

FOCAL SPOT

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FALL/WINTER 2017 How Pediatric CT Protocols Help Protect Kids for a Lifetime
MALLINCKRODT INSTITUTE OF RADIOLOGY // WASHINGTON UNIVERSITY // ST. LOUIS



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Thirty years ago Marcus Raichle, MD, climbed a mountain in Pakistan for the sake of science.



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Cover Photo: Marilyn J. Siegel, MD, professor of radiology and pediatrics, is a recognized industry expert when it comes to CT protocols for children.



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Richard Wahl, MD, and R. Gilbert Jost, MD

On September 30, 2017, former MIR director R. Gilbert Jost, MD, officially retired. In a letter to his friends and colleagues, Jost reflects on his time at Mallinckrodt and some of the revolutionary advancements that happened during his tenure.

I first came to Mallinckrodt in 1972 to begin my residency, fully expecting to return to the East Coast after three years of training. The department was much smaller then, only eight residents to a class and all of the clinical activities were confined to the original building. But a lot of change was in the air. In 1972, the first CT scanner was introduced at RSNA (I was there to see it), and soon some of the earliest CT scanners were delivered to the department. Before long, in Mallinckrodt's laboratories, the first PET scanner was invented and built. Soon MRI arrived on the scene, again with Mallinckrodt playing a leading role, and all within the period of a few years.

It was a very exciting time, and so it seemed to make sense to stay in St. Louis. Of course, since that time the pace of technological change in our specialty has progressed exponentially, culminating in the transition of a film-based to an electronic-based specialty. It has been a wonderful time of innovation and it was exciting to be at a place like Mallinckrodt, which always seemed to be at the forefront, pushing the envelope.

I find it satisfying to look back to my residency days and realize how far we have come. It has been a thrilling time to be a radiologist, and I have enjoyed a wonderful career. But it has been especially satisfying to be a radiologist at Mallinckrodt, where there is an aspiration to be the best, to be the first, and where the collaborative, collegial, interdisciplinary culture is unique. No doubt about it, Mallinckrodt is a very special place. I wouldn't want to have worked anywhere else.

I never thought seriously about being a department chair, but my decision to accept that role is among the best decisions I have ever made. I feel extremely lucky to have had a chance to play a role in charting the future course of this great department. Thanks to all my friends and colleagues who have been so supportive through the years.

With my very warmest regards,

Gil Jost
Professor Emeritus
Mallinckrodt Institute of Radiology

IDEAS Trial Update



Barry Siegel, MD

Preliminary results of the Imaging Dementia – Evidence for Amyloid Scanning (IDEAS) trial are in, and they’re better than anticipated, says Barry Siegel, MD, professor of radiology at MIR and a member of the study’s steering committee.

“We met our first target.”

The “we” Siegel refers to is the IDEAS study leadership, a small group

of senior scientists and professors. And the “first target,” or Aim 1 of the national trial, was to determine the impact of brain amyloid PET scans on managing patients 65+ years, who have experienced cognitive decline of an unknown cause, and met the appropriate use criteria for clinical amyloid PET.

Amyloid plaque builds up in the brains of patients with Alzheimer’s and is a core characteristic of the disease. Before brain amyloid PET scans, amyloid plaque could only be detected in autopsies, making a diagnosis of the disease in living patients difficult.

The IDEAS study is a response to the 2013 Centers for Medicare & Medicaid Services (CMS) decision not to cover the amyloid PET scans in persons with suspected dementia or neurodegenerative disease. Although CMS concluded at the time that there was insufficient evidence of the imaging exam’s value in making diagnoses and treating these conditions, it is paying for one scan per participant in the study.

Participants are Medicare beneficiaries from throughout the U.S. and will number 18,500. MIR is one of 378 PET imaging facilities and has scanned 204 patients so far.

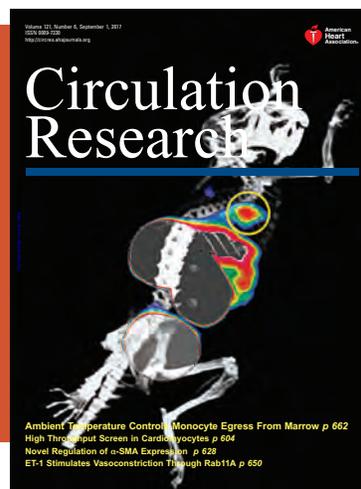
Aim 1: Exceeding Expectations

“Results exceeded our expectations by almost a factor of two,” says Siegel. Changes in medical management occurred in 67.8% of patients with progressive but mild cognitive decline, and 65.9% in patients with atypical dementia. Researchers originally hypothesized a 30% change in medical management.

Results are interim and reflect approximately 4000 of the 11,000 patients enrolled in this portion of the study. Dementia specialists participating in the study completed assessment forms before their patients underwent the PET scan and 90 days after the exam. The forms were analyzed by statisticians to identify and document changes in patient management. They wanted to see if there was a change in medication and/or in counseling.

Aim 2: Expect a Wait

“The harder part will happen when we sit down and do the much more complicated analyses of Aim 2,” says Siegel. It will involve comparing Medicare claims of patients enrolled in the study against a cohort of matched patients, who did not have the amyloid PET scan and were not involved in the study. The goal is to determine the impact of the scans on major outcomes. Medicare is really interested in outcomes, Siegel says. They want to see if hospitalizations and emergency department visits decreased in those patients whose medical management changed. “That’s going to be a tough one. We’re not positive one way or another whether or not we’re going to be able to prove that,” Siegel says. “We’ll see what happens but it’s going to take a while, probably two years before we have the answer.”



A PET/CT scan of a new PET tracer developed at MIR was featured on the front cover of the September 1 issue of *Circulation Research*.



New Scanners Mean More Time for Research

Investigators who use the Center for Clinical Imaging Research (CCIR) and the East Building MR Facility can expect greater scheduling flexibility and advanced imaging capabilities thanks to two new MRI scanners and a major upgrade to an existing unit.

Two new scanners – a 3T Prisma and 3T Vida by Siemens – were installed in June and August 2017, respectively. And in February 2018, an existing Trio scanner will have an extensive upgrade to a Prisma Fit. The new equipment brings the number of human-imaging MRI research scanners up to five, says Pamela K. Woodard, MD, Senior Vice Chair and Division Chief of Radiology Research Facilities.

The scanners are primarily used for clinical and translational imaging research, though not exclusively by radiologists or medical doctors. Deanna Barch, PhD, professor of psychological and brain sciences at the School of Arts & Sciences at Washington University, is one regular user who benefits from the addition of new and advanced equipment.

“It’s allowed us to initiate new studies,” says Barch, who examines healthy brain development and differences in brain development associated with schizophrenia and mood disorders such as depression. “The new (3T Prisma) scanner makes it possible for us to expand recruitment and testing for a number of national multi-site studies.”

While the Prisma Fit upgrade will provide the CCIR with the latest in neuro-magnetic resonance imaging, the Vida scanner is the first of its kind in the U.S.

