomes New Associate Dean for Research

Industrial engineering Professor Sandra Eksioglu was named the college's interim associate dean for research Jan. 1, replacing

Heather Nachtmann, who stepped down to focus on other professional opportunities.

Eksioglu joined the college in 2019 as the Jim M. and Marie G. Hefley Professor in Logistics and Entrepreneurship. Her academic interests include operations research, network optimization and algorithmic development. Her work has been funded by National Science Foundation and U.S. departments of energy, transportation and homeland security.

The college recruited Eksioglu from Clemson University, where she was an associate professor. Prior to that, she served on the faculty at Mississippi State University. She received her Ph.D. in industrial and systems engineering from the University of Florida.

The National Science Foundation awarded Eksioglu a CAREER Award in 2011. The U of A selected her for the SEC Academic Leadership Development Program in 2021, and she is a fellow of the Institute of Industrial and Systems Engineers.

The College of Engineering's team of associate deans also includes Bryan Hill, associate dean for student success, and Kevin Hall, associate dean for academics.

Industrial Engineering Professor Named Head of Department



Chase Rainwater, an alumnus and professor of industrial engineering known for his outstanding student mentorship, was named head of the Department of Industrial Engineering on June 1. He takes the helm from Ed Pohl, who was named dean of the U of A Graduate School and International Education.

Rainwater earned a Bachelor of Science in Industrial Engineering from U of A in

2004 and a Ph.D. in industrial and systems engineering from the University of Florida in 2009.

He joined the College of Engineering as an assistant professor of industrial engineering in 2009 and achieved the rank of professor in 2021. He also has served as associate department head, director of the J.B. Hunt Innovation Center of Excellence, inaugural director of the Master of Science in operations analytics program and co-director of the Arkansas Security Research and Education Institute. He is a fellow of the Institute of Industrial and Systems Engineers.

Rainwater is regarded as an exceptional educator, teaching numerous courses in computing, as well as optimization, probability and statistics. His research interests include supply chain logistics, security and food safety. His work has been supported by the National Science Foundation and U.S. departments of transportation, homeland security and education, in addition to multiple national labs, nonprofit organizations and companies.



Nachtmann Named Arkansas Research Alliance Fellow

Heather Nachtmann, professor of industrial engineering and the Earl J. and Lillian P. Dyess

Endowed Chair in Engineering, was named an Arkansas Research Alliance fellow in May.

The program recognizes scientists and engineers already resident at a university or institution in Arkansas for their ongoing, exemplary contributions to the state's core research focus areas with a \$75,000 grant paid over three years. The program recognizes research leaders with an established history of impact and includes membership into the alliance's Academy of Scholars and Fellows.

Nachtmann's research contributions to the state include economic impact and operational studies of the McClellan-Kerr Arkansas River Navigation System and the Ouachita River. She also serves on the leadership team of the Arkansas Economic Development Commission's Data Analytics that are Robust and Trusted (DART) Center while also leading advanced mobility efforts for the University of Arkansas.

Nachtmann has published more than 100 peer-reviewed publications and generated more than \$17 million in research grants as principal investigator. She serves as director of the Maritime Transportation Research and Education Center, a U.S. Department of Transportation University Transportation Center, and the Mack-Blackwell Transportation Center.

Nachtmann received her bachelor's, master's and Ph.D. in industrial engineering from the University of Pittsburgh. She has been with the College of Engineering since 2000.

Matlock Recognized as Fellow of the American Ecological Engineering Society



Biological and agricultural engineering Professor Marty Matlock was named a fellow of the American Ecological Engineering Society.

The society bestows fellow recognition to members with exemplary qualifications and sustained excellence in contributions to practice, research and education in the field of ecological engineering. Fellows are leaders in their discipline and accomplished members of the society with a minimum of 10 years' active membership.

Matlock received the society's Odum Award in 2022, the society's highest honor. The Odum Award honors two of the most influential figures in defining and pioneering the concepts and practices of ecological engineering, Howard T. and Eugene Odum. The award recognizes a lifetime of achievement and contributions during the honoree's career to research, education and practice in the field of ecological engineering.

