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CONSTRUCTION SAFETY

LABS ON THE MOVE

ONE TEST FOR ALL VIRUSES

# Outlook



Washington  
University in St. Louis

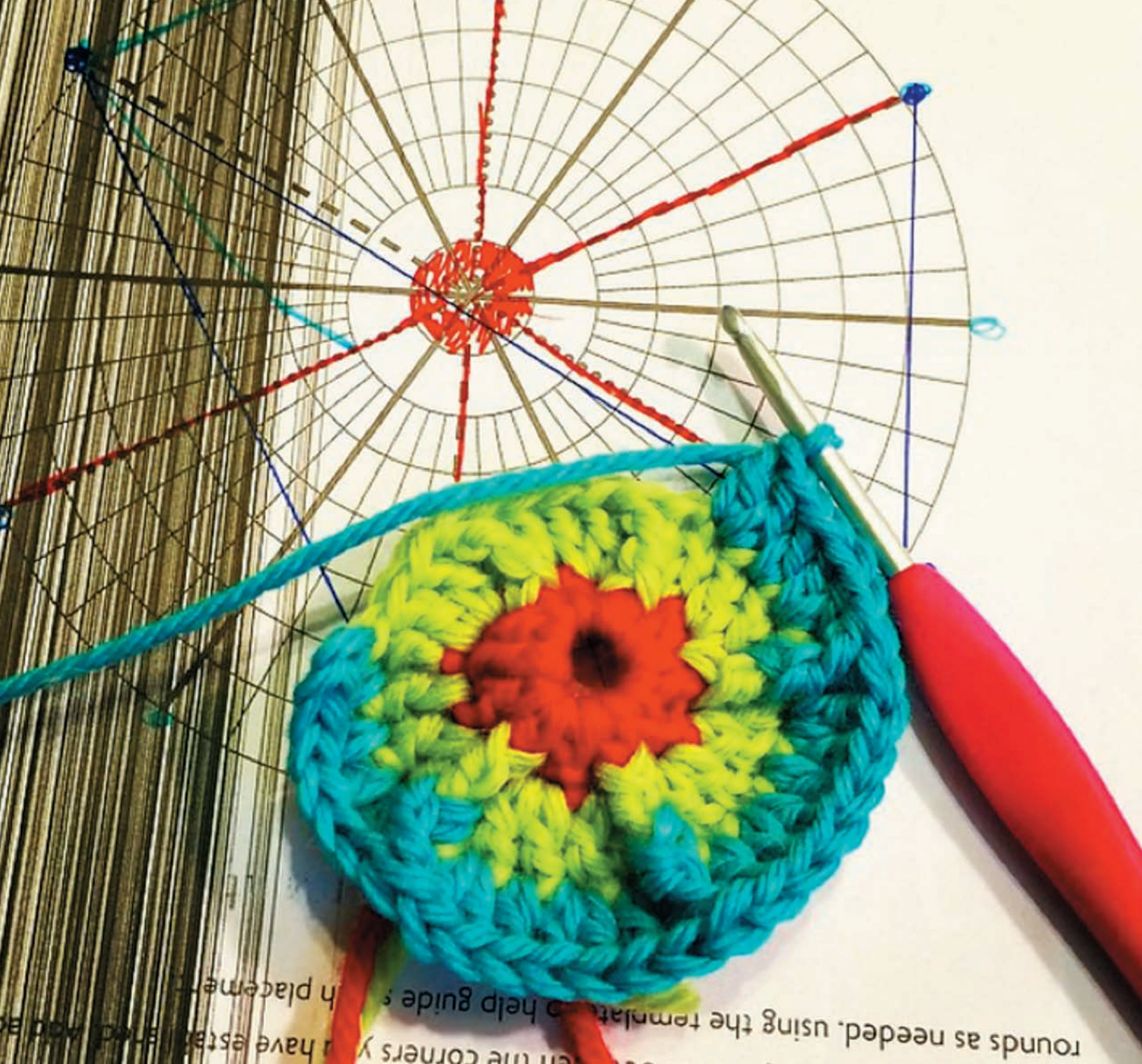
SCHOOL OF MEDICINE

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WINTER 2015-16

## GET YOUR Game On

The biomedical frontier of  
personalized 3-D printing



## Circle of support


Each loop of crocheted yarn is interdependent on another; miss a loop or fray it and the structure becomes unstable. Stroke survivor Lindsay Obermeyer came to appreciate her dependence on caregivers, family and friends. The artist, treated at the Washington University and Barnes-Jewish Stroke & Cerebrovascular Center, became fascinated with the research of Amar Dhand, MD, DPhil, who studies social networks and stroke outcomes. The two began collaborating on ways to artistically visualize the support networks of stroke patients. Obermeyer plans an installation that will include 1,600 crocheted images, the number of stroke patients treated annually at Barnes-Jewish Hospital.

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# Outlook

Washington University School of Medicine

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## Labs on the move

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## Building better health

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## Going viral

22 A test developed at the School of Medicine is capable of detecting virtually any virus that infects people and animals.

**COVER** Living without full use of her hands is normal for Olivia, who developed a rare autoimmune disease as a baby. Researchers recently made Olivia, now almost 5, a powdery-blue mechanical prosthesis decorated with dinosaurs and her name in cursive. 3-D printing allows researchers to customize raw materials to meet specific health needs and, in the process, is heralding a new direction in patient care. See page 10.

PHOTO BY JERRY NAUNHEIM

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ROBERT BOSTON

# Understanding the preemie brain

## Increased risk of neurological and psychiatric issues calls for earlier intervention

**B**abies born prematurely face an increased risk of neurological and psychiatric problems that may be due to weakened connections in brain networks, new research shows.

Studying brain scans from premature and full-term babies, School of Medicine researchers zeroed in on differences in the brain that may underlie such problems.

“The brain is particularly ‘plastic’ very early in life and potentially could be modified by early intervention,” said principal investigator Cynthia E. Rogers, MD, assistant professor of child psychiatry. “We usually can’t begin interventions until after symptoms develop, but what we’re trying to do is develop objective measures of brain

development in preemies that can indicate whether a child is likely to have later problems so that we can intervene with extra support and therapy early on to try to improve outcomes.”

One of every nine infants in the U.S. is born early and, thus, with increased risk of cognitive difficulties, problems with motor skills, attention deficit-hyperactivity disorder, autism spectrum disorders and anxiety.

Rogers, along with senior author Christopher D. Smyser, MD, assistant professor of pediatric neurology, and colleagues in the Washington University Neonatal Development Research Lab, used functional magnetic resonance imaging and diffusion tensor brain imaging to compare 58 babies born at full term with 76 infants born at least 10 weeks early.

The researchers found that some key brain networks — those involved in attention, communication and emotion — were weaker in premature infants.

“We found significant differences in the white matter tracts and abnormalities in brain circuits in the infants born early, compared with those of infants born at full term,” said Rogers, who treats patients at St. Louis Children’s Hospital.

Scans show differences in preemies’ resting-state brain networks, particularly in a pair of networks previously implicated in learning and developmental problems.

Rogers said these brain circuit abnormalities likely contribute to problems that materialize as the children get older. The researchers are continuing to follow the children as they develop over time.

# Pharmacy partnership seeking better meds

St. Louis College of Pharmacy and the School of Medicine are joining forces to find better, safer and more effective ways to use prescription medications to improve health. Researchers from the two institutions are collaborating to create the Center for Clinical Pharmacology.

Initial focus will be on translational and clinical research to better understand and improve pain treatment. The new center will concentrate on how to best use existing drugs to treat pain, as well as on developing and identifying new analgesic drugs and other therapeutic approaches for pain.

About 100 million American adults are affected by chronic pain, more than the total affected by heart disease, cancer and diabetes combined. Tailoring treatments to individual patients is one of the center's goals.

"This collaborative venture between the academic institutions of pharmacy and medicine is unique in the field of clinical pharmacology and a major strength," said new center director Evan D. Kharasch, MD, PhD, the Russell D. and Mary B. Shelden Professor of

Anesthesiology and professor of biochemistry and molecular biophysics at the School of Medicine. "Combining the expertise of both institutions will allow us to develop and deliver on the promises of precision medicine and find the most effective ways to treat individual patients."



St. Louis College of Pharmacy

Researchers also will try to prevent some of the abuse problems associated with pain medications. Prescription opioid analgesics play a role in 17,000 deaths every year in the U.S. Studies estimate that societal costs are more than \$70 billion annually, including health-care costs, costs for lost productivity in the workplace and costs in the criminal justice system. Dependence on opioid painkillers can become a gateway to heroin and other drugs of abuse, Kharasch said.

Also joining the center as co-director is Karen Seibert, PhD. Seibert is a professor of pathology and immunology and of genetics, director of Genomics and Pathology Services and associate director of shared services at the Siteman Cancer Center.



ALLISON BRAUN

**WHEN I'M 64** Today's freshmen have a 50 percent chance of living to see their 100th birthdays. A new course, "When I'm 64," gives Washington University undergraduates a taste of the physical and mental challenges associated with aging. It is co-taught by Susy Stark, PhD, assistant professor of occupational therapy, and faculty in psychology and social work. The goal is to build understanding and highlight career opportunities in working with older people.

## Bhayani named chief medical officer of Washington University Physicians

Sam B. Bhayani, MD, has been appointed chief medical officer (CMO) of the Faculty Practice Plan.

In this newly created position, Bhayani will work closely with James P. Crane, MD, associate vice chancellor for clinical affairs and chief executive officer of the Faculty Practice Plan. The plan, known as Washington University Physicians, ranks among the five largest academic group practices in the U.S.

As CMO, he will work with the medical schools's clinical departments to ensure that services and programs are "best in class" in terms of clinical quality, patient outcomes, patient safety and patient satisfaction.



Sam Bhayani, MD

In partnership with BJC HealthCare, Bhayani also will help design and implement the new, unified electronic patient medical record system. Further, he will facilitate the development of strategies and payment models focused on population health management and value-based health care, and will work with Crane to coordinate and communicate with BJC on systemwide initiatives that affect the plan.



ROBERT BOSTON

**GOING GREEN** First-year medical students volunteered at St. Louis-area gardens to see how community-building efforts can improve patients' health. City Seeds Urban Farm (above) is part of Gateway Greening, a non-profit organization working to sustain green spaces and address urban problems such as limited access to fresh produce.

## Silverman named head of pediatrics

Gary A. Silverman, MD, PhD, has been named the Harriet B. Spoehrer Professor and head of the Department of Pediatrics. With the new appointment, effective in April, Silverman will become pediatrician-in-chief at St. Louis Children's Hospital and executive director of the Children's Discovery Institute, a partnership of the school and hospital.



Gary Silverman, MD, PhD

A highly regarded neonatologist, Silverman comes from the University of Pittsburgh School of Medicine, where he is vice chair for basic research in the school's Department of Pediatrics and at Children's Hospital of Pittsburgh. He also is the Twenty-Five Club Professor of Pediatrics, Cell Biology and Physiology at the medical school and division chief of newborn medicine at Children's Hospital of Pittsburgh and Magee-Womens Hospital. Both hospitals are part of the University of Pittsburgh Medical Center.

Silverman succeeds Alan L. Schwartz, PhD, MD, who has led the department since 1995. Schwartz will remain on the faculty and devote more time to national leadership commitments, mentoring faculty and trainees, and to his research.

# Why parasite makes TB infections worse

Scientists have shown how a parasitic worm infection common in the developing world increases susceptibility to tuberculosis. The study demonstrated that treating for parasites reduces lung damage seen in mice that also are infected with tuberculosis, thereby eliminating the vulnerability to tuberculosis (TB) that the parasite is known to cause.

The study raises the possibility of using inexpensive and widely available anti-parasitic drugs as a preventive measure in places where the parasite and TB are common — stopping infection with the parasite and reducing susceptibility to TB and the risk of a latent TB infection progressing to disease. The research appears in *The Journal of Clinical Investigation*.

