

2019 | Vol. 6

# explore

Research at the University of Missouri-Kansas City

## MISSION TO MAARS

New discoveries at the intersection  
of water and magma









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*Explore* is published by the UMKC Office of Research and Economic Development in collaboration with the UMKC Division of Strategic Marketing and Communications to highlight the achievements and contributions of UMKC researchers.

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UMKC

*Students take part in a "trash-cano" — a volcano simulation in a trash can — experiment led by Alison Graettinger, Ph.D., assistant professor of Earth and Environmental Sciences. Read more about Graettinger's teaching on page 16. / Photo: Brandon Parigo*

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# Welcome to explore



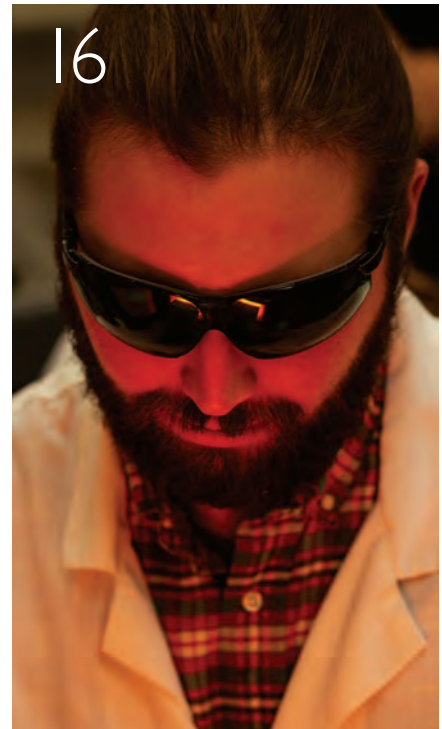
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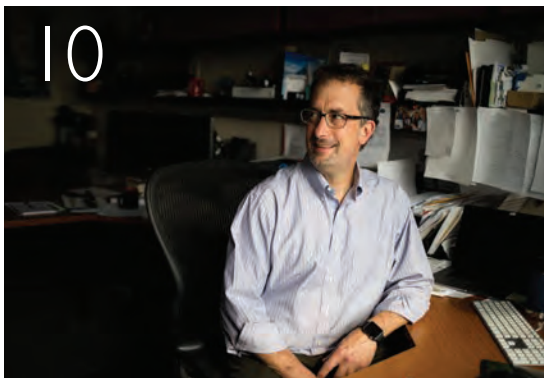
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## LETTER FROM THE CHANCELLOR



*“We live in a world that cries out for discovery-driven solutions to intractable problems. We will answer that call with a resounding “Roo Up!”*

The Carnegie Classification System for colleges and universities places the University of Missouri-Kansas City in the category of “high research activity.” That’s a hard-won achievement we are quite proud of. The terminology, however, is a bit too dry to really fire the imagination.

The term I prefer is “thriving discovery enterprise.” Let me take a moment to unpack what that phrase means to me.

To “thrive” means to grow or develop vigorously; to flourish. We have set a high bar for growth of our research activity. Our targets include doubling our annual research expenditures from \$29.2 million in 2018 to \$60 million by 2028 and increasing the annual number of patents filed by our people from the current three-year average of 17 to 20 in three years, 25 in five years and 30 in 10 years.

Some might find such goals daunting. At UMKC, we find them exhilarating.

“Research” is an activity; “discovery” is productive activity. We seek to create new knowledge not for its own sake, but for the power it holds to generate positive change. At UMKC, we like to say that discovery is not a goal; it is a means by which we realize our goals.

And our goals are not ours alone; they have been developed through thoughtful partnerships with businesses, arts institutions, nonprofit

organizations and local governments in the Kansas City region and throughout the state of Missouri. UMKC is leading the way in taking the region forward, creating a culture of progress that shapes not only our institution, but also the communities and institutions around us.

The dictionary defines an “enterprise” as “a project ... that is important or difficult or that requires boldness or energy.”

“All of the above” is how we see the road ahead. And we relish it.

In the pages that follow, you will see examples of the kind of boldness and energy that drives our research activity; that boldness and energy is the source of our confidence that we can overcome the challenges ahead and reach our goals.

The future demands no less. We live in a world that cries out for discovery-driven solutions to intractable problems. We will answer that call with a resounding “Roo Up!”

Count on it.

C. Mauli Agrawal, Ph.D.  
Chancellor





“UMKC is on the verge of something great,  
and I am looking forward to being part of it.”

It is my great pleasure to bring you this issue of Explore magazine, my first edition since joining UMKC in August. When I first began learning about UMKC, I was excited to hear about the dynamic new chancellor and the outstanding faculty and staff that have created a community of excellence, specifically in the realm of research. After speaking more with Chancellor Agrawal, Provost Barbara Bichelmeyer and other faculty, it became clear to me that UMKC is on the verge of something great, and I am looking forward to being part of it.

Looking forward, I hope to identify our strengths as a university and build on those strengths to meet the needs of our community and beyond. I have already seen impressive research in the areas of big data, the health sciences and other STEM and non-STEM fields.

Within the pages of this magazine you will see how UMKC faculty members are working to combat climate change, disease and poverty. You will read about how they are working with the world's tiniest technologies and scaling some of our greatest peaks in the pursuit of answers. It is my goal over the coming months and years to create an environment where these types of activities can thrive.

One area in which UMKC faculty already excel is collaboration. Nearly all of our schools are involved in cross-disciplinary proposals

at any given time. And as many of you already know, research does not simply happen in the laboratory. Research is part of the fabric of everything we do here at UMKC, and it is my goal to expand our research capabilities and elevate the research enterprise that guides our learning and inspires discovery.

I hope to help position this university as a top-tier research institute and support our faculty in pursuing competitive grant opportunities and partnering with some of the nation's most prestigious schools. UMKC has the potential to become a global resource for addressing some of our world's most significant challenges. I invite you to read about what is happening now in this issue of Explore and get a glimpse of the exciting future that is to come.

A handwritten signature in black ink, reading "Chris Liu".

Yusheng (Chris) Liu, Ph.D.  
Vice Chancellor for Research



# PUTTING GRANT DOLLARS TO WORK

Propel program boasts 100% job placement rate for students with disabilities



*Each day before classes begin at UMKC, Alexis Petri, Ed.D., meets with members of the UMKC Propel program, a transition program for young adults with intellectual and developmental disabilities. Petri and her staff assist the Propel students with becoming independent, navigating adult life and, of particular note, finding a job. The program currently boasts a 100% job placement rate for graduates. / Photos: Brandon Parigo*









by Bridget Koan

Since its creation in 2015, 21 students have graduated from the UMKC Propel program, a transition program for young adults with intellectual and developmental disabilities. The job placement rate for those graduates? 100 percent.

“This is huge,” says Alexis Petri, Ed.D., principal investigator and project director, because the rate of employment for people with disabilities is approximately 30%. Petri, who is also an associate research professor in the UMKC College of Arts and Sciences’ Department of Psychology, also emphasizes how employment can profoundly change the lives of those with disabilities.

“Work plays a big role in most adults’ lives, yet many people with disabilities are either unemployed or underemployed,” Petri says. “This is truly a shame, for not only does this situation make their lives smaller and poorer, it means that people with disabilities don’t get

to be full members of society or contribute to their families and communities as much as they could and want.”

People who attend college, including those with intellectual disabilities, are more likely to have a job and earn more at that job. People with intellectual disabilities who attend college are also more likely to live alone, be financially independent, be able to use public transportation, which, in turn, gives them more opportunity to participate in a variety of activities.

“College also gives people with intellectual disabilities a network of lifelong friends,” Petri adds.

Through her research, Petri bridges theory and practice to create change and allow access to higher education for people of a variety of abilities. She has experience working with National Science Foundation grants and others that look at learning supports for

post-traditional students, such as military veterans who are now learning differently and want to major in college STEM programs.

And as an educational leader passionate about social justice, inclusion, access and public policy, Petri is ideal for leading the UMKC Propel program in accordance with the UMKC mission “to promote learning through the discovery, preservation and dissemination of knowledge of public value across a broad spectrum of disciplines and fields of study.”

## THE DAY-TO-DAY BUSINESS OF IMPROVING LIVES

The UMKC Propel program began Oct. 1, 2015, with a U.S. Department of Education grant from the Transition Program for Students with Intellectual Disabilities and operates under the UMKC Department of Psychology. As principal investigator of the grant, Petri’s main responsibilities are in collecting data, managing relationships and sharing the Propel story.

