2019 | Vol. 5

explore

Research at the University of Missouri-Kansas City

COMBATTING THE CRISIS

UMKC researchers and health professionals are on the front lines in the war on opioids

explore

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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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A recent collaboration between the School of Medicine and School of Computing and Engineering discovered ways to reduce risk in pelvic sling surgery. / Photo: Brandon Parigo

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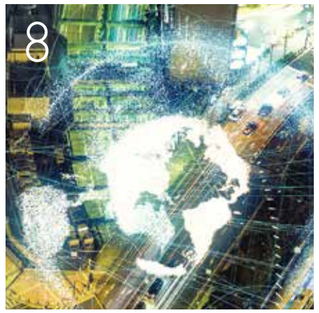
Welcome to explore



Cover Photo: Brandon Parigo

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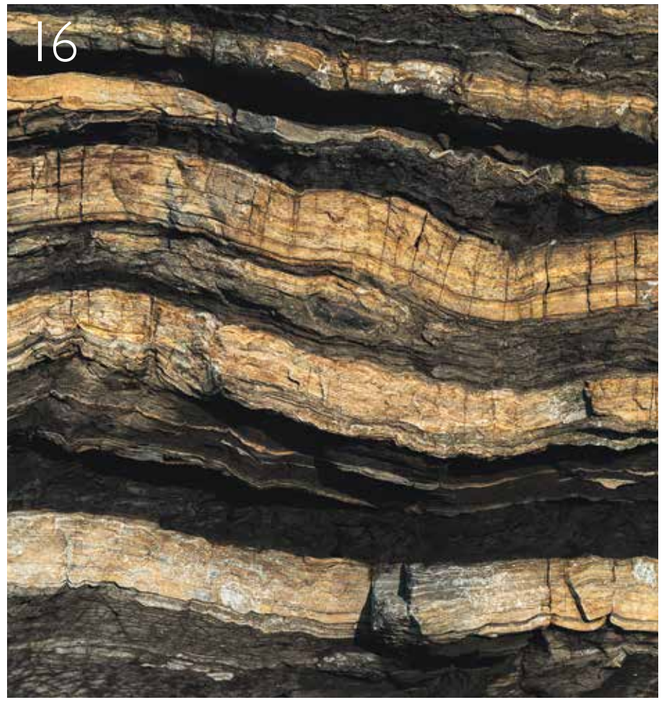


"We are in need of nothing short of an effort the scale of an Apollo mission to turn the tide of the opioid crisis.

No other time in history illustrates the power of research than that of the 1960s. During nine short years, what started as an earth orbital flight translated into a lunar landing and safe return for astronauts to earth. The accelerated pace of research during this decade owes its success to a will to solve a problem and the capital investment to accomplish the goal. The value of such efforts to change the course of history or to turn the tide on a catastrophic crisis cannot be underestimated.

At present, society faces daunting challenges to health and wellness. And in the midst of seeking solutions, it is becoming increasingly apparent that developing new medicines to treat symptoms is an unsustainable approach to wellness. In fact, this approach has, in part, contributed significantly to the most alarming medical crisis of our generation — death by opioid overuse.

Today, every 10 minutes in the U.S., someone will lose their life to opioids. Countless others will receive life-saving emergency medical treatment and/or hospitalization. The number of deaths has doubled in the last decade with no sign of slowing — the U.S. is in the midst of an opioid epidemic. If there was ever a time to invest resources in a problem, the time is now. We are in need of nothing short of an effort the scale of an Apollo mission to turn the tide of the opioid crisis.

Daunting as it may be, I am hopeful because of the research and evidence-based practice conducted here at UMKC by a number of teams working in parallel to address the opioid epidemic. Because of their efforts, which are also aided by funding from federal and state agencies, families have hope that their loved ones are less likely to lose their battle. And the knowledge gained on how to effectively prevent and treat opioid addiction will become part of accepted medical practice and help curb the crisis on a larger scale.

We have much to celebrate in this issue of *Explore*, and I hope you are enthused and energized by the work of our talented faculty members. I hope too that you join with us in our efforts to battle the health-care crisis of our generation and as we strive, through education, research and service to improve the quality of life in Kansas City and beyond.

Lawrence Dreyfus, Ph.D.
Vice Chancellor for Research
and Economic Development

“Discovery is not a goal, rather a process through which we realize goals.

As a public research university, UMKC has a three-part mission: education, discovery and engagement. These three aspects of our work should not take place in isolated silos, rather, they are best done when they are deeply intertwined and in service to meet societal needs.

This publication, Explore, highlights research that develops new knowledge which brings together the three fundamental aspects of our mission. As our students work side-by-side with faculty to develop new knowledge, we are teaching them processes of discovery that prepare them to become our future leaders, researchers, teachers and workforce. Our discovery enterprise is informed by, influenced by, and enhanced by our engagement with the greater community. Discovery is not a goal, rather it is a means by which we realize our goals. Through discovery, UMKC will act as a transformational agent of positive change for our community and the world.

Our research activity is also guided by a fundamental fact of 21st century life. When the first universities came into being centuries ago, new knowledge emerged slowly and with great difficulty. Today, the advancement of knowledge occurs so quickly that it’s almost impossible to keep up. We float in an ocean of data and information that is growing exponentially. All of us in higher education are called to adapt the ways we research, teach, engage and serve to reflect this new reality. Here at UMKC, we are committed to answering this call.

One exciting new initiative being led and championed by Chancellor Agrawal is the creation of a new Data Science Institute with the mission to improve quality of life for people in the Kansas City Metro, the State of Missouri and beyond. The Institute will be dedicated to analyzing the massive data sets available to us and finding answers to the questions and problems that confront us — answers that in many cases are already here, hiding in plain sight, awaiting creative analytics to bring them forth.

Data analytics is emerging as a powerful new frontier in a wide array of research areas, from health care to national defense. While we have had data analytics capacity in many of our academic units for some time, the new Institute will provide an interdisciplinary nexus for this work, allowing great minds from multiple fields to collaborate and learn from each other.

The future will be what we make of it. Read on to see a preview of the future we are building here in the Kansas City Metro and in the heart of America.

Barbara A. Bichelmeyer, Ph.D.
Provost and Executive Vice Chancellor

Q&A

Ryan MOHAN

Ryan Mohan, Ph.D., explores the role a protein complex plays in cell mutations.

Photo: Brandon Parigo

by Gail Borelli

Q: What is the focus of your research?

A: Our team investigates how multiprotein complexes protect the brain. Learning more about the structure and function of these multiprotein complexes will help us understand why mutations, which can often occur, lead to many different diseases. In a number of neurodegenerative diseases, we know which proteins malfunction, but we don’t know precisely how these malfunctions lead to disease and possibly death.

Q: What are the practical applications of your research?

A: This research could open the door to curing terrible neurodegenerative diseases such as spinocerebellar ataxia and Huntington’s. I think we are on to something and getting closer to finding the truth about these gene mutations.

Q: Any recent discoveries?

A: We are studying the SAGA protein complex, which normally protects the eyes’ nervous systems from damage. We already knew SAGA could regulate gene expression – helping to decide whether to turn genes on or off. We looked for additional functions and found the complex is also a major regulator of the cytoskeletal networks that maintain cell structure and shape. This may help us understand why damaging SAGA can lead to miscommunications in the brain and possible degeneration.

Q: How did you get interested in molecular physiology?

A: I was pursuing my Ph.D. at a time when it was becoming clear how critical genes and multiprotein complexes are to every aspect of body function. Filling the gaps in the scientific knowledge seemed important to me. I enjoy the day-to-day pursuit of discovery in our research.