The society was founded 24 years ago to promote the development of sustainable ecosystems that integrate human society with its natural environment for the benefit of both by fostering education and outreach, extending professional development and associations, raising public awareness and encouraging original research.

Matlock was a founding member and served as president of the society in 2007-2008.

Chancellor Emeritus John White Receives Book of the Year Award

John White, chancellor emeritus of the University of Arkansas, received the Joint Publishers Book of the Year Award from the Institute of Industrial and Systems Engineers for his book, *Why It Matters: Reflections on Practical Leadership*, from Greenleaf Book Group Press.



This is White's fourth Book of the Year award from the institute, as he was awarded the Joint Publishers Book of the Year Award in 1974, 1986 and 2015.

The book draws on White's six-decade career as a corporate leader, chancellor, dean, educator, engineer and consultant.

Engineering Departments to Combine, Expand Opportunities for Students and Faculty

The U of A Department of Electrical Engineering and Department of Computer Science and Computer Engineering were combined in August to form a single, integrated department named the Department of Electrical Engineering and Computer Science.

The restructuring will bring numerous benefits for students, particularly in the expansion of educational opportunities, said Jia Di, who has been head of computer science and computer engineering since January 2021, and will lead the new department.

"Students currently enrolled in the program will gain access to a broader range of technical electives previously unavailable to them," Di said.

The new structure will also facilitate seamless transitions between electrical engineering, computer engineering and computer science programs.

The change was supported by Juan Balda, University Professor and head of the electrical engineering department, who retired in July after 34 years at U of A.

Increased cooperation between faculty members from different disciplines is expected to yield a significant boost in research productivity, Di said.

The newly combined department began operations Aug. 15. 🌸

Student Highlights

Mechanical Engineering Student Named Goldwater Scholar

Stephen Pierson, a Fayetteville native and an honors mechanical engineering junior, was named a 2023 Goldwater Scholar.



Stephen Pierson

The annual award goes to the top students nationwide in mathematics, science and engineering. Pierson will receive a scholarship of up to \$7,500 from the Barry Goldwater Scholarship Foundation for his senior year.

The Barry M. Goldwater Scholarship was established by Congress in 1986 to honor the United States senator. The program was designed to foster and encourage outstanding students to pursue research careers in the fields of the natural sciences, engineering and mathematics. Universities and colleges may nominate up to four students each year.

Pierson's primary research focuses on microchannel heat sinks, and he is supported by a State of Arkansas Student Undergraduate Research Fellowship.

Pierson's research mentor is Han Hu, assistant professor of mechanical engineering.

Civil Engineering Student Lands U.S. Department of Transportation Award

Lizbeth Juarez-Bartolo, B.S.C.E. '21, garnered University Transportation Centers' Outstanding Student of the Year award, sponsored by the U.S. Department of Transportation, for her continued research in transportation planning, transportation policy and infrastructure systems.



Center: Lizbeth Juarez-Bartolo

Each year, students are honored for their achievements and promise for future contributions to the transportation field at an annual banquet. These students are selected based on their accomplishments in such areas as technical merit and research, academic performance, professionalism and leadership.

After receiving a bachelor's degree in civil engineering from the U of A in 2021, Juarez-Bartolo took a position as a graduate research assistant while pursuing her master's degree in transportation engineering.

Juarez-Bartolo's projects include serving as CEO of a startup, selling remote sensor technology for a National Science Foundation program, and creating and deploying a statewide traffic safety survey. While working on various research projects, she has also participated in the Institute of Transportation Engineers.

Juarez-Bartolo was nominated by her adviser, Sarah Hernandez, associate professor of civil engineering, and Heather Nachtmann, director of the U of A's Maritime Transportation Research and Education Center. 🌸

College of Engineering Mourns Schmitt, Dean Who Increased Focus on Research and Fundraising

By **Jennifer P. Cook**

The College of Engineering lost an influential leader and longtime friend May 29 with the passing of Neil M. Schmitt, an electrical engineering alumnus who served as dean of the college from 1983 to 1996 and ushered in an era of heightened focus on research and fundraising.

