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Research at the University of Missouri-Kansas City



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Cover: A School of Computing and Engineering graduate student prepares to collect ocular biometric data in the CIBIT Research Lab.

Photo by: Dan Videtich

UMKC

Encouraging innovative a



This publication provides a glimpse at a few representative samples of the kinds of research under way on a daily basis at the University of Missouri-Kansas City. It is a window into the essence of this university.

Gail Hackett, Ph.D.

Executive Vice Chancellor
and Provost

If you want to know what UMKC is really all about, this booklet will tell you more than any campus tour, alumni testimonial or television commercial ever could.

That's because research isn't something we do, it is fundamental and foundational to who and what we are.

UMKC is an urban research university. That means we exist to serve the needs of the Greater Kansas City community and the state of Missouri. To meet that responsibility, we must do more than merely transmit knowledge. Our charge is to create and discover new knowledge that can be applied to addressing the unsolved problems and unmet needs of this community.

Research is how we create and discover that knowledge. It is also central to the teaching and learning environment of a research university. The research conducted by our faculty immerses them in their fields, and places them on the cutting edge of those disciplines. Their teaching will always be informed by the latest developments in their field.

Just as importantly, research and creative activity offer our students opportunities to witness and participate in the process of discovery and creation. This not only enhances their education in ways that a non-research university

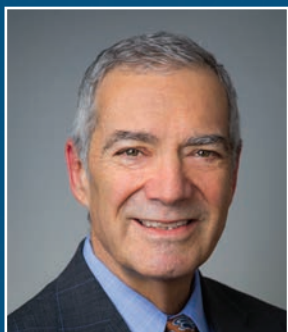
cannot match; it lights the fire of passion for inquiry and discovery in many of these students, helping create the next generation of thought leaders and knowledge creators.

As a researcher in the field of Psychology, I have experienced first-hand the thrill of discovery. As a teacher-scholar, I have shared that experience with students and colleagues. As UMKC's chief academic officer, my mission is to make the process of discovery integral to the education of every student who earns a degree from this university.

I invite you to enjoy this sampling of our many journeys of discovery at UMKC.



nd translational research



Research is one of the hallmarks that distinguish a great university from other institutions of higher education. And yet, the general public's understanding of research is relatively obscure.

Lawrence Dreyfus, Ph.D.

Vice Chancellor for Research and
Economic Development

As a career-long researcher, the inevitable question(s) regarding the nature of my research would periodically arise at family and social gatherings. As a microbial pathogenesis with an expertise in molecular mechanisms of microbial intestinal disease, I would often simply say, “the goal of our efforts is to cure diarrhea.”

Though overly simplified, that one phrase summed up decades of research by numerous scientists investigating the fundamental biology of the effect of a microbial assault on the human intestine, the result of which, often ending in death. Our dream was that the fundamental findings would be

translated into treatments and cures, to relieve suffering and save lives. Though on the “discovery” end of the research continuum, we were nonetheless part of the broader picture of what has become known as translational research: the application of basic discoveries to affect change.

At UMKC researchers from both of our campuses are actively engaged in translational research that will, ultimately, improve the quality of life. These include efforts to: provide cures for genetic, metabolic and infectious diseases; protect our environment; affect social

justice; increase the understanding of human behavior as it relates to health and well-being; develop new materials that improve sustainability; and develop new strategies for financial and national security.

In our first issue of *Explore*, we spotlight the research of some of our talented faculty members. It is particularly rewarding for me to introduce these researchers to you since my office has the unique perspective of seeing firsthand just how dedicated, professional and talented these faculty member are. They truly embody the mission of our Office: *Translating Ideas into Innovation*.

Research for the public good

Researchers find success by applying the techniques of translational methodologies.

If you Google “translational research,” you’ll undoubtedly find flow charts, Venn Diagrams and explanations that attempt to define it.

More simply put, translational research is turning scientific discoveries into new medicines and treatments.

UMKC has built an infrastructure and teams who excel at it: with faculty whose discoveries in health and technology can change lives through collaboration with hospitals and other universities, and through commercialization of intellectual properties, that take new discoveries to the marketplace.

“The time is right at UMKC for translational research to go big,” says Rafia Rasu, an associate professor in the UMKC School of Pharmacy.

Rasu, whose mantra is “you can have a miracle drug, but if no one can afford it, then who will experience the miracle,” performs economic analysis on pharmaceuticals — an important aspect of translational research.

Clinical trials conducted at UMKC are benefitting local residents, such as asthma sufferer David Pamperin.

Inhalers are his constant companion — attacks tend to occur every other day — and cost him hundreds of dollars every few months. Earlier this year when he read an ad for a medicine-free asthma research trial at UMKC, he signed right up.

“I guess you’d call me a severe case,” Pamperin, a FedEx delivery driver says. He has missed work when his wheezing

became unbearable and landed him in the emergency room. “You really can’t do anything else when you have to concentrate on breathing.”

Asthma is a common lung disease that makes breathing difficult for millions of Americans of all ages. In 2011, it was estimated that 25.9 million Americans had asthma, including 7.1 million children.

Pamperin made four months of weekly visits to UMKC, one of 18 American Lung Association Asthma Clinical Research Centers in the U.S. The study, led locally by School of Medicine researcher Gary Salzman, a pulmonologist at Truman Medical Center, is examining whether a safe, non-pharmaceutical device that is used for sleep apnea can also improve asthma.

The device, known commonly as a sleep mask, provides continued positive airway pressure (CPAP), which keeps breathing passages open during sleep to make airways more relaxed.

For the study, clean, humidified air is blown into the lungs in order to prevent airways from collapsing. The chest and lungs are more expanded, helping patients to breathe easier.

Salzman says CPAP treatment has huge potential. “This could improve the lives of millions night and day,” he says.