Q: What is a typical day like in the lab?

A: It is bustling. Our team has a senior scientist, two graduate students and 10 undergraduates, each working on one small part of the larger project - understanding how SAGA works to keep the nervous system healthy. We hold Skype calls with collaborators in Israel or other countries, and we meet after dinner for a lab meeting to share progress, troubleshoot difficult experiments and share new ideas.

Undergraduates are an important part of our team. They start in the lab after their freshman or sophomore year. I let them try different tasks and figure out what part of the research best suits them, then they practice and take off! We recently submitted a paper to the Journal of Cell Biology that listed six undergraduates as co-authors.

Meet the researcher

Ryan D. Mohan, Ph.D.
Assistant professor, School of Biological Sciences, Division of Cell Biology and Biophysics

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

Joined UMKC: 2015

Check out these research stories online: *info.umkc.edu/research*

Bone Dynamics

UMKC researcher advances our understanding of the process of bone formation

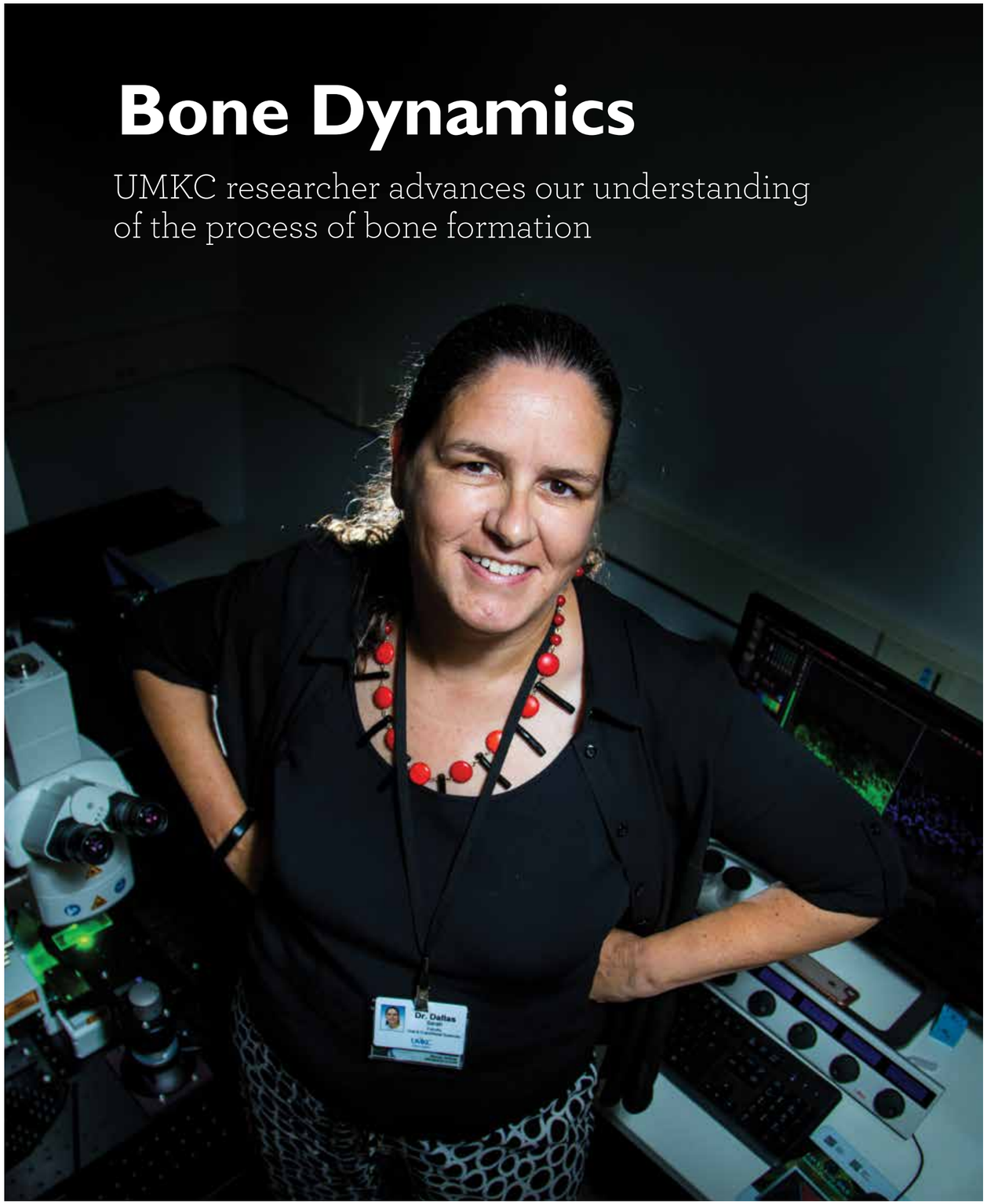


Photo: Brandon Parigo

by Kelly Edwards

Most people think of a bone as a rigid, even dead structure like a skeleton in a museum. To Sarah Dallas, Ph.D., it's a fascinating matrix of active cells at work. And she has the images to prove it.

With the use of high-tech microscopes at the UMKC Confocal Imaging Core, Dallas has pioneered the method of taking time-lapse images of live bone cells over a period of days and assembling them into movies that provide novel insights into how the living cells work to form the mineralized bone matrix.

Dallas serves as director of the imaging core and the muscle and bone phenotyping core, which supports the research efforts of a diverse range of investigators at UMKC. Her research specializes in techniques for live-cell imaging and is now moving toward the imaging of cells within live animals.

Two pieces of the core's equipment, a confocal microscope and multiphoton microscope, are used to capture fixed cell images and images of live animal cells. These microscopes, obtained through funding from a series of National Institutes of Health grants, are the highly-specialized machines that Dallas used to develop her unique approach to the imaging of cell functions and their dynamic actions in assembling bone tissue.

"The study we're doing is basic science research," Dallas says. "It's a step back from clinical applications, but we're trying to identify potential approaches for preventing bone loss."

Dallas is an internationally recognized expert in her work with a particular cell called an osteocyte. Her imaging projects have proven the cell, once considered to be completely inactive because it is embedded within the bone matrix, to be extremely dynamic. Recently, osteocytes have been found to control the activities of two other important bone cells: osteoblasts, which form bone, and osteoclasts, which resorb bone.

Bones are in a constant state of turnover, where bone is being resorbed and replaced. With age or disease, that delicate process becomes imbalanced and results in bone loss, known as osteoporosis.

In addition to developing a better understanding of the fundamental underpinnings of bone loss, Dallas' work could also have implications for treating bone disorders such as osteogenesis imperfecta, or brittle bone disease, a genetically inherited disease that affects children and makes their bones even more susceptible to fractures.

"In terms of clinical applications, the more we know about osteocytes, the more we'll be able to tap into their potential for developing drugs for preventing bone loss in osteoporosis and other bone conditions," Dallas says.

Dallas' research projects have three primary targets: looking at bone cell dynamics, exploring how the extracellular bone matrix is assembled and studying the role of osteocytes in age-related bone loss.

Her work has also expanded to looking at the interaction of bone and muscle in aging. As bone mass declines throughout the aging process, so does muscle function. In collaboration with muscle biologists, she is exploring the crosstalk between bone and muscle with the idea that the tissues may be linked in some way so that they actually share signals that lead them to deteriorate together.