Schmitt was 82.

“I’m saddened by the passing of my dear friend, colleague and mentor Dr. Neil Schmitt,” said Provost Terry Martin. “Dr. Schmitt was my professor when I was a student, and he hired me when I joined the university in 1983. We worked alongside each other as faculty members and when he was the dean of the College of Engineering. He was truly an incredible person, and he had an immeasurable impact on my life and career as well as the university and campus community.”

He continued to cheer on the college after retirement, and its current leader, Dean Kim Needy, in recent years.

“Throughout his career and into his retirement, Neil never stopped advocating for the College of Engineering nor encouraging its leaders. I will

forever be grateful for his support through a kind word or inspirational note,” she said.

Schmitt earned bachelor’s and master’s degrees in electrical engineering at the U of A before completing his doctorate at Southern Methodist University in 1969. After military service, he worked as a systems engineer for IBM, then at Texas Instruments developing military radar systems.

His academic career began in 1970 when he joined the U of A as an assistant professor of electrical engineering. He spent time doing postdoctoral work at Baylor College of Medicine in 1971 before becoming department head of electrical engineering in 1973. He was named dean of the college in 1983, serving 13 years, and returned as interim dean from 2001 to 2002.

“We have lost one of the greats,” said John R. English, professor of industrial engineering, who served as dean of the college from 2013 to 2020. “Many, many people, including myself, have been significantly touched by the life of Dean Schmitt. I loved him dearly.”

Among his many accomplishments, he oversaw the design and construction of Bell Engineering Center and led the transformation of a factory in south Fayetteville to become the Engineering Research Center. Schmitt also started and supervised the Genesis Technology Center, which was recognized early as the premier technology incubator in the United States.

During Schmitt’s tenure, the college broke campus records for fundraising and established a new model for donor relations. He was inducted into the college’s Hall of Fame in 2014. 🌸



Neil Schmitt

In Memoriam notes were compiled by the Arkansas Alumni Association from July 1, 2022, to June 30, 2023.