“The system has many cutting-edge advantages, including motion correction capabilities, special in-coil shim features that will optimize brain imaging, and elastography for assessment of fibrosis and tissue material properties,” says Woodard. “We’ll be using the scanner in clinical trials and other research studies involving cancer patients and patients with neuro-degenerative diseases, such as Alzheimer’s, as well as for cardiac imaging.”

A crane lifting the seven-ton Vida 3T scanner up ten floors for its installation at the Center for Clinical Imaging Research.

A Heart For Haiti

Jennifer Nicholas, MD, MHA, has always been drawn to teaching and a sense of fair play. Before attending medical school, Nicholas was a bilingual elementary school teacher in South Central Los Angeles. During her residency, she taught basic ultrasound skills to primary care physicians in Nicaragua and in a rural clinic in Kenya.

But Nicholas, who joined MIR in 2016, has also had a long-standing interest in using technology to improve radiology education. As a medical student, she won an award from the Radiological Society of North America (RSNA) for a computer-based program she developed to teach the BI-RADS lexicon. Eight years later, while teaching at the Feinberg School of Medicine at Northwestern University, Nicholas developed an iPad-based curriculum to prepare radiology residents for independent call.

Today the assistant professor of pediatric radiology at MIR wants to improve the learning opportunities for the 18 radiology residents at L'Hôpital de l'Université d'Etat d'Haïti (HUEH) in Port-au-Prince. It's the only radiology residency program in Haiti and its students have limited access to educational resources.

Opening Her Home

Nicholas first visited Haiti in spring 2013 with a group from the American College of Radiology. That's when she became acquainted with its residents and medical students who were interested in the specialty. "Over the next three and a half years, I visited Haiti six times and hosted several Haitian radiology residents at my home in Chicago so that they could attend two major meetings, RSNA 2015 and the International Pediatric Radiology meeting in 2016."

During those visits, Nicholas and the residents talked about their visions for radiology in Haiti. They wanted to elevate the specialty among referring physicians. They wanted to improve the radiology department at the general hospital (HUEH) where their program is based and they wanted to introduce a level of subspecialization in radiology that didn't yet exist in Haiti. Much work was needed to realize these dreams, but it was clear to Nicholas that the residents were willing to meet the challenge. They just needed the resources.

Long Distance Learning

"Residents have a small library that consists of donated textbooks and an Apple iMac that wasn't connected to the Internet until June 2017," says Nicholas. "They spend their days performing and interpreting studies without



Jennifer Nicholas, MD, MHA

attending radiologist input. Once or twice a day, an attending radiologist is available to review complex cases and to provide instruction and feedback."

They lacked a structured curriculum that's important for a radiologist in training, and Nicholas was determined to give it to them long-distance with a platform for interactive learning.

She applied for and was awarded a 2017 Education Scholar Grant from RSNA. With it, Nicholas purchased tablet computers and preloaded them with textbooks, presentations, articles, videos and a library of cases to create a dynamic educational toolbox for each student. Nicholas delivered the tablets on September 4, just days before Hurricane Irma swept over the island.

Building a Virtual Classroom

Though her trip was cut short due to the hurricane, Nicholas was there long enough to instruct residents on how to use the tablets and the applications they contained. She introduced them to components of the curriculum, including the "flipped classroom" model of learning, in which they will be sent cases to preview and evaluate independently before biweekly virtual conferences with Nicholas via Skype. With the help of a software representative, she built a secure network for residents to discuss cases with her at MIR.

Going the Distance

"Basically, I am facilitating the curriculum long distance," says Nicholas. "Coming up with the schedule, gathering cases, giving feedback on reports and coordinating the lectures series, which is where residents, fellows and attendings from Mallinckrodt will be able to participate."

If you have a case to share or want to present a lecture, email: nicholasj@wustl.edu 📧

Scanning for Clues

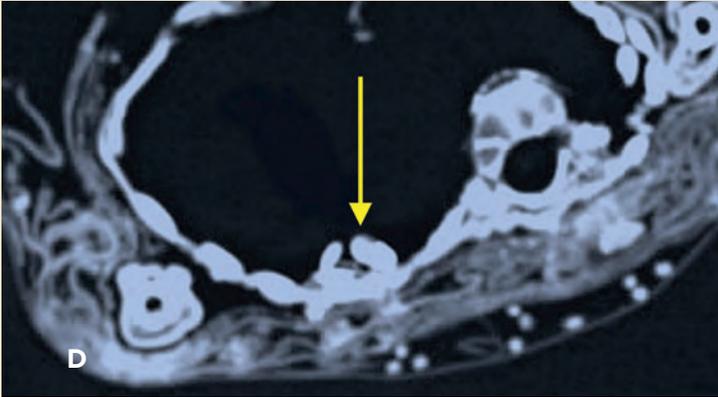
Dinosaur skulls and a baby mummy offer insight into the ancient past.

Portions of skulls from two teenage Triceratops and the mummified remains of a seven-month-old baby boy were among the latest patients scanned by MIR radiologists. Researchers from the St. Louis Science Center hope the CT scans, performed on September 16, will provide clues into the ancient past.



Patient: Triceratops **A** Michelle Miller-Thomas, MD, with one of the two Triceratops skull fragments.

B Scans will help unearth clues about the Triceratops. **C** MIR's Vincent Mellnick, MD, and Sanjeev Bhalla, MD, (left to right) watch as a WashU paleontologist examines a Triceratops skull fragment.



Patient: Infant Mummy **D** An arrow points to a carved artifact in the infant's chest cavity. **E** The infant mummy swaddled in a layer of linen. **F** The Science Center's collections manager prepares the child mummy for a CT scan. **G** CT data can be manipulated to show different details. **H** MIR radiologists and a CT technologist studying the monitor during a scan.



Left to right: James R. Duncan, MD, PhD, Vice Chair for Quality and Safety at MIR, Madelyn Scheipeter and her mother, Monica, and MIR's safety team coordinators, Mike Harrod and Bekah Phelan.

by Pam McGrath

Safety First

How Pediatric CT Protocols Help Protect Kids for a Lifetime

For many, saving small amounts of money here and there over time can make a significant difference in their financial future. According to James R. Duncan, MD, PhD, professor of radiology, the same is true with radiation exposure in children.

“If we make decisions that reduce radiation, whether in the dose used to complete a CT scan, a fluoroscopic procedure or being creative in obtaining the information we need through other imaging modalities, then we are helping to establish a radiation budget that can reduce a child’s lifetime exposure,” he explains.

Budgeting for pediatric exposure to radiation began in the 1980s, when computed tomography (CT) started coming into its own. CT gave radiologists the unique ability to produce cross-sectional images that provided detailed pictures of the body's soft tissues. Today, CT imaging is a trusted, vital tool in helping clinicians diagnose disease and injury in people of all ages.

From the start, Mallinckrodt Institute of Radiology (MIR) has been at the forefront of developing pediatric CT protocols. Now its pediatric radiology specialists have established what is proving to be an effective outreach program that ensures children receive the lowest possible dose of radiation while undergoing CT scans at hospitals throughout the BJC HealthCare System. At its core is the doctrine followed by all medical professionals who treat pediatric patients: Children are not simply small adults.