Dallas discovered her fascination with research and bone biology while working on her undergraduate degree at the University of Birmingham, U.K., and her Ph.D. at the Royal Veterinary College in London. While she was doing post-doctoral work on bone-related cancers at the University of Texas Health Science Center in San Antonio, a particular project led her to explore the role of protein-regulating growth factors on the bone matrix.

She returned to the U.K. to work at the Welcome Trust Center for Cell Matrix Research in Manchester, where Dallas says she thought she would stay and finish her research career. That changed when her post-doctoral supervisor from San Antonio, Lynda Bonewald, Ph.D., one of the world's leading bone scientists, called in 2011 and recruited Dallas to join her mineralized tissue research group at UMKC.

Dallas' research projects, while continually funded by the NIH since 2001, have become internationally known. Last year, a crew from the Japanese public television network, NHK, came to UMKC to interview Dallas and film a segment for an eight-part documentary on the human body that featured experts from throughout the world.

"Some of our work directly relates to osteoporosis and some to inherited connective tissue disorders like osteogenesis imperfecta," Dallas says. "The rest is basic science that feeds into all of these. Understanding the fundamental mechanisms of how these cells work feeds into the future for figuring out potential treatments for diseases."

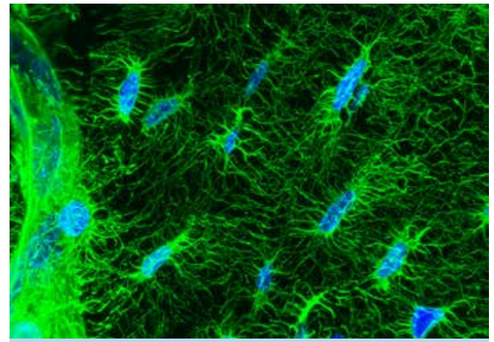


Photo: Courtesy of Sarah Dallas

Confocal image of osteocyte cells found in the mineralized part of bone tissue. Osteocytes form a neural-like network that senses bone loading during exercise and adjusts bone mass to avoid fracture.

Meet the researcher

Sarah Dallas, Ph.D.
Lee M. and William Lefkowitz Endowed Professor,
School of Dentistry

Research Interests: The role of osteocytes in regulating bone mass, the dynamic interactions of bone cells, and the effects of bone-muscle crosstalk on the skeleton

Joined UMKC: 2011

Accomplishments: Internationally recognized bone research has been continually funded by the National Institutes of Health since 2001. Pioneered the use of time-lapse live cell imaging to produce movies of cells actively assembling and mineralizing the bone matrix and of bone cell-to-cell interactions.

Big Opportunity for Big Learning

Grant accelerates corporate partnerships in research

by Patricia O'Dell

Researchers from the UMKC School of Computing and Engineering are launching the Center for Big Learning in conjunction with their participation in the National Science Foundation's Industry and University Collaborative Research Center Program. The NSF grant of $3 million to four universities over the next five years is designed to encourage innovative research in artificial intelligence and deep learning, and significant partnerships between university researchers and industry nationwide.

The initial phase incorporates NSF partnerships with four universities: University of Missouri–Kansas City, Carnegie Mellon University, University of Florida and University of Oregon. Each university will recruit at least three industry partners that are interested in big learning solutions who will match NSF funding. The program could lead to a potential investment of $1.5 million in UMKC alone.

The UMKC team is led by Zhu Li (director), and Yugyung Lee (co-director) with active participations from faculty members including Sejun Song, Praveen Rao, Reza Derakhshani, Shui-Qing Ye from the School of Computing and Engineering. The center will be supported by SCE faculty ZhiQuiang Chen, Baek-Young Choi, Chi Lee, Shui Ye and Yongjie Zheng and Peter Koulen, faculty researcher from the School of Medicine. They will collaborate with researchers from the other sites.

While private companies seem to have more access to capital for this type of research, it is more cost-effective for them to form university partnerships.

"It's very exciting," Lee says. "These companies don't know what the product is yet. They want to find out what's possible. We have the opportunity to take on some risky projects and develop prototypes, and they can take the solutions."

Because individual workers with comparable education and experience can be very expensive for companies, especially for cutting-edge research, supporting university research can be incredibly cost-effective, especially with the structure of this project at UMKC.

"We'll be creating a workforce prepared with top-tier knowledge of this sector right here in Kansas City," says School of Computing and Engineering Dean Kevin Truman. "Through this industry partnership, faculty have the opportunity to develop some of the most exciting new technology solutions that will be going to market immediately. This isn't just researching to know the answer, this is researching to create actual processes that will impact real people in real time."

Each of the research projects, which will be located in the new Robert W. Plaster Free Enterprise and Research Center expected to open in 2020, are focused on network management, deep learning, artificial intelligence, the web and the Internet of Things.

This technology will enable systems to analyze large data sets and develop new prediction models that allow for more sophisticated processing and voice and image recognition. In its current form, this is the technology that drives systems like Amazon's Alexa and Microsoft's Cortana. As the technology develops, it will enhance sophisticated applications such as heart monitoring implants.

"Our mission is to accelerate the innovation and impact to the real work," Li says. "UMKC has its own unique strengths in embedded systems deep learning in imaging, compression, communication and fully embedded systems."

The team has attracted five industry partners this year with which to collaborate: RIC Semiconductor, CloudMinds, Electronic Telecommunications Research Institute, SquareOffs and Tencent Media Lab. These companies, as well as the participating schools and their partners, will have access to all of the research generated by the consortium.

This is a key selling point when attracting partners.

"All the universities did a fantastic job of getting commitment letters from potential industry members and coming up with compelling projects for the full proposal submitted last year," Rao says. "As result, the NSF panelists were impressed by the team and, ultimately, the Center for Big Learning was funded."

Derakhshani, who has experience in both academia and the private sector through his role in developing the technology that led to EyeVerify (now Zoloz), which was the largest technology transfer project in the university's history, agrees.

"Industries coming to universities to solve their problems is a good model. This means that academics don't create solutions that are looking for a problem," he says. "In industry, you are always looking at your quarterly results. That's what's right about the partnership. Academia doesn't have quarterly reports. We can focus on creating new and interesting knowledge. We fill the gap."

Industry partners

To date, the UMKC site of the Center for Big Learning (CBL) has secured five research partners. The team will work with each company to develop artificial intelligence and big learning solutions for their specific challenges. The resulting technology will be shared with other CBL members.

RIC Semiconductor is a Dallas startup working on novel 77Ghz RF solutions for radar, imaging and communications. **CloudMinds** is developing mobile-internet cloud services, a platform to augment Cloud AI with human intelligence, secure private networks connecting robots and smart devices to Cloud AI and mobile devices as a robot control unit. CloudMinds is co-funded by the CEO of Softbank, the owner of Sprint. **Electronic Telecommunications Research Institute** is a Korean government-funded research center focused on core technologies in information, communications, electronics and broadcasting. **SquareOffs** is a micro debate platform designed to raise awareness, engagement and traffic for online publishers and brands. **Tencent** is a leading provider of internet value-added systems in China focused on social media platforms and digital content services.

Meet the researchers

Zhu Li, Ph.D.
Director, Center for Big Learning; Associate professor, Department of Computer Science Electrical Engineering
Joined UMKC: 2015

Yugyung Lee, Ph.D.
Director, Center for Big Learning; Professor, Department of Computer Science Electrical Engineering
Joined UMKC: 1999

Reza Derakhshani, Ph.D.
Associate professor, Department of Computer Science Electrical Engineering
Joined UMKC: 2013

Praveen Rao, Ph.D.
Associate professor, Department of Computer Science Electrical Engineering
Joined UMKC: 2007

Sejun Song, Ph.D.
Associate professor, Department of Computer Science Electrical Engineering
Joined UMKC: 2013

Earning Her Stripes

How zebra fish are helping this researcher understand human development in a brand-new way

Researcher Hilary McGraw, Ph.D., in her lab filled with hundreds of zebra fish tanks / Photo: Brandon Parigo

by Lindsey Mayfield

Inside the UMKC School of Biological Sciences, you'd expect to find classrooms, labs, offices and study spaces.