The first nine Propel students graduated in May 2018. In May 2019, the Propel program celebrated its second cohort with 12 graduates. In 2020, 17 Propel students will graduate.

“College also gives people with intellectual disabilities a network of lifelong friends.”





In August 2019, Propel welcomed its largest incoming cohort with 33 new students.

Propel students are enrolled full time at UMKC. More than half the time, they're attending class with students without intellectual development disabilities. Individualized coursework based on personal goals helps students focus on academic learning, work-based learning, career exploration, social learning and independent living skills. Propel students pay full tuition and many are eligible for Pell Grants. Students have on-campus jobs to help with the cost.

"Instead of struggling with what they can't do, Propel students learn what they can do. Students learn about their abilities, and connect their abilities with their goals, hopes, and dreams," Petri says. "Like college, Propel is not easy. We want students to face life and career barriers while in our program so we can help them."

## A UNIQUE PROGRAM WITH UNIQUE OUTCOMES

Petri says the ultimate success of the program is measured by how many graduates are in the workforce. Considering their

100% job placement rate, it's safe to say the Propel program is thriving. Propel alums are currently working in restaurants, nonprofits, education, shipping, custodial services, nursing homes, assisted living facilities and as teachers' aides.

While in the program, students get specific training to prepare for the workplace. Each semester, they earn work-based learning hours, which gives them resume experience. During the summer months, Propel students stay busy working and volunteering in the community. On May 28, 31 Propel students were sworn in as summer associates in the Volunteers in Service to America program, part of the Corporation for National and Community Service.

The average GPA across Propel is 2.96. Upon completion of the program, students receive an undergraduate certificate — in Leadership, Employment, and Community Engagement, which is recognized by the Missouri Department of Higher Education. Many courses transfer to other institutions if students choose to continue their studies.

"Propel also helps the UMKC campus understand this group of people," Petri says. "It's helping our campus be out ahead of the curve, which gives us an opportunity for knowledge translation. Diversity



## Meet the researcher

### Alexis Petri, Ed.D.

Associate research professor, Department of Psychology, College of Arts and Sciences

Principal investigator and Project director, Propel


**Research Interests:** Access to postsecondary education, urban education, civic engagement, service-learning, evaluation, data visualization and cities

**Joined UMKC:** 2008

and inclusion during the post-secondary education experience for students with disabilities can provide a well-rounded academic experience for all students."

The UMKC Propel grant ends Sept. 30, 2020, but Petri hopes it can continue because the community is beginning to learn more about the initiative. While there are similar programs around the country, Petri says Propel is unique because it is focused on academics and employment. She says other programs are primarily designed to offer students with disabilities an academic experience.

Moreover, Petri says her goal is to educate people, through Propel, about UMKC and all its resources.

"I have this hope that Propel gets people to think of UMKC," she says. 



# FROM COMPETITORS TO COLLABORATORS

UMKC researcher leading new consortium of Kansas City hospitals to improve the value of health care





by Kelly Edwards

On the wall of his office, John Spertus, M.D., M.P.H., displays three documents framed side by side. They are a perfect representation of his work in developing measurement tools to quantify patient symptoms, function and quality of life in dealing with cardiovascular disease, not to mention his nearly 20 years as an instructor in the School of Medicine.

The first document is a 2000 journal article about the Kansas City Cardiomyopathy Questionnaire, which Spertus created. The second is a line graph that skyrockets upwards, showing how often that article has been cited — more than 900 times between 2000 and 2017. The third is a 2017 letter from the Federal Drug Administration qualifying the questionnaire to be used in clinical trials to approve new devices for heart disease.

“Nobody thought what we were doing was important when we started,” Spertus says. “In the scientific community it wasn’t considered real science.”

That’s not the case now. The measurement tools he and his research group developed have been translated into nearly 100 languages for use throughout the world.

The Kansas City Cardiomyopathy Questionnaire and the Seattle Angina Questionnaire are just two of the tools he created to guide physicians and patients in their medical decision-making. Both are recognized by experts around the world

Spertus first became interested in this type of research when he observed that evolving treatment strategies for heart patients seemed more focused on technical endpoints and less on the individual patient.

“It seemed to me like an egregious wrong that when we were testing new therapies, we weren’t figuring out if these therapies made the patients feel better or not,” Spertus says. “That bothered me.”

He set out to change the way medicine looks at patients and developed his first questionnaire as a measurement tool for coronary disease in 1992. Now, Medicare is looking at using one of his questionnaires as a quality measure for angioplasty patients. Two years ago, the FDA certified one of his tools so drug companies using the questionnaire to show a benefit from their product can legally make the claim the product improves symptoms or function of heart patients.

The American Heart Association has also recognized Spertus’ efforts with three major awards: the Distinguished Scientist Award, a Lifetime Achievement Award and the Council on Quality of Care and Outcomes Research Distinguished Achievement Award.

Now, after more than 20 years describing patient and treatment characteristics associated with patient-centered outcomes and guiding clinical trials to measure those outcomes, Spertus says he is refocusing his efforts to improve health care in Kansas

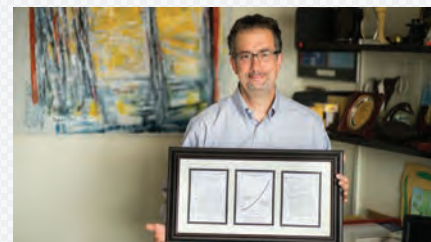
“Nobody thought what we were doing was important when we started... it wasn’t considered real science.

as the gold standards for measuring patients’ symptoms, function and quality of life in coronary artery disease and heart failure.

“Our group has spent a lot of time looking at variations in care, trying to figure out if the care we’re giving is appropriate for the patient, based on their risks and benefits, or if it’s really reflecting the doctor’s preference rather than the patient’s,” Spertus says. “Once you have a good measurement system, you can try to change the way you deliver care and see if it makes things better. That’s what our group is committed to doing.”

City, specifically. He and his research team have engaged 14 of the region’s hospitals and health-care entities to form the Quality and Value Innovation Consortium, a unique collaboration to explore and implement new strategies in the delivery of care.

During the past year, Spertus looked at nearly 40 projects these health-care groups were using to improve their care. He found two overlapping issues of concern on which the consortium will initially focus its attention: addressing the opioid epidemic and transitions of care to reduce 30-day



## Meet the researcher

### John Spertus, M.D., M.P.H.

Daniel J. Lauer / Missouri Endowed Chair in Metabolic and Vascular Disease Research, UMKC School of Medicine

Director of Health Outcomes Research, Saint Luke’s Mid America Heart Institute

**Research Interests:** Cardiovascular outcomes research using data about patients’ outcomes to determine the treatment most likely to succeed for a given patient considering treatment.

**Joined UMKC:** 2000


*Hanging in Spertus’ office are three documents that represent his life’s work: an important journal article he authored, a graph showing the number of times the article has been cited by other researchers, and a letter approving Spertus’ research to be used in clinical trials.*

readmission rates for heart failure patients.

Each of those projects will have a team of four researchers engaging a cohort of six to 10 hospitals to implement and evaluate new and different strategies.

“What’s novel about this project is that we’re getting all of these different hospitals to collaborate and engage in trying different strategies to figure out what works and what doesn’t,” Spertus says. “We’re hoping to build a culture of collaboration in the region. While the hospitals compete for patients, they can all collaborate on safety and delivering high-value health care.”