“Scientists and doctors have known that having both infections — this parasitic worm and tuberculosis — results in increased susceptibility to severe lung disease than having TB alone,” said Shabaana A. Khader, PhD, associate professor of molecular microbiology. “But if we don't understand why co-infection increases the susceptibility to TB, it is difficult to know how to deal with the situation.” Public health experts estimate that one-third of the world's population is infected with TB.

Most of these infections are not active and cause no symptoms because individuals' immune systems are effective at containing them. According to the researchers, people with latent tuberculosis infections have a 10 percent lifetime risk of developing active TB. And that risk may go up when people are infected with a type of parasitic worm called helminths, which are common in parts of the world where TB is also prevalent.

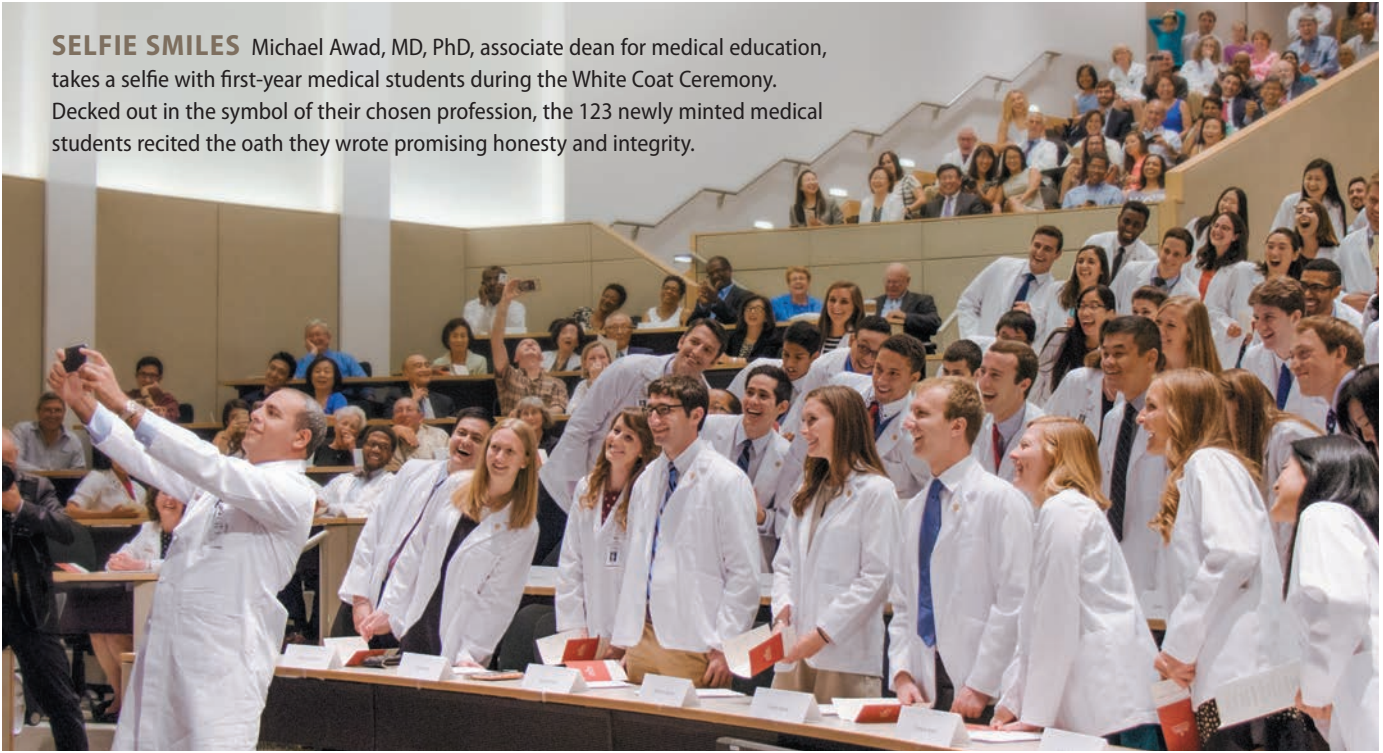


Parasitic worms linked with TB

Khader said that scientists have suspected that the parasitic infection has some way of blocking the protective immune response needed to keep TB in check. But Khader and her colleagues found that something else is going on.

“We showed that the parasite activates a type of immune cell that drives inflammation rather than inhibiting the immune response that protects against active TB,” Khader said. “If you treat the parasite alone in these mice that also have TB, you go back to having the good immunity against TB.”

**SELFIE SMILES** Michael Awad, MD, PhD, associate dean for medical education, takes a selfie with first-year medical students during the White Coat Ceremony. Decked out in the symbol of their chosen profession, the 123 newly minted medical students recited the oath they wrote promising honesty and integrity.



ALLISON BRAUN

## Drug trio beats deadly infection

**T**hree antibiotics that, individually, are not effective against a drug-resistant staph infection can kill the deadly pathogen when combined as a trio, according to new research.

The researchers have killed the bug — methicillin-resistant *Staphylococcus aureus* (MRSA) — in test tubes and laboratory mice, and believe the same three-drug strategy may work in people.

“MRSA infections kill 11,000 people each year in the United States, and the pathogen is considered one of the world’s worst drug-resistant microbes,” said principal investigator Gautam Dantas, PhD, an associate professor of pathology and immunology. “Using the drug combination to treat people has the potential to begin quickly because all three antibiotics are approved by the FDA.”

The drugs — meropenem, piperacillin and tazobactam — are from a class of antibiotics called beta-lactams that has not been effective against MRSA for decades.

Working with collaborators in the microbiology laboratory at Barnes-Jewish Hospital, Dantas’ team tested and genetically analyzed 73 different variants of the MRSA microbe to represent a range of hospital- and community-acquired forms of the pathogen. The researchers treated the MRSA bugs with the drug combination and found that it worked in every case.

Then, in experiments conducted by collaborators at the University of Notre Dame, the team found that the drug combination cured MRSA-infected mice and was as effective against the pathogen as one of the strongest antibiotics on the market.

“Without treatment, these MRSA-infected mice tend to live less than a day, but the three-drug combination cured the mice,” Dantas said. “After the treatment, the mice were thriving.”

Dantas explained that the drugs, which attack the cell wall of bacteria, work in a synergistic manner, meaning they are more effective combined than each alone.



Piperacillin and tazobactam (bottle on left) and meropenem — more effective when used together

The researchers also found that the drugs didn’t produce resistance in MRSA bacteria — an important finding since more and more bacteria are developing resistance to available drugs.

The team is investigating other antibiotics thought to be ineffective against various bacterial pathogens to see if they, too, may work in combination with other drugs.

“We started with MRSA because it’s such a difficult bug to treat,” he said. “But we are optimistic the same type of approach may work against other deadly pathogens, such as *Pseudomonas* and certain virulent forms of *E. coli*.”





ROBERT BOBSON

**TEAM SPIRIT** Once a Cardinal, always a Cardinal. David H. Perlmutter, MD (left), has returned to St. Louis to take over as executive vice chancellor for medical affairs and dean of the School of Medicine. His tenure began Dec. 1. A former Washington University faculty member, Perlmutter succeeds Larry J. Shapiro, MD, who stepped down after leading the medical school for 12 years. Shapiro will continue working at the medical school as the Spencer T. and Ann W. Olin Distinguished University Professor.

## National Academy of Medicine elects Wahl as member

Richard L. Wahl, MD, the Elizabeth E. Mallinckrodt Professor and head of radiology, has been elected to the National Academy of Medicine, formerly known as the Institute of Medicine. Election is considered one of the highest honors in the field of health and medicine in the U.S.

Wahl, also director of the Mallinckrodt Institute of Radiology, was among the first to combine internally delivered radiation therapy for non-Hodgkin's lymphoma with techniques that use the immune system and nuclear medicine imaging to inform and precisely target treatments. The combined approach, now FDA-approved, is known as radioimmunotherapy and is considered one of the first "precision medicine" approaches in human cancer treatment.



Richard Wahl, MD

He has been a leader in introducing and using positron emission tomography (PET) to diagnose a broad array of cancers and other diseases.

Wahl also is at the forefront of efforts to combine quantitative data from PET scans with CT and MRI to form "fusion" images that can help physicians more precisely diagnose and characterize cancers.

## Painkiller abusers use cheap, available heroin

Drug abusers are not completely abandoning prescription opioids for heroin. Instead, many use the two concurrently based on their availability, according to a survey of 15,000 patients at drug-treatment centers in 49 states.

The findings also reveal regional variations in the use of heroin and prescription painkillers. "On the East and West coasts, combined heroin and prescription drug use has surpassed the exclusive use of prescription opioids," said senior investigator Theodore J. Cicero, PhD. "This trend is less apparent in the Midwest, and in the Deep South, we saw a persistent use of prescription drugs — but not much heroin."

Across the country in 2014, almost 42 percent of drug users in treatment reported they had taken heroin and prescription painkillers within a month of entering treatment, up from 23.6 percent in 2008, the researchers found. "We see very few people transition completely from prescription opioids to heroin; rather, they use both drugs," he said. "There's not a total transition to heroin, I think, because of concerns about becoming a stereotypical drug addict."

A professor of neuropharmacology in psychiatry, Cicero said that although heroin has spread beyond inner cities into suburban and rural areas, many users still associate the drug with junkies they've seen depicted in movies and on television.



"People used to tell us quite often, 'At least I'm not using heroin,' when we asked about their drug abuse," Cicero said. "But in recent years, many have come to ignore that aversion, both because heroin is cheaper and accessible and because they've seen friends and neighbors use heroin."

Cicero's team conducted anonymous surveys when users entered drug treatment, asking about drugs of choice and patterns of use and abuse. Survey takers also had the option of giving up their anonymity to answer more detailed questions about their drug use. The study included detailed data from 267 such patients. Of them, 129 reported they had abused prescription opioids prior to heroin, and 73 percent cited factors such as cost and accessibility when explaining why they began using heroin.

The federal government's push to shut down "pill mills" and doctors illegally prescribing painkillers has made it harder to get prescription painkillers, Cicero said.

# LABS on the move

**Opening of research  
facility signals new era  
in collaborative science**

# 4515 MCKINLEY



Central stairwell

ERIC YOUNG

**A** new building dedicated to interdisciplinary research on some of the most complex problems in human biology is now open on the Medical Campus. The collaborative, state-of-the-art environment will support rapidly changing scientific techniques and the explosive advancement of genetics and genomics.

The six-story facility brings together groups of investigators and adds 138,000 square feet of highly flexible, open labs.

Designed for LEED Silver certification, the \$81.1-million building replaces some of the older, less efficient research lab spaces. Built for investigator comfort, labs in the building conveniently are located adjacent to office space, separated only by glass walls. This gives researchers the flexibility to step away, take notes, make journal entries, or even have a snack, while still monitoring activities on the bench. Communal spaces, like conference rooms, kitchens and break areas, are centralized and easily accessible.

To encourage cross-disciplinary dialogue, the design also incorporates “neighborhoods” on each floor — where researchers working on dissimilar projects might be gathered into smaller clusters. In one large lab, for example, researchers studying male infertility will work alongside scientists investigating autism and others studying diabetes and metabolism, all in mice.

Researchers making the move include those from: the Department of Genetics; the Center for Genome Sciences & Systems Biology; the Division of Oncology in the Department of Medicine; the Center for Regenerative Medicine in the Department of Developmental Biology; and Mallinckrodt Institute of Radiology’s (MIR) Optical Radiology Lab and Molecular Imaging Center. Until now, the 16 faculty members in the genetics department have been working in six different locations.