What you might not expect to find is a room filled, floor-to-ceiling, with fish tanks.

The space resembles something like a high-tech pet store, without all the colored rocks and miniature castles. It's kept at a balmy 82 degrees, and a complex filtering system runs through each tank, keeping the water clean and at the right salinity.

It's all part of the research being conducted by Hillary McGraw, Ph.D., an assistant professor of cell biology and biophysics. She's spent most of her academic career studying the zebra fish and what their development can teach us about human development.

Despite the obvious differences in size, habitat and biology, zebra fish and humans share some of the same developmental processes. McGraw says there is a lot to be learned about humans by studying these tiny organisms.

> *"Being able to take live video of the processes I'm studying is such a powerful tool.*

"The really amazing thing about zebra fish is that they are fertilized and develop outside of the mother," she says. "So we can watch really early processes in formation because they're just in water and not inside another organism."

Another great thing about zebra fish is that they're essentially transparent, meaning researchers can observe their cell movements in real time.

McGraw pulls out a laptop and shows a video of a two-day-old zebra fish embryo. Its cells have been biologically engineered to emit a glowing, green color, so she can observe how they move through the body.

"We can see a lot of things happening that you couldn't see in other animals," McGraw says. "Being able to take live video of the processes I'm studying is such a powerful tool."

When you picture cancer research, you may think of patients in a hospital, receiving a new treatment or taking part in the study of a new medication. Those kinds of studies, however, take place near the end of the research process.

McGraw and her zebra fish are, as she puts it, at the "starting point of cancer research."

Many cancers begin at the very earliest stages of human life – within a developing embryo. The cancer will take a certain process that was used in the developing embryo and reactivate it in the adult, which helps it to invade cells throughout the body.

McGraw hopes her work will help inform what goes wrong during cancer cell movements, and how to stop cancer in its earliest stages.

"When you have just a tumor, a tumor can be removed. But once the cancer cells start to move throughout the body, that's when things really go wrong," she says. "So if we can figure out how to stop that, I think that is one of the critical points in cancer biology."

McGraw's work could also help treat hearing impairment in humans. Zebra fish — like many types of fish — have a sensory system that allows them to sense changes in water currents.

The cells that make up the sensory system in zebra fish are very similar to hair cells within the human ear – with one very important difference.

"These cells in our ears – they don't grow back, which is why we go deaf. When they're damaged, they're just gone," McGraw says. "But in fish, these cells are actually able to grow back."

Understanding how fish are able to regrow their sensory cells could help researchers understand how to regrow the cells in human ears after hearing loss has occurred.

Inside her brand-new lab space, McGraw pulls out a petri dish and places it under a microscope. In the dish are several zebra fish that she estimates to be three — no, four — days old.

"They're very small. You can kind of see them swimming around in there," she says. "At this stage they have nice big eyes, and they're starting to hunt for food."

As she peers carefully into the microscope, the obvious question arises: Do you have fish at home? She laughs.

"I actually don't. It's so much easier to have this controlled environment here. And I have a cat, so those don't mix very well."

After less than a year at UMKC, McGraw's research is still in its preliminary stages. She hopes, however, that her work will help form some of the questions researchers are asking many years from now.

"Every time you answer one problem, it kind of opens up the next question," she says. "That's what I really like about science, is that it's constantly evolving and progressing."

McGraw has spent 16 years studying zebra fish. / Photo: Brandon Parigo

Meet the researcher

Hillary McGraw, Ph.D.

Assistant professor of cell biology and biophysics, School of Biological Sciences

Research Interests: Developmental biology, organ formation in embryos

Joined UMKC: 2017

COMBATTING the Crisis

Armed with data, evidence-based practices and prevention strategies, UMKC researchers and health professionals are on the front lines in the war on opioids

by Stacy Downs

Each day in the United States, 144 people die from opioids.

As if that's not startling enough, an estimated 2 million Americans are addicted to prescription opioids, and more people die each year from overdoses than car crashes.

National leaders in 2017 declared America's opioid epidemic a public-health emergency — a designation typically reserved for natural disasters.

University of Missouri-Kansas City health professions faculty and staff are combatting the crisis on multiple fronts locally, regionally and nationally — all armed with research. Their work is an all-out 360-degree approach: from mining data to educating future health professionals and training current care providers to helping people and their families who are struggling with the highly addictive class of painkiller.

"It's not just an urban problem or a rural problem, it's an everywhere problem," says Heather Lyons-Burney, clinical assistant professor at the UMKC School of Pharmacy. "One thing is not going to fix this problem. We have to attack it from different angles."

DATA TELLS THE TALE

The research of Maureen Knell, clinical associate professor in the School of Pharmacy, is being cited with greater frequency in the wake of the opioid crisis.

The New York Times, *The Kansas City Star* and Kansas Public Radio have featured Knell and longtime collaborator Rafia Rasu of the University of Kansas School of Pharmacy. For years, they've been analyzing data from about 690 million outpatient clinic visits by patients who suffer from chronic pain not related to cancer.

They've detected some surprising patterns. People 35 to 49 years old were more likely to get an opioid prescription than younger adults — and more likely to get one than those over 65.

"Maybe physicians have the assumption that they're safer in middle-aged patients," Knell says.

Primary-care doctors were more likely to prescribe opioids than specialists, especially if they had a longstanding relationship with their patients.

Financial factors might be at play, with providers more likely to steer

Photo: Brandon Parigo

Medicaid patients toward inexpensive generic opioids for pain rather than alternatives like physical therapy or newer brand-name non-opioid painkillers, Knell found.

Linked to that, Knell and Rasu discovered discrepancies in opioid prescribing that seemed to be more cultural than clinical. Poverty and chronic health conditions are higher in the South, which could explain the higher rates of opioid prescription there.

> *"It's not just a rural problem or an urban problem, it's an everywhere problem.*

"As far as the patterns we saw, we found that opioid use was reported in 14.3 percent of the total patient visits," Knell says.

The pair also found that Hispanic patients, regardless of where they lived, were 30 percent less likely to get an opioid prescription than their non-Hispanic counterparts.

They said that could be due to language barriers that make it more difficult for patients to describe their pain, making physicians feel less confident they will be able to communicate how to take the drugs safely. Or it could be that Hispanics have a higher tolerance for pain, which is consistent with other studies as well, Knell says.

So what are the key takeaways from these findings?

Knell says prescribers aren't always following guidelines like those from the American Academy of Pain Medicine and the Centers for Disease Control and Prevention. A prescription has to be appropriately written, and they need to verify if a patient already has tried something else as a first-line therapy.

Also, Knell and Rasu hope to influence policymakers, public health officials and health care providers through their research.

Up next: Knell and Rasu want to analyze newer data. Their last study was based on data from 2000 to 2007, the most recent when they started.

BUILDING CAPACITY FOR ACTION

One of the main reasons our nation has not been able to address the opioid epidemic is because we don't have the workforce capacity to do so, says Laurie Krom, co-director of the Addiction Technology Transfer Center Network, called the ATTC for short.