Pamperin hopes that the research that made his life better can do the same for so many others who live with asthma.

“It gives you more control over your life,” Pamperin says. —*Stacy Downs*

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HEALTH IMPROVEMENTS



► **Dr. Gary Salzman**

Professor of Medicine at the School of Medicine, Pulmonologist at Truman Medical Center and Director of the UMKC Asthma Clinical Research Center

RESEARCH INTERESTS: General pulmonary medicine, asthma and chronic obstructive pulmonary disease, critical care medicine, pulmonary rehabilitation

JOINED UMKC: 1985



► **Rafia Rasu, Ph.D.**

Associate Professor at the School of Pharmacy

RESEARCH INTERESTS: Outcomes research, health services research, pharmacoeconomics, pharmacoepidemiology, economic evaluation of health care intervention, women's health and public health

JOINED UMKC: 2005

ILLUSTRATION: DAVE EAMES

The effects of aging on bone health

Trailblazer's cutting-edge research on bone remodeling has redefined the view of aging joints.

As a promising young scientist, Lynda Bonewald got plenty of advice from researchers with far more experience in the field of bone and mineralized tissue research.

They told her not to waste time on the osteocyte, the most common bone cell. Sure, they were plentiful, she was told, but not influential. All structure, no function. The action in bones took place on the surface, not buried deep in the interior where the osteocytes dwelled.

Powerful microscopes and cutting-edge technologies by Bonewald's group revealed long extensions projecting from osteocyte cells, like the dendrites that connected nerve cells. That implied function, and Bonewald says she was determined to discover what that function was.

Today, decades and millions of dollars in research grants later, Bonewald is one of the leading bone scientists in the world. She leads a team of international researchers at UMKC who are following up promising evidence indicating that osteocytes function in a manner similar to endocrine organs, sending vital coded messages through the musculoskeletal system. Unlocking the remaining secrets of the osteocyte could open the door to treatments and cures for osteoporosis, a disease of low bone mass predisposing to fracture, brittle bone disease and other painful, crippling and often fatal diseases associated with aging.

Thanks to her pioneering efforts, the osteocyte is now the focus of much bone

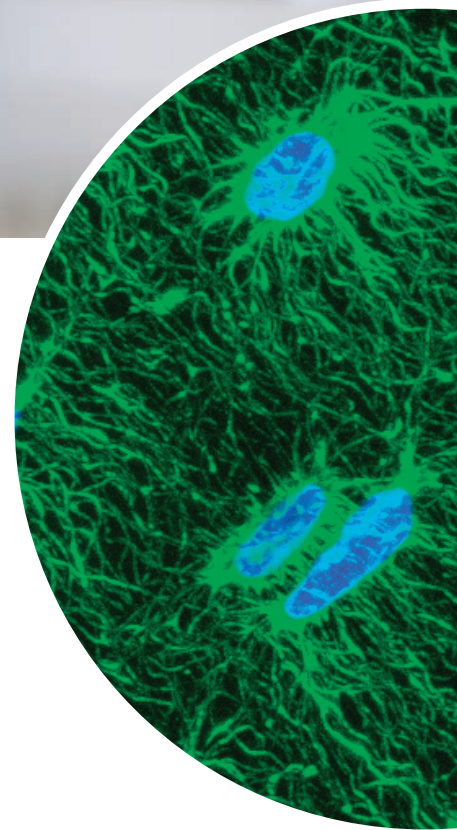
research around the world, a major target for development of therapeutics to prevent bone loss, treat osteoporosis, prevent fractures and accelerate bone healing.

In her current primary project, she is principal investigator for a five-year, \$8.3 million program project grant from the National Institute on Aging, part of the National Institutes of Health, to study the relationship between osteoporosis and sarcopenia (loss of muscle mass) as people age. The research focuses on how bone and muscle cells biochemically communicate with each other in health and disease.

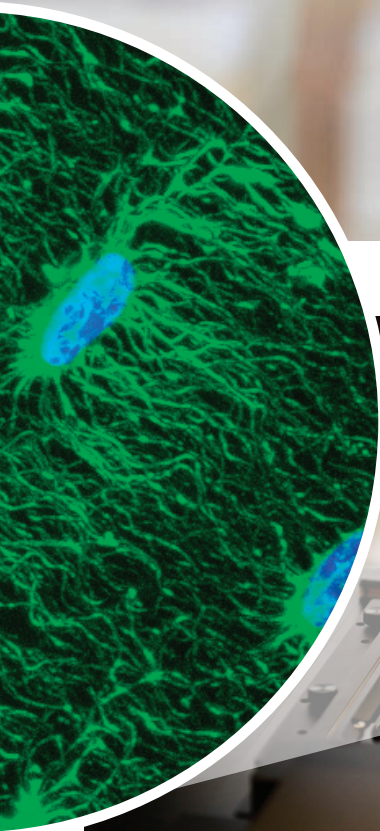
Then there's a "side project" she is working on with her chemistry colleagues: a 21st century bone cement, for use in joint replacement and other surgeries, that represents a potential billion-dollar entrepreneurial opportunity.

"Each year, more than 1 million Americans undergo joint replacement surgeries. As the baby boom generation ages, that figure will increase substantially," Bonewald says. "Those surgeries require the use of bone cement to attach the artificial joint replacement to the surrounding bone. But the cement commonly used for those procedures damages the surrounding bone, causing pain, and requiring additional procedures.

"With our knowledge of bone structure and function, we are developing a new bone cement without these damaging side effects. The new bone cement is a major advance on the bone cement that has been used for over 40 years for hip and knee replacement." —*John Martellaro*



Osteocytes, as seen through a laser imaging microscopic, comprise 90 to 95 percent of all bone cells in adult bone and are the longest living bone cell.