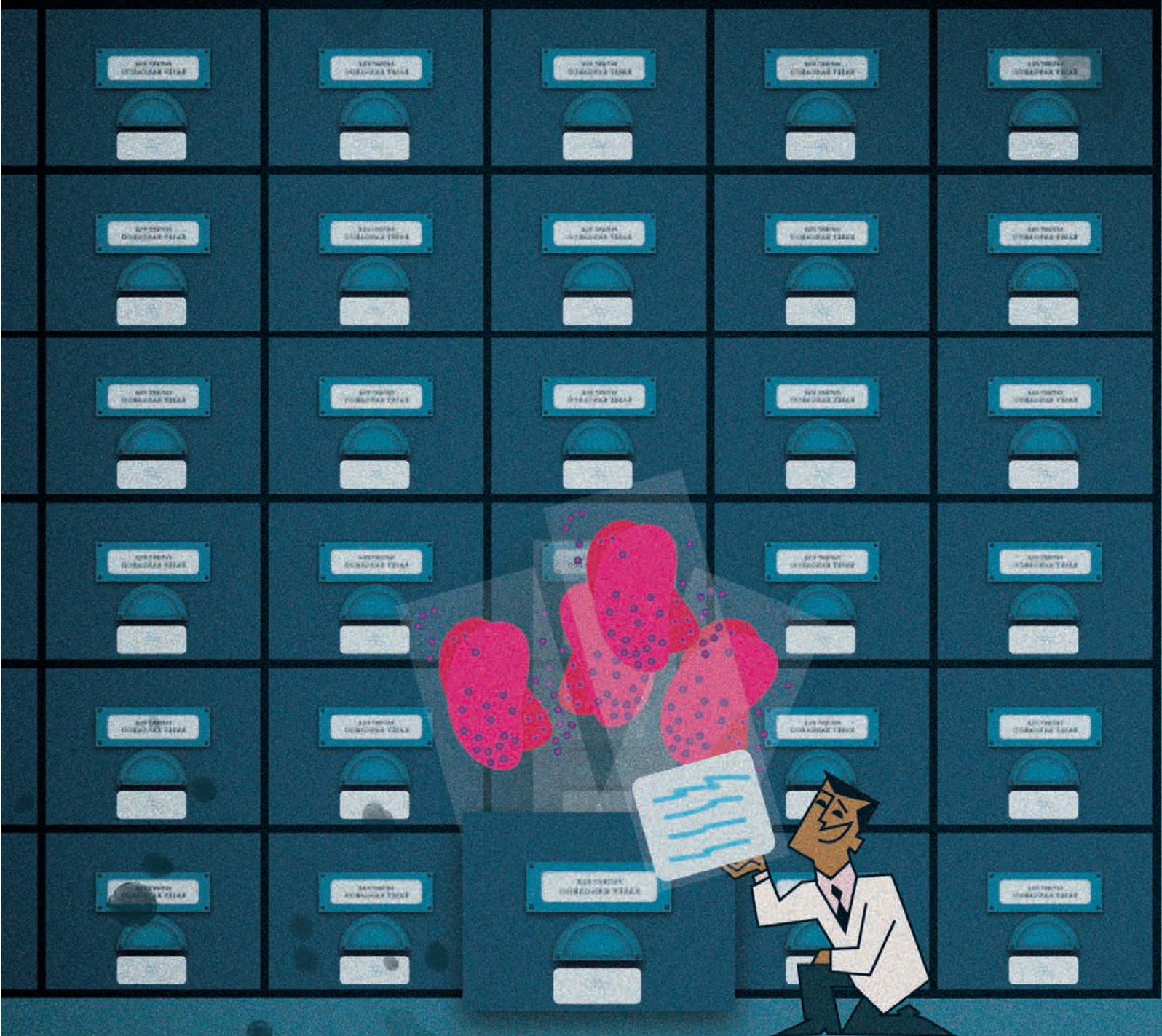
Spertus says he wants to finish his career by implementing everything he and his research group have learned over the years through projects like the Quality and Value Innovation Consortium.

“My hope is that UMKC will be able to continue to support and sustain this effort,” he says. “It’s very gratifying because it’s giving back to our community. This isn’t just about building a research infrastructure. We’re trying to make a difference in Kansas City.” 



# OUT OF MANY, ONE

Creating a new device to help pathologists  
pinpoint regions of interest



*Left: It can take hours, or even days, for pathologists to manually review slides looking for clues to inform diagnosis or treatments. Rao and his team are working on new technology to streamline that process.*



by Kelsey Haynes

With new advances in technology come increasingly innovative ways to improve the quality of life and care. The digital age has changed the way people move through life, the way communities are governed and the way medical professionals diagnose our healthcare issues.

Praveen Rao, Ph.D., is working with a team of pathologists to find a way to automate the everyday tasks of pathologists so that they can focus more on customizing treatments for patients.

Rao's work centers on a concept called Whole Slide Imaging, a fairly new wave for digital pathology in the United States. These imaging scanners, which were only approved by the Food and Drug Administration in 2017, will allow pathologists to scan and project tissue slides on screen and use computer algorithms to pinpoint which regions of the slide are important or contain cells of interest. The pathologist can then focus on those specific regions for examination and diagnosis, rather than spending their time manually reviewing each slide.


But what if there was a way for the machine to not only store digital scans — they're significantly large in size and currently there's no way to store files digitally — but also to automatically detect cellular and mitotic activity?

That's what Rao and his team are working on: new techniques to distribute data from whole slide images. They're building a scalable storage system that will allow different parts of the slide image to be quickly assessed. The National Science Foundation has provided funding for the team to explore commercializing their system. They also submitted a tier one UM System proposal for additional project funding.

As of now, only two companies sell their scanners to hospitals for pathologists to digitize tissue slides and use them for primary diagnoses. Even with digital pathology, Rao says federal law still requires slides to be physically stored for several years, in case doctors need to refer back to them. The storage system Rao and his team are working on will consist of a cluster of machines working together to store and manage data. The goal is to eventually be able to discard physical slides, archive the whole slide image and add new images as they are collected — all using Rao's storage system.

"Our team is working to apply deep learning algorithms to the images for a good storage system," Rao says. "In exploring the commercialization of our product, we argue that this platform can be used for next-generation analytics, which we are also working to build so we can package it all together."

They're hoping that, eventually, pathologists will be able to look at a patient's tissue and make a conditional diagnosis, then send the DNA for genomic sequencing. When the DNA comes back it, should help doctors customize treatment based on what a patient's genetics tell them work best to treat that particular individual.

"If a computer algorithm can predict things accurately, then it relieves pathologists from things like having to manually count how many cells in a particular region have undergone transformations of classifying cells by looking into the microscope," Rao says. "The more we automate and let the computer do its job, the faster and more scalable it'll be for a doctor to prescribe customized solutions." 



## Meet the researcher

### Praveen Rao, Ph.D.

Associate professor, Department of Computer Science Electrical Engineering, School of Computing and Engineering

**Research Interests:** RDF indexing and query processing, Cloud computing and information management, XML indexing and query processing, big data and analytics

**Joined UMKC:** 2007

### QUICK FACTS

- Digital pathology is regarded as one of the most promising avenues of diagnostic medicine
- Digital pathology's market worth is expected to reach nearly \$756.1 million by 2022
- Countries currently using digital pathology methods for diagnoses include Canada, the Netherlands and the United Kingdom.

### BENEFITS OF DIGITAL PATHOLOGY

- Speeding and simplifying access to histopathology information
- Helping staff work more efficiently
- Centralizing teamwork





# A GOOD NIGHT'S SLEEP? ALL IN A DAY'S WORK

Faculty join forces to examine  
the mysteries of sleep





by Kaylyn Hedges

We've all been there. Maybe you had a stressful day at work, drank too much coffee or watched one too many episodes on Netflix. You stayed up too late, and the next day, you're paying for it.

You don't need a scientist to tell you that sleep is crucial to overall health, but even in 2019, no one knows why, or even exactly how sleep is regulated. Those are questions Stephane Dissel, Ph.D., an assistant professor in the School of Biological and Chemical Sciences, is trying to answer.

"We still do not know why we sleep," Dissel says. "We know it's important, and we can describe sleep from a brain activity point of view, but what really is happening and why it's important that we sleep is still a question. It's still a mystery."

It's a mystery he's not solving alone. Dissel is part of a team of faculty members in the School of Biological and Chemical Sciences with a unique collaborative relationship. Each member of the team is working on their own separate projects, but in each case, the research involves sleep.

Assistant professor Ryan Mohan, Ph.D., is studying neurodegeneration, which is clearly associated with lack of quality sleep, and associate professor Samuel Bouyain, D.Phil., is an expert in X-ray crystallography. It's a technique he used to determine the structure of a protein dubbed "bride of double-time," which is believed to play a role in the biological clock.

Professor Jeffrey Price, Ph.D., is another collaborator. He was an author on two of the seven key publications on circadian rhythms that led up to the 2017 Nobel Prize in Medicine. But since then, his focus has somewhat shifted.

"A lot of the circadian field has moved into sleep, actually, at least in the fly community," Price says.

Yes, the fly community. That's another way these scientists are linked. Fruit flies, the annoying insects you can't keep away from your trash can, are an essential part of their research. In their labs, these faculty use state-of-the-art equipment that allows them to see stunning levels of detail, all the way down to the individual neurons in a living fruit fly's brain.