#### **The building will house two new centers:**

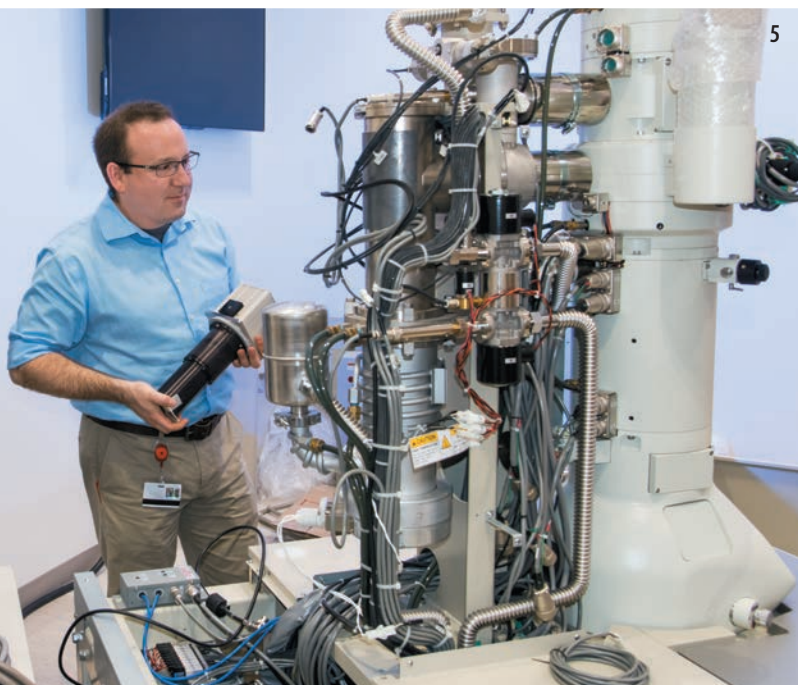
**The Center for Multiple Myeloma Nanotherapy**, also part of MIR, will develop therapies for multiple myeloma, a cancer of immune cells in bone marrow. The National Cancer Institute awarded \$13.7 million in research support.

**The Center for Cellular Imaging**, established by the departments of Anatomy and Neurobiology and of Cell Biology & Physiology, will serve as a shared technology resource for the medical school community. The center will facilitate the use of multi-scale cellular imaging technologies to investigate, at unprecedented resolution, the 3-D structure and dynamic behavior of biological systems. ☐

ROBERT BOSTON



- 1 Work/study carrels adjoin labs
- 2 Collaborative social spaces
- 3 Benches ready for research
- 4 Central corridors connect all spaces
- 5 Microscopy lab setup
- 6 Unpacking boxes upon boxes



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yet affordable  
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# Lending a hand

DETACHED PROSTHETIC LIMBS in pink and blue add flare to a colorless scene of Bunsen burners and beakers, microscopes and magnifiers, computers and chemicals sprawling inside the Minimally Invasive Surgery (MIS) Biomaterials Laboratory at Washington University School of Medicine.

But the lab's superstar — a desktop 3-D printer — appears nondescript, a big black box of a wallflower, a device resembling a microwave both in its appearance and in its revolutionary potential to transform an

industry. The powerhouse prints three-dimensional body parts, including the prosthetic hands and arms in bubble-gum pink and baby-boy blue. The tool allows researchers to shape raw materials to meet specific health needs and, in the process, is heralding a new direction in patient care.

Globally, the medical industry is experimenting with 3-D printers to treat patients, tailor-making everything from skull fragments to fingers and teeth to heart valves and stents. Scientists, including those at the School of Medicine, also have ventured into the field of regenerative medicine by printing structures from living cells instead of inorganic materials. The ultimate goal in the medical field is to print a patient's own cells, for instance, to regrow complex nerves after an injury or to create implantable organs for transplant patients that could eliminate waiting lists and organ rejection.

**BY KRISTINA SAUERWEIN**



Not-quite-5-year-old Olivia repays her priceless gift with a hug for biomedical engineering student Savannah Est, a member of the research team that designed and fabricated Olivia's new mechanical hand.



At the MIS lab, physicians, scientists and engineering students have carved a niche in 3-D printing: Producing prosthetic arms and hands for children who have lost limbs due to disease or accidental injury. The team's efforts have attracted a lot of media attention since pediatric patients typically are poor candidates for traditional prostheses, mainly because fitted prostheses can cost tens of thousands of dollars and need frequent resizing and replacement to keep pace with a child's growth. By comparison, materials for a 3-D printed prosthesis can cost a few hundred dollars.

"The possibilities with 3-D printing in health care have the power to revolutionize medicine," said Charles Goldfarb, MD, chief of orthopedic surgery at St. Louis Children's Hospital, who works closely with patients to determine eligibility for prostheses. "It's exciting."

**S**ydney Kendall received a pink robotic arm seven years after she lost her right arm, just below the elbow, in an accident involving a jet ski, boat and rampant rope at the Lake of the Ozarks in central Missouri. Sydney, who lives in suburban St. Louis, was 6 years old at the time, in kindergarten, and, after having just mastered how to print her name, had to re-learn how to write with her left hand. The stares, pointing, awkward and sometimes rude comments thickened her skin during a life stage often marked by innate innocence.

The robotic arm, humorously named "Pinky," arrived with fanfare during Sydney's last year of middle school, in May 2014, when she was 13 and in the eighth grade. Powered by a nine-volt battery, the pink prosthesis used a microchip and motion-detecting sensor on Sydney's shoulder to activate fingers, including independent thumb movement, restoring her ability to throw a ball or move a computer mouse with her right limb.

News media big and small spotlighted Sydney and her pink prosthesis, which looked both primitive and futuristic, a long plastic tube with five spindly mechanical fingers, novel in its ability to help a child amputee regain hand and arm function.

Sydney's classmates called her famous.

Designed by three Washington University seniors studying biomedical engineering and in collaboration with Shriners Hospitals for Children St. Louis and School of Medicine physicians such as Goldfarb who provided medical expertise, the pink prosthesis cost approximately \$200 in materials and took less than a week to print. “My robotic arm was popular, and it made some things easier,” Sydney said, “but, honestly, I had grown used to doing things with my left hand and sometimes it was easier not to wear it.”

Sydney also found the wire connecting the shoulder sensor to the prosthesis cumbersome and inconvenient.

Neither Sydney, her parents nor the three undergraduate students who initially fabricated the prosthesis expected perfection. Quite the opposite. It was the students’ first attempt at a pediatric robotic arm, and it wasn’t as if a successful prototype existed elsewhere. When the MIS team got involved with the project, the prosthesis impressed the scientists; however, they knew they could make improvements. “We wanted to hear what worked and what did not,” said Dominic (Nick) Thompson Jr., a School of Medicine staff scientist who is leading MIS efforts to create pediatric prostheses. “Our goal is to do whatever it takes, for however long, to help kids.”

Based on the family’s feedback, Thompson and two Washington University biomedical engineering undergraduates working in the MIS lab — Nabeel Chowdhury and Savannah Est — created a second prosthetic arm for Sydney that offered a wider range of wrist movement. Sydney controls its functions through myoelectric technology that uses electrodes to read the surface electrical current generated when her arm muscles contract.

She received her new hand late last summer, just in time for her first day of high school.

The prosthetic boasts fancy monogrammed initials and a blue hue because, Sydney said, “I got tired of everyone thinking pink was my favorite color.” Perhaps an even bigger bonus for the teenager: She can hold a cell phone with the prosthetic hand and type with the other.

Not bad for the lab’s bulky 3-D printer that is two years old and initially cost \$2,500.

American engineer and physicist Charles Hull developed 3-D printing — officially called stereolithography — during the 1980s for manufacturing purposes, according to the National Inventors Hall of Fame. However, as technology advanced, materials improved and the cost of both decreased significantly during the past few years, 3-D



Fabricating custom prostheses has been a learning process for patients and researchers. Charles Goldfarb, MD, evaluates Sydney Kendall, now using her second robotic hand.

printing has become the darling of the medical and bioengineering industries.

A 3-D printer works similar to an inkjet printer, Thompson said, but instead of ink printing letters and numbers, a 3-D printer uses spools of plastic filament as “ink.” The plastic is heated and extruded by the 3-D printer to form layers to create 3-D models designed by researchers using computer design software.

Although Sydney’s second prosthesis offered significant improvement in aesthetics and weight, it still had issues. The grip strength of the prosthesis, for example, needed to be stronger to allow Sydney to perform additional activities. “Her feedback is invaluable,” Thompson said, “because it brings us closer to creating a problem-free prosthesis.”

Chowdhury, the biomedical research engineering major, is devising plans for a third prosthesis for Sydney. He plans to earn combined MD/PhD degrees because he wants to specialize in 3-D pediatric prostheses. “The need is great,” said Chowdhury, who envisions the low-cost limbs as options to help disabled children from low-income areas both in the U.S. and abroad.





JERRY WALUNHEIM

Evaluating her new mechanical arm, Olivia consults with her research team: (from left) Savannah Est, Nabeel Chowdhury and Nick Thompson.

Living without full use of her hands is normal for Olivia. Although she was born healthy, by four months of age she mysteriously developed a rare autoimmune disease — Infantile Polyarteritis Nodosa/Atypical Kawasaki — that inflamed her blood vessels and caused multiple life-threatening aneurysms. To restore blood flow and prevent infections, School of Medicine surgeons amputated Olivia’s right hand, the fingers from her left hand and part of her right foot.

Almost 5 years old, Olivia walks normally and her foot is unnoticeable with shoes. Her hands, however, proved more challenging. Over the years, she has perfected using her teeth (or her knees) to steady objects, and uses her partial left hand and her right wrist to grasp crayons or drinking cups.

“I do things different than my sisters,” said Olivia, the second youngest of five sisters living in Southern Illinois. “My mom says that’s OK.”

Despite her impressive ability to adapt without hands, surgeons removed part of a bone in her left hand to encourage a squeezing motion. For her

right hand, the MIS lab’s Thompson, Chowdhury and Est made Olivia a powdery-blue mechanical prosthesis decorated with dinosaurs and her name in cursive.

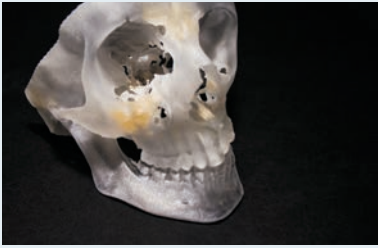
A mini-cable system in the mechanical hand operates with the flex of Olivia’s wrist.

“Look at me, look at me,” Olivia shouted in the lab last fall when she received her prosthesis. The brown-haired precocious preschooler practiced one-handed maneuvers such as throwing a foam ball and holding a cup.

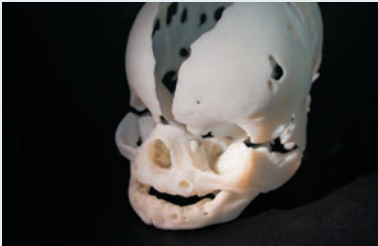
Her beaming brightness and obvious self-pride inspired a scientist’s eyes to mist.

But all wasn’t perfect. After a few minutes wearing her prosthetic hand, Olivia dissolved in frustration. Her arm muscles lacked the strength to sustain movement in the mechanical hand. The scientists noted possible modifications for easier, prolonged movement and promised Olivia another hand.

Est bent down toward Olivia’s level and said, “One day, you’ll be able to print your own hand yourself.”



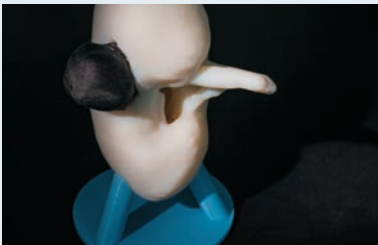
Surgical construction of an adult skull



Rendering of a pediatric patient's skull



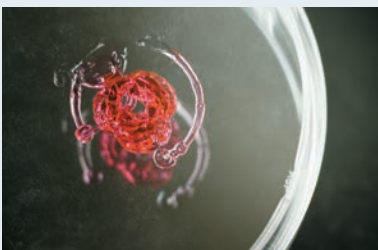
Model of an aorta



Model of a patient's kidney with tumor



Uterus and cervix disassembled for study



Experimental modeling of aortic valve

# Charting the 3-D frontier

**T**he Minimally Invasive Surgery Biomaterials Lab and the Division of Plastic and Reconstructive Surgery are collaborating on a growing list of 3-D printing innovations.