► **Lynda Bonewald, Ph.D.**

Vice Chancellor for Translational and Clinical Research, Curators' Professor, Lee M. and William Lefkowitz Professor, Director of the UMKC Center of Excellence in Dental and Musculoskeletal Tissues and Director of the Bone Biology Research Program at the School of Dentistry

RESEARCH INTEREST: Specializes in osteocyte biology, mechanotransduction and crosstalk with other tissues, specifically muscle

JOINED UMKC: 2001

ACCOMPLISHMENTS:

2006 – Distinguished Scientist Award in Mineralized Tissue recipient
2006 – W.S.S. Jee Remodeling in Bone (RIB) Award recipient
2005 – Named University of Missouri Curator's Professor
2012-13 – President, American Society for Bone and Mineral Research



BOB STECKMEST

Is a glue-like putty the next Gatorade?

University of Florida researchers invented Gatorade, the popular sports drink in 1973. Since then, it's estimated that the Gatorade Trust has earned more than \$150 million in royalties for the university, allowing it to invest in dozens of health research programs.



A marble-sized sample of the new bone cement that Bonewald and her team have developed can solidify into a nearly rock-hard state within 15 minutes. The current cement commonly used for hip replacements or knee replacements has been used for more than 40 years.



► **Dr. John Spertus**

Lauer/Missouri Endowed Chair and Professor of Medicine at the School of Medicine

RESEARCH INTERESTS: Assessing patients' health outcomes, measuring health care quality and the use of information technology

JOINED UMKC: 1996



► **Mary Gerkovich, Ph.D.**

Associate Professor of Biomedical and Health Informatics at the School of Medicine

RESEARCH INTERESTS: Specializes in decisions people make about maintaining positive health behaviors and changing unhealthy health practices

JOINED UMKC: 2005



► **Dr. William E. Lafferty**

Professor and Hicklin Endowed Chair, Office of Health Services and Public Health Outcomes Research at the School of Medicine

RESEARCH INTERESTS: Seeks to balance cost, access and quality of health care in new areas of public interest such as complementary and alternative medicine

JOINED UMKC: 2009





Removing the clinical guesswork

School of Medicine investigators are utilizing outcomes research to control costs and strengthen patient care.

Outcomes researchers at UMKC recognize there is no such thing as one-size-fits-all health care. In an effort to offer more tailored care, thousands of case histories are being analyzed to determine the most effective patient treatments.

These researchers are global experts in bioinformatics — a field that combines computer science and medical science with the goal of elevating patient care and cutting healthcare costs.

“We try to understand what characteristics in patients influence their outcomes,” says Dr. John Spertus, the Lauer/Missouri Endowed Chair and Professor of Medicine at UMKC. “Through intensive interviewing, we capture information about patients such as their health and work histories, social demographics, gender and genetics.”

During medical school, Spertus observed that many patients were tested and treated even when there was no evidence of benefit. “Sometimes there is harm from trying things, and sometimes the risk of treatment exceeds the benefits,” he says.

Spertus’ research isn’t just an exercise in number-crunching. His team is working on ways to integrate their statistical findings into physicians’ general practice for the benefit of ordinary patients.

Although his research focuses on cardiology, all aspects of medicine can benefit from outcomes research, he says.

Another question of interest to UMKC researchers is how outcomes can be improved for patients in underserved urban areas.

Dr. Mary Gerkovich, associate professor of biomedical and health informatics, is researching the circumstances that prevent chronically ill patients served by urban safety-net hospitals from obtaining the care they need. Thus far, extensive patient interviews have revealed that transportation hassles and work schedules interfere with doctor appointments and lab visits, she says.

“Ill patients are in care and then fall out. Eventually they show up in the emergency room if they fall out of care, and we’re trying to prevent that kind of high-cost hospital care,” Gerkovich says.

The data gathered from the Truman Medical Center can be generalized to other urban safety-net hospitals. Although the problem is complex, some solutions may be as simple as providing transportation passes to patients.

Dr. William Lafferty, the Merl and Muriel Hicklin Missouri Endowed Chair of Internal Medicine, leads a study on improving outcomes by increasing diversity in the health care workforce and instituting more diversity awareness in training. The National Institutes of Health grant that funds the project was awarded to the Schools of Dentistry, Medicine, Nursing and Pharmacy.

A goal of the study is to develop evidence-based educational practices that will encourage more health sciences graduates to work in urban areas. “It seemed to fit perfectly with UMKC’s mission, in that one of our goals is to truly serve the community,” Lafferty says. —Gail Borelli

► Jannette Berkley-Patton, Ph.D.

Assistant Professor of Psychology at the College of Arts and Sciences, and Director of the UMKC Community Health Research Group

RESEARCH INTEREST: HIV/STD, diabetes, and heart disease/stroke education, screening and linkage to care interventions in African American churches

JOINED UMKC: 2005

ACCOMPLISHMENT: Received a \$800,000 National Institutes of Health career development grant to focus on HIV testing in American churches in 2008

Received a \$1 million National Institutes of Health grant as co-investigator to focus on building a network of faith, community and health organization partners to address African American health disparities in 2010

Received a \$850,000 National Institutes of Health grant focused on a diabetes, heart disease and stroke intervention in African American churches in 2013

What is a health disparity?

A disproportionate number of health conditions and deaths compared with the general population

African Americans make up 13 percent of the U.S. population ...



... but represent almost half of all new HIV cases.



Health factors affecting African Americans

- Unhealthy housing
- Poor air quality
- Lack of health insurance
- Lack of Influenza immunizations
- Lack of colon cancer screening
- Infant deaths
- Heart disease
- Homicides
- Obesity
- Asthma
- HIV
- Diabetes
- Hypertension

Jannette Berkley-Patton and
the Rev. Eric Williams

4¹/₂

African American
diabetes patients
were 4½ times
more likely to have
diabetes-preventable
hospitalizations
than whites.