For 20 years, UMKC has housed the national and regional ATTC coordinating offices. Their top mission: accelerate the implementation of promising addiction treatment and recovery practices and services. The topic of opioids dominates the ATTC's news and upcoming events lists.

The ATTC is part of the Collaborative to Advance Health Services at the School of Nursing and Health Studies. To address the workforce problem, the Collaborative, in partnership with the American Academy of Addiction Psychiatry, was awarded an $8 million grant for two years from the Substance Abuse and Mental Health Services Administration to support primary-care providers in the prevention and treatment of opioid-use disorders.

The project is an unprecedented alliance of physician, nurse, allied healthcare and behavioral health organizations with broad national, regional and state networks and technical expertise in preventing, treating and supporting recovery from substance-use disorders.

"This money will go to provide training and assistance to build the capacity of physicians and counselors to provide treatment in evidence-based care," says Krom, who also is an investigator on the grant, the work of which will benefit those needing treatment nationwide.

"Our hope is that it will have an impact on the people and communities who are suffering," says Holly Hagle, co-director of the ATTC Network, UMKC assistant research professor and principal investigator on the grant.

In addition to Hagle and Krom, Patricia Stilen, director of the regional ATTC Network, also at the Collaborative to Advance Health Services at UMKC, is an investigator on the grant.

Those people suffering are close to home. In 2016, more than 900 people in Missouri died from overdosing on opioids. According to state data, one in every six deaths was opioid-related.

Krom says 419,000 people in Missouri have diagnosed substance abuse disorders. She says 17,000 of those people are children between 12 and 17 years old.

"Kansas City, St. Louis and southwest Missouri are really being impacted by the opioid epidemic," she says.

PREVENTING PROBLEMS

When Heather Lyons-Burney first became a pharmacist two decades ago in Missouri, prescriptions for heavy-duty pain medication were only given for the worst suffering, for those who just underwent surgeries, who had cancer or who were in hospice care.

But then the tide turned.

Newer agents — opioids — with long-lasting pain relief would take care of those who suffered back and other types of ongoing pain. No need to worry about addiction, right?

Wrong.

People sought them for more than pain relief and soon pill mills — places where unethical doctors hand out prescription drugs like candy — sprouted up across the country.

The health-care industry cracked down on itself, and the tide has turned again.

"Providers are looking for other ways for patients to manage pain instead of narcotics," she says. "Like physical therapy and chiropractic care, for example."

As a pharmacist, Lyons-Burney has become involved with preventing opioid use on many levels in Missouri:

- Through leadership positions in the Missouri Pharmacy Association and the Ozark-area pharmacy community where she lives and works.
- Through county coalitions in Greene County in Springfield and Taney County in Branson.
- Through the choice not to carry controlled substances at Faith Community Health, the nonprofit clinic she helped establish.
- Through working with Generation Rx, a prescription drug misuse prevention program run by university student pharmacy chapters.
- Through teaching future pharmacists at UMKC. She's based at the UMKC School of Pharmacy at Missouri State University in Springfield, but through broadcast classes, teaches students at the two other locations in Kansas City and Columbia.

This past summer, she has been researching how prevention efforts have worked through survey data.

"We have a responsibility to people to fight this problem and help people," Lyons-Burney says. "We're getting there."

Meet the researchers

Holly Hagle, Ph.D.
Co-director of ATTC Network; assistant research professor, School of Nursing and Health Studies
Joined UMKC: 2017

Maureen Knell, Pharm.D.
Clinical associate professor, School of Pharmacy
Joined UMKC: 1997

Sarah Knopf-Amelung, M.A.
Director of KC Perinatal Recovery Collaborative, School of Nursing and Health Studies
Joined UMKC: 2014

Laurie Krom, M.S.
Director of ATTC Coordinating Office, School of Nursing and Health Studies
Joined UMKC: 2004

Heather Lyons-Burney, Pharm.D.
Clinical assistant professor, School of Pharmacy
Joined UMKC: 2014

Patricia Stilen, MSW
Director of Mid-America ATTC Network, School of Nursing and Health Studies
Joined UMKC: 1999

MOTHERHOOD AND ADDICTION

The KC Perinatal Recovery Collaborative kicked off in June and is an initiative to improve family-centered addiction care for pregnant and parenting women and their families in the Kansas City metro area through cross-systems collaboration.

The need is clearly there. Missouri had a 358 percent increase in neonatal abstinence syndrome in just five years, between 2011 and 2016. Neonatal abstinence syndrome (NAS) occurs when a mother uses drugs while pregnant or passes the substance through breast milk or the placenta. Infants born with NAS may experience a wide range of withdrawal symptoms, including mild tremors and irritability, fever, excessive weight loss and seizures.

The KC Perinatal Recovery Collaborative is led by the Mid-America Addiction Technology Transfer Center, a program of the Collaborative to Advance Health Services at the UMKC School of Nursing and Health Studies. The aim of the Collaborative is to coordinate the work of multidisciplinary systems to develop a comprehensive array of recovery programming with a range of OB/GYN, neonatal, residential and outpatient care along with employment and vocational assistance and family-friendly recovery housing.

The range of services that mothers in recovery and their families need are often in silos and lack a coordinated network that is easy to navigate. This project will bring these partners together to improve family-centered services and coordination.

"When addiction occurs during motherhood, it affects the whole family and requires a comprehensive and compassionate response," says Sarah Knopf-Amelung, coordinator of KC Perinatal Recovery Collaborative and senior program coordinator at the UMKC School of Nursing and Health Studies. "We are excited to convene this group of leaders in Missouri and Kansas to help make sure we are doing the best for mothers and their families."

Disaster Hunter

Uncovering the past to predict future disasters

by Bridget Koan

To many, boulders scattered on the ground are nothing more than big rocks. But for Tina Niemi, Ph.D., geosciences professor and undergraduate geology adviser at UMKC, boulders often tell a story. It's an opportunity for her to uncover the underlying geological and environmental history.

"Most large boulders require a high-energy event to move them," Niemi says. "In the Bahamas, where I teach a field methods class over spring break, we have been monitoring how the coastal environment changes with storms and hurricanes. We've discovered that hurricanes can move boulders that weigh tens of tons. Previously, only tsunamis were thought to move this type of megaboulders."

In addition to teaching UMKC students about geology, including a popular class on the archaeology of ancient disasters, Niemi conducts research on disasters ranging from earthquakes and tsunamis to hurricanes and climate change. Niemi and her students collect and analyze data used for estimating the probability of natural disasters and quantifying regional hazards. Her lab at UMKC, the Geoarchaeology, Paleoseismology and Sedimentology (GAPS) Lab, is interdisciplinary and incorporates related subjects such as history, archaeology, geochemistry, paleontology, geophysics and stratigraphy in researching these disasters. Besides the Bahamas, Niemi has conducted research in the Baja region of México, on the San Andreas fault in California, on the New Madrid Seismic Zone in Missouri and on other faults zones in Israel, Jordan, Turkey and India.

"Everything we do involves studying young sediments and artifacts," Niemi says. "We dig or core into sedimentary deposits and use geophysical and remote sensing imaging technologies to look back in time to find the physical evidence that record past earthquakes or hurricanes, the changes in climate and sea level and to find out how humans have altered the environment in the past."

Niemi juggles multiple projects while serving as a mentor to numerous undergraduate and graduate students. In fact, her dedication to undergraduate research was recognized in 2016 by UMKC's Excellence in Mentoring Award. One project that recently concluded, the Baja Basins Research Experience for Undergraduates (REU), was a National Science Foundation-funded program that combined research and training in mineralogy, volcanology and neotectonics.