"There is tremendous excitement at Washington University and other universities about devising medical applications for 3-D printing," said L. Michael Brunt, MD, chair of the MIS lab and a professor of surgery. "Hardly a day goes by that I don't hear of something new."

Two years ago, the lab became involved in 3-D printing to design and fabricate hernia surgical mesh. As interest grew, so did the opportunities.

MIS scientists have ventured into creating plastic organs such as kidneys and uteruses for surgical training tools as well as developing techniques for bio-printing, in which living cells are used to form structures.

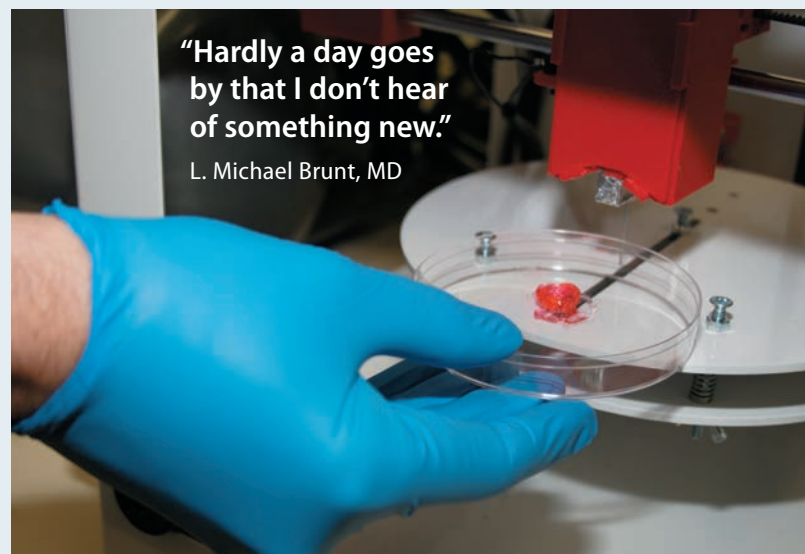
Anatomical models printed directly from CT scans allow physicians to evaluate patients with extraordinary precision, said Albert S. Woo, MD, associate professor in plastic and reconstructive surgery, who is leading many

**Learn more about the lab's 3-D design and printing services: [wuimis.wustl.edu](http://wuimis.wustl.edu)**

of the university's innovations in 3-D printing. As director of the Cleft Palate and Craniofacial Institute at St. Louis Children's Hospital, Woo can correct facial deformities using parts produced on his department's 3-D printer.

Another benefit is the potential for reduced costs. Traditional robotic limbs can cost between \$50,000 to \$70,000. Materials for a 3-D prosthesis hover closer to \$200. But price comparisons can be misleading: Pediatric limbs cost a few hundred dollars in materials but that doesn't include scientists' labor or capital investments, with some 3-D printers running as high as \$350,000.

The medical school has only a few 3-D printers; both Brunt and Woo emphasized the need for more to stay at the forefront. "Three-dimensional printing in the medical field is in its infancy," Woo said. "It's exploding with opportunities and transforming health care." □



**"Hardly a day goes by that I don't hear of something new."**

L. Michael Brunt, MD

ERIC YOUNG

The aortic valve, created using hydrogel, is a first step toward printing with living cells.



# Building better

# HEALTH

Keeping the toughest jobs safe requires boots-on-the-ground research and a can-do company attitude. A campus building project is putting these ideas in motion.

BY DEB PARKER

**SUCK IT UP.** When it comes to chronic injuries, that's been the mantra in the macho, male-dominated, highly competitive culture of commercial construction. However, industry experts and younger generations of construction workers are realizing that attitudes and behaviors must change for safety to improve.

The sector has made major strides in reducing acute injuries from construction-site accidents. Less attention has been placed on preventing musculoskeletal injuries caused by force, repetition, awkward posture and overexertion. The costs are great, both to the company and the individual.

Such injuries make workers less effective, potentially more dangerous, and often result in prolonged absences and early retirement.

Is it possible to modify these physically demanding jobs? And, if so, what's the most effective way to reach millions of front-line workers?



ROBERT BOSTON

As it turns out, St. Louis is the perfect backdrop to find the answers; it is home not only to offices of the safety-conscious Clayco, a national innovator in the design-build industry, but also to School of Medicine occupational health experts who are among a handful of researchers worldwide dedicated to measuring and improving the safety climate in construction.

Together, the medical school team and Clayco won a \$1 million, five-year grant from the National Institute of Occupational Safety and Health and the CPWR Center for Construction Research and Training. Through this, an on-campus building project is serving as a research lab of a different sort.

Now, as tradespeople labor on Mid-Campus Center, an administrative building for the medical school and Barnes-Jewish and St. Louis Children's hospitals, the researchers methodically observe. The hope is that the resulting recommendations will be adopted into construction safety management systems around the country.

Headed by Bradley A. Evanoff, MD, the Richard A. and Elizabeth Henby Sutter Professor of Occupational, Industrial and Environmental Medicine and director of the Division of General Medical Sciences, the team conducts research on improving health and decreasing disability among working populations.

Over the past 20 years, the researchers have embarked on a wide range of studies: smoking cessation among blue-collar workers; carpal tunnel syndrome; welding exposures; back injuries in health-care professionals;

## THE GOAL

### National impact in construction safety

and obesity intervention programs in the workplace. These community-based studies often have involved recruiting large numbers of employees and cooperating closely with employers and labor unions.

One such study focused on fall prevention in residential construction. The team's Vicki Kaskutas, OTR/L, OTD, helped the St. Louis Carpenters Joint Apprenticeship Program improve training, adding a mock house showcasing safety equipment and a dummy to demonstrate fall arrest gear. (Later, the Occupational Health and Safety Administration hailed Kaskutas' website cataloging 150 fall prevention devices as the most comprehensive resource of its type.) John Gaal, EdD, of the Carpenters' District Council of Greater St. Louis & Vicinity, said that the house mock-up and its fall demonstrations became "the world model to teach fall protection." He added: "Until you have a tier-one institution like Washington University doing this research, industry won't listen. There is no doubt that we are safer now."

Eventually, researchers turned their attention to commercial construction workers, who face myriad risks in ever-changing, complex environments.

## A DEADLY FOUR, PLUS ONE

Years ago, OSHA identified the four leading causes of fatalities in construction. These are known as the Focus Four: electrical, struck-by, caught-in-between and falls.

An OSHA training course educates workers on how to avoid such dangers, and these four categories are the primary focus during federal inspections of construction sites. Because of sustained attention at multiple organizational levels, these hazards have been significantly reduced.

However, musculoskeletal injuries — low back pain, knee injuries, tendonitis, torn rotator cuffs and carpal tunnel syndrome — remain commonplace. Many construction-related tasks push the human body beyond its natural limits as workers lift heavy materials, hold vibrating equipment, apply force, bend, kneel, twist, grip and reach overhead.

School of Medicine researchers suggest adding one more important area of emphasis: ergonomics.

The science of ergonomics examines the relation between workers and their environments. This approach identifies uncomfortable or difficult tasks and seeks practical, adaptive solutions for improvement. The goal is to make sure workers stay safe, comfortable and productive.

Traditionally, ergonomics programs have been viewed as an add-on to safety programs, lacking the management support and commitment necessary to bring about changes in behavior and work design.

“Reducing chronic injuries has taken a backseat to acute injuries,” Evanoff said. “For good reason. Acute injuries cause many fatalities. Chronic injuries are just accepted as part of the job. We want to know — are there ways to keep productivity up, without beating the body up in the process? Can we do a better job of affecting chronic disease?”

## THE CHALLENGE

Construction work pushes the human body to its limits, and beyond



ROBERT BOSTON

At the Mid-Campus Center construction site, Hector Lozoya, senior safety engineer for Clayco, discusses progress with occupational health researcher Brad Evanoff, MD.



## THE INDIVIDUAL WORKER

In earlier studies, principal investigator Ann Marie Dale, PhD, research assistant professor of medicine and occupational therapy, learned that individual construction workers, while willing to adapt, lacked the power to change the culture.

Over a five-year period, the team worked with seven different subcontractors on job sites. There, they observed sheet metal workers, floor layers, carpenters and other tradespeople in action, photographed their activities and engaged in dialogue. Each week, Dale participated in “tool-box talks” to discuss improving ergonomics. The team also created sets of laminated safety cards. Bound to carabineers for quick, easy access, these card sets gave tips on how to lift properly, minimize vibration and choose hand tools.

As Dale built trust within St. Louis construction trades, she began evaluating the effectiveness of participatory ergonomics — leveraging worker experience to identify and correct factors that negatively affect health. After training, workers improved the safety and healthfulness of their work by trying new tools and changing the way they performed tasks. For example, floor layers proposed using an extended handle on spray cans to reduce the time spent kneeling. Dale also realized that a construction worker is more likely to invest in a safer hand tool than a subcontractor is to purchase a safety device or service a lift to keep it operating safely.

In a remodeling project, workers were removing old carpet from classrooms. Sometimes workers pulled carpet by hand; other times they used an automatic puller. The device required significantly less hand force, but, as several workers were performing this task at different sites, its availability depended upon coordination with management.

“What we found is that construction workers don’t have enough control over their environment,” said Dale, who is triple-certified in ergonomics, occupational therapy and hand therapy. She realized she needed to go higher in the organization.

“Workers made changes, but not enough to reduce symptoms. Giving knowledge is not enough. Construction managers such as Clayco define the safety of the workplace. They can require safe practices from their subcontractors, so they can have the greatest influence on worker safety.”



Onsite dialogue and observation have proven critical for understanding the constantly changing construction environment. Ann Marie Dale, PhD, queries Bob Hohman and Scott Sams.

## THE SYSTEM LEVEL

About the same time Dale was working to secure grant funding for a project involving a construction manager, Clayco was looking for ways to better integrate ergonomics into its safety program. “Clayco recently added overexertion as its fifth focus area, but, as a company, we hadn’t yet put structure around it,” said Todd Friis, vice president of risk management at Clayco, who regularly conducts safety audits at about 30 job sites across the country.

The team now is studying how the safety climate set by a construction manager affects the behavior and attitudes of subcontractors and their employees. “We know that some subcontractors improve their safety procedures to qualify for work with safety-conscious construction managers,” Dale said. “We’re trying to see if such changes persist and how they happen, and whether the safety requirements of the larger construction managers help shape the regional safety culture among smaller contractors.”

Team members regularly visit the Mid-Campus Center site, recording current practices and assessing safety knowledge among workers.

Walking about the site, Dale makes comments: “That piece of equipment is too heavy for that worker. If that task was being performed at waist-level instead of on the ground, he wouldn’t have to strain so much.”

“We are giving them our eyes ... what’s good and bad related to ergonomics,” Dale added. “Our role is to build into their safety program so they can use that knowledge every day.”

Researchers attend the morning huddles, which include a mix of safety information and warm-up exercises. “The huddles set the tone,” Friis explained. “Every day we ask, ‘What are the risks today based on my scope of work? What do I need to mitigate?’”

Remaining cognizant of tight production schedules, the research team is gaining information from the workers, both through on-site interaction and surveys.

“The survey questions are clever,” Friis said. “One question asks whether the worker has ever been hurt by overexertion. And, of course, most answer no. Another question asks whether a partner or buddy has ever been injured. And, of course, they all answer yes. They may not say it about themselves, but they’ll say it about a buddy ... injuries that, up until now, haven’t come to the surface.”

Direct feedback from workers is crucial, Evanoff said. “It’s truly been a participatory model. We can come in and see hazards, but to make changes, we need the day-to-day collaboration. They’re the ones with the deep knowledge. Describing the risk factors, in retrospect, is the easy part. How to reduce risk factors in a complicated, dangerous, dynamic environment — that’s the tough part. It takes a deep understanding of what the work is like.”

Researchers also participate in Clayco’s weekly planning meeting, talking through the next phases of construction. Their questions are specific: How are you going to transport that rebar? How are workers lifting those panels? Ergonomics is about anticipating all the steps and putting the best tools and equipment in place beforehand.