—Kansas City area health
disparities report, 2006

Faith in research

Psychology professor works to improve health disparities of African Americans in church-community settings.

A theme of healthy living runs throughout Calvary Temple Baptist Church at 29th and Holmes in Kansas City, a longtime collaborator with the University of Missouri-Kansas City Community Health Research Group. There are stacks of black health magazines, HIV prevention posters and, most profoundly in the Calvary Community Wellness Center, rows of treadmills and elliptical trainers and a rock-climbing wall.

People often ask Calvary's pastor, the Rev. Eric Williams, why this focus on health — at church?

"I've comforted people who have had amputations because of diabetes," Williams says. "I've talked to people on their deathbeds who wish they had exercised more or who wish they hadn't smoked so much. We half-joke that we have funerals for church members, bury them and then come back to the church and eat the food that killed them. Macaroni and cheese, collard greens with ham and fried chicken."

Williams, who once thought exercising was a luxury, practices what he preaches now by making much healthier choices.

African Americans top the charts in nearly every health disparity, says Jannette Berkley-Patton, director of the UMKC Community Health Research Group and assistant professor in the UMKC Department of Psychology. She is the primary investigator of an \$850,000 National Institute of Minority Health and Health Disparities grant that's focusing on African American health disparities in church-community settings.

The KC FAITH Initiative will address diabetes, heart disease and stroke by developing a pilot church-based health intervention study that will include education, screening and linkage to care

strategies. Eleven local churches identified the focus of the initiative through a faith community health needs assessment survey. Six local churches will be involved in the pilot intervention.

"Life expectancy for African Americans is four years shorter than whites, even with all of the medical advances in this country," Berkley-Patton says. "We are working closely with churches to bring about changes in health, particularly for chronic diseases like HIV, STDs, and, more recently, with a focus on diabetes and heart disease and stroke."

..... “
**In recent years,
evidence-based practice
and strategies have made a
difference with HIV and AIDS.**
— Rev. Eric Williams

..... ”
Berkley-Patton also is the principal investigator of a National Institute of Mental Health-funded project, "Taking It to the Pews," to examine religiously-appropriate HIV testing intervention strategies in African American churches. Now close to 30 churches in the Kansas City region — and 10 in Montgomery, Ala. — have used "Taking It to the Pews" toolkit materials and activities that include HIV education and testing strategies that can be infused into their church services.

Calvary Community Outreach Network is co-developer of Taking It to the Pews.

"In recent years, evidence-based practice and strategies have made a difference with HIV and AIDS," Williams says. "Now is the time to do those same things with diabetes, heart disease and stroke." —Stacy Downs

Gut feelings: The effect of food on the brain

Psychology researchers make gut-brain connection to food and obesity.

Drs. Jared and Amanda Bruce are a great team — both inside and outside the academic realm — when it comes to examining the relationship between brain function and health.

This husband and wife duo are using neuroimaging to uncover how the brain responds to various food-related stimuli with the ultimate hope that knowledge from their research can impact two critical components of national health outcomes: decision-making on the individual level, and the marketing that influences those decisions.

The Bruces began collaborating in graduate school at Penn State.

“We co-authored several studies and later worked in the same clinic doing psychotherapy,” Jared says.

Today, Jared serves as associate professor and director of the Clinical Neuropsychology Lab, while Amanda heads UMKC’s Behavioral Rewards and Incentive Networks (B.R.A.I.N.) Lab.

The couple collaborated on an ongoing project with researchers at University of Kansas Medical Center to investigate the implications of bariatric surgery on neural networks and, most recently, had a paper accepted for publication in *Obesity*.

“The bariatric study looks at brain changes in people who’ve lost a significant amount of weight with bariatric surgery versus those who’ve lost weight with behavioral dieting,” Amanda says. “What we discovered is that when shown pictures of food, study participants who’ve lost weight with behavioral dieting showed

increased activity in the prefrontal cortex, which is associated with things we value.”

Amanda’s work in the B.R.A.I.N. Lab also has garnered national attention for its findings on how advertising affects children’s brains. The study found that the brain of obese children respond with less activation than healthy weight children’s brains in areas associated with self-control.

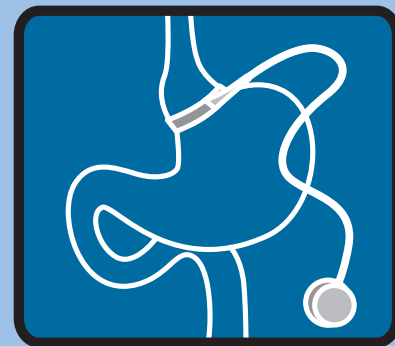
According to Amanda, it raises the question of whether it is ethical to market unhealthy food to children. Many companies already seem to be deciding that it’s not. In 2013, Taco Bell dropped kids’ meals from its menu, and The Walt Disney Co. enacted new regulations to promote healthy eating.

Amanda is now recruiting participants for a study to build upon her research on the neurological effects of food advertising. Her next study will examine brain response to food decision-making in kids. In addition, she is collaborating with food economists at Kansas State and Oklahoma State Universities to examine adult-consumer responses to various types of controversial food technologies.

And while Jared’s brain research niche remains primarily in neurological disorders, he also studies multiple sclerosis and is working with the National Hockey League on preventing, assessing and treating concussions.

Jared and Amanda say they enjoy collaborating formally on the bariatric study and informally on all of their projects. “Teamwork at its best,” he says.

—Chandra Blackwell



BARIATRIC WEIGHT- LOSS VS. DIET WEIGHT-LOSS

THE GOAL:

To examine the neural mechanisms underlying weight loss and how those mechanisms differ according to the method of weight loss.