1940s

Austin Bollen BSEE ‘47 of El Dorado on July 31, 2022

Barrett S. Duff BSCHE ‘49 of Pasadena, California, on Sept. 20, 2022

James Edward Stice BSCHE ‘49 of Austin, Texas, on July 16, 2022

1950s

James H. London BSCHE ‘50 of Oklahoma City, Oklahoma, on March 28, 2023

Ronald P. Bridges BSME ‘51 of Heber Springs on Nov. 22, 2022

Corley P. Senyard Sr. BSME ‘51 of Greenwell Springs, Louisiana, on Oct. 8, 2022

William T. Stewart BSEE ‘55 of Fort Myers, Florida, on April 6, 2022

Hugh V. Piper BSAGE ‘57 of Peoria, Illinois, on June 21, 2022

Jim Frazier BSCE ‘58 of Helena on July 28, 2022

Ron E. Totty BSEE ‘58, MSEE ‘61 of Melbourne, Florida, on Feb. 14, 2022

Richard L. Bennett BSIE ‘59, MSME ‘61 of Fort Worth, Texas, on April 25, 2022

J. D. Chastain BSEE ‘59 of Siloam Springs on Sept. 28, 2022

Louis W. Hart Jr. BSIE ‘59 of Charlottesville, Virginia, on June 17, 2022

Wayne Robbins BSEE ‘59 of Saint Charles, Missouri, on Dec. 3, 2021

1960s

Jim L. Reed BSIE ‘60 of Tyler, Texas, on Feb. 7, 2023

Chuck E. Yates BSCE ‘60 of Volente, Texas, on Dec. 19, 2022

Donald L. Zimmerman BSEE ‘60 of Berryville, Virginia, on Jan. 21, 2023

Samuel W. Cupps BSME ‘61 of Muskogee, Oklahoma, on Oct. 11, 2022

William R. Ragland BSEE ‘61 of Hilton Head, South Carolina, on July 8, 2022

Harold L. Culp BSME ‘62 of Little Rock on July 23, 2022

Sid Fitzgerald BSCE ‘64 of Mabelvale on Sept. 20, 2022

Jerry Wayne Medlin BSIE ‘66 of Napa, California, on July 6, 2022

Kirk Pond BSEE ‘66 of Cape Elizabeth, Maine, on Oct. 26, 2022

Fredric Clark BSEE ‘67 of Fayetteville, Tennessee, on March 9, 2023

William Hix Smith Jr. BSAGE ‘67 of Nashville on Oct. 18, 2022

1970s

Mike A. Limbird BSIE ‘70, MSE ‘90 of Little Rock on Oct. 15, 2022

Willis M. Ponder BSEE ‘72 of La Grange, Texas, on Sept. 19, 2022

David M. Walker BSCE ‘76 of North Little Rock on June 10, 2022

Karen Chotkowski BS ‘77, BSCE ‘85 of Fayetteville on Jan. 6, 2023

Ronald V. Lester MS ‘78 of North Little Rock on Nov. 5, 2022

Michael R. Munson BSEE ‘79 of Searcy on Oct. 6, 2022

1980s

Amin Yazdanian PHD ‘86 of Washington D.C. on April 1, 2022

1990s

Kevin Henry BSBAE ‘99 of New York, New York, in September 2022

Class Notes

Class Notes were compiled by the Arkansas Alumni Association from July 1, 2022, to July 1, 2023.

1960s

John A. White Jr.

BSIE '62 of Hilton Head, South Carolina, is the recipient of the Joint Publishers Book of the Year Award from the Institute of Industrial and Systems Engineers (IISE) for his book, *Why It Matters: Reflections on Practical Leadership*, from Greenleaf Book Group Press.

Dean Covey III

BSCHE '67 of Gainesville, Florida, was appointed to the Utility Advisory Board of the Gainesville Regional Utility.

Troy C. Alley Jr.

BSEE '69 of Desoto, Texas, is the co-recipient of the 2023 Arkansas Alumni Association Johnson Fellowship.

1980s

David Macchiarolo

BSEE '84 of Greensboro, North Carolina, is an Undersea System Architect and engineering project manager at General Dynamics.

Heather Leigh Walker

BSCHE '89, MSCHE '93, PHD '96 of Fayetteville received the Nontenure Track Teaching Award

from the College of Engineering on May 6. This Dean's Excellence Award honored excellent performance during the 2021-22 academic year.

1990s

David Eugene Shinn

BSEE '90 of Seaford, Virginia, is the Associate Director for Labs and Facilities in the Engineering Directorate at NASA's Langley Research Center.

2000s

Patrick A. Kelly

BSEE '00 is a colonel in the Connecticut Air National Guard on May 26, 2022. He currently serves as the Commander of the 103rd Medical Group, a position he has held since Oct. 4, 2020.

Demond Dortch

BSIE '02 of Lincoln, Nebraska, is the assistant vice president and chief mechanical officer at BNSF Railway. He will assume systemwide responsibility in driving and continuing alignment and advances in reliability, efficiency and productivity across the mechanical department.

Chase Everett

Rainwater BSIE '04 of Springdale received the 2022 Outstanding Public Service faculty award from the College of Engineering.

Daniel Matthew Klein

BSCMP '06, MBA '14 of Fayetteville was named as a U of A Employee of the 4th Quarter. He is a master scientific research tech in electrical engineering.

James Allen McCarty

BSBE '06, MSBE '15, PHD'20 of Fayetteville was inducted into the Arkansas Academy of Biological and Agricultural Engineers. He has been an environmental quality manager with the Beaver Water District in Lowell since February 2017.

Nupura Sudhir

Bhise BSBE '07 of Baltimore, Maryland, was inducted into the Arkansas Academy of Biological and Agricultural Engineers. She is an accomplished biomedical researcher with experience in academic and startup environments.