"The Baja Basins REU project that was funded from 2015-2017 sought to encourage undergraduate students to do research and to pursue science careers," Niemi says. "In our case, we recruited women, Hispanic students and veterans as participants."

Niemi's project was unique because it included both field and laboratory components. Fieldwork was conducted each year at a tectonically active rift basin along the Gulf of California, facilitating research in both tectonics and earthquake hazards. In addition to field research, student workers also experienced life on an active copper mine and learned how ore is extracted and processed. The project integrated emerging technology by utilizing field tablets for mapping and drone digital aerial imagery. Then students collected lab data using a variety of analytical instruments and worked with faculty to interpret and present the data. Niemi is hopeful that a three-year continuation of this project will be funded.

Another of her projects focused on the Dead Sea fault system. Niemi said the Dead Sea fault is similar to the San Andreas fault system in California where the land shifts laterally in an earthquake. To date past earthquakes, her team investigated several archaeological sites in Jordan that sit on top of the fault.

"If you know the repeat time of earthquakes, then you can say something about the expected return time in the future," Niemi says.

Niemi's team also looked at faults and evidence of earthquakes offshore in the Gulf of Aqaba.

"We actually identified what we think is a large tsunami event that occurred about 2,000 years ago," Niemi says. "We were analyzing microfossils throughout a core collected in shallow water. The variation in the species with depth tells us something about how the climate has changed over the past several millennia. Remarkably, there's a zone that is completely devoid of microfossils that appears to record runoff from land in a tsunami. Most of our research focuses on understanding the seismic hazard of an area and a tsunami is not a hazard that is locally recognized."

During the summer of 2018, Niemi traveled to India for the fifth time to continue her research on earthquakes at the tectonic boundary between India and Asia. Niemi's work in India began in 2014 when she received a Senior Fulbright Specialist Award to Kurukshetra University in Haryana, India. She taught tectonics and paleoseismology seminars and interacted with students and scholars.

"The Fulbright Award really opened doors and helped me meet colleagues who are working on earthquake hazards in India," Niemi says.

Niemi's new work is on the Himalayan Frontal Thrust fault at the convergent, tectonic boundary between Asia and the Indian subcontinent. Niemi says the fault looks like it pushed up a large scarp, which is a step or offset on the ground surface where one side of a fault has moved vertically with respect to the other. To determine the earthquake history of the fault, Niemi and her students dug a large trench and examined the geology. A grant from the UMKC Funding for Excellence program helped support this effort.

"In India, we are working hard to understand the magnitude and recurrence of earthquakes," Niemi said. "Everyone is very sensitive about whether a magnitude nine (earthquake) is possible. It would be catastrophic. We're working with the Disaster Mitigation and Management Center in Uttarkhand State. We are hopeful that the new reconnaissance study in India will allow us to write a National Science Foundation proposal for future earthquake research."

The purpose of her summer 2018 trip to India will be to examine the large boulders Niemi discovered on a previous trip. She thinks they may be related to a catastrophic event, such as an outburst from an earthquake-dammed lake, and she wants to find out what it was.

Wherever her travels lead on the hunt for evidence, she's sure to have an adventure and to help us understand potential future disasters.

On her most recent trip to India, Niemi studied a debris field to understand the history of a previous earthquake to estimate its magnitude. / *Photo: Tina Niemi*

Meet the researcher

Tina Niemi, Ph.D.
Professor of geosciences, College of Arts and Sciences

Research Interests: Neotectonics, Paleoseismology; Archaeoseismology; Tectonic Geomorphology; Quaternary Geology; Sedimentology; High Resolution Seismic Reflection and Geophysics; Geoarchaeology; Near Eastern Archaeology; Geoscience Education

Joined UMKC: 1995

Left: Niemi's work often includes thorough examinations of rock. She and her students collect and analyze data used for estimating the probability of natural disasters and quantifying regional hazards.

Progress, Measured in Increments

Examining the treatment of schizophrenia

by John Martellaro

This is not a story about a stunning scientific breakthrough or a cure for a debilitating and deadly disease that haunts individuals and families.

No, this is a story about slow, steady, incremental progress. About mitigating symptoms and minimizing side effects; about a long-term battle against a lifetime illness for which a partial reduction in symptoms represents a major victory, and simply convincing patients to take their medication is a constant challenge.

The disease is schizophrenia. It has no cure, and the dysfunctional organ is not the kidney or the colon, but the brain.

In the UMKC School of Pharmacy, faculty researchers Roger W. Sommi, Pharm.D., FCCP, BCPP; and Leigh Anne Nelson, Pharm.D., BCPP; are working to help people living with this disease alleviate their symptoms and reclaim their lives.

Drug therapy for schizophrenia presents multiple challenges that researchers are working to overcome. Drugs are only partially successful at reducing the number and severity of symptoms; they have numerous and often debilitating side effects; and the side effects combine with delusional and cognitive symptoms to make even basic adherence — taking your medication every day — a struggle.

"With medication, on a good day, you might see an average of 70 percent of symptoms relieved," Sommi says.

The price of that progress is both metabolic and neurologic side effects. The former includes weight gain, increased cholesterol levels and higher risk of diabetes; the latter, abnormal involuntary movements that can be embarrassing and stigmatizing.

It should come as no surprise, then, that according to one of the multicenter studies conducted at the UMKC site, 75 percent of patients stop taking their medication during the course of 18 months of treatment.

Much of the research, therefore, focuses on either reducing side effects or finding ways to increase adherence with the medication regimen.

"The side effects are not pleasant. Newer medications have tried to make them a little more tolerable," says Sommi, a professor of pharmacy practice and administration and psychiatry. A member of the UMKC faculty for 31 years, Sommi says that while getting patients to take their medication regularly remains a major challenge, successes in that area can produce a significant improvement in the quality of life for patients.

One area of progress has been changing the formulation of existing antipsychotic drugs — for example, replacing traditional pills with fast-dissolving oral medications or long-acting injectables. Hospitalized patients often become skilled at hiding a standard pill in a cheek while pretending to swallow, then spitting the drug out later. A fast-dissolving tablet makes that more difficult.

Long-acting injectable antipsychotics replace daily pills with injections that can last anywhere from two weeks to three months. In trials, these new formats have reduced relapse rates and kept patients out of the hospital for longer periods.

"We're really hoping we can move the relapse and recovery needle with these drugs," Sommi says.

Nelson, a UMKC School of Pharmacy alumna who has been on faculty since 2005, says medication adherence can have huge impacts.

"We can get patients back into high school, back into college, see them become employed, get them to be functional in society," she says.

She participated in a five-year National Institute of Mental Health study of young people recovering from their first episode of schizophrenia. The key finding: "We can make a big impact on a young person if we can get them to adhere to their medication schedule and give them some insight into their disease state."

Another key reason to promote adherence: Relapse or episodes of acute psychosis destroy brain cells by over-exciting them.

"The more time people spend sick, the more they lose," Sommi says.

Still, progress is measured in increments. A multicenter study done here at UMKC looking at the impact of long-acting injectable antipsychotics, for example, shows that people with schizophrenia released from jail who receive these medications have, on average, one fewer re-incarceration per year than those treated with pills.

Better, but not a breakthrough.

"There's always hope," Sommi says. All of the drugs currently prescribed for schizophrenia work on the same basic premise: adjusting the mix of brain chemicals — neurotransmitters — that govern brain function. These drugs reduce brain chemistry to a simple equation, he says; too much dopamine, too much serotonin.