Setting a Radiation Budget

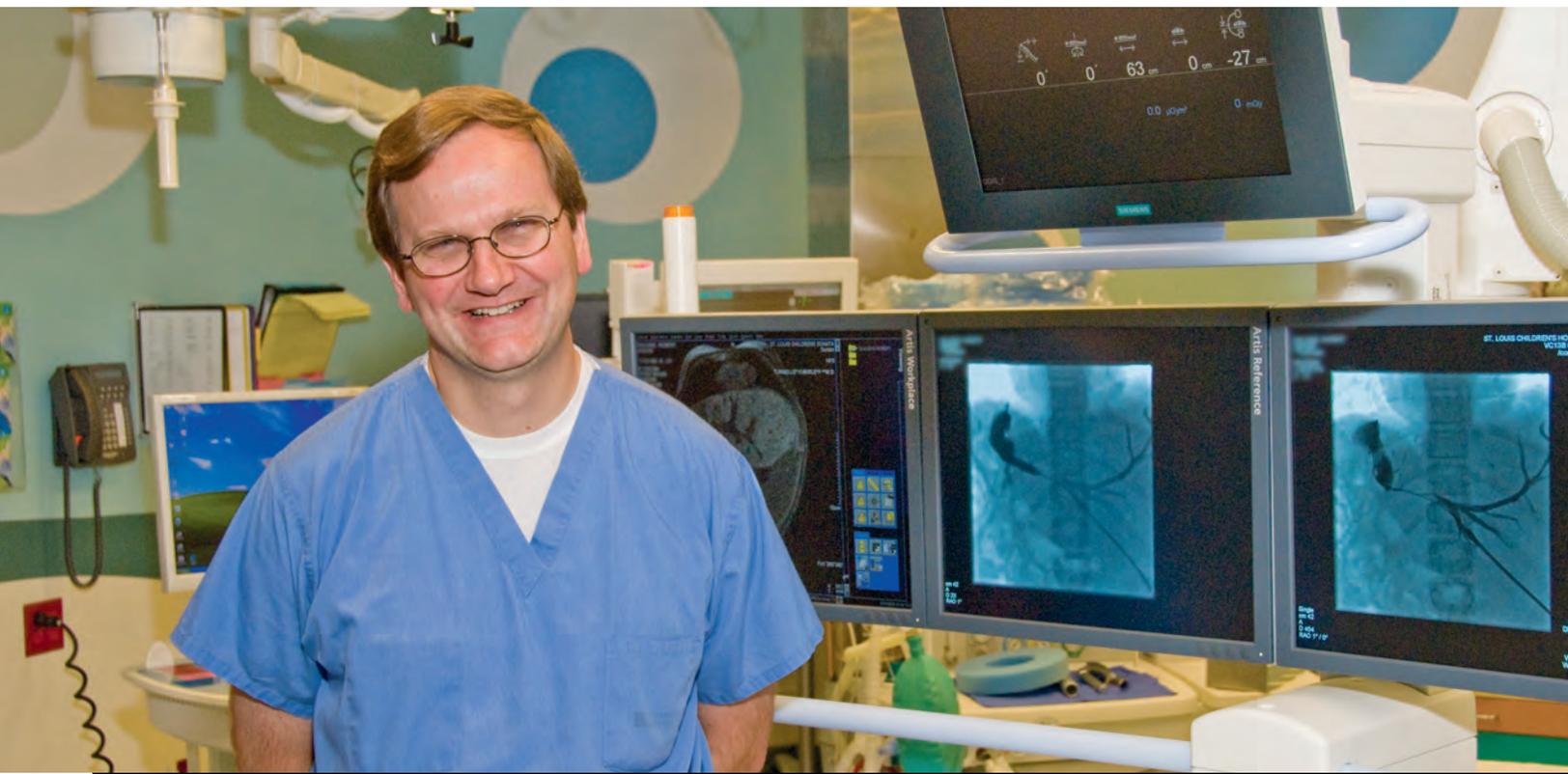
Duncan is among the leaders of this outreach effort. "National campaigns such as the Image Gently Alliance established in 2007 have raised awareness

of the need to adjust radiation dose when imaging children," he says. "More recently, The Joint Commission, an independent, not-for-profit organization that accredits and certifies health care organizations, has emphasized the importance of including patients' radiation exposure in their medical records."

Between March 2015 and January 2017, the hospitals improved from 8% to 85% compliance.

At MIR over the past decade, the radiologists who specialize in pediatric imaging at St. Louis Children's Hospital (SLCH) have made significant progress in reducing radiation exposure during CT imaging. A study published in 2015 in *RadioGraphics* reported a twofold reduction in CT radiation exposure in pediatric patients between 2007 and 2012. This was achieved by adhering to low-dose CT as a standard protocol. In addition, they cut CT use in

James R. Duncan, MD, PhD, a professor of radiology, was appointed Vice Chair for Quality and Safety in 2015.





Marilyn J. Siegel, MD, along with technologist Christi Lappe reviews a pediatric CT scan.

children by approximately 50% over the five-year period by increasing the availability of magnetic resonance and ultrasound imaging, neither of which use radiation.

“These are impressive improvements that have been championed by MIR’s pediatric radiology specialists,” says Duncan. “Unfortunately, statistics show that only about 20% of pediatric imaging occurs at pediatric specialty hospitals such as St. Louis Children’s. The other 80% are done at local community hospitals, where in a typical busy day their radiology department may perform scans on 20 adults, then one child, followed by another 20 adults. Pediatric protocols need to be followed for that one child, but that doesn’t always happen.”

Change Was Needed

The success of SLCH in reducing its patients’ radiation exposure, and the knowledge that the 11 other hospitals in the BJC Healthcare System

may not be achieving the same results, spurred MIR to launch an outreach program designed to ensure compliance with pediatric CT protocols. The first step was to evaluate the current usage within BJC. The statistics were telling.

“When Children’s Hospital was included in the evaluation, use of pediatric protocols stood at 60%. When Children’s Hospital was excluded, that dropped to 8%,” says Duncan. Clearly changes were needed. Fortunately, a BJC-wide Radiology Clinical Expert Council had been formed and that group selected pediatric CT protocols as one of its first improvement initiatives. A dose monitoring system was purchased and used to collect data from all CT scanners within the system.

“This dose monitoring system captures the child’s date of birth, date of CT exam, exam name, protocol used for the study, identifiers for the CT scanner and hospital, as well as dose metrics such as dose length product and CT dose index,” explains Michael Harrod,

quality and safety coordinator technologist at MIR. “This has proven to be a real advantage in our ability to track whether or not pediatric CT protocols are being used appropriately.”

To further improve support, Timothy Street, a clinical application specialist for BJC HealthCare, and Christi Lappe, charge technologist at St. Louis Children’s Hospital, began visiting individual BJC hospitals to educate radiology technologists about pediatric CT protocols and the dose monitoring system.

“This was particularly important because Tim and Christi are technologists themselves, so they were able to effectively communicate to people with

Mallinckrodt Institute of Radiology (MIR) was at the forefront of developing pediatric CT protocols.

the same backgrounds and training,” says Bekah Phelan, MIR’s quality and safety nurse coordinator.