In addition, the researchers are reviewing Clayco’s monthly safety dashboards, which list total reported injuries and their causes. “It’s full disclosure,” Friis said. “It’s like looking in our sock drawer.”

## THE CHANGE

Reducing risk requires a deep understanding of the work that can only come from the workers

## A MODEL TO EMULATE

In the end, the researchers will propose ideas to benefit workers and help eliminate soft-tissue injuries. Clayco will decide which changes to adopt as part of an enhanced safety and ergonomics program.

“In the next months, this will move from observation to tactical implementation,” Friis said. “That’s been the real differentiator here. This isn’t someone sitting at a computer running reports, but researchers who are interacting in the field.”

Friis credits Dale as someone with “the right skill level and temperament to work with our guys. She has spent a lot of time in the field and it comes across.”

Dale, co-chair of the building and construction committee for the International Ergonomics Association, travels globally to network and share knowledge with a small niche of likeminded researchers.

“For Clayco, it’s been great to partner with such passionate people as we consider how to enhance our program,” Friis said. “The enthusiasm rubs off on our guys. And it keeps them on their toes. Here are people with PhDs evaluating and assessing our programs.”

“All the guys are talking about it,” said Hector Lozoya, Clayco senior safety engineer. “It will be very interesting to see what they find, what their recommendations are and how it will affect productivity. Are big companies willing to make the changes?”

Recently, Clayco CEO Bob Clark temporarily halted operations at the site when he spotted something he thought was unsafe.

Lozoya recalled: “Some of the guys were worried about deadlines and kind of grumbling. I said, ‘Let’s not look at it that way. You are working for an owner that’s concerned about your safety. Everyone’s going to go home at the end of the day.’”

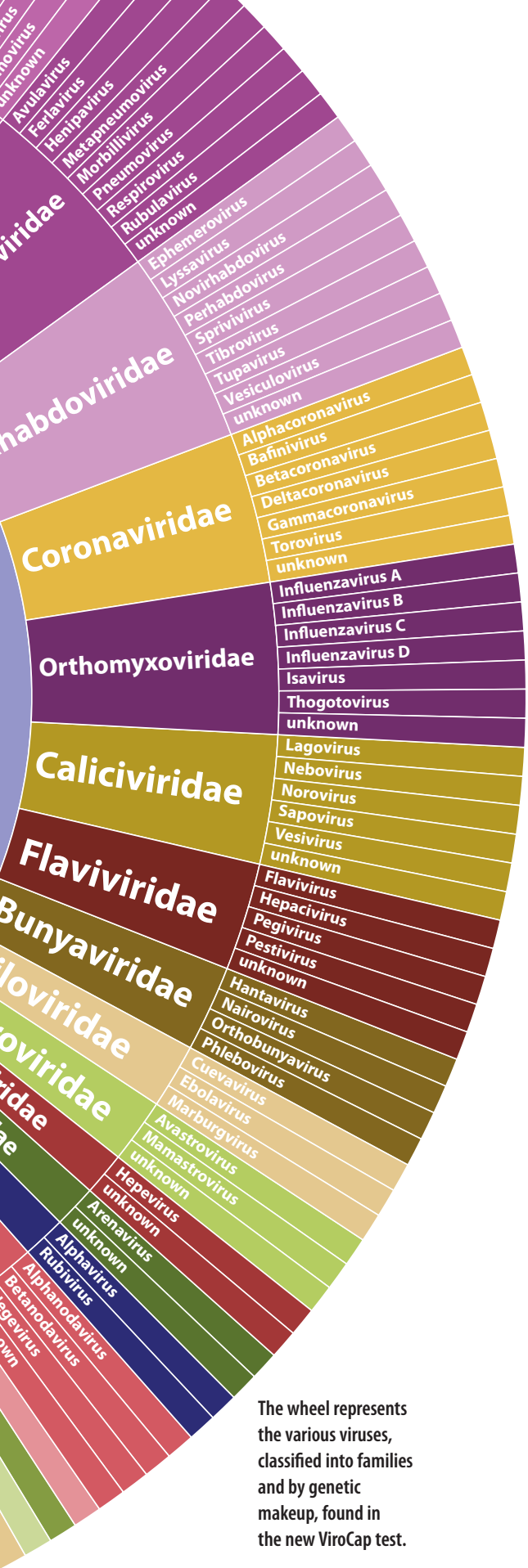
Ultimately, new protocols could be developed in many key areas, such as orientation and training, written policies, signage, bidding procedures and inspection forms. A year after the changes, the researchers plan to come back, survey workers and make comparisons.

The goal is to create a program that exerts influence regionally and nationally. “Obviously, we have to get buy-in from all levels — owner to worker — so safety and ergonomics are incorporated into every aspect of the process and simply become the way we do business,” Friis said.

“Really, our interest is the whole industry,” he added. “We want to go big with this. This is a significant opportunity to transform the industry.” □







# Going VIRAL

One new test detects all likely suspects

**T**HOUSANDS OF VIRUSES plague the human body, spawning everything from the mildly annoying common cold to deadly illness, and new threats continue to appear. When serious disease strikes, the question immediately becomes: **“Which virus is it?”**

Doctors must act on well-informed suspicions to order the necessary tests. And low levels of bad bugs can evade detection. Even after an exhaustive workup, the cause may remain a mystery.

A new test developed at Washington University School of Medicine is capable of detecting virtually any virus that infects people and animals and could make such uncertainty a thing of the past.

BY CAROLINE ARBANAS AND GAIA REMEROWSKI

***“With this test, you don’t have to know what you’re looking for,”***

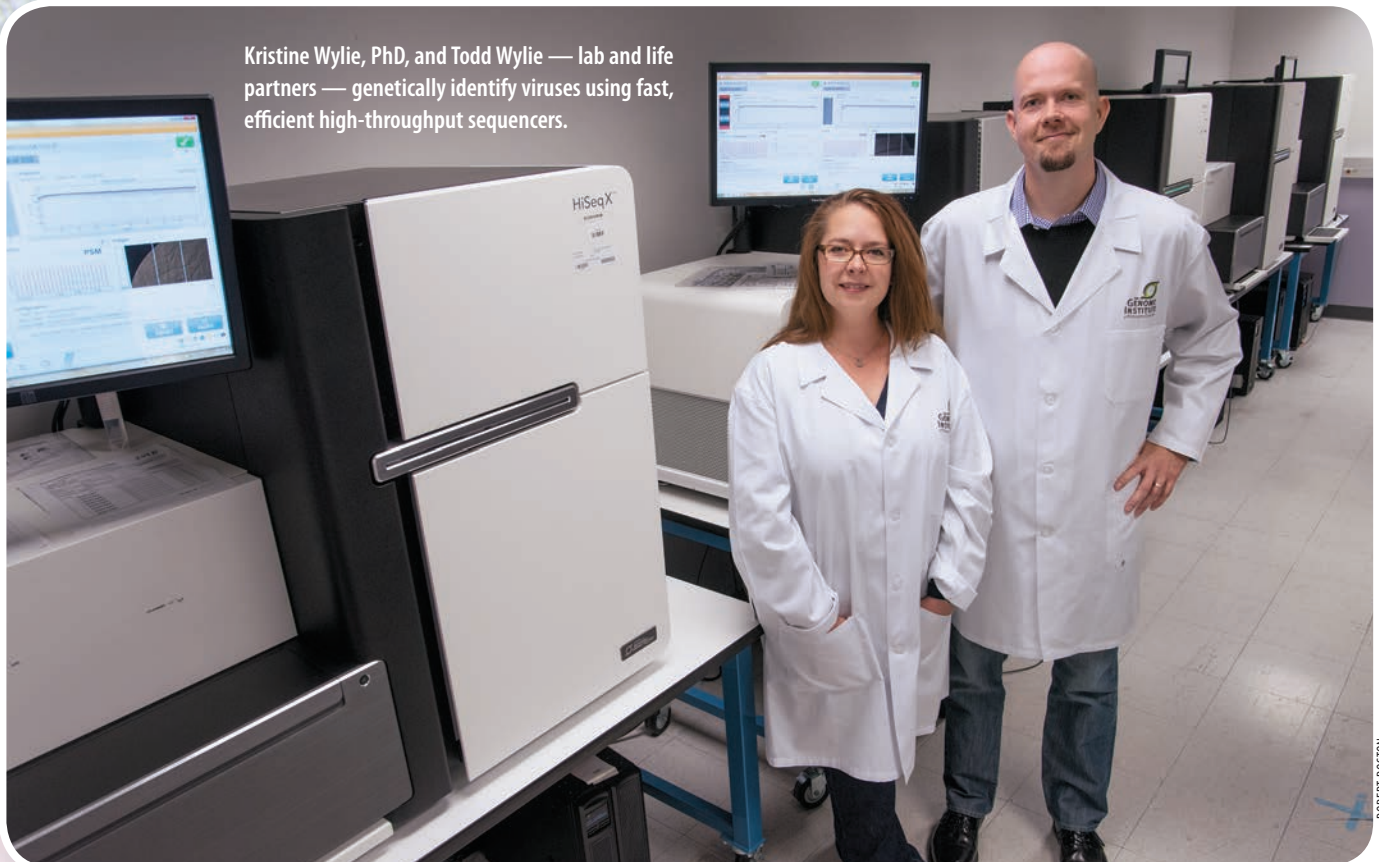
said Gregory A. Storch, MD, the study’s senior author and the Ruth L. Siteman Professor of Pediatrics. “It casts a broad net and can efficiently detect viruses that are present at very low levels. We think the test will be especially useful in situations where a diagnosis remains elusive after standard testing or in situations in which the cause of a disease outbreak is unknown.”

The test could be used to detect outbreaks of deadly viruses such as Ebola, Marburg and severe acute respiratory syndrome (SARS), as well as more routine viruses, including rotavirus and norovirus, both of which cause severe gastrointestinal infections. Storch’s team already used an earlier version of the test to determine which particular strain of the respiratory virus, enterovirus D-68, was causing an outbreak of unusually severe illness in children last year.

The Washington University team is making the technology publicly available for the benefit of patients and research.

Developed in collaboration with the university’s Elizabeth H. and James S. McDonnell III Genome Institute, the new test sequences and detects viruses in patient samples and is

Kristine Wylie, PhD, and Todd Wylie — lab and life partners — genetically identify viruses using fast, efficient high-throughput sequencers.



ROBERT BOSTON





**Victoria Fraser, MD, with donors John C. Shapleigh and Camilla “Kimmy” Shapleigh, whose late husband John B. Shapleigh II, MD, foresaw the need for improved hospice care. A new educational fund will further that mission.**

# Palliative care PROGRESS

**Shapleigh family legacy ensures dignity, care and compassion for those living with chronic disease and at the end of life**

BY HILARY DAVIDSON

**A**lthough Americans are living longer due to advances in U.S. health care, many suffer from chronic health problems that may cause years of pain and distress. Palliative care focuses on managing symptoms and improving the quality of life for patients with serious acute and chronic illnesses. Nationally, there is a shortage of fellowship-trained, board-certified palliative care and hospice physicians, putting these experts in high demand. The School of Medicine is expanding efforts to train a new generation of such specialists, aided by a generous donation from a local family.

The terms “hospice” and “palliative” care sometimes are used interchangeably. But hospice care provides comfort to those with a life expectancy of six months or less. Palliative care specialists manage patients’ ongoing physical and psychological symptoms, requiring multidisciplinary approaches and effective communication between the patient, the patient’s family and the medical staff.

“Many chronic diseases have multiple symptoms that are difficult to manage. Although not life-threatening, these symptoms can be quite disabling and disheartening for patients and their families,” said Victoria Fraser, MD, chair of the Department of Medicine and the Adolphus Busch Professor of Medicine. “Reducing these symptoms and helping people be as active as they can be and as comfortable as they can be, is really the goal of palliative care.”