"But it's not that simple. The brain is a very complex organ," Sommi says. "The taxonomy for psychiatric illnesses we have now is really inadequate in terms of predicting who will respond to what drug. We make the decision based on matching the side effects profile of a given drug to the risks the patient has for those side effects. The patients often feel like guinea pigs because we keep trying different things."

Now, researchers such as Nelson and Sommi are looking down alternative pathways. Both are long-term leaders in the College of Psychiatric and Neurologic Pharmacists. Nelson is a current board member, Sommi a past president.

"We're looking for things that challenge the neurotransmitter-based approach," Sommi says. "If we can understand better how people develop schizophrenia — the genetic basis — that could lead to more precise diagnosis and treatment."

SCHIZOPHRENIA

According to the National Institute of Mental Health, schizophrenia is a chronic and severe mental disorder that affects how a person thinks, feels and behaves.

People with schizophrenia may seem like they have lost touch with reality. The disease afflicts about one in every 100 people worldwide and does not discriminate on the basis of race, gender or socioeconomic status. Symptoms include hallucinations, delusions, agitated body movements and difficulty focusing or paying attention.

"People with schizophrenia account for a disproportionate number of people who are permanently disabled, a disproportionate amount of people who are homeless, and a disproportionate amount of Medicaid spending," Sommi says.

Photo: Brandon Parigo

Meet the researchers

Leigh Anne Nelson, Pharm.D., BCPP
Associate professor of pharmacy and psychiatry, School of Medicine and School of Pharmacy

Research Interests: Antipsychotic use and schizophrenia

Joined UMKC: 2005

Roger W. Sommi, Pharm. D., FCCP, BCPP
Associate professor of pharmacy and psychiatry, School of Medicine and School of Pharmacy

Research Interests: Drug treatment of schizophrenia and other psychiatric disorders

Joined UMKC: 1987

The Little Things in Life

Small creatures and small gestures mean big success for genetic researcher

by Brian Schneweis

Leonard Dobens, Ph.D., is not afraid to admit he spends much of his time with flies. Instead, he sees the beauty and importance of studying these tiny organisms.

Dobens is currently researching the role of a gene called Tribbles in embryonic development and diseases. He uses Drosophila melanogaster, more commonly known as the fruit fly, as a model system. Dobens' work focuses on analyzing the common features of the Tribbles proteins that are shared by all animals, including humans, and are important for their activity and during development. He has found that the fruit fly is a great place to begin to understand the basic ways in which Tribbles functions.

"The fly is a 'fruitful' place for both testing structure and function and sorting out genetic pathways," Dobens says. "The fly uses insulin to control its metabolism, and we can manipulate gene function very easily using powerful genetic tools to determine the effect of Tribbles on cell growth and cell division. We've uncovered some interesting new findings."

Among those findings, the Tribbles gene was implicated in insulin signaling, meaning it is upregulated in exercising or starving animals and dials down insulin release in peripheral tissue.

"The implications of that are enormous — it is the 'skinny gene' that, when turned on, blocks fat formation," Dobens says.

> *"My mentors led by example … I have strived to do science with a human face, like they all did.*

Additionally, Dobens and his team are currently doing genetic screens to find new genes that will work with Tribbles in its cellular functions. In humans, the Tribbles gene has been connected to defects in metabolism, and the fruit fly has shown promise in the testing of compounds for various diseases.

"Demonstrating that the Tribbles gene regulates insulin signaling in the fly has opened up the field to better understand its connection to metabolic disease and cancer," Dobens says. "More recently, we showed that a human Tribbles variant associated with Type 2 diabetes has the same function in the fly, building on our original finding."

The effects of this research could change lives. Dobens hopes fly Tribbles can serve to test small molecules and eventually develop drugs to alleviate insulin resistance in diabetic patients and block insulin-dependent tumors in cancer patients. And all this began with his work as a biology and pre-med major cleaning dishes in a Boston College lab.

"After four years of washing dirty fly vials — or despite this — I became interested in Drosophila research," Dobens says. "To choose the fruit fly as a model was such a lucky choice. It has proven an unrivalled model to understand how genes work together to build cells, tissues and whole organisms. Now that genomes are completely sequenced and all the genes in an organism are known, the next great challenge will be explaining how those genes work together to build an animal. The fly offers a chance to accomplish this in my lifetime!"

Dobens, while successful in his own right, knows he can only accomplish these great feats with a strong team of bright, hard-working students by his side, so he applies that same passion to mentoring students. He believes in paying forward what his mentors from Boston College, Harvard Medical School and others in his long career in academia have bestowed upon him.

"My mentors over the years showed enormous patience with me and welcomed me into their labs, which were exciting and warm places to grow as a scientist," Dobens says. "They were generous in their time, impressive in their knowledge of the subject, and interesting in the ways that they thought about science," he says. "They led by example. I have strived do science with a human face, as they all did."

Dobens says his mentors created an atmosphere unlike any he had experienced before. They made learning fun and dynamic, and sought to infuse the latest findings into teaching, all of which he admires and tries to replicate in his classes at UMKC. He believes in drawing upon his students' and colleagues' diverse skills to attack a problem from a variety of angles.

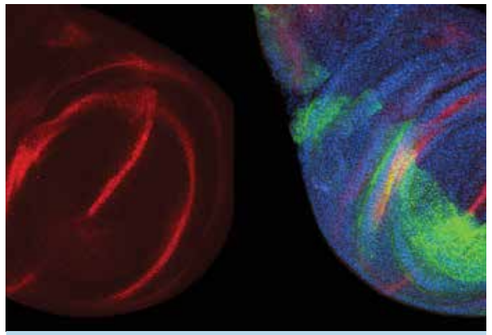
"The students at UMKC often bring a level of maturity and training that has a lot of relevance to working in a lab," Dobens says. "Multitasking when waiting tables is exactly what running three experiments at once is like!"

There is no denying his work with students, both inside and outside his classroom and labs, has paid off. Past students he has mentored have performed and presented groundbreaking research in hormone therapies, won local and national awards in science and engineering fairs, and earned the first and only prestigious National Science Foundation graduate fellowship in the history of the UMKC School of Biological Sciences.

Meanwhile, Dobens' own research with Tribbles could potentially change the methods health-care providers use to treat prevalent, chronic diseases and the ways in which people who live with them cope — and it all started with a fly.

Whether it's the diminutive animals he studies in his lab or the detailed guidance he offers his students, Dobens has proven the smallest things in life can have the biggest impact.

Christopher Nauman is one of the students Dobens has enjoyed mentoring throughout his research at UMKC. / Photo: Brandon Parigo



Dobens uses stains to identify different effects of gene expression in Drosophilia wings. In the image on the right, he has highlighted green fluorescent protein (GFP) marking Neuralized gene expressionin the wing. In that same image, the red stain marks the Wingless gene. By highlighting just the red stain in the image on the left, Dobens can see how the Neuralized/GFP has reduced the Wingless gene levels in cells.

Meet the researcher

Leonard Dobens, Ph.D.
Professor of molecular biology and biochemistry;
Director of research, School of Biological Sciences

Research Interests: Cell-cell signaling pathways, developmental mechanisms of pattern formation, model organisms, structural biology, transcriptional control

Joined UMKC: 2001

Accomplishments: Runs a research lab supported by the National Science Foundation and National Institutes of Health

Photo: Brandon Parigo

UMKC receives largest non-health research funding

by Callie Thrutchley

The U.S. Department of Defense's Office of Naval Research has awarded a $7.2 million grant and a $7.7 million contract to UMKC to develop technologies to reduce national security threats from drones.