With all elements in place, the Radiology Clinical Expert Council began tracking the use of pediatric CT protocols at BJC hospitals. Between March 2015 and January 2017, the hospitals improved from 8% to 85% compliance. (This excludes SLCH, which consistently complies with the pediatric protocols.) While the improvement is impressive, the goal is to reach 95% compliance in pediatric CT protocol use at the BJC hospitals.

Moving the Dial Down

MIR’s pediatric radiologists are experts at reading children’s CT imaging studies, even when very low doses of radiation are used. It’s a learned skill, and one not easily achieved by radiologists who mainly deal with adults.

“The fact is, however, that even a 10% decrease in radiation dosage is significant in reducing a child’s exposure,” says Duncan. “Decreasing the number of exams, the images per exam and the dose per image are the ways we can lower children’s exposure. If you can move the dial on each of those, the savings are amazing.”

Other methods include carefully considering the need for follow-up scans, reading scans forwarded by referring hospitals rather than automatically scheduling another CT, and determining if other imaging techniques can provide the same answer as CT.

The key for radiologists, says Duncan, is to always keep in mind that these are children. “A 15-year-old may look fully grown, but there are vast differences between that patient and his or her 85-year-old great-grandmother,” he says. “Pediatric and adolescent patients have a lifetime ahead of them. We need to budget their radiation exposure wisely for their well-being in the future.”

Setting the Bar for Safety

Mallinckrodt Institute of Radiology has developed approximately 50 pediatric CT protocols, 15 to 20 of which are most commonly used. Marilyn J. Siegel, MD, professor of radiology and pediatrics, has extensive background in developing pediatric CT protocols and in working with Siemens, a developer of imaging technology, to test the manufacturer’s latest CT products. She also reviews and accredits CT protocols submitted by radiology facilities across the U.S. to the American College of Radiology.

“Protocols are based on technology, and it is technology that has impacted our ability to reduce dosage in children,” she explains. “Since advances in CT imaging occur rapidly, it has become standard practice to review and update protocols annually to ensure we are providing our pediatric patients with the safest, highest quality scans possible.”

Siegel cites automated tube current as the initial significant automated advance in CT technology. Tube current determines the number of electrons accelerated across the X-ray tube per unit of time. Today’s scanners are automated to select the best tube current for each patient based on variations in structure density within the scanned area of the body.

Kilovoltage is another advance that has changed protocols for both adults and children. Kilovoltage controls the radiographic contrast of an X-ray image.

“Previously this parameter was fixed at 120. That is more than is needed for children. Now,



The “Panda Scanner” at St. Louis Children’s Hospital.

kilovoltage can be adjusted as low as 70 and as high as 140,” says Siegel. “We can produce high quality, readable scans for pediatric patients at very low kilovoltage. Our pediatric protocols have automatic default settings for the lower kilovoltages.”

A 15-year-old may look fully grown, but there are vast differences between that patient and his or her 85-year-old great-grandmother.

Harrod describes the structure of protocols as branches on a tree upon which an individual CT scan is built.

“Each branch provides particular parameters of the CT scan – for instance, the type of study needed, whether it is adult or pediatric, and the area of the body. With that information, the protocol shows

default settings for elements like rotation time and beam current,” he says. “But some tweaking still can occur based on, for instance, range. An example would be scanning both the cervical spine and head to avoid having to do two separate scans, which lowers the patient’s radiation burden.”

Siegel notes that today, low-dose CT scanning is a reality, and MIR is committed to providing the most current technology available to achieve that goal.

“In plotting pediatric CT dosage over the years, I found that in 2000, when automated current modulation was introduced, our mean dose was 8.1. When we added automated voltage to that, our mean dose was reduced to 5.8. And when we added another new development, iterative reconstruction, the mean dose went down to 2.7,” she says. “Each of these advances has been factored into our pediatric CT protocols to produce default settings that accurately reflect the needs of our patients.”



MEET YOUR IMAGE GUIDES

The Evolution of Interventional Radiology

The journey of interventional radiology is defined not by destinations but by the paths traveled. Procedures that once required surgery, sutures, scars, hospitalizations and lengthy recoveries can be completed via a brief trip to an IR suite, followed by a bandage and good night's sleep at home.

"We cross many organ systems and disease states. The underlying theme is that we do minimally invasive, image-guided procedures," says Michael D. Darcy, MD, professor of radiology and chief of interventional radiology at Mallinckrodt Institute of Radiology (MIR), "The vast majority are done through a tiny skin nick that doesn't need a stitch."

Interventional radiology, or IR, was recognized as its own primary specialty in 2012 by the American Board of Medical Specialties. IR procedures have replaced surgical options in addressing many injuries and diseases. Its scarcely invasive approaches have been proven to reduce recovery time, hospital stays and risks.

Many interventional radiology procedures formerly handled in operating rooms have become commonplace in the IR suite. Implanting permanent vascular access, treating hepatic and renal cancers, and opening vessels with implantable stents, to name a few. In addition, "a transplant program or a Level 1 trauma center can't be accredited without interventional radiology," says Darcy. "There are procedures that simply can't be done with standard surgical techniques."

MIR's interventional radiology service, which was established in 1987 at Washington University School of Medicine, is one of the 12 largest in the U.S. Few

major IR centers are located in the Midwest. "The closest comparable center – that provides the full range of services and handles the complicated cases that we do – would be in Chicago," Darcy says.

Early Intervention

Charles Dotter, MD, a radiologist at Oregon Health & Science University, is credited with the genesis of interventional radiology in the 1960s. His first patient, not considered a surgical candidate, was at risk of losing her foot due to an arterial blockage. Dotter passed catheters across the narrowing, re-established blood flow and the foot healed. And thus began the IR revolution.

Dotter's groundbreaking procedure was followed by a rapid rise of IR techniques. Radiologists have expanded the range and scope of interventions in step with advances in imaging and devices. Key to IR's evolution is innovation resulting from radiologists' collaboration with device manufacturers.

"We would think of an idea and the catheter companies would build it," Darcy says. "Or they would come to us with a new device and we would say, 'What can we use it for?'" Innovation grew with new needs.

Large catheters used for the embolization of colonic bleeding 35 years ago have been replaced. "The tools they used blocked off fairly large vessels and there was a very high infarction rate," Darcy says. "Now we have a slew of micro-embolic devices that allow us to go to the wall of the bowel and block a very selective blood vessel."

As interventional radiology grew, so did its applications.

"With the technology that we possess in IR, there is no vessel in the body that we cannot reach, whether it is in the brain or in the feet," says Raja Ramaswamy, MD, assistant professor of radiology and surgery. "What brought me to interventional radiology was working with virtually all organ systems and a wide scope of diagnoses and disease processes. It is a very innovative field."

Jennifer Gould, MD, focuses on the monitor as MIR resident Wei Wang, MD, helps her perform a procedure.



Michael D. Darcy, MD, professor of radiology and chief of interventional radiology at MIR.