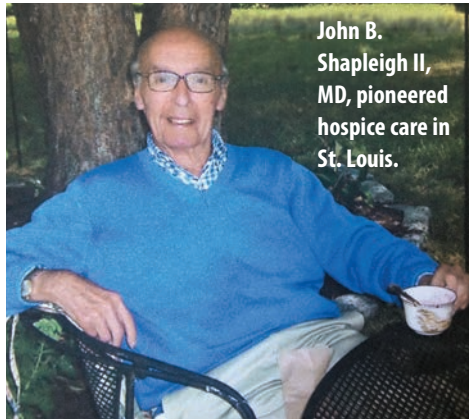
In memory of a man who dedicated his life to compassionate care, family members recently endowed the Dr. John B. Shapleigh II Hospice and Palliative Care Education Fund. This fund is helping the School of Medicine grow its hospice and palliative care education program to meet increasing demand.

## Shapleigh’s caring mission

In the 1970s, Shapleigh, MD ’46, pioneered hospice care in St. Louis. In the 1990s, he worked to create and manage the region’s first stand-alone hospice house, de Greeff Hospice House, which has helped thousands of patients and families, and is still in operation today.

Later, he turned toward advocacy, forming the Hospice Foundation of Greater St. Louis with his son, John C. Shapleigh, LW ’76. The nonprofit served as an educational resource for health-care providers, patients and their families from the late 1990s to the mid-2000s.

Shapleigh II died in 2011. However, his wife, Camilla “Kimmy” Shapleigh, along with John C. Shapleigh and his



John B. Shapleigh II, MD, pioneered hospice care in St. Louis.

wife, Anne, also LW ’76, are committed to furthering this work. “We thought this would be consistent with the original purpose of the Hospice Foundation of Greater St. Louis, and continue to carry out my father’s mission,” said John C. Shapleigh.

## A broad initiative

The fund is the first step in an initiative that will include a new outpatient clinic, a fellowship program, a research program and more extensive general educational programs. The medical school is recruiting physician faculty who are board-certified in hospice and palliative care to treat patients, establish best practices and train future providers.

“We want to raise the level of general knowledge among providers and create more palliative care and hospice specialists,” said Maria Dans, MD, assistant professor of internal medicine and clinical director of palliative care services.

Educating more doctors will improve patients’ access to better palliative and end-of-life care, Fraser said. “One of the challenges is that many patients are not referred to palliative care or hospice care until just a few days before they die,” she said. “If we can do a better job of educating everyone and get more patients into care, we can reduce pain and suffering and prevent unnecessary hospitalizations, readmissions and trips to the emergency room for pain or symptom control.”

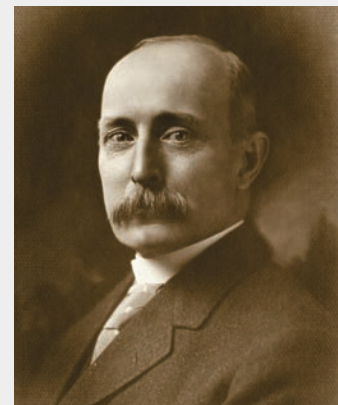
“This wonderful gift provides a tremendous jumpstart for us at an opportune time,” Fraser added. “Palliative and hospice care are important, not only here but nationally.”

# 100+

## years of dedication

### The Shapleighs and Washington University

**T**hrough this latest donation, the Shapleighs build on an impressive legacy of service to the university. Anne and John C. Shapleigh have generously supported School of Law scholarships, and many family members have attended the university. The Shapleighs’ connection to Washington University began over a century ago when John Blasdel Shapleigh I, John C.’s great grandfather, rose to prominence in the newly formed Washington University School of Medicine. From 1896–1923, he was professor and chair of the Department of Otology (now Otolaryngology), and served as dean of the faculty in 1901–02. Committed to education, he endowed a scholarship for two medical students that continues to shape the future of medicine.



John Blasdel Shapleigh I, MD

# Journey through Parkinson's

**Dedicated family forges partnership, brightens hope for alleviating the disease**

**J**oel S. Perlmutter, MD, the Elliot Stein Family Professor of Neurology and director of the Movement Disorders Section at the School of Medicine, still carries the small pocket knife that patient Frederick G. Oertli gave him some 15 years ago. “I’ve always treasured it,” Perlmutter said. The tool is a reminder of a patient and his family who became friends, then partners in research.

Oertli, AB ’55, formerly a principal at Guarantee Electrical Co., was diagnosed with Parkinson’s disease in 1993. In 1999, he became Perlmutter’s patient, and remained under his care until his death in 2014.



At first, Oertli went to medical appointments alone. As his condition worsened, his wife, Jo, accompanied him, and she became increasingly interested in Perlmutter's research.

Perlmutter encouraged the Oertlis to learn as much as they could about Parkinson's disease, a degenerative condition characterized by the death of dopamine-producing neurons in the brain. Lack of dopamine, a neurotransmitter that helps nerve cells "talk" to each other, results in motor symptoms such as shaking, slowness and difficulty of movement, and, as the disease progresses, dementia. Deep brain stimulation and the medication levodopa alleviate symptoms, but there is no known cure.

## Joining the effort

The Oertlis became active in the St. Louis chapter of the American Parkinson's Disease Association. After meeting others who were also touched by the disease, the Oertlis decided to invest in research, and made a gift to Washington University for Perlmutter's work. Jo Oertli continues her support, and finds comfort in being part of the effort to better understand and treat the illness.

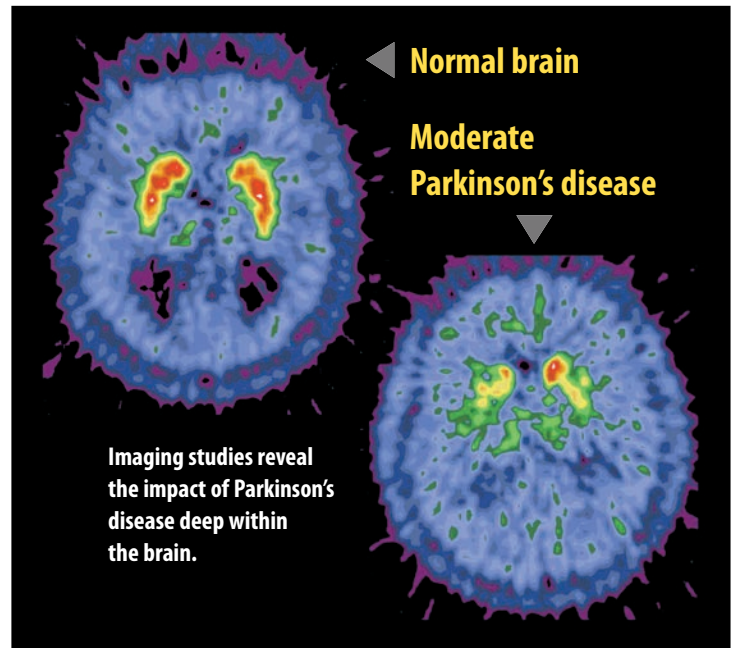
The Oertlis' contribution has expanded research possibilities by supporting aspiring physician-scientists at the School of Medicine early in their careers. "For the last three years, the Oertlis have funded our fellows," Perlmutter said. Two former "Oertli fellows" now work alongside Perlmutter as faculty members, and several new fellows are training with him.

Perlmutter studies the disease on many fronts: researching new drugs, developing ways to image the brain and examining the link between Parkinson's disease and dementia, to name a few. However, Perlmutter emphasized, the most important way to move the field forward is by training young scientists who will continue the work.

## Fine-tuning treatment options

The Oertlis' support was a game-changer for Mwiza Ushe, MD/MA '07, HS '11, assistant professor of neurology and director of the Deep Brain Stimulation Program for Parkinson's Disease and Tremor. "Without the Oertlis' support that first year as a fellow, there's no way I would have had time to collect enough data to write a grant and get funding to begin my career," Ushe said.

In the critical juncture between residency and fellowship, many would-be researchers are not able to support themselves while they conduct enough research to successfully compete for grants. Federal funding for training dollars is



scarce, and competition is fierce. "This is where a lot of very smart residents and fellows give up on research," Ushe said.

Ushe is focused on better understanding how deep brain stimulation (DBS) works to optimize its use.

DBS is a non-drug treatment for motor symptoms of Parkinson's disease. In DBS, a small electrode is surgically placed in a tiny area deep in the brain called the subthalamic nucleus (STN). The electrode sends electrical pulses through the brain, helping the patient to complete movements disrupted by Parkinson's disease. Although DBS is effective, scientists aren't sure how it works, and the surgery for electrode placement is invasive.

Initially, it was believed that patients would benefit only from stimulation of the upper STN. However, with Perlmutter's guidance, Ushe and his colleagues found that stimulation of other locations of the STN also helped. Positron emission tomography (PET) images of the brains of test subjects showed that stimulation of various parts of the STN triggered different neuronal pathways.

"What we're starting to show is that you can stimulate in different parts of the STN and see the same output and improvement in function, but the brain actually is using different pathways to get that same improvement," Ushe said.


Led by Perlmutter, the team is contributing to scientific understanding of the causes and mechanisms of Parkinson's disease, moving the field toward a time when Jo Oertli's dream of a cure will be fulfilled.

"It's a horrible disease," said Jo Oertli. "That's why I am committed to finding a cure. I am confident that someday it will happen, thanks to the dedicated work of doctors like Joel Perlmutter and his colleagues."

**Joel S. Perlmutter, MD, with Jo Oertli and David M. Holtzman, MD, head of the Department of Neurology.**



# Going places



Cynthia A. Wichelman, MD (foreground), associate professor of emergency medicine, leads second-year students on a spring break trip to Guatemala, where they helped care for patients.

**Alumni philanthropy supports student activities, spreads School of Medicine mission worldwide**

**S**chool of Medicine students are benefiting today from scholarships and opportunities to do community service or study abroad, thanks to the generosity of those who went before them.

“Alumni annual support helps our students become better physicians by providing opportunities to practice clinical skills, take on leadership roles and build relationships,” said Greg Galakatos, MD ’91, HS ’96, president of the Washington University Medical Center Alumni Association (WUMCAA).

WUMCAA recently allocated more than \$235,000 from the medical school's Annual Fund, an account that is supported by unrestricted gifts up to \$999 from alumni and former house staff.

More than 1,300 donors contributed an average of \$159 each; together, these contributions are making a major difference in the education and training of School of Medicine students.

Scholarships are chief among WUMCAA priorities. This year, the association's Executive Council allocated \$160,000 toward the Distinguished Alumni Scholarship Program (DASP).

Since 1989, four students annually have been granted four-year, full-tuition DASP scholarships, funded in part by Annual Fund gifts. In addition, WUMCAA's Executive Council selects four outstanding alumni faculty members — one per scholarship — to honor as namesakes, helping to spark mentoring relationships with the recipients.

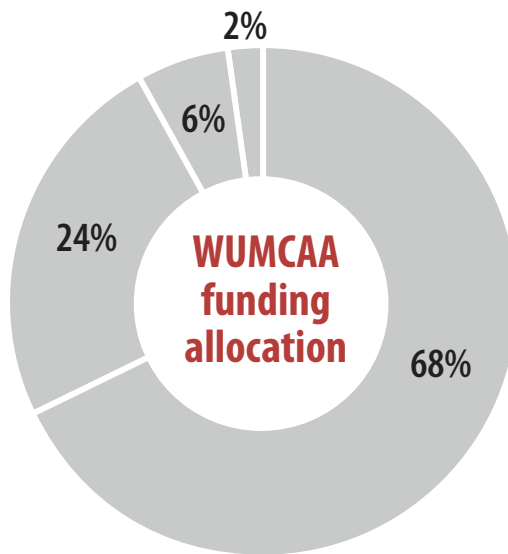
**T**he second largest funding allocation went to student groups. As part of the funding process, student leaders are asked to prepare proposals on behalf of their organizations, and the Executive Council selects projects to support.

Many of these endeavors enable students to expand their knowledge base while serving the community. These experiences help students prepare to meet the challenges of providing 21st-century health care.