These are the largest non-health research awards received at UMKC. The team of investigators also includes researchers from the Missouri University of Science and Technology and the University of Missouri, in collaboration with several other organizations. Researchers will focus on advancing high-power microwave electronic countermeasure technologies.

Drone threats range from intelligence gathering, to delivery of a weaponized payload, to being caught in the air intake of a jet engine.

The threat from drones, whether intentional or unintentional, is disproportionate in cost and complexity compared to the damage they can cause. For example, a few-hundred-dollar drone could destroy a billion-dollar stealth bomber.

Currently, no cost-effective protection from this potentially devastating threat exists.

"Our team of faculty and students are developing counter-technologies to eliminate threatening drones safely, including new ways to assess, predict and defend," says Tony Caruso, UMKC associate vice chancellor of research and physics, electrical engineering professor and lead investigator on the grant.

The goal of the efforts is to evaluate and demonstrate the capability of those counter-technologies developed through the grant award. The grant will also fund 10 new Ph.D. students and positions for 12 undergraduate researchers.

Fields' drone research was previously featured in Explore, Vol. 4.

Increasing access to clean water in Africa

by Kelsey Haynes

Access to consistent and safe drinking water is one of the biggest challenges facing humanity, and in many African countries the clean water shortage is getting worse. John Kevern, Ph.D., associate professor of civil engineering, has been working alongside graduate students from the University of the Western Cape to help find a feasible solution for the crisis.

Water scarcity, or lack of safe drinking water, in South Africa is often the result of climate change, growing population and heavy metal contamination from abandoned mines. According to the South African Department of Mineral Resources, 6,000 neglected mines are filling with water and causing an outflow of acidic water from metal or coal mines.

"In one location, about 11,000 people live around an abandoned mine, many of them unemployed miners unable to afford housing elsewhere," Kevern says. "Fundamentally, social justice comes down to access to safe drinking water."

Kevern and his team have discovered that by using waste fly ash, a byproduct of coal combustion, from two regional power plants, they can neutralize the acid mine drainage and help generate clean water. When fly ash is inserted into the mine and mixed with acid water it creates a hard, nonporous material. That helps prevent any additional oxygen and water from getting into the mine and causing further pollution. The chemical composition of fly ash makes it a common and cost-effective ingredient in treating acid mine water.

Since Kevern returned to the U.S., he has been working remotely with the Western Cape students who are continuing to conduct full-scale filter testing in the lab. The neutralization process, Kevern says, is fairly mature. The team's next steps are to figure out what to do with the excess waste. Their idea is to use the waste to make cement to fill the mine and prevent drainage from reoccurring.

The team will pilot the project this winter. If the project goes as planned, they hope to implement this solution across the continent. That means two things for Africa: more jobs for students and increased access to clean water.

Kevern's concrete and filter research was previously featured in Explore, Vol. 2.

Below: Kevern and the team of students and researchers he's working with at the Univeristy of Western Cape. Above: The team is working to create a filter to treat acid mine water. / Photos: John Kevern

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.

$211.7 million
Total of proposed projects

241
Number of extramural awards received by UMKC faculty in FY 2018

431
Number of proposals submitted in FY 2018

17
Patent applications filed

$43.7 million
Amount awarded to UMKC research and related projects in FY 2018

$29.2 million
Total research expenditures

62.7%
Percentage of total dollars coming from the federal government

20.6%
Yield on awarded projects

17
Number of invention disclosures filed in FY 2018

Q&A

Karl KADOR

School of Medicine researcher Karl Kador, Ph.D., develops bioengineered "bicycle wheels" that may help restore vision.

by Gail Borelli

Q: What is the focus of your research?

A: We are exploring how best to transplant new cells into the retina to replace damaged ganglion cells, which normally transport signals from the eye to the brain. Retinal cells are like spinal cord cells in that they cannot repair themselves. Once they are damaged, they are gone. We are researching how tissue engineering techniques can be used to encourage implanted cells to grow into the optic nerve, ultimately restoring vision to patients suffering from glaucoma or optic nerve injuries.

Q: How does your engineering background influence your research?

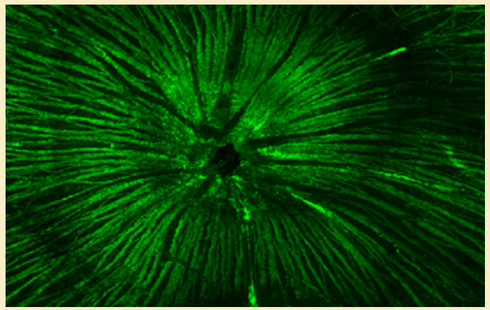
A: In the lab, we design and build three-dimensional scaffolds from biomaterials. When cells are just injected into the eye, they grow randomly. But we have shown that by using a scaffold structured sort of like a bicycle wheel with spokes, we can make the ganglion cells grow toward the center of the wheel. The scaffolds supply directional cues to the ganglion cells that replace the missing synapses, or nerve signals, and guide those signals from the eye to the brain.

Q: How important is your NIH funding?

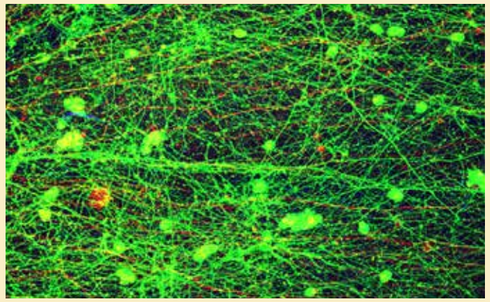
A: In April of 2018 we were very fortunate to receive a major grant award from the National Institutes of Health that will provide UMKC with $1.94 million over the next five years. It will allow us to hire a post-doctorate researcher, a technician and perhaps a graduate student as well. This will help speed up our research, which like all research, can be slow and incremental.

Q: What is your favorite part of the research process?

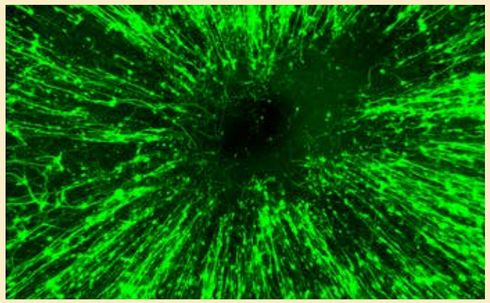
A: We image the mature cells using fluorescent colors, which allows us to trace their growth. I love seeing these beautiful images, which also represent hope for people with severe vision impairments.



Mouse retina RGC Axons. / Photos: Karl Kador



RGCs injected alone.



RGCs transplanted on a scaffold.

Meet the researcher

Karl Kador, Ph.D.
Assistant professor, Department of Ophthalmology, School of Medicine

Research Interests: Developing modified biomaterials to create and transplant new cells that replace damaged or dead cells in the retina

Joined UMKC: 2017

Creation of UMKC Health Sciences District

With a collaboration unlike any other in the nation, many of Kansas City's leading health-care institutions have agreed to align more closely to form the UMKC Health Sciences District. It is one of 18 areas in the country that have public schools of medicine, pharmacy, dentistry and nursing in one location along with a children's hospital and an adult, acute-care hospital. But the inclusion of city, county and state agencies make the UMKC Health Sciences District one of a kind.

The newly created district combines the unique expertise and services of 10 partners to spur research and community outreach in service of the Kansas City region and beyond.

Learn more at ***umkchealthsciencesdistrict.org***.

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