“Something new is always coming,” adds Jennifer Gould, MD, associate professor of radiology. “The complexity of much of what we do is increasing. Now when I insert a catheter, chances are I am going to do more than diagnosis. I am going to do a minimally invasive procedure that could make a profound difference for a patient. They could go home that day or the next.”

Rapid Recovery

Darcy has devoted much of his research to transjugular intrahepatic portosystemic shunts (TIPS) to address portal hypertension, where a stent is placed in the cirrhotic liver from the portal vein to a hepatic vein.

A transplant program or a Level 1 trauma center can't be accredited without interventional radiology.

The procedure lasts about an hour and the patient goes home the next day. TIPS basically has replaced the surgical procedure, says Darcy. “In the era of surgical portacaval shunts there was a major incision,

multiple days if not weeks in the hospital, usually weeks of recovery and mortality was much higher.”

Approaching lesions with catheters rather than scalpels spares healthy tissue and may help patients avoid surgery. Uterine fibroid patients, for example, may be eligible for an IR procedure rather than a hysterectomy.

“We combine the techniques of catheterization and injection to block arterial supply to the fibroids,” Darcy says. “That shrinks the fibroids and in many cases takes care of the problems without surgery.”

Ramaswamy expects interventional radiologists increasingly will deploy embolization to treat prostate disease. More than half of men over the age of 60 have enlarged prostates and about 3 million men in the U.S. are diagnosed with prostate cancer annually. “IR can offer a minimally-invasive treatment approach by going into the vascular supply and delivering medications that help to decrease the size of the prostate,” he says.

IR also is an adjunct to surgery when post-operative complications arise. In the past, if a patient developed bleeding or post-operative abscess they would go to surgery and have a large incision made, Ramaswamy says. “Now in IR we make an incision the size of a pin, go directly to the site, and stop the bleeding or drain the infection.”

Targeting Cancer

The ability to deliver chemotherapy, embolization and ablation through the narrowest pathways presents interventional radiology with opportunities for prominence in oncology treatment.

“Chemo doesn’t work very well by itself for some liver cancers and many patients present beyond the point of surgical resection,” Darcy says. “We can insert a probe percutaneously under CT guidance and ablate the tumor with heat or cold. We can prolong life and sometimes achieve cures. For some small tumors the results are close to what can be accomplished surgically.”

IR delivery will assure the precise placement of coming chemotherapies, Ramaswamy says.

“The future of oncology is more targeted drug therapies including nanoparticles to treat tumors. If we know the exact biology of the tumor we can make a personalized drug that specifically targets the tumor.”

The Clinic Experience

Early on, IR founder Dotter advocated for interventional radiologists to assume greater patient management responsibilities. It didn’t make sense, he argued, for radiologists to return patients to practitioners unfamiliar with IR procedures.

“We are very aggressive about following our patients,” Darcy says. “We had a formal clinic here 30 years ago, long before many IR groups did.”

The clinic provides a much better way of assessing patients and gives the interventional radiologists time to discuss the procedure and its ramifications with the patient. “It also makes things much easier for the referring doctors because we take care of pre-certifications and arrange admissions,” says Darcy.

“The clinic experience is something I love about the field,” says Sarah Connolly, MD, who joined the interventional radiology section in July after completing an IR fellowship at MIR. “It plays an important role in allowing us to establish the physician-patient relationship and provides an opportunity for teaching.”

The Accreditation Council for Graduate Medical Education approved dedicated integrated interventional radiology residencies in 2014. Mallinckrodt Institute of Radiology organized one of the first programs and matched its first two residents in 2016.

“It’s a five-year program, following one year of internship, that compresses diagnostic radiology down to three years and a couple of months and leaves the remaining time, almost two years, for interventional radiology training,” says Gould, who also is MIR’s diagnostic radiology residency

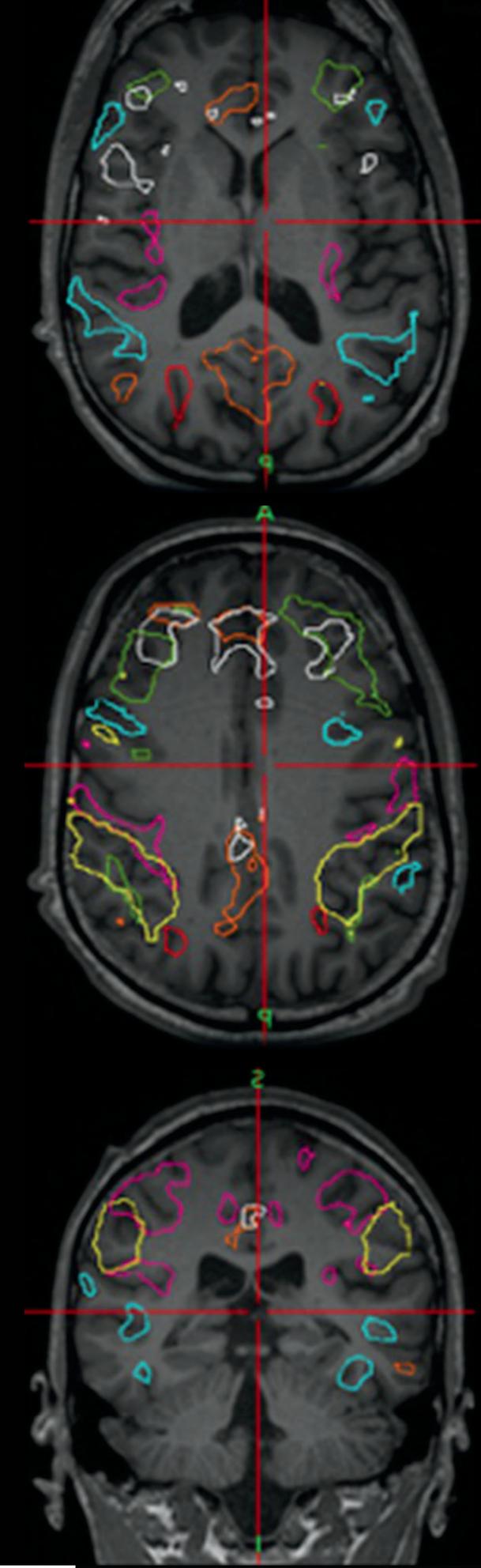
IR delivery will assure the precise placement of coming chemotherapies.

program director. “The traditional way to become an interventional radiologist had been to do a four-year diagnostic radiology residency followed by a one-year IR fellowship.”

Connolly looks forward to the continued development of IR education at Mallinckrodt. “The passion and innovation historically applied to developing new tools and procedures in IR also needs to be applied to the training of IR residents,” she says. “The broad case mix in IR and the benefits of deliberate practice suggest a role for incorporating standardized and graduated simulation into IR residency training and I look forward to being a part of this moving forward.”



The ability to treat various organ systems is what attracted Raja Ramaswamy, MD, to interventional radiology.



by Mary Konroy

Gray Matters

Navigating the Brain During Neurosurgery

It's a conundrum that every neurosurgeon faces. Remove too little tumor and you decrease a patient's chance for survival. Damage healthy tissue near a critical brain function and the patient may incur neurological deficits, impacting his or her ability to see, speak and move.