"There are all sorts of similarities in the way sleep is regulated between humans and flies, so we're using this model because it's extremely valuable in terms of genetics," Dissel says.

The setup is ideal. Each researcher is independent, but has a built-in support system of other scientists who are capable of having complex conversations about sleep homeostasis. They can also help troubleshoot when, for example, your fruit flies are "doing weird stuff," as Dissel puts it.

It's a group that took decades to assemble. Price was the first to arrive at UMKC in 1999, followed by Bouyain in 2006 and Mohan in 2015. Dissel is the newcomer, having only arrived in 2018. He says the opportunity for collaboration drew him to UMKC, after years doing sleep research with fruit flies at Washington University in St. Louis.

"The main factor was that there were already people using the fly as a model in this school," Dissel explains. "I wanted to be in a place where I would not be isolated."

Isolation is not an issue within this team. Not only are their research areas connected, so are their work areas.

"It's not very hard to get in contact with them," Price says, while gesturing toward the door to his office. "The Bouyain lab is right over here and I'm right down the hall, so we just bump into each other in the hallway. Stephane is on the hallway on the other side, and Ryan is right above me."

They have meetings, but they're not formal, or even scheduled. One topic that's always of interest, besides fruit flies, is technology. The next time you complain about your iPhone being obsolete after just a few years, imagine what it's like to keep track of technological advances that happen almost *daily*. That's often the case for researchers who work with fruit flies.

"There will be new technology tomorrow that will give you the possibility of doing something you couldn't do five years ago," Dissel says. "Having more people in the department is a good thing, especially given the technology aspects of things. They may have heard something that I missed."

As the scope of research continues to grow, so does the department. One recent addition is Jialin Wang, a visiting Ph.D. student from China Agricultural University who is hoping to shed more light on the link between Price's and Dissel's research. Wang is studying a gene called DBT, which she already knows has a role in circadian rhythm and suspects may also be involved in sleep.

"Dr. Price and Dr. Dissel are experts in these aspects," Wang says, and they offer

## Meet the researchers

### **Samuel Bouyain, D.Phil.**

Associate professor, Division of Cell Biology and Biophysics

**Research Interests:** Molecular mechanisms that control protein phosphorylation and coordination of cell adhesion and cell signaling

**Joined UMKC:** 2006

### **Stephane Dissel, Ph.D.**

Assistant professor, Division of Molecular Biology and Biochemistry

**Research Interests:** Neurobiology of sleep and memory and understanding the function and regulation of sleep

**Joined UMKC:** 2018

### **Jeffrey Price, Ph.D.**

Professor, Division of Molecular Biology and Biochemistry

**Research Interests:** Posttranslational control of circadian rhythms and the links between apoptosis and circadian rhythms

**Joined UMKC:** 1999

### **Ryan Mohan, Ph.D.**


Assistant professor, Division of Cell Biology and Biophysics

**Research Interests:** Understanding the function of multiprotein complexes critical for neuroprotection

**Joined UMKC:** 2015

her knowledge, mentorship and facilities that brought her to UMKC from halfway around the world.

Price says he hopes the work he and his fellow faculty are doing attracts more researchers interested in sleep, circadian rhythms and fruit flies, from undergraduate students to experienced scientists who have already spent decades in the field.

"I'm hoping we can become a hub for basic genetic research," Price says. 

(Left to right) Mohan, Price, Bouyain and Dissel where you can often find them: in the School of Biological and Chemical Sciences, working together to solve complex problems surrounding sleep. / Photo: Brandon Parigo



# MISSION TO MAARS

New discoveries at the intersection of water and magma



“We had to ask ourselves, ‘How do we deal with the fact that we’re all currently sitting in an active volcano surrounded by 3 million people. What if it erupted?’





by Lindsey Mayfield

When Alison Graettinger, Ph.D., says she's a volcanologist, most people picture massive structures in exotic places, like Mount Kilauea in Hawaii or Mount Vesuvius in Italy.

Graettinger, however, spends a lot more time looking at the ground than she does at the sky. Her area of expertise is studying Maar volcanos — broad, crater-like types that form when magma comes into contact with groundwater, often exploding before it ever reaches the surface.

In short, she spends a lot of time looking at holes.

Graettinger estimates she's spent thousands of hours looking at various photos and satellite images, trying to determine whether they show simple craters or evidence of Maar volcanic activity, even if it occurred thousands of years ago.

In addition to meticulously cataloguing various craters, Graettinger also spends research time out in the field, either examining Maar volcanoes or trying to recreate them.

This sometimes involves enduring heat, rain, bugs and long hikes to reach her version of the promised land: a crater or body of water that may have once been a Maar volcano. Other times it means digging a hole, filling it with dynamite and ping pong balls, then watching it detonate and recording where everything lands when the dust settles.

Though Graettinger spends more time digging holes than summiting volcanoes, the ultimate goal of her research is to help the people who *do* spend time on and around those potentially dangerous sites. When it comes to how lava interacts with water and the explosions that sometimes follow, geologists have a lot more questions than answers. Graettinger's expertise can help researchers create an action plan for a specific volcano and how things could progress if it erupted.

That plan looks something like a tree, mapping all the different things that could occur, then what could occur next, and so on. In the event of an eruption, that detailed plan can save precious minutes and hours, and help officials determine how best to protect the people nearby.

It's a thought that Graettinger and her colleagues wrestled with while they were attending a conference in Italy.

"We had to ask ourselves, 'How do we deal with the fact that we're all currently sitting

in an active volcano surrounded by 3 million people. What if it erupted? How much time do you need to get them out, and what science do you need to do that?'"

That's where Graettinger comes in.

## VOLCANOLOGY: NOT JUST AS SEEN ON TV

Technically, Graettinger's journey to volcanology began when she was getting her undergraduate degree from the University of Puget Sound in Tacoma, Washington. Non-technically, though, it began when she was an adventurous kid growing up in Reno, Nevada.

"I was a muddy, dirty child. I went into caves — my brother would send me first," she says. "I was going to be a veterinarian, as all small children are, and my mom would tell me things like, 'You know, they need veterinarians on the moon!' She always wanted me to push higher."

Eventually, Graettinger's love of science and the outdoors took her to the University of Puget Sound in Tacoma, Washington, as a geology major.

As she prepared to graduate with her undergraduate degree, she knew she wanted to go to graduate school. She compiled a list of programs that all revolved around petrology — things like crystals and chemistry that, today, help her inform the magma part of her research — and brought them to her professor.

The professor, though, responded with two sentences that profoundly changed the trajectory of her career: "I have to be honest with you, I don't think that's what you want. You want to study volcanoes."

At 20, Alison's response was, "You can do that?" She could see Mount Rainier from campus and, judging by her professor's response, clearly had an interest in volcanology, but, as she puts it, "I just assumed that was a thing you only did on TV."

Her professor's suggestion, though, was all she needed to make her decision.

"It was as simple as that — having somebody who paid attention and knew something more than I did," she says. "I ran with it."

From there, she was off to the University of Waikato in New Zealand to earn her master's.









There, she got her first real experience with volcanology, climbing a mountain with one of her professors. After hours spent hiking through the rain, and somewhat to the confusion of her professor, she described the day as “a dream.”

“What’s some rain? I’m on the side of a volcano, I’m in New Zealand. My brain was just exploding at the time,” she says. “We were in terrible conditions, but I was just that jazzed.”

It was clear she had found her niche. After New Zealand, it was on to the University of Pittsburgh to earn her doctorate, four years of post-doctoral work at the University of Buffalo and, finally, to UMKC to serve as an assistant professor in the Department of Earth and Environmental Sciences.

## THE WORLD MEETS AT UMKC

That first exposure to volcanology has taken Graettinger from New Zealand to Kansas City to, somewhat literally, Mars. Using her expertise from examining thousands of potential Maar volcanoes, Graettinger created a set of guidelines to help other scientists make their own identifications.

Those guidelines are being used to identify volcanoes not just here on Earth, but also in space. Scientists at NASA are using Graettinger’s data to examine potential Maar activity on Mars. Since Maar volcanoes require water to form, their presence would indicate that water exists on Mars, even if buried deep below the surface. Other researchers are using her research to look for Maar volcanoes on one of Saturn’s moons, Titan.