THE METHOD:

Fifteen obese participants were recruited prior to bariatric surgery and 16 obese participants were recruited prior to a behavioral diet intervention. MRI scans, during which patients were shown a series of food and non-food images, were conducted before and 12 weeks after surgery/behavioral intervention.

THE SURPRISE:

The participants who lost weight via behavioral means showed increased activity in the prefrontal cortex – which is associated with things we value.



► Jared Bruce, Ph.D.

Associate Professor of Psychology at the College of Arts and Sciences

RESEARCH INTERESTS: Health neuropsychology; multiple sclerosis, concussion and obesity

JOINED UMKC: 2007



Top 10 fast-food logos that light up kids' brains

- Dr Pepper
- Pizza Hut
- Coke
- Wendy's
- Cheetos
- Domino's
- McDonald's
- Starbucks
- Taco Bell
- 7-Up

ILLUSTRATION: DAVE EAMES

PEDIATRIC LOGO STUDY

THE GOAL:

To evaluate brain activation in response to common food and nonfood logos in healthy weight and obese children.

THE METHOD:

Ten healthy weight children and 10 obese children underwent MRI scans while viewing food and nonfood logos.

THE SURPRISE:

"We anticipated that brain activity would differ between the healthy-weight and obese children when looking at these logos," says Amanda, "but were surprised by how they differed."



► Amanda Bruce, Ph.D.

Assistant Professor of Psychology at the College of Arts and Sciences

RESEARCH INTERESTS:

Neuroimaging of obesity; childhood obesity and eating behaviors; neuroeconomics and neuromarketing; functional magnetic resonance imaging (fMRI); feeding interventions for medically complicated children

JOINED UMKC: 2009



ILLUSTRATIONS: DAVE EAMES

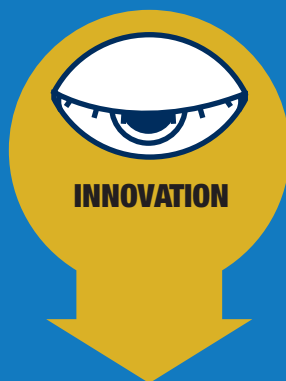
LAB-TO-MARKET: EYE-VEIN BIOMETRICS

Here's how Reza Derakhshani's discovery became a commercial product.



OBSERVATION

Derakhshani and fellow researchers see the growing need to securely access personal information.



INNOVATION

In 2004, both have an idea for eye-vein biometrics, which would allow people to scan the vessels in the white part of their eye.



TURNING POINT

In 2007, the professors are issued a patent for the technology to develop a smartphone app that scans the eye for secure verification.



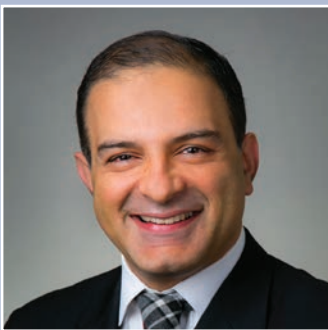
PAYOFF

With the help of the UMKC Innovation Center and the Office of Technology Transfer, the vascular-based biometric technology was commercialized.



Why not a fingerprint scanner?

The main advantage of eyeprints for cell phones is that they do not need additional hardware and work with existing phone cameras, while providing accuracies at least as good as fingerprints. A fingerprint scanner may be easily tricked by a gummy finger, or even carefully pressed Play-Doh.



► Reza Derakhshani, Ph.D.

Associate Professor at the School of Computing and Engineering

RESEARCH INTEREST:

Computational intelligence with applications in biomedical signal and image processing and biometrics

JOINED UMKC: 2004

Eye on security

Researcher capitalizes on the future of smartphone security with vascular imaging of the eye.

Passwords are about to be a thing of the past — and UMKC is showing them the door. The replacement? A mobile app that can identify a person by scanning the vasculature patterns in the whites of his/her eyes. The ramifications are huge. Smartphone users all over the globe could soon use their “eye prints” to unlock accounts and access files.

And it’s all because of a collaboration among UMKC’s Innovation Center, the Office of Technology Transfer and an associate professor in the UMKC School of Computing and Engineering.

Nine years ago, Associate Professor Reza Derakhshani knew he’d hit a major breakthrough. With help from Arun Ross, an associate professor who at the time worked for West Virginia University, and UMKC School of Medicine Associate Professor Rohit Krishna, Derakhshani had created an identification system — one that seemed more likely to have come from a James Bond movie than a laboratory. The then-unnamed technology was notable for the fact that it was nearly foolproof. After all, the vasculature in every person’s eyes is unique. Twins, and even clones, don’t share the same vasculature.

There was just one problem. Derakhshani needed to find a venture capitalist to further develop the technology and direct the new start-up. Enter: UMKC’s Office of Technology Transfer, and UMKC’s Innovation Center. The Office of Technology Transfer immediately began working on patenting, marketing and licensing the technology. Over the years, James Brazeal, director of the Office of Technology Transfer, has been instrumental to this lengthy process.

The Innovation Center, which helps

people start and grow businesses, was able to help with the more unconventional task of finding the perfect CEO.

“We were always waiting for someone to call us with an idea,” says Maria Meyers, Innovation Center director. “But a new grant from the National Sciences Foundation, ‘White Board to Boardroom,’ allowed us to look at the work being done at research institutions like UMKC and pair state-of-the-art research with the right management team.”

Meyers and her team set out on a non-traditional journey. They had the breakthrough technology, but they needed a visionary entrepreneur to take it to the next level. So they created a “CEO want ad,” a brief video that explained the technology and the type of leader they’d want.

At the time, the team imagined that its most practical applications would be in an airport, or maybe even in a casino’s security camera. After all, the technology could read a person’s identity from up to 10 feet away.

Then entrepreneur Toby Rush asked the question, “Can you do this on a cellphone?”