Although existing surgical navigation systems are pre-loaded with an anatomical map of a patient's brain, they don't contain the location of language, vision and motor control centers. That information is obtained separately, and requires patient cooperation before or during brain surgery.

Now researchers from Washington University School of Medicine (WUSM), including Mallinckrodt Institute of Radiology (MIR), are collaborating to provide neurosurgeons with a way to make these surgeries easier, more efficient and safer for patients.

Researchers at WUSM and MIR, along with medical device maker Medtronic, are developing a software program that merges images of patient's brain anatomy with the location of key functional centers of the brain to create personalized 3D brain maps. The goal is to embed the software in a surgical navigation system that can be used by neurosurgeons anywhere.

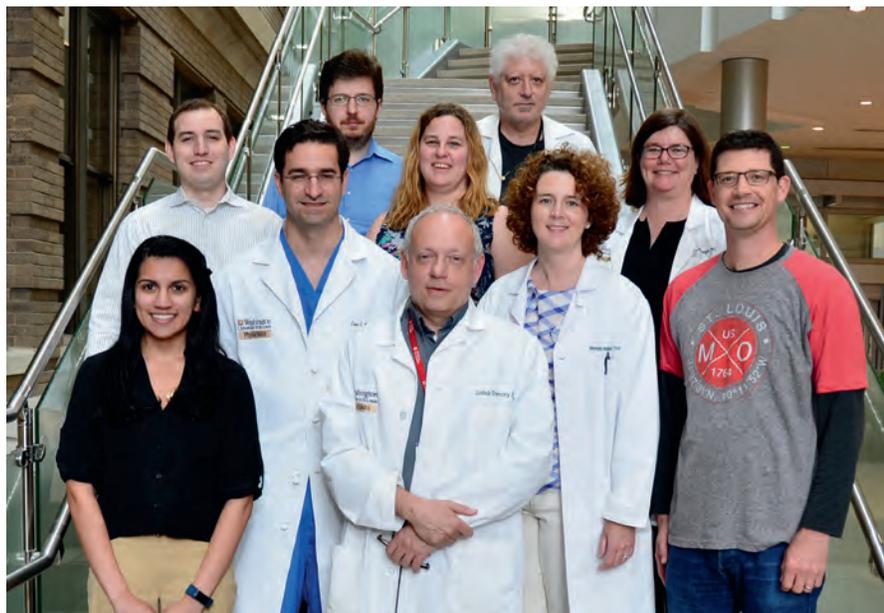
"In many ways, the traditional way of getting information for the surgeon doesn't work for every patient," says Joshua Shimony, MD, PhD, associate professor of radiology at MIR.

"With the new 3D mapping, not only will the surgeon know where they are in the brain but they'll know what that part of brain does," says Eric Leuthardt, MD, professor of neurosurgery at WUSM.

Shimony and Leuthardt are co-principal investigators of this research, which is being financed by a \$3.6 million grant from the National Cancer Institute of the National Institutes of Health.

MIR was one of the first institutions to publish an article about this new paradigm for pre-surgical planning.

Shimony is a member of MIR's neuroradiology clinical section and Neuroimaging Laboratory (NIL). Leuthardt is director of the Center for Innovation in Neuroscience and Technology for the Department of Neurological Surgery. Together they've been working on the software since 2010. "The new grant will allow us to build upon and continue our research," Shimony says.



Joshua Shimony, MD, PhD (first row, center) and a multi-disciplinary team from MIR and WUSM were involved in developing the software that creates 3D brain maps.

If You Build It, They Will Come

Unlike most grants, where an investigator comes up with an idea and then seeks funding, this was research guided by topic, says Shimony. The need was specific. The NIH put out a request for an application, or RFA. "They wanted to encourage industry-academic collaborations in neuroimaging, and they wanted it in the area of cancer."

The timing was perfect. Shimony and Leuthardt previously worked with Medtronic, and had been investigating how to extract "resting state" data from functional MRI (fMRI) scans to localize speech, vision and motor control centers.

The concept was novel, and MIR was one of the first institutions to publish an article about this new paradigm for pre-surgical planning. It appeared in



Eric Leuthardt, MD, (above) is co-principal investigator of the NIH-funded grant with Joshua Shimony, MD, PhD.

Academic Radiology in 2009 and Shimony was the lead author. Despite his early involvement, Shimony didn't appreciate the significance of resting state as soon as his NIH peers did. His colleagues at the time, including MIR pioneering radiologist and neurologist Marcus Raichle, MD, were studying resting state after discovering that a previously unknown brain network – called the default mode – could be seen with it. It was their work that piqued Shimony's interest. "It kind of dawned on me that this might be something big."

“Resting” Doesn't Mean Inactive

Resting state doesn't mean the brain is at rest. It means the patient is resting, daydreaming or not engaged in a task during their scan. The brain remains busy.

Task-based fMRI requires patient cooperation. Patients have to perform a task. They may have to tap their finger, repeat a word, or look at flashing lights. "We look for stimulation changes in the brain associated with the process."

"But task-based fMRI doesn't work in about half of the patients who need brain scans," says Shimony. They include patients who are cognitively impaired,

perhaps because of a brain tumor, or have certain physical limitations or are very young or very old. "The thinking then became if you can figure out a way to acquire this information from resting state fMRI, you could solve the problem."

It turns out you can. "Different systems in the brain carry on internal communication even when at rest," says Shimony. "By analyzing resting state data for this internal communication, we can obtain information very similar to that acquired with the task fMR." And it's faster and more reliable.

"We often have to do multiple attempts for traditional fMRI," says Michelle Miller-Thomas, MD, assistant professor of radiology. In fact, functional MRI has a failure rate estimated at 30%, which means the results are not useable and the scan has to be repeated.

"What's unique about this resting state technique compared to a more traditional functional MRI is that the patient doesn't necessarily have to comply with what we want them to do," says Miller-Thomas, who also runs the advanced imaging service in neuroradiology.

Advantages and Challenges

Resting state fMRI is easy to perform. "All the patient has to do is lie quietly in the MRI scanner," says Shimony. They can even sleep or be sedated, which is helpful in very young patients and those with anxiety.

In some cases it's an alternative to cortical stimulation, a process that localizes brain function with an electrical current during surgery while the patient is temporarily awake. This method increases the length and cost of surgery, and has some risks, including seizures.

But resting-state fMRI has its own set of challenges, including, how to process the advanced imaging datasets so that it can be used clinically. To accomplish this and to use resting state fMRI in their navigational system, Shimony and Leuthardt relied on neuroscientists and computer programmers to develop software to process the raw data. Carl Hacker, an MD/PhD student, together with colleagues, developed the software that is a key component of the analysis. The Neuroimaging and Informatics Center at MIR also played a major role in creating an imaging pipeline and interface to transfer

patient information to PACS stations and the operating room. They formed a mechanism to transfer data back and forth.