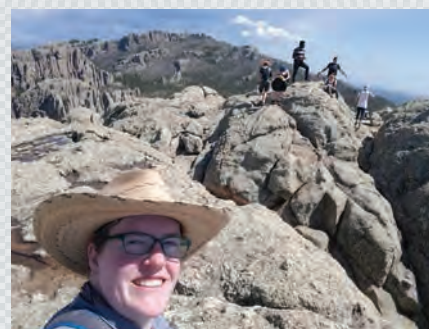
Back on Earth, Graettinger’s field work takes her around the world — to Iceland, Chile, France, Spain and Italy, just in recent memory — but also across the United States. This summer alone, she traveled to South Dakota, Montana, Wyoming, Idaho and Oregon, examining volcanic sites of all shapes and kinds.

Her work has been supported by government and nonprofit groups like the National Science Foundation and the Geological Society of America, as well as the University of Missouri Research Board and the UMKC Funding for Excellence Program. She also collaborates with researchers from the University of Buffalo in New York, which houses the Center for Geohazards Studies, as well as Yamagata University in Japan and the University of California, Davis.

When she’s not traveling the globe, she’s using her lab in Flarsheim Hall to simulate the reactions she observes in the field.

In a small, dark room on the fourth floor sits a furnace that can reach temperatures of 2,900 degrees Fahrenheit. Graettinger uses it to re-melt lava from around the world, creating “small pours” to examine two things: how well the sample melts (and therefore, whether it can be used in a field experiment) and how it mixes with sediment (the loose material magma encounters as it approaches ground level).

That information can help inform the larger experiments Graettinger performs in the field, trying to answer questions like, “What happens if you blow something up in layered ground? What happens if you move it up, move it down, do a whole bunch, do them close together in time, move them side-to-side? What can we do here in the field to compare to the natural world?”



## Meet the researcher

### Alison Graettinger, Ph.D.

Assistant Professor of Earth and Environmental Sciences, College of Arts and Sciences


**Research Interests:** Processes and deposits of magma water interactions using field work, experiments and remote sensing

**Joined UMKC:** 2016

*(Above) Graettinger’s work ranges from laboratory experiments to adventures across the globe. Here she is pictured hiking with students during Geosciences Field Camp over the summer. (Top left) Graettinger leads one of her students’ favorite experiments: “trash-nado,” in which the class simulates a volcano using a trash barrel in the UMKC Quad. / Photo: Brandon Parigo*

The beauty of Graettinger’s research is that she can conduct her experiments anywhere — from a field in Buffalo to a lab in Flarsheim to the Quad in the middle of campus. Her “trash-cano” demonstration is a particular favorite among students, probably because it involves an explosion, but also because it allows them to apply what they’ve learned in the classroom to a real-world experiment.

Students take an active role in Graettinger’s research, too — assisting on lava pours, poring over satellite images of craters, even traveling with her to help collect data in the field. It’s important, Graettinger says, that students be able to ask questions and make their own discoveries, no matter how small.

“It’s just fun to watch them, when they say, ‘Wait, you mean nobody’s done this before? I’m the first? I get to answer this when nobody had an answer before?’ That’s an important part of learning,” Graettinger says. “And even if you don’t become a researcher, just knowing that not everything has been done and there are still problems to solve — that’s a critical part of education.” 

*(Left) Graettinger wears both her regular glasses as well as protective frames to observe a student pouring melted lava from a furnace. / Photo: Brandon Parigo*





**LOOKING FOR**





# KINDER CURES

Why is Erin Bumann sticking her beak into other species' business? To someday help children heal.





by Greg Hack

Erin Bumann, D.D.S., Ph.D., M.S., is a licensed and board-certified pediatric dentist, but her research aims to solve problems far beyond what most children experience.

“Sometimes faces don’t form correctly, and these children can have issues with breathing, eating and speaking,” Bumann says.

Right now, the only treatment available for these children is invasive surgery. Bumann, however, is working to find gentler treatments in a somewhat surprising place — by studying the face and jaw structures of birds.

“The primary goal of my lab is to identify nonsurgical methods to modulate the size and shape of the bones in the face, so these children either do not need to undergo surgery or need less invasive surgery,” she says.

## SEARCHING FOR NATURE’S CLUES

To come up with methods for redirecting how the jaw and other facial bones grow and develop, Bumann experiments with bird models. She studies what happens when the cells that give ducks a long, broad bill are transplanted into quail models and the cells that produce the short, narrow quail jaw are transplanted into duck models.

The transplanted cells are called neural crest mesenchyme (NCM) — cells that give rise to many other types of cells, including those that make craniofacial bones and cartilage.

“Birds are an ideal model system for what we’re looking at,” Bumann says. “It’s a little bit of mad science.”

The type of work Bumann and her team engage in takes a unique set of skills — skills she is happy to help cultivate in UMKC dental students.

“These transplants are unique. You have to do them underneath microscopes,” Bumann says. “It’s great to have dental students with good hand skills to do these surgeries. And we can watch these cells migrate out and differentiate, so there are lots of things we can begin to look at.”

Bumann’s work has already indicated that the neural crest mesenchyme control the activity of osteoclasts — cells that resorb bone to shape the birds’ developing jaw structures.

The hope is that Bumann’s discoveries eventually lead to human therapies to correct or greatly lessen potential craniofacial problems. Such problems can often be detected by ultrasound, so therapies might be possible even in utero, much like the way

surgeons can correct or mitigate heart or spinal defects before birth.

Therapies could also be effective throughout childhood, Bumann says, as much jaw and facial development occurs after birth and through adolescence.

Craniofacial abnormalities are one of the most common birth defects requiring invasive surgery, so the benefits of alternative therapies would be great. Being able to better grow or regrow facial bones also could help some accident victims and patients with cancer.

## THE EXCITEMENT OF UNANSWERED QUESTIONS

Bumann got the research bug as an undergraduate when a professor at the University of Michigan set her to work on an unsolved mathematical function.

“I was good at math but hated it because the answer was always in the back of the book,” she says. “Why redo all these problems when we know the answer? Finding out there were these unanswered questions, and I could work on them, was exciting.”

Dental school at the University of Michigan followed, along with work in a research lab. Bumann also earned and enjoyed





## Meet the researcher

**Erin Ealba Bumann, D.D.S.,  
Ph.D., M.S.**

Assistant professor, School of Dentistry,  
Department of Oral and Craniofacial  
Sciences

**Research Interests:** The role of neural  
crest mesenchyme cells in regulating the  
formation of facial bones

**Joined UMKC:** 2017

“The primary goal of my lab is to identify nonsurgical methods to modulate the size and shape of the bones in the face, so these children either do not need to undergo surgery or need less invasive surgery.

summer research fellowships, including one with the National Institutes of Health's National Institute of Dental and Craniofacial Research.

Then she was off to earn her doctorate at the University of California, San Francisco. There she was introduced to the duck-quail research system, and her Ph.D. thesis was titled, “Mesenchymal Regulation of Jaw Length.”

Bumann joined UMKC in 2017, drawn to the School of Dentistry by its internationally known research on bone mass and how bone and muscle cells “talk” with each other. A key part of that research involved osteocytes, once thought to be a relatively inactive part of bones.


“This department showed that osteocytes play a large role in bone formation, aging, a whole host of functions. It's kind of humorous that before some of the UMKC research, people thought osteocytes didn't do anything,” she says, since they make up 90 to 95 percent of the cells in bone.

It's still widely believed that osteocytes aren't active in utero, Bumann says, and her group is challenging that assumption, along with seeing how the NCM cells may regulate how the osteocytes, which come from NCM, form facial bones.

“I'm trying to see if the osteocytes are playing a role in bone development, and if so, how,” Bumann says. “So we're using different imaging systems here that I have not had access to in the past. Very fun!”

Those imaging systems include confocal microscopes, which use laser scanning and greatly increase the resolution of images; multiphoton microscopes, especially useful for 3D imaging; and micro-CT scanning, similar to hospital CAT scans but on a smaller scale with greater resolution.

Bumann also loves working with and mentoring her lab crew — currently a lab manager, a postdoctoral fellow, a dental student and three undergraduates with interest in dentistry.

“I started in a research lab in my undergraduate training and it is why I am in the position I am in today,” Bumann says. “I think it is very important to give back and mentor future generations of scientists and dental professionals.” 



A man with grey hair and glasses, wearing a brown blazer over a teal shirt and dark pants, sits in a bright yellow armchair. He is in a classroom setting with a white brick wall behind him. The wall is decorated with numerous children's drawings, including portraits and abstract colorful patterns. To his left is a wooden shelf filled with various colorful toys and supplies, and a wicker basket. The floor is made of polished concrete.