Since then, the company has grown steadily and garnered significant attention, including the 2013 Silicon Prairie Award for Startup of the Year. Recently, EyeVerify beat out eight other finalists from across the globe for a chance to win up to \$1.3 million in funding in the Get in the Ring worldwide entrepreneurial competition.

“There’s great satisfaction of knowing that it’s a cutting-edge technology that has huge benefits beyond what’s already out there,” Meyers says.

The process was a long time coming for Derakhshani, who has worked for years in biometrics. These days, he can say with certainty what’s on the horizon for EyeVerify: “We’re gonna kill the password.” —Kristin Pitts

Nuclear detector

Associate professor develops handheld device to help detect the unexpected threat of terror.

In a small physics lab in Flarsheim Hall, Associate Professor Anthony Caruso and a team of student researchers are close to developing technology that could stop a future nuclear terrorist attack.

Caruso's research, already responsible for attracting more than \$3 million in funding, spinning off one commercial startup and the creation of a new line of products for another, didn't start out to stop a nuclear terror threat.

But that changed when Caruso met a naval research program officer who believed that Caruso's research may improve the ability to detect illicit nuclear material in transit.

"He was dead serious about this mission," Caruso says. "Dead serious."

When the program officer heard about Caruso's portable neutron detection technology research, he saw an application for the Navy: a hand-held device that can detect particles emitted from nuclear material(s) on a ship, pinpoint their location and decipher what isotope they had come from.

The technology Caruso is developing is superior to existing nuclear detection tools on several levels.

The instrument could be light enough to carry; older technology is built using detectors and shapes that are heavy and bulky, anything but portable. It is based on the detection of neutrons, which aren't easily blocked; older technology detected gamma rays only, which can easily be encased in lead or steel and blocked. And it can detect the location of nuclear particles and determine their source.

In 2009 Caruso's team, including

Professor Douglas McGregor from Kansas State University and Professor William Miller from the University of Missouri-Columbia, first began work on a portable nuclear detection device when awarded a grant from the Office of Naval Research. The team later demonstrated that the technology worked with testing at an East Coast naval base.

During the demonstration, the group's spectrometer found and identified all of the nuclear sources that had been hidden in various places around a ship.

"That was a big deal as we had demonstrated the art-of-the-possible," says Caruso, the project's principal investigator.

Now the spectrometer needs to be transformed into a commercial product that can be manufactured and will hold up in real-life situations. Caruso estimates that finish line is still two years away.

A Kansas City-based startup called U2D Inc. has licensed the technology and is working on building the device the Navy may eventually use in the field. Radiation Detection Technologies Inc. in Manhattan, Kan., produces the detectors for the spectrometer and is developing detectors for other commercial applications.

Meanwhile, Caruso's lab at UMKC is working on the next level of this research.

Caruso says the example provided by program officers and scientists at the Office of Naval Research and Naval Research Laboratory enriched his sense of patriotism.

"I busted my butt because I wanted to help solve this mission," Caruso says. "It's a huge deal."

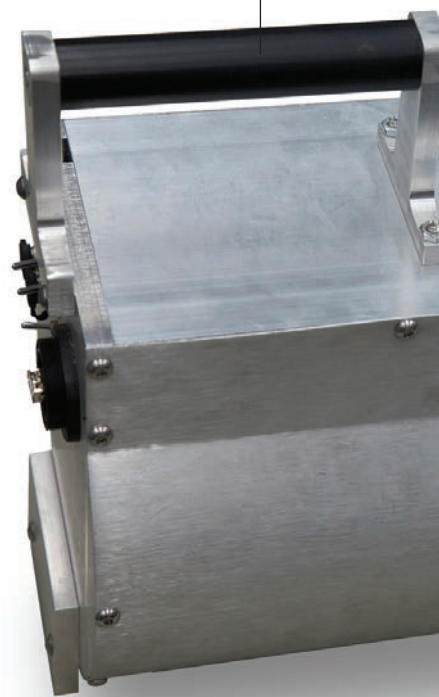
—Suzanne King Raney



JANET ROGERS

THE PORTABILITY:

The 18-pound instrument is lighter and much more efficient than similar instruments currently used by the U.S. Navy.

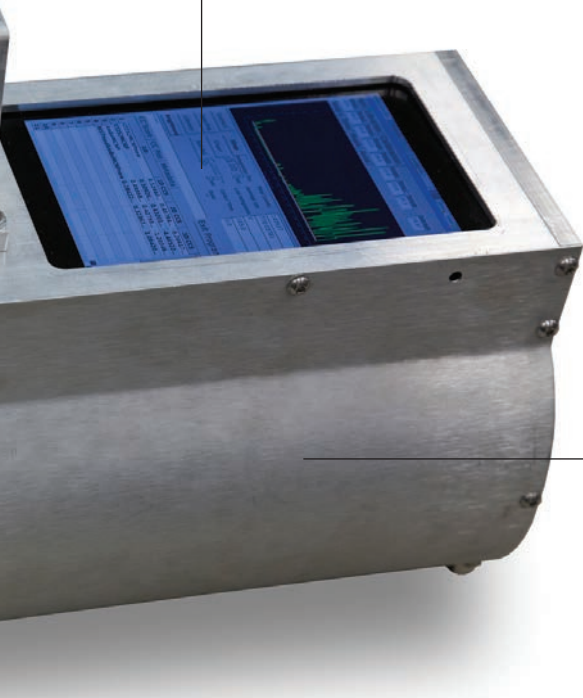




Associate Professor Anthony Caruso (center) analyzes data for the U.S. Navy with graduate students (left to right) Stephan Young, Brent Rogers, Research Associate Joseph Crow and Cory Hoshor.

THE SCREEN:

A Nexus 7 touchscreen pad lets the user manage and process the neutron data collected.