In a concerted effort that involved a diverse range of talents — from neuroscientists to computer programmers to graduate students — locations of brain functions were laid on top of the anatomic images. “What we’re creating for surgeons are pictures or an idea of where the important parts of the brain are for specific functions,” says Miller-Thomas. “Surgeons can then plan their surgeries before they enter the operating room. They can plan their approach and may see whether one approach may disrupt one of these important centers or the fibers that connect them.”

Supply and Demand

Results were good, and demand for resting state fMRI grew as word got out among neurosurgeons.

“It got to the point where it became very desirable to stop treating this as experimental medicine and treat it as a clinical method,” Shimony says. “We studied it in many patients for a couple of years, and it worked really well.”

In 2015, with the help of a Barnes-Jewish Foundation Grant, resting state fMRI was offered as a routine clinical service for neurosurgeons performing brain surgery at Barnes-Jewish Hospital. Since then, they’ve performed over 1000 cases using resting state fMRI.

“I think this effort characterizes and separates us,” Leuthardt says. “We’re the only institution in the nation that regularly uses resting state fMRI for clinical surgery.”

Time Will Tell

While the product works for research and in academic hands at MIR, it still needs some extensive refinement before it’s commercially available.

“Right now, it’s kind of an interim solution to incorporating the data into the navigation system, and we want to come up with an elegant, permanent solution,” Shimony says.

“There are a lot of details that need to get hammered out,” says Leuthardt. “There’s the grand and dramatic vision that we’ve implemented. But getting this to a hard-baked clinical algorithm that anybody can use, that actually requires a lot of work.”

Michelle Miller-Thomas, MD, runs the advanced imaging service in neuroradiology.



ALUMNI SPOTLIGHT

by Kristin Rattini

Sandra Ruhs, MD, is the director of the women's imaging department at Diagnostic Imaging Associates in Des Moines, Iowa. The practice's mammography department has been named one of the "Breast Imaging Centers of Excellence" through the ACR since July 2013. Ruhs, who was instrumental in launching a new multidisciplinary clinic for women's health in 2017, relishes radiology's vantage point across the medical spectrum.

What attracted you to radiology?

I took a non-linear path to radiology. After I graduated from college, I was a medical technologist working in a lab. I determined that I needed more of a challenge. I went to medical school when my son, Kevin, was 2 and my daughter, Diane, was 8. It wasn't an easy path. At that point, I assumed I would go into family practice, pediatrics or pathology because those were the three areas I knew the most about.

It wasn't until my senior year that I got enough exposure to radiology and determined that I wanted to maintain a cross-sectional path across all aspects of medicine. Radiology does that. And because it's shift work and provides some structure in scheduling, radiology seemed to be the best fit for my family.

Why did you choose Mallinckrodt for your residency training?

I was extremely fortunate that Mallinckrodt chose me. An advisor at Iowa strongly suggested I apply. I was intimidated by Mallinckrodt and its grandeur. My interview was good but overwhelming. I mean, Stuart Sagel and the giants of the training ground were all there. It was their reference books they were using. I didn't put Mallinckrodt as my first match because I wasn't sure I wanted to go that high-key. I didn't get my first match. Mallinckrodt was my number two and they accepted me. I loved it from day one.

Which instructors at Mallinckrodt made the greatest impression upon you?

As program director of body imaging at that time, Dennis Balfe had a huge influence. He was a hands-on person; we learned by doing. He was able to appreciate the learning curve that all of the residents had to go through. Yes, he could do it faster and better, but we kids had to learn, and he allowed us some freedom to do it while still following procedure.



Ruhs running the 2015 IMT half-marathon in Des Moines.

Seeing how well Jay Heiken spoke and interacted so smoothly with peers in the rest of the hospital was a great influence. Bill Middleton is still one of the ultrasound kings in imaging. Bill could lean over and adjust your hand on the transducer to show you something you were overlooking or how to optimize the imaging. Hal Bennett was a young staff member at that point. He was unfailing in putting in the long hours and the extra time when needed, and he was always there, eager and smiling.

Your practice, Diagnostic Imaging Associates, is practically its own Mallinckrodt alumni chapter.

Yes, the group I work with is just under 40% Mallinckrodt graduates. We know each other's training and can bounce ideas and questions off one another.

CAREER PROFILE

SANDRA RUHS, MD

2000 // Abdominal Imaging Fellow

Mallinckrodt Institute of Radiology,
Washington University School
of Medicine

1998 // Diagnostic Radiology Resident

Mallinckrodt Institute of Radiology,
Washington University School
of Medicine

1994 // MD

University of Iowa Carver College
of Medicine

1986 // BS

University of Iowa

What do you enjoy about body imaging and women's imaging?

It goes back to why radiology is important – it deals with the whole body. Abdominal scans, CT, those are the work horses of oncology, urology and emergency medicine. It's a strong, diverse and multidisciplinary field. Women's imaging is a natural offshoot of that. It's the same modalities and cross-exposure to primary care, family practice, surgeons and oncologists.

You played a critical role in opening a new clinic this year, the Mercy Comfort Health Center for Women. Please tell us more about the clinic.

It was an idea that a breast surgeon and I and a couple other friends had for about eight years. We worked with Mercy Hospital's administration to develop a site where women in their prime of life – post-child-bearing years up through geriatric medicine – can receive all their care. We offer internal medicine, pelvic, urology, gynecology, breast cancer imaging and breast health imaging in multiple modalities. We've added a wellness therapist, physical therapist and mental health therapist, services that are needed on a regular basis. We opened in April and have been steadily building clientele by word of mouth.

What are your interests beyond radiology?

Most of the residents I worked with at Mallinckrodt know my kids. My daughter, Diane, used to babysit for some of them. Diane is now an engineer for UPS in Louisville and has two daughters, ages 5 and 2. My son, Kevin, is an engineer at Polaris in a suburb of Detroit and has a 2-year-old daughter. We have a Disney cruise planned for the whole family; vacation is a way for us to spend time together.

About five years ago, a friend in our group asked if I wanted to start running. I went from a 5K in the spring to a 10K in the summer to a half marathon in the fall. Since then, I have become a bit compulsive and have run at least one or two half marathons every year. I did my first full marathon last fall. Running is a nice physical challenge, and a mental challenge as well – to test your limits, to see if you can get beyond a point of discomfort or boredom and finish your goal. //



"Nana" Ruhs enjoying story time with two of her granddaughters, Amelia and Jacqueline.

Honors/Awards

David H. Ballard, MD, a second-year resident at MIR, was awarded a 2017 Alpha Omega Alpha Postgraduate Award. Ballard is also the recipient of the Radiological Society of North America William W. Olmsted Editorial Fellowship for Trainees. This program benefits trainees who are interested in scholarly publications and the editorial processes at medical journals.

Sanjeev Bhalla, MD, professor of radiology and Vice Chair for Education, earned an Radiological Society of North America Honored Educator Award in 2017.

Joy Haven, PhD, MBA, executive director of business affairs for MIR, was honored by the Healthcare Businesswomen's Association for her "significant contribution to the organization's continued success." Haven was recognized for her work mentoring the organization's Ohio chapter, which won the Chapter Excellence Award in 2016. She has mentored the chapter since 2015.