Catherine I. Erickson

BSBE '07 of Chevy Chase, Maryland, was inducted into the Arkansas Academy of Biological and Agricultural Engineers. She is an engineer at the Food and Drug Administration's Center for Tobacco Products, reviewing tobacco product applications to help accelerate the transition to a healthier America.

William James

Richardson BSBE '07 of Fayetteville is an associate professor at the Ralph E. Martin Department of Chemical Engineering at the U of A.

Eric Specking

BSCMP '09, MSIE '13, PHD '20 of Fayetteville received a 2022 Honors College Staff of the Year Award.

Eric Specking

BSCMP '09 MSIE, '13 PHD '20, assistant dean of enrollment and retention for the U of A's College of Engineering, has been selected to participate in the INCOSE Technical Leadership Institute. Upon completion of the two year learning journey, Specking will be inducted as a

full member of The Leadership Institute.

2010s

Wendyam Fernand

David Traore PHD '10 of Van Nuys, California, is one of the participants who completed a National Science Foundation Innovation Corps program, funded by an NSF grant, to explore commercialization of a new type of high torque electric motor and controller for robotic applications. The team was also awarded the I Corps program's New York I Corps Hub Spirit Team Award.

Shane R. Wells

BSME '10 of Phoenix, Arizona, is the Regional Engineering Director for HP Engineering's new Phoenix office.

Jackie Micheletto

BSBA '12, MSOM '15 of Fayetteville received a 2022 Superior Staff Service Award from the College of Education and Health Professions. She is the assistant director of financial affairs for the college.

Cameron David

Murray BSCE '12, MSCE '14, associate professor of civil engineering, received a \$3 million grant

from the U. S. Army Corps of Engineers to investigate novel solutions to military infrastructure problems. During this two year project, Murray and his team of colleagues and students will collaborate with the U.S. Army Engineer Research and Development Center.

Alexander H. Nelson

BSCMP '12, MSCMP '13 of Fayetteville received the 2022 Rising Teaching Award from the College of Engineering.

Gage Greening

BSBME '14, PHD '19 is a senior grant consultant at ScienceDocs. At ScienceDocs, Greening supports entrepreneurs, startups, small businesses, and academic investigators developing innovative biomedical technologies to strategically conceptualize and prepare grant proposals to government agencies such as the NSF, NIH, and DoD to secure funding.

Adedoyin Ayomide Abe

BSME '18, MSME '22 of Fayetteville is the recipient of the Anderson Graduate Fellowship for the 2022-23 year from Tau Beta Pi, the engineering honor society. She will

continue her graduate work at the U of A researching surface engineering and lubrication technologies.

Lillie Haddock

BSBE '19, MSBE '22 of Leawood, Kansas, received a Fulbright U.S. Student Program award to Australia to study the role of water markets in managing climate change and low water availability. She will conduct research at University of Melbourne during the 2022-23 academic year as part of a project that will focus on policy mechanisms to manage declining water availability with the university's Managing Climate Variability and Change Lab Group.

2020s

Kaylee Henry

BSBME '20 of Prairie Grove received a Graduate Research Fellowship from the National Science Foundation. She is a Ph.D. student at Northwestern University where she researches optimizing parameter settings for deep brain stimulation devices.

Gianna Therese

Busch BSBME '21 received a Graduate Research Fellowship

from the National Science Foundation. She is a Ph.D. student in bioengineering at University of Pennsylvania where she researches single cell metabolic heterogeneity in cancer.

Natalie M. Curry

BSBME '21 received a Graduate Research Fellowship from the National Science Foundation. She is pursuing a Ph.D. in bioengineering and biomedical engineering at Vanderbilt University.

Lashae Ashanique

Hall BSCHE '22 of Fayetteville is the recipient of the 2022 FutureFuel Scholarship Award.

Ashley Acord

MSOM '23 of Tontitown is the recipient of the scholarship offered by the Master of Science in Operations Management program.

Md Khursidul

Islam MSOM '23 of Fayetteville is the first recipient of the Amass Family Master of Science in Operations Management.



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