Prototype solid state neutron spectrometer

This third-generation prototype is used to scan and identify neutron-emitting sources.

THE GUTS:

Inside the instrument, 128 individual semiconductor-based neutron detectors are embedded within the same kind of plastic used to make milk jugs.



► Anthony Caruso, Ph.D.

Associate Professor at the College of Arts and Sciences

RESEARCH INTEREST: Studying the relationship between metallicity and magnetism, developing new methods to measure the energy of free neutrons, understanding how electrons move in thin films and finding ways to recover and reuse energy in hybrid-electric vehicles

JOINED UMKC: 2007

► **Kevin McCluskey, Ph.D.**

Research Professor at the School of Biological Sciences, and Curator of the Fungal Genetics Stock Center

RESEARCH INTEREST:

Characterization of classical mutants by complementation and chromosome walking, as well as whole genome sequencing

JOINED UMKC: 2004



Fungal Genetics Stock Center

The Fungal Genetics Stock Center (FGSC), a resource available to the fungal genetics research community and educational and research organizations across the U.S. and the world, was established to preserve strains that were important in genetics research. The FGSC is funded largely by grants from National Science Foundation and to a smaller extent by payments made by researchers who use its services.

1960

Fungal Genetics Stock Center founded at Dartmouth College

2004

Center moves to UMKC's School of Biological Sciences

35

Number of countries that FGSC distributes fungi globally

3

Number of times the FGSC moved before landing at UMKC

250,000

Number of strains that FGSC has distributed since moving to UMKC



JANET ROGERS

Fungal diversity

Researchers explore the potential locked inside the world of fungal genomes.

For UMKC researcher Kevin McCluskey, fungi are more than just simple microorganisms — they are his research emphasis.

“Fungi are interesting because they are an essential part of nutrient cycling in the environment, can cause disease in plants and animals, form symbiotic associations with plants and algae, and are important for the chemical and biotechnology industries as well as pharmaceutical, food and beverage production,” he says.

Today, McCluskey serves as the curator of the Fungal Genetics Stock Center at UMKC and as a research professor at the School of Biological Sciences.

His work with fungi has led to a collaborative project with the U.S. Department of Energy Joint BioEnergy Institute worth up to \$1.2 million. The grant will provide DNA genome sequencing for up to 600 strains of *Neurospora crassa*, a mold species used in classical genetics and also as a model for biofuel development. Collaborators on the grant include Blake Simmons and Scott Baker of the Joint BioEnergy Institute.

“Scientists are looking at new ways of turning plant material into fuel, and *Neurospora crassa* is a model for how microbes can help this process,” McCluskey says. “*Neurospora* can break down some complex sugars and can be used as a research tool to understand how other organisms break down more complex plant material.”

Neurospora crassa is a common plant-associated mold that grows along with sugar cane and other plants and that also grows on bread in open-air bakeries. It was first described as “pink bakery mold” during the Napoleonic Wars. Classical genetic analysis was used to study *Neurospora crassa* beginning in the 1940s. Scientists chose this simple harmless mold for early genetic

studies because it is easy to make mutants and do genetic crosses for study.

With the grant, McCluskey and his collaborators will choose among the

..... “

**Scientists are looking
at new ways of turning
plant material
into fuel.**

— Kevin McCluskey

..... ”

many mutant strains of *Neurospora crassa* in the Fungal Genetics Stock Center at UMKC and grow the samples for DNA production. The DNA is sent to the U.S. Department of Energy Joint Genome Institute in Walnut Creek, Calif., where DNA sequencing is carried out.

DOE provides preliminary analysis, consisting of comparing each DNA sequence against a well-curated “reference” genome DNA sequence. This reference is the same strain that was used to make many of the mutants, which simplifies the process.

“Our community decided to use the same strains in the early 1960s so that we are all comparing apples to apples, as it were,” he says. “When we look at the differences in the new DNA sequence, and then ask if the same difference is found in any of the other strains we are sequencing, we can identify the unique mutation in each individual strain.”

Knowing the sequence of each mutant may be important in enabling researchers to use *Neurospora* as a tool to understand how complex biological processes can be utilized for production of fuel and for processing of food and feed.

—Stacy Downs

2,000

Aspergillus (a genus of several hundred mold species) housed at FGSC

18,000

Neurospora (widely used in genetics for its quick reproduction) strains housed at FGSC