# ENGAGED STUDENTS ARE BETTER STUDENTS

UMKC education researcher Eric Camburn hopes his studies of teachers and their methods pay off for education



by Grace Hobson

For one of his latest research projects, Eric Camburn, Ph.D., and his colleagues filled a large SUV with boxes upon boxes of artifacts that had the potential to answer a question as big as: How can we improve the learning experiences of high school students?

The boxes, packed with teacher assignments and student work, are key to Camburn's \$3.6 million study of an educational program that, at its height, was implemented in as many as 80 public high schools in Iowa. The state poured more than \$3 million into the Authentic

called the Day Reconstruction Method to understand teacher tasks throughout a given day and how they feel about those tasks.

The United States has more than 3.5 million public school teachers. Understanding their work lives and well-being is crucial to improving education, Camburn says.

"It's a very demanding, grueling job, and, surprisingly, there just isn't a solid research base that documents systematically in the way this tool will how teachers feel about their work while they're doing it," Camburn says.

The Day Reconstruction Method tool will aid researchers in other education studies — and would have been handy in the Iowa high schools study, he says.

The Study of Iowa High Schools looks at teacher efficacy in implementing the Authentic Intellectual Work initiative. The program was designed by Camburn's Wisconsin colleague Fred Newmann to encourage high schools to better engage students with more rigorous assignments that apply to real-world, "authentic" situations.

Newmann's program is based on the idea that rigorous, authentic intellectual work will prompt students to become more invested in their own education and, thereby, improve their achievement. The Iowa Department of Education widely adopted the program, and the program's leaders encouraged Camburn to study the teaching method's effectiveness.

Camburn, working with colleague Peter Steiner, Ph.D., now an associate professor at the University of Maryland, began designing the study in 2013. The research examines 44 high schools, half of which have the program, and half that do not.

The Authentic Intellectual Work initiative requires assignments to be designed for higher-order thinking. Rubrics allow teachers to score assignments to make sure they are sufficiently intellectually rigorous and authentic. Teachers gather in groups — an algebra teacher would meet with other math department teachers, for example — to score assignments and ensure adherence to the program's lofty goals.

Thousands of those assignments then made their way into boxes piled high in the SUV. Trained Iowa educators scored the artifacts using the program's rubrics to determine how well they adhered to the guidance and goals

“It's a very demanding, grueling job... this tool will [tell us] how teachers feel about their work.”

Intellectual Work program in hopes of increasing student engagement and, ultimately, achievement. But does it work? Was the state of Iowa's investment worth it?

Camburn is conducting the Study of Iowa High Schools, funded by the U.S. Department of Education, to answer those questions and more.

"Along the way I think we are also going to be able to tell stories about, what does it take to implement rigorous programs like this?" Camburn says. "And what does it take to encourage teachers to change their practices to adopt rigorous teaching practices?"

Camburn brought the Study of Iowa High Schools with him from the University of Wisconsin when he joined UMKC in 2018. He also brought a project in which he and three colleagues around the country are developing a web-based tool

## Meet the researcher

### Eric Camburn, Ph.D.

Professor and Sherman Family Foundation Endowed Chair, School of Education, and director, Urban Education Research Center

**Research Interests:** School improvement, school leadership, professional learning, survey measurement of education practice

**Joined UMKC:** 2018

of the Authentic Intellectual Work initiative.


Camburn measures students' engagement with their schoolwork by looking at metrics such as skipped classes and how they feel about school. Iowa state assessment scores will tell the achievement story.

The study also looks at how teachers are engaging with the program. Are they participating in the scoring meetings? Are they taking advantage of the professional development opportunities offered to improve their methods? Are they changing how they teach?

"If, over time, teachers are changing their practice in a way that's consistent with Authentic Intellectual Work standards, our theory is that the experiences students have in the classroom will be better," Camburn says.

Preliminary findings suggest the program had a small, positive impact on student achievement. The research team is exploring this result in more depth by seeing whether the program was more effective for particular groups of students, or in particular types of schools.

The Iowa education department, with a change in leadership, is no longer backing the Authentic Intellectual Work program. But dozens of schools have chosen to continue with it.

"Interestingly enough, for many programs, that would have been the death knell," Camburn says. "For this program, there was enough support and interest that it's been sustained. There are still dozens of schools in the state of Iowa that are basically doing it on their own because they value it so much." 





# A PASSION FOR **SAFE SLEEP**

Researcher finds startling statistics  
in infant car seat use

“Our natural instinct was that the parents in these situations may not be able to afford cribs or bassinets. The car seat may be the only place they have to put their child to sleep, whether they’re homeless or don’t have the space to devote to a crib.”



by Bryce Puntenney

A recent study by Jeffrey Colvin, M.D., resonates with any parent who has ever loaded an infant into a car seat. It has also caught the attention of news outlets like the TODAY Show, *People Magazine*, *U.S. News and World Report* and *The New York Times*.

Colvin's team studied 10 years of data from 45 states on infant fatalities that occurred in car seats or other sitting devices, such as strollers and bouncers. His group found some startling information.

In a vast majority of these infant deaths, the car seat was not being used in the car. Instead, it was being used at the family's home as a substitute for a crib or a bassinet. Less than 10 percent of those 348 deaths involved the car seat or sitting device being used for its intended purpose.

Colvin thinks these findings resonated with the public because all parents — himself included — have let their child sleep in a car seat. After all, he said, who hasn't opted to let a baby sleep rather than jostling them awake to move them to a crib?

"In so many of the cases I studied, you see a reflection in something you yourself have done as a parent, or you remember times where you've done something very similar," Colvin says.

Colvin stresses the importance of this information, not just for parents, but for any caregiver that may be in a child's life, including grandparents, babysitters and family friends. Colvin says caretakers should remember the ABCs of safe sleep: Alone, Back and Crib. Every infant needs to sleep alone, on their back and in a crib or bassinet.

Colvin says his experience as a pediatrician at Children's Mercy shaped how his team reacted to the information. Since the hospital is a safety-net provider for the area, its staff has a high sensitivity to, and experience with, low-income families. Studies have found that infant mortality is disproportionately high among this demographic.

"Our reaction to this finding wasn't that parents weren't acting in their children's best interest," Colvin says. "Our natural instinct was that the parents in these situations may not be able to afford cribs or bassinets. The car seat may be the only place they have to put their child to sleep, whether they're homeless or don't have the space to devote to a crib."

The idea for this research started with one of Colvin's residents during her residency at Children's Mercy, specifically in the Neonatal



## Meet the researcher

### **Jeffrey Colvin, M.D.**

Clinical associate professor,  
UMKC School of Medicine

**Research Interests:** Children with  
medical complexity, child advocacy,  
inpatient pediatrics

**Joined UMKC:** 2006


Intensive Care Unit. She was curious about whether car seats played a role in sudden infant death syndrome (SIDS) or other related child deaths.

Colvin often works alongside residents or students on a research. In fact, he has a new student or resident, preferably someone who hasn't had much opportunity in research, lead each project. This mentorship is critical to keeping Colvin's work fresh and sustaining his joy in research.

"When you're working with a student and this is their first time for everything, you re-experience not just the fear and anxiety of presenting to a ballroom of your peers, but also the excitement of having abstracts and manuscripts accepted," he says.

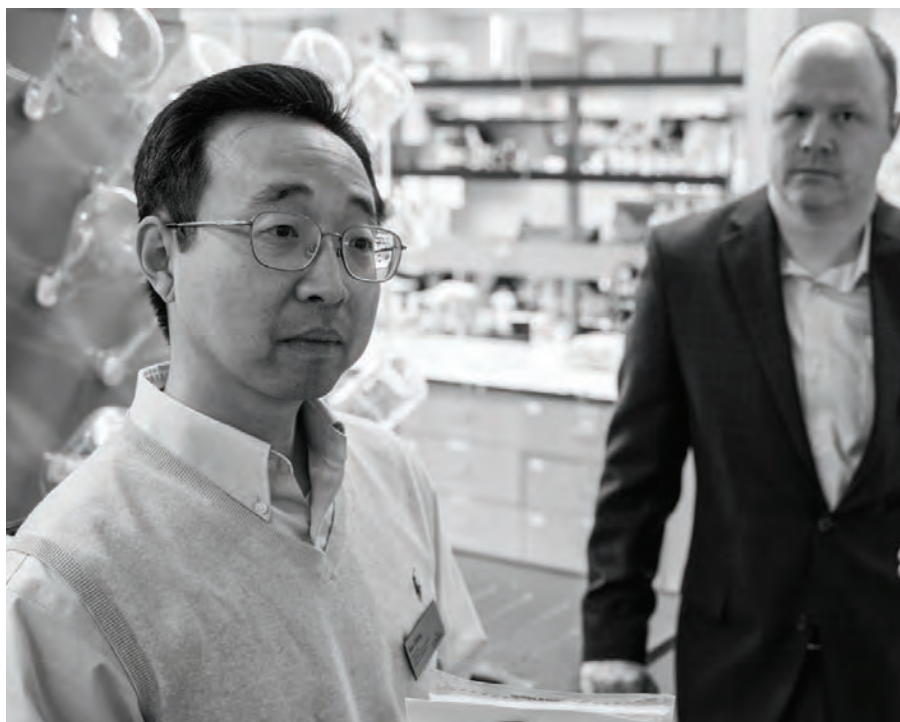
Next up for Colvin is broadening the scope of his research by investigating health disparities among low-income families, specifically the disproportionately high rate of infant mortality. He's studying how poverty affects that disparity and what risk factors associated with poverty might be modifiable.