For example, more than 90 percent of medical students participate in the Saturday Neighborhood Health Clinic, which provides health care to uninsured patients in St. Louis City.

Student volunteers with the Young Scientist Program teach hands-on scientific investigation to disadvantaged youth in hopes of fostering interest in STEM (Science, Technology, Engineering and Mathematics) careers. Along the way, medical students develop communication and leadership skills as well as new perspectives on issues facing urban youth.

Those who participate in the Geriatrics Outreach Group organize a yearly "Senior Prom," a free event featuring live music, dancing, dinner and intergenerational fun for students and St. Louis elders. Through social interactions such as this, students gain an understanding of the medical and social challenges experienced by older adults.



**Scholarships: 68%**

**Student groups, educational initiatives and community outreach: 24%**

**Other student activities: 6%**

**Academic and honor societies: 2%**



**The Geriatrics Outreach Group organizes an annual "Senior Prom" and other intergenerational events.**



**Medical students involved with the Young Scientist Program teach hands-on science investigation to area youth.**



**More than 90 percent of medical students participate in the Saturday Neighborhood Health Clinic, which provides health care to uninsured patients in St. Louis County.**

**W**UMCAA also is supporting the new student-led initiative Connections, which aims to improve the student experience by promoting inclusion and cultural awareness. In the stressful environment of graduate school, students tend to cluster with people like themselves, said co-founder Jessica Miller, an MD/PhD student in biomedical engineering.

Connections works to help students transcend this behavior by offering seminars on diversity-related topics and facilitated discussions. Such events help dissolve barriers by giving people the chance to honestly ask questions and learn from each other, Miller said.

Miller believes students need communication skills, not just for patients, but also to have meaningful interaction with their peers.

WUMCAA also funds study abroad. Each year, the Forum for International Health and Tropical Medicine (FIHTM), the medical school's global health interest group, sends students to locations such as Guatemala, Thailand and Malawi where they interact closely with faculty participating in research or health care. Upon returning, students share their findings at an annual university-wide global health symposium. Opportunities are expansive as FIHTM seeks to prepare students for a global understanding of the intricacies of health care.

**Connections promotes inclusion and cultural awareness among students.**

## WUMCAA leadership

Jim Avery, HS 93

Sylvia Awadalla, HS 89

Fred Balis, MD 89, HS 92

Marc Bernstein, MD 92

Thomas Blanke, MD 71

Andy Blatt, MD 92

Archna Calfee, MD 01

Gregory Cizek, MD 90

Jeff Crespin, MD 93,  
HS 96

Tom De Fer, HS 92

James W. Forsen Jr.,  
MD 88, HS 94

Gregory Galakatos,  
MD 91, HS 96

Harvey Glazer, MD 76

R. Mark Grady, MD 89

Ian Hagemann, MD/PhD  
08, HS 12

Charles Harris, MD/  
PhD 02

James Keeney, MD 93

Judy Lieu, MD 92, HS 98

Robert McMahon,  
MD 89, HS 92

Andy Mohapatra, MD 16

Lisa Moscoso, MD/PhD  
98

Linda R. Peterson,  
MD 90, HS 93

Paul Robiolio, MD 89

Joel Schilling,  
MD/PhD 03, HS 09

Mary Beth Scholand,  
MD 90

Alistair Scriven, MD 90

Emily L. Smith, MD 68



ROBERT BOSTON

## 1930s

**Yvonne Bost Pickett, NU 38**, published a memoir of her years as a nurse at Queen's Hospital in Honolulu during World War II, titled "Our War: My Life as a Nurse in Hawaii, 1941-1945."

## 1950s

**Lynn Frerking, NU 54**, retired in 1997 after working as both a medical and surgical nurse but stays involved in the medical field as a hospice volunteer. She and her husband, Ken, have enjoyed watching their grandchildren grow and spend their free time keeping active. They will celebrate their 60th anniversary next year.

## 1960s

**Earl Hearst, MD 69, LA 66**, and his playing partner won a bronze medal for men's doubles in pickleball at the Maryland Senior Olympics.

## 1970s

**Jerry Schriver, HA 71**, is pleased to announce that his daughter, Elizabeth, is attending Washington University School of Law, and he recently enjoyed visiting her on campus.

**Mark Braunstein, HS 75**, teaches at the Georgia Tech College of Computing in Atlanta, is associate director for health systems at the Institute for People and Technology and associate editor of the IEEE (Institute of Electrical and Electronics Engineers) Journal of Biomedical and Health Informatics. He is also an invited contributor to the InformationWeek health-care blog and founded several successful health IT companies. His book, "Practitioner's Guide to Health Informatics," was published in spring 2015.



## Promising students matched with faculty mentors

Recipients of the Distinguished Alumni Scholars Program (DASP) scholarships are matched with an outstanding alumni faculty member, opening the door for mentoring. This year's DASP honorees and scholarship recipients are: (from left) C. Robert Cloninger, MD '70, HS' 73, the Wallace Renard Professor of Psychiatry, and Kevin Garza; Thomas J. Baranski, MD/

PhD '92, associate professor of medicine and of developmental biology, and Stephen Hawn; Thomas C. Bailey, MD '84, HS '87, professor of medicine, and Weston McCarron; and David A. Hunstad, MD '95, HS '98, chief, Division of Pediatric Infectious Diseases, associate professor of pediatrics and of molecular microbiology, and Daniel Friedman.

## 1980s

**David J. Baltzer, HA 81**, is president-elect of the Missouri Health Executives Group, the Missouri chapter of the American College of Healthcare Executives.

**Vicki Smith, OT 86**, received a Roster of Fellows award from the American Occupational Therapy Association and is associate vice president for program development at Keuka College in New York.

## 1990s

**Howard Epstein, MD 91, LA 86**, recently joined the executive leadership team at PreferredOne health plan in Minnesota as executive vice president and chief medical officer. He is a volunteer for Washington University, serving on the Alumni Board of Governors, and is active with the Greater Twin Cities United Way.

**Charles W.M. Roberts, MD 95, GM 95**, has been named to head the cancer center at St. Jude Children's Research Hospital in Memphis, Tenn. He will serve as executive vice president and director of the St. Jude Comprehensive Cancer Center and as the Lillian R. Cannon Comprehensive Cancer Center Director Endowed Chair in the Department of Oncology.

**Mario Harding, HA 96**, was named associate chief operating officer of ancillary services at Denver Health. He has been with Denver Health for nine years, most recently as the Department of Medicine's administrative director. Harding joined Denver Health in 2006 as the administrative director of Behavioral Health Services and received the CEO Commendation Award in the Department of Behavioral Health in 2010. He will support the current leadership in the areas of lab, radiology, pharmacy and perioperative services with administrative and managerial oversight of patient care, staff development and education. Harding is a fellow with the American College of Healthcare Executives.

## 2000s

**Christina Ahn Hickey, MD 09, GM 09**, is on the faculty of the Division of Pediatric Gastroenterology, Hepatology and Nutrition at Washington University School of Medicine. She enjoys spending time with her daughter, Olivia Marie, and is a freelance editor for an indie publishing company.

**William McCoy IV, MD 13**, was awarded a clinical research grant from the American Acne and Rosacea Society.



## Career in motion

PT alumna tests split-belt treadmill on stroke patients

**W**alking on a split-belt treadmill — with one leg stepping forward, the other backward and both moving at different speeds — sounds tricky, but people adapt quickly, said alumna Amy J. Bastian, PhD, PT '95, recently named the first chief science officer at the Kennedy Krieger Institute in Baltimore.

"It isn't hard at all!" Bastian said. "People do this readily."

Bastian is using the device to probe how the nervous system controls movement and to help neurologically impaired patients regain motor skills. Early studies suggest that the treatment rewires the brain, temporarily improving asymmetric walking patterns in stroke survivors.

When healthy people walk on a split-belt treadmill, with one belt moving three times faster than the other, they immediately take a larger step on one leg. In other words, they limp. But within minutes, they self-correct and resume an even stride. Once both belts return to normal speed, most people find they cannot walk normally. The newly learned pattern must actively be unlearned.

With stroke patients, researchers use the treadmill to make limps worse, driving the nervous system to adapt. "Just like we trained a limp into a healthy person (albeit temporarily) we train a limp out of a stroke survivor," she said.

The research demonstrates how

new motor patterns are stored and how people with brain damage respond differently.

"We already appreciate that the brain is very plastic and responds rapidly to reflect even simple patterns of movement training," Bastian said. "I imagine that we will become much more sophisticated in the future by using combinations of motor pattern training, non-invasive brain stimulation, pharmaceutical interventions and general exercise to improve movement and change brain function."

Bastian, who has coauthored more than 100 scientific papers and many book chapters, received a prestigious Javits award from the National Institutes of Neurological Disorders and Stroke.

She recalls Washington University as a scientifically exciting, nurturing place to work and credits two special mentors: the late Tom Thach Jr., MD, a pioneering brain researcher and professor of neurology and physical therapy, and Shirley A. Sahrman, PT, PhD, professor emerita of physical therapy, of neurology and of cell biology and physiology.

"Tom taught me how to think about difficult problems and devise simple solutions. I miss him very much," Bastian said. "Shirley is one of the rare individuals who makes you want to be better at everything you do."

## IN MEMORY

### ALUMNI

#### John A. Headrick, MD 58

Headrick died Monday, July 20, 2015. He was 83. Headrick worked for many years in internal medicine at Christian Northeast Hospital. He was also a family man and enjoyed teaching his sons about sports, particularly baseball and football. Headrick is survived by his wife, Barbara; son, John Andy Headrick Jr. (Jami); grandchildren and a great grandchild.

#### Duane C. Hellam, MD 59

Hellam died Friday, July 31, 2015. He was 82. Born in Kittanning, Pa., Hellam later earned a bachelor's degree in chemistry with distinction from Arizona State University. He graduated from Washington University School of Medicine, cum laude, was a Jackson Johnson scholar, a recipient of the Borden Award and was elected to Alpha Omega Alpha. His internship and residency were completed at Barnes Hospital. From 1961–66, he collaborated in cellular biophysics at the National Institutes of Health (NIH). From 1966–1975, Hellam worked at Washington University Diagnostic Center. In 1976, he joined The Springfield Clinic of Internal Medicine in Springfield, Mo. Hellam was an active member in the Greene County Medical Society and the Missouri State Medical Association and served on numerous committees at St. John's Regional Health Center. He enjoyed many hobbies but was especially fond of racing cars competitively and playing violin. He is survived by his wife, Judy; children Todd, Leslie and Lauraine Ayers-Briel; stepdaughter Danielle Tuscher; grandchildren; and sister.

#### Elbert Herman Leigh, MD 61

Leigh died Monday, May 4, 2015. He was 83. Leigh was born in Bolivar, Mo., and grew up in Warrensburg, Mo., where he met and married his high school sweetheart, Lucile. Before attending medical school, Leigh served in the U.S. Air Force during the Korean War. He earned a bachelor's degree from Central Missouri State College and a medical degree from

Washington University. Leigh was board-certified in family medicine, psychiatry and child and adolescent psychiatry. Along with being a practicing physician in these fields, he also was a professor and was a charter fellow of the American Academy of Family Medicine. Leigh had a passion for the outdoors, carpentry, wood-working and playing and building classical guitars. He is survived by his wife of 64 years, Lucile; their children, Steven (Leah), Vicki (Peter Muller) and Jason (Paige); and grandchildren.

**Brian T. Lew, MD 82**

Lew died June 25, 2015. He was 57. Lew was an interventional cardiologist at Fairview Southdale Hospital and North Memorial Medical Center. After earning a medical degree at Washington University, Lew completed a residency and fellowship at the University of Minnesota. He is survived by his wife, Sheron; sons, Michael and Brandon; siblings; and nieces and nephews.