JANET ROGERS

By the Numbers: UMKC Research

Amount UMKC contributes
to Missouri's economy

\$631 million

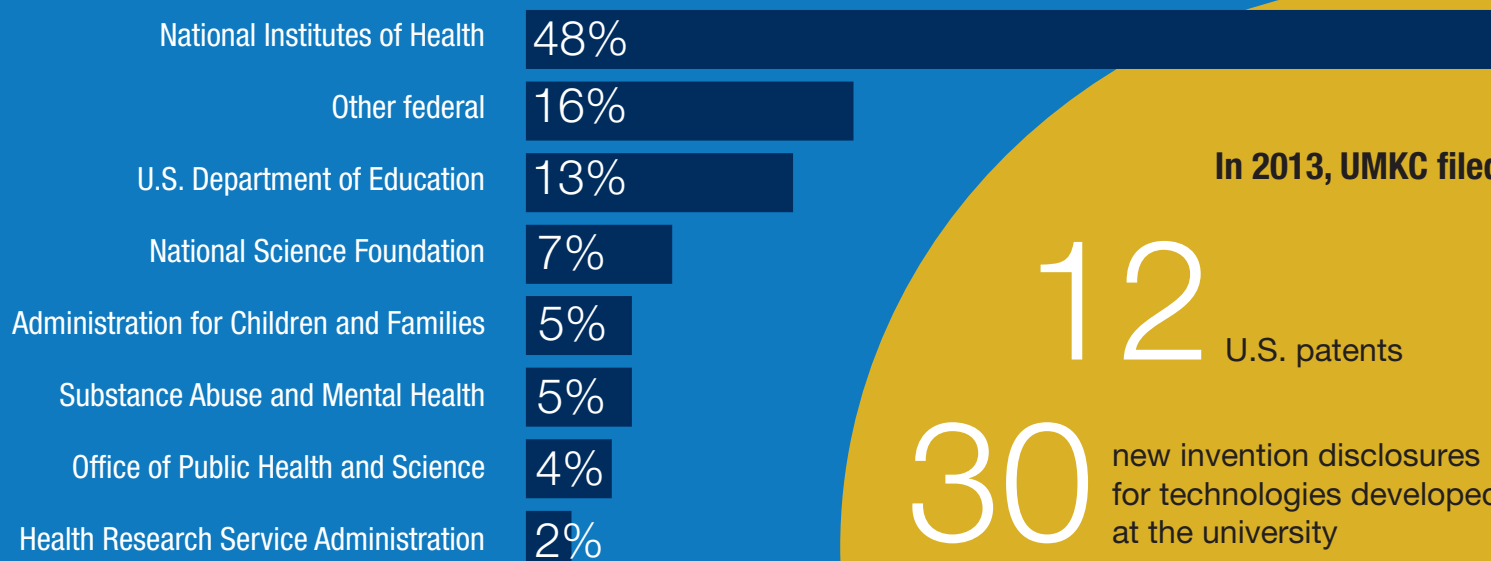
Where \$34 million research support comes from...



...and what it is used for



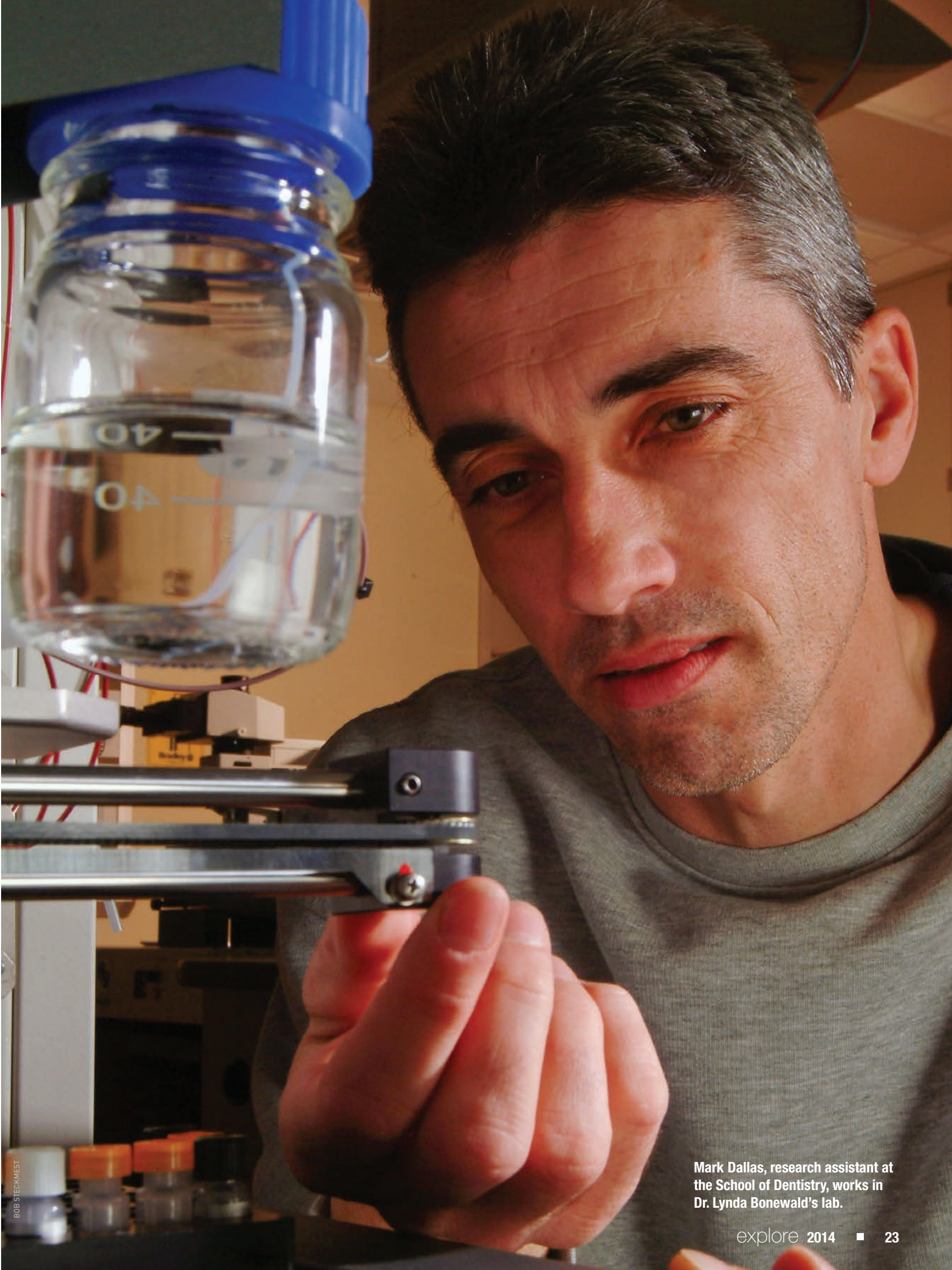
Where the federal research money comes from:



In 2013, UMKC filed...

12 U.S. patents

30 new invention disclosures
for technologies developed
at the university



Mark Dallas, research assistant at the School of Dentistry, works in Dr. Lynda Bonewald's lab.



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Translating Ideas into Innovation

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