Further down the road, Colvin hopes his work is less focused on risk factors and more focused on interventions. He says clearly identifying and quantifying risk factors could make it possible to take concrete action to reduce those stressors.

"If we can help families not only get a safe space for their infant to sleep but also help with those other stressors in their life, that will allow safe sleep to rise higher on their list of priorities." 

*Colvin's research shows that more than 90 percent of infant car seat deaths occurred when the device was being used outside of the car, often as a substitute for a crib or bassinet.*





## Meet the researcher

### **Kun Cheng, Ph.D.**

Curators' Distinguished Professor,  
School of Pharmacy

**Research Interests:** Novel checkpoint inhibitors for various cancers, drug delivery systems for macromolecules

**Joined UMKC:** 2007

# THREE TIMES THE RESULTS

Multiple grants and patents support researcher's novel treatments for cancer and other diseases

*by Jenny McNamara*

Kun Cheng, Ph.D., spends his days looking for tiny solutions to some very big problems.

His research focuses on peptides, tiny molecules made up of amino acids. Peptides present an exciting new avenue for research into drug therapy for various cancers and other serious diseases. Cheng has made it his mission to continuously uncover and improve peptide-based treatments.

That mission has been supported three times by the National Institutes of Health and its various entities, putting Cheng on the forefront of treating cancer and other diseases.

In 2017, the National Institute of General Medical Sciences granted Cheng \$1.2 million to explore a peptide-based treatment for prostate cancer. Cheng's team aimed to improve the solubility and specificity of a chemotherapy drug using a peptide-based platform and successfully obtained a U.S. patent for the project earlier this year. Currently,

Cheng's team is working to show that this platform can be used for other chemotherapy agents that have poor solubility and specificity.


"Immunotherapy using monoclonal antibody has now evolved into the most promising therapy for various cancers," Cheng says. "However, its large size may limit its activity inside tumor tissues. This peptide-based system demonstrates very promising anti-tumor activity."

Cheng notes that peptides are more flexible than antibodies, because a much wider array of drugs can be attached to them. They also trigger no immune response, making them safer than antibodies as well.

Cheng has also obtained a patent for his combination therapy for alcoholic liver fibrosis. This project, funded by a \$1.758 million grant from the National Institute on Alcohol Abuse and Alcoholism, aims to reverse alcoholic liver fibrosis using nanotechnology to deliver a gene-silencing large molecule called siRNA that was discovered in Cheng's laboratory. Currently, liver fibrosis has no standard treatment and, left untreated, leads to cirrhosis, an irreversible condition. In Cheng's treatment, peptides are used for targeted drug delivery to reverse liver fibrosis, displaying their diverse capabilities.

Cheng's third project funded by the National Institutes of Health expands upon the use of peptides for cancer treatment. In 2018, he received a \$1.772 million grant from the National Cancer Institute to develop a targeted delivery platform for checkpoint inhibitors. This research was recently published in the *Journal for Immunotherapy of Cancer*, and Cheng plans to present it at several conferences.

He was particularly excited to present at the 2019 Midwest Drug Development Conference in Omaha, because it gives the research valuable exposure to attract crucial industry partners. The next step is to obtain an international patent for the project, a lengthy and laborious endeavor. The right industry partners can make all the difference in this process, Cheng says, and he is hopeful for what the future holds.

"The increased interest in peptides is a trend that I expect to grow," Cheng says. "For certain applications, peptides do have more advantages, and I am excited about the next steps in this research." 





## Meet the researcher

### **Gary Foutch, Ph.D.**

Research faculty, School of Computing and Engineering

**Research Interests:** Fate limited reactions and separations, ultrapure water processing

**Joined UMKC:** 2014



# Q&A

## Gary FOUTCH

Working to curb infection  
in some of the world's most  
vulnerable communities

*by Sara Atchison*

For the past eight years, the Bill and Melinda Gates Foundation has been challenging scientists and researchers to solve a problem that impacts more than 880 million children worldwide: How do we treat human waste in remote parts of the world to prevent the spread of parasites and disease?

Gary, Foutch, Ph.D., joined the challenge in 2012 at Oklahoma State University, when he was awarded his first grant as part of the Bill and Melinda Gate's Foundation "Reinvent the Toilet" project. In 2014, Foutch relocated to the UMKC School of Computing and Engineering, where he was awarded a second round of funding to further his research and complete his prototype.

Today, nearing the end of the project, Foutch reflects on what he's accomplished and what lies ahead.

### **Q: What spiked your interest in this challenge?**

**A:** I printed off the original request for proposals and put it on my desk. Every day I came in and read it. After about two months, my idea crystallized. But, ultimately, it was the cause that drew me in. You know the pictures of nearly starving children with big bellies? Some of these kids will pick up handfuls of gravel and eat it, just to feel full. I wanted to contribute to solving a health problem on a global scale.

### **Q: Tell us more about the science. What issue are you working to remediate and how does your technology work?**

**A:** The issue of infection comes when acaris roundworms are allowed to sit in pit latrine sanitation systems in remote communities. This waste is often not hauled away and appropriately destroyed, so people, especially children, are very susceptible to being infected again and again, even when health aid organizations offer treatment.

Our technology uses the same basic process used to make the plastics you come into contact with every day. Human waste passes through high temperature chambers and comes out the other side sanitized.

### **Q: Now that you are nearing the end of your research, what's next?**

**A:** We now have a single heater that can process 4,000-5,000 kilograms of waste per hour — four times the processing capacity we had only a year ago. Our prototype is ready for final testing, and I'll be traveling to Africa with it this fall. My partner at the University of KwaZulu-Natal, Professor Chris Buckley, a world-renowned expert in sanitation, will be assisting me. We are also in discussions with a manufacturing company in India to produce the viscous heaters. By using a supplier close to the center of outbreaks of acaris roundworm, we could keep costs down and offer our solution to communities with very few resources.

*(Above) Foutch's prototype during a brief stop on campus before heading to Africa for final testing. / Photo: Brandon Parigo*



# BETTER TOGETHER

In the growing field of data science, UMKC researchers take an inclusive approach to solving complex problems

*by Mike Plunkett*

What's the point?

This sentence is often said in exasperation. But also, this statement sums up the levels of complexity related to data.

In projects big and small, data science and data analytics — often used interchangeably, despite distinct differences — drive decision-making in business, government and academia. Using the right data correctly and for the right purposes requires expertise and sensitivity. It's a high-stakes challenge.

Brent Never, Ph.D., says UMKC is more than ready to meet that challenge.

"We're a comprehensive university, and that makes us different from other universities, particularly in this region," Never says.

Part of what makes UMKC different is its recently created Institute for Data Education, Analytics and Science (IDEAS), of which Never is coordinator. The vision of the institute is to position UMKC as the top option for data science education, research and service in the region, building on the university's strengths in biomedical informatics, big data analytics, image analysis, natural language processing and geospatial analysis.

The institute is just one way UMKC is harnessing the depth and breadth of its resources to use data for good.

## PUTTING PATIENTS FIRST

Mark Patterson, Ph.D., M.P.H., engages both small data and big data in his pharmacy research, which focuses on improving the

accuracy of the prescription process and, therefore, health outcomes.

Since 2016, Patterson has worked to build a registry of prescription discrepancies that occur during transitions of care between hospitals and nursing homes in rural areas.