**Albert P. Scheiner, MD 53, LA 49**

Scheiner died Thursday, July 9, 2015. He was 87. Referred to by friends as "AP," Scheiner earned an undergraduate degree from Washington University, Phi Beta Kappa. He graduated from the School of Medicine in 1953 before beginning a pediatric internship at the University of Rochester School of Medicine and Dentistry's Strong Memorial Hospital. From 1955-1957, he was a captain in the U.S. Air Force, serving as a pediatrician, and afterward returned to Rochester as chief resident in pediatrics. He joined the faculty at University of Massachusetts Medical School in 1975 where he was professor of pediatrics and chairman of the Developmental Pediatric Outpatient Clinic. Scheiner thoroughly enjoyed working with and teaching students and residents. He retired at age 85 and spent time painting, sailing, skiing and supporting local theater. He is survived by his wife, Barbara; three daughters, Laurie, Cathy and Martha; and grandchildren.

**Joe Robert Smith, MD 55**

Smith died Monday, June 22, 2015. He was 87. Smith served in the U.S. Army from 1946-48. Afterward, he graduated from Central Missouri State University with a major in zoology and minor in

chemistry. He attended the University of Missouri School of Medicine and Washington University School of Medicine before serving an internship at Kansas City General Hospital and a residency in ophthalmology at Washington University. Smith entered into practice in Columbia, Mo. He was a long-time member of the Downtown Rotary Club, serving on its board of directors. Smith was a sportsman and enjoyed hunting and fly-fishing as well as painting and studying British history. He is survived by his brother, Richard Smith; daughters, Susan Smith Bell (James), Margaret Smith Whitmer (Gary) and Audrey Smith Feuerbacher (James); grandchildren; and a great granddaughter.

**Bruce White, MD 64**

White died Wednesday, Sept. 2, 2015. After attending Beloit College, he graduated from Washington University School of Medicine and completed general surgery training at Jewish Hospital and plastic surgery training at The Ohio State University. Afterward, White returned to St. Louis and founded St. Louis Cosmetic Surgery Inc. In 1967-68, he served in Vietnam, as part of the U.S. Air Force's medical health assistance program. In addition to his private practice, White traveled to Washington, D.C., annually to lobby on behalf of the Plastic Surgery Society. He also was an avid athlete and enjoyed running, swimming, rowing and weight training. He is remembered by family and friends for creating beauty in the world and as a talented and compassionate surgeon. White is survived by his wife of 49 years, Ellen; children Daniel (Jennifer Haro), Laura White, MD, (Bradley Levinson); and brother.

came to Washington University from the University of Houston, where he earned a master's degree in psychology and was elected to Phi Beta Kappa. During his time in Houston, he participated in a research fellowship at MD Anderson Cancer Center. He earned a bachelor's degree, magna cum laude, from Purdue University. Burnight was born in Evanston, Ill., and lived in Park Ridge, Ill., before leaving for college. He is survived by his father, Tom Alan Burnight; a sister; grandparents; and several aunts, uncles and cousins. He was preceded in death by his mother, Judith Lynn (Mann).

**Lisa Cristine Simone**

Simone, 25, a doctoral candidate in the Program in Physical Therapy, died unexpectedly Sept. 29, 2015, in St. Louis. Simone, who was to receive a doctor of physical therapy (DPT) degree in May 2016, took her life. Simone loved music and played several instruments; the cello was her favorite. Her greatest passion, however, was dance. She began dance lessons at age 3, trained for many years at the Saint Louis Ballet School and eventually performed with the company. Her love of dance also led to her career choice. She was inspired to become a physical therapist after suffering a serious dance injury and being treated by Lynnette Khoo-Summers, DPT, an associate professor of physical therapy at Washington University. The ability to isolate and understand movement fascinated her, and she was thrilled when she was accepted into the university's physical therapy program. During graduate school, she was especially dedicated to working with patients with neurological problems. A St. Louis-area native, she earned a bachelor's degree in biological sciences, summa cum laude, from the Missouri University of Science and Technology in Rolla. She is survived by her parents, Tom and Tina Simone; her brother, Nick; and her grandparents.

## S T U D E N T S

**Timothy Blair Burnight**

Burnight, 28, a doctoral candidate in the Program in Physical Therapy, died unexpectedly Sept. 4, 2015, at Barnes-Jewish Hospital. Burnight was to receive a doctor in physical therapy degree in May 2016. He was passionate about health and wellness, was the recipient of several scholarships and was an advocate on behalf of patients. He worked weekends as an aide at a local hospital. Burnight

**Submit Classnotes online:  
[wumcnews.org/classnotes](http://wumcnews.org/classnotes)**

## Shirley Ann Sahrman, PT, PhD

*Professor emeritus of physical therapy,  
of neurology and of cell biology & physiology*

### Where did you go to high school?

*Nerinx Hall High School, where I won the senior  
award for excellence in athletics and academics. In  
those days, even at 5'4" you could play basketball!*

### Why physical therapy?

*I wanted to help children who were paralyzed  
due to polio. For somebody who was as active as  
I was it was hard to imagine people who couldn't  
participate in athletics, or couldn't even walk.*

### What's your legacy?

*The Movement Science Program, which I developed  
and directed, has increased the pool of academic  
researchers whose work infuses this field with  
new knowledge of human movement.*

*Like Dr. Sahrman, consider supporting  
Washington University School of Medicine  
through an estate gift, life income plan or  
other planned gift. For more information, visit  
[plannedgiving.wustl.edu](http://plannedgiving.wustl.edu) or call 800.835.3503.*



LEADING *Together*

The Campaign for Washington University

*Consult with your legal or tax adviser  
before making a charitable gift.*

Shirley Ann  
Sahrman, PT, PhD,  
and Louise

### Favorite honor:

*The Mary McMillan Award. It is the highest honor  
from the American Physical Therapy Association.*

### How does a movement expert stay active?

*Walking four to five miles a day with my dog,  
Louise, a Louisiana Catahoula Leopard Hound.*

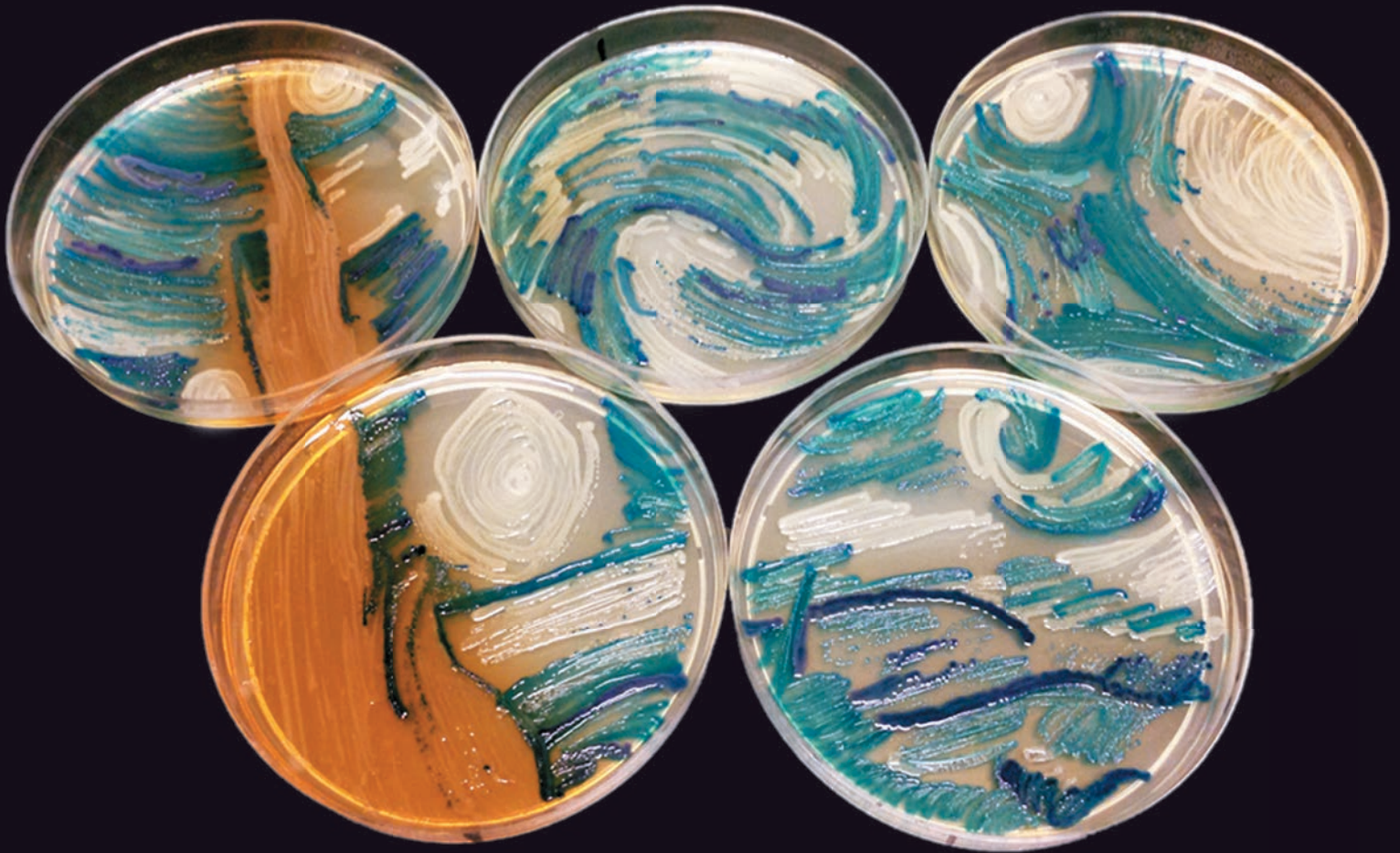
### I support the School of Medicine because:

*I couldn't imagine a better place, where mentors,  
colleagues and students set wonderful examples.  
That's why I put off retirement for so long!*



# Agar art

Five Petri dishes recently sprouted a masterpiece. The canvas was a special type of agar — the clear, jelly-like substrate of microbiology experiments — which produces various colors when exposed to bacterial enzymes. Research lab supervisor Melanie Sullivan applied bacterial “paints” to the agar to recreate Vincent van Gogh’s “Starry Night.” The piece was submitted to the American Society for Microbiology’s 2015 agar art contest. Sullivan works in the lab of Stephanie A. Fritz, MD, whose group studies organisms involved in pediatric infectious diseases.



## *Proteus mirabilis*

A bacterium known for its swarming motility that is a common cause of urinary tract infections

## *Acinetobacter baumannii*

An often drug-resistant bacterium that is found in hospital environments and affects people with weakened immune systems

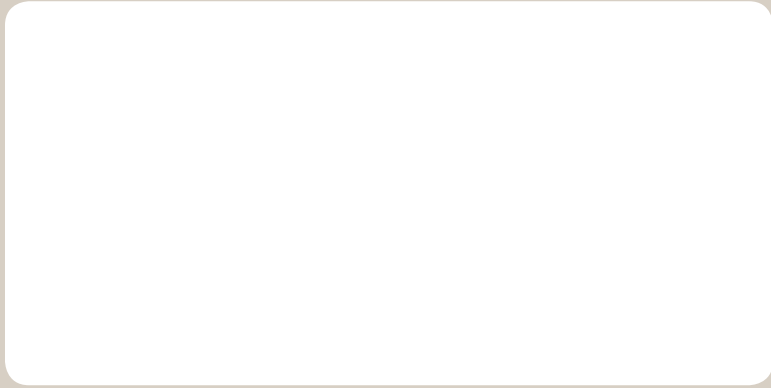
## *Enterococcus faecalis*

A gastrointestinal tract bacterium that often causes urinary tract and more severe infections, particularly in hospital environments

## *Klebsiella pneumoniae*

A bacterium normally found in the mouth, skin and intestines that may cause pneumonia, meningitis and other health-care-associated infections





**Going up** Work progresses on the new Mid-Campus Center, the site of a major research effort to study construction risks and develop guidelines that could have wide impact on the health of U.S. builders. Below, proper harnessing reduces fall risk, but the workers' repeated wrapping and tying of wires around rebar could lead to musculoskeletal injury. See the story on page 16.