*Mark Patterson, Ph.D., M.P.H.*

With support from the American Association of Colleges of Pharmacy, he works with another pharmacist and a nurse to analyze mismatches in discharge orders, looking for breakdowns in communications that adversely affect high-risk patients.

Patterson's registry links patients, prescription orders and communication failure locations. The goal is to pinpoint where the discrepancy occurred and follow up with quality improvement standards to fix system flaws.

Another of Patterson's projects uses big data to investigate prescribing patterns

of long-acting antipsychotic injectables administered during hospital stays. Together with fellow School of Pharmacy professors Yifei Liu, Ph.D., and Steve Stoner, Pharm.D., Patterson uses millions of points of data from thousands of patients to measure and compare anti-psychotic utilization rates across multiple drug brands. The data comes from Cerner Health Facts, a massive de-identified, real-world health database.

Much of Patterson's work has been creating the parameters to clean and design the data sets, making big data more manageable to analyze. Patterson says it's a majority of the work.

"It takes a lot of patience and attention to detail to quality check and build an analytic dataset," Patterson says. "Getting there takes months."

The desired result of improving health across the region, though, is worth it.

## FIGHTING BLIGHT, ONE DATA POINT AT A TIME

Never and Bloch School colleague Jim DeLisle, Ph.D., have teamed up to use data analytics for urban-core neighborhoods. In the case of abandoned housing, for instance, they work to identify which houses could tilt or flip a neighborhood.

"How do you pick the 1,000 houses that if you could clean up, are going to make that neighborhood better for residents?" he says.

DeLisle and Never created "Abandoned to Vibrant," a database of abandoned homes in





*Brent Never, Ph.D.*

the Kansas City area. The site pulls reported data from public officials and citizens: code violations, 311 calls and the like. Using spatial analysis and the data analytic software Alteryx, the researchers created what Never calls a “Zillow for distressed homes” that transforms data points into a visual platform that can be used by officials and citizens.

In particular, the project provided residents key information on homes they could buy from the Land Bank of Kansas City to flip or occupy themselves. This information is especially important because of a city law stating that residents have 120 days to bring homes bought by the Land Bank up to code.

In many cases, Never says, families buy the wrong house and are not equipped to deal with structural deficiencies. They put in their money and time, only to have the city repossess the house in the end. This new platform can help potential home buyers

avoid that situation long before they buy. For their work, DeLisle and Never were awarded the 2018 Alteryx Excellence Award.

Never says his research on abandoned homes will continue through a proposed grant with the National Science Foundation, which will allow him and his colleagues to examine blight on residential streets using cameras on trash dumpster trucks. The goal is to head off potential homes before they are abandoned and create blight.

“It’s easier to intervene now and pay \$1,000 to mow the lawn, than to pay \$10,000 to deal with abandonment,” Never says.

## WHERE DATA MEETS PRIVACY

Tony Luppino, J.D., believes that, when it comes to the intersection of data and the law, it’s crucial for lawyers to be included in the conversation. Luppino is working with the



*Tony Luppino, J.D.*

MetroLab Network, a national consortium of cities and universities focusing on civic innovation, on a Model Data Handling Policy to help cities pursue the benefits of data while respecting privacy and civil liberties.

UMKC students and faculty developed the policy with local government and other organizations. It addresses such questions as: Who decides what data to collect and how to store it? When and how is consent sought to collect, use and share a person’s data? What oversight systems are appropriate to manage data handling processes?

“Everyone sees the value of data-driven decision-making, and cities have been wanting that,” Luppino says. “But data handling decisions require balancing of potential risks and benefits, on which the public ought to weigh in to help inform decision makers.”

The School of Law has organized collaborations at intersections of law, technology and public policy since 2014, when a team led by former Dean Ellen Suni, supported by the Ewing Marion Kauffman Foundation, worked to help law faculty and students across the country explore uses of technology. While not a data scientist, Luppino sees the need for attention to law in data science endeavors.

“Even though I focus on unintended consequences, I appreciate the value of data science in improving public services, health, safety and economic opportunities,” he says. “Data collection and analysis can productively inform policy and decision-making, and I’m all for that if done responsibly.”





## Meet the researcher

### **Anthony (Tony) J. Luppino, J.D.**

Rubey M. Hulen Professor of Law and Director of Entrepreneurship Programs, School of Law

**Research Interests:** Business organizations and planning, entrepreneurship, securities regulation, taxation

**Joined UMKC:** 2001

### **Brent Never, Ph.D.**

Associate professor, Henry W. Bloch School of Management

**Research Interests:** Spatial analytics, public policy analysis, nonprofit management

**Joined UMKC:** 2009

### **Mark Patterson, Ph.D., M.P.H.**

Associate professor, School of Pharmacy

**Research Interests:** Exploring the role of health information technology to improve communication, prescribing patterns and medication reconciliation within post-acute care settings

**Joined UMKC:** 2010

## **EMPOWERING INDIVIDUALS THROUGH HEALTH AND NEIGHBORHOOD DATA**

KC Health CORE, a project led by the UMKC Center for Economic Information and Children's Mercy, works with agencies throughout the Metro to research regional health disparities and intervention.

*by Stacy Downs*

### **What is KC Health Core?**

The KC Health Community-Organized Resource Exchange (CORE) is a multi-year initiative awarded by the Health Forward Foundation to facilitate and coordinate regional health disparities research and intervention via a neutral data exchange platform.

### **Who are the data partners in this initiative?**

Children's Mercy leads the project alongside the UMKC Center for Economic Information. Data contributors also include:

- mySidewalk for its data library, apportionment tool and web interface
- Mid-America Regional Council for primary geospatial and regional data contributor
- The Kansas City Missouri Health Department for micro-level pediatric blood lead testing
- The UMKC Center for Neighborhoods as a community engagement partner

### **How is the community involved?**

The project utilizes a model for neighborhood engagement and advocacy in the research and policy-design process, developed by the UMKC Center for Neighborhoods. Another example of community involvement is in Wyandotte County, Kansas, where researchers are collaborating with WYCO Livable Neighborhoods and the H.E.A.T. project neighborhood leaders and leadership team.

### **What will neighborhoods and people able to do with the data?**

The data will help empower neighborhood leaders through neighborhood planning activities, which are supported by a network of researchers and students continually involved in the process of solving problems at the local level. This could lead to grant funding and other resources to benefit people subject to health disparities.

## **KEEPING CONNECTED**

The one common element for successful data research is connectivity.

That's why IDEAS is so effective. The institute works to provide guidance and expertise in data to researchers across all fields, not just a chosen few. That spirit of collaboration pulls researchers like Never, Patterson and Luppino together to support data science.


The institute has three main functions: offering for-credit educational classes and certifications through various academic units, using UMKC researchers to collect and analyze data for industry and community good and, finally, fostering the multidisciplinary research capabilities across UMKC.

IDEAS, though, is just one facet of Chancellor Mauli Agrawal's strategic goal to promote data research on campus. That goal is also being realized through the health

informatics work being done through the UMKC Health Equity Institute, led by Jannette Berkley-Patton, Ph.D., associate professor in the UMKC School of Medicine. Another important group is the NexGen Data Science and Analytics Center, headed by associate professor Praveen Rao, from the School of Computing and Engineering, and housed on campus through \$20 million in support by the University of Missouri System. And, of course, UMKC researchers continue to work with local municipalities and organizations like Children's Mercy hospital.

The overall hope is to create synergy in both the sciences and humanities, using data-driven principles to advance a mission for the common good.

"It blows my mind what people are doing at UMKC," Never says. "It's been a great opportunity."

And that is the point. 



# data points

MORE THAN NUMBERS

## UMKC IS A RESEARCH UNIVERSITY ON THE MOVE.

UMKC plays a major role in the Kansas City metropolitan area as an educator, employer and research leader. The following data are more than just numbers — they reflect the excellence of UMKC faculty, whose creative endeavors set us apart as a research university and economic engine in the heart of Kansas City.



**268**

Number of extramural awards received by UMKC faculty in FY 2019



**\$200.7 million**

Total of proposed projects



**12**

Patent applications filed



**403**

Number of proposals submitted in FY 2018



**\$38.2 million**

Amount awarded to UMKC research and related projects in FY 2019



**\$35.3 million**

Total research expenditures



**45.4%**

Percentage of total dollars coming from the federal government



**19%**

Yield on awarded projects



**18**

Number of invention disclosures filed in FY 2018





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