Amy Patel, MD, is the first fellow ever to receive the American College of Radiology RADPAC(R) Advocate of the Year Award. RADPAC is radiology's political action committee.

Monica Shokeen, PhD, assistant professor of radiology, was elected secretary of the Women in Molecular Imaging Network at the World Molecular Imaging Congress effective spring 2018.

Kimberly Wiele, MD, assistant professor of radiology, was inducted as a fellow by the American College of Radiology.

Pamela K. Woodard, MD, professor of radiology and Senior Vice Chair and Division Chief of Radiology Research Facilities, received the 2017 Distinguished Achievement Award from the Council on Cardiovascular Radiology and Intervention.

Grants

Tammie L. S. Benzinger, MD, PhD, associate professor of radiology, and **Yong Wang, PhD**, received a \$3.6 million five-year grant from the National Institutes of Health for "Quantification of Neuroinflammation in Alzheimer's Disease Using Diffusion Basis Spectrum Imaging."

Mikhail Y. Berezin, PhD, assistant professor of radiology, received a five-year, \$1.9 million grant from the National Institutes of Health for "An Imaging-based Approach to Understand and Predict Chemotherapy Induced Peripheral Neuropathy."

Joseph P. Culver, PhD, professor of radiology, received \$2.9 million for a five-year grant from the National Institutes of Health to study "Mapping Functional Connectivity with Fluorescence Molecular Tomography."

Joseph P. Culver, PhD, professor of radiology, **Joseph Ackerman, PhD**, professor of radiology, and **Joseph A. O'Sullivan, PhD**, the Samuel C. Sachs Professor of Electrical Engineering, together received a five-year grant for \$1.4 million from the National Institutes of Health for "21st Century Imaging Sciences: Graduate Student Training."

Adam T. Eggebrecht, PhD, instructor in radiology, received a two-year \$419,375 grant from the National Institutes of Health to study "Mapping Language Processing in Children with Autism Spectrum Disorder with Diffuse Optical Tomography."

Brian A. Gordon, PhD, assistant professor of radiology, received a five-year \$622,915 grant from the National Institutes of Health for "Neuroimaging Markers of Emerging Dysfunction in Preclinical Alzheimer Disease." Gordon also received a \$25,000 research grant

from Longer Life Foundation for "Examining the Contribution of Diabetes and Obesity to Alzheimer Disease."

Joseph E. Ippolito, MD, instructor in radiology, received a one-year \$151,339 grant from the National Institutes of Health to study the "Characterization of Sexual Dimorphism in Glioma Metabolism."

Daniel S. Marcus, PhD, associate professor of radiology, received a four-year \$2.7 million continuation grant from the National Institutes of Health for his research on "The XNAT Imaging Informatics Platform."

Joel S. Perlmutter, MD, professor of neurology and member of the MIR Neuroimaging Laboratory, and **Zhude Tu, PhD**, professor of radiology, together received a five-year, \$3 million research grant from the National Institutes of Health to study "PET Probes for Imaging the Vesicular Acetylcholine Transporter." The two researchers also received another five-year grant for \$3,075,671 from the NIH for "Neuroimaging of PDE 10A."

Sheng-Kwei Song, PhD, professor of radiology, together with **Wilson Z. Ray, MD**, associate professor of neuro-logical surgery, received a five-year, \$2.3 million continuation grant from the National Institutes of Health to study the "Predictive Value of Diffusion MRI in Cervical Spondylotic Myelopathy." Song also received a three-year grant from the National MS Society for \$648,975.80 to study "How Does Optic Neuritis Impact Nerve Function and Its Assessment."

Joshua S. Shimony, MD, PhD, associate professor of radiology, received a five-year \$1,559,967 grant from the National Institutes of Health to study “5/5 Neurocognitive and Neuroimaging Biomarkers: Predicting Progression Toward Dementia in Patients with Treatment Resistant Late-Life Depression.”

Yi Su, PhD, assistant professor of radiology, received a two-year grant from the National Institutes of Health for \$275,000 to study the “Feasibility of Challenge-Free QSM based Quantitative Mapping of Cerebral Metabolic Rate of Oxygen” and a three-year grant for \$300,000 from the BrightFocus Foundation to study “Blood Brain Barrier and Metabolism in Aging and Alzheimer Disease.”

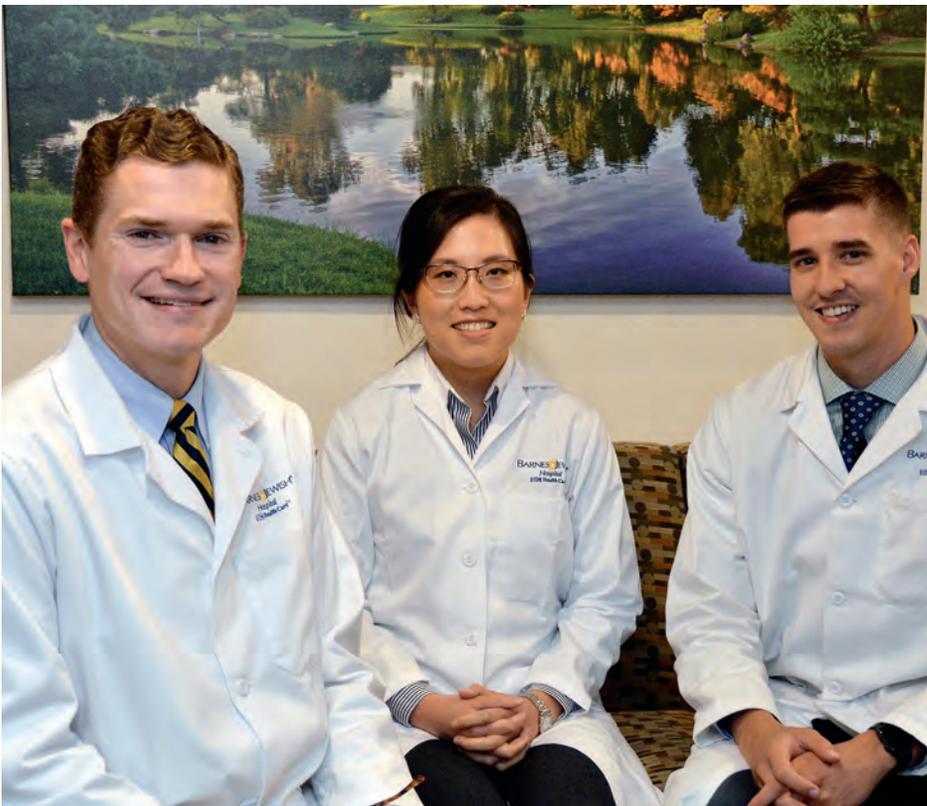
Zhude Tu, PhD, professor of radiology, together with **Delphine Chen, MD**, associate professor of radiology, received a five-year \$2,840,217 grant from the National Institutes of Health for “PET Sphingosine-1-Phosphate Receptor 1 (S1PR1) Radiotracers for Multiple Sclerosis.”

Andrei Vlassenko, MD, PhD, assistant professor of radiology, and **Manu Goyal, MD**, assistant professor of radiology, received a five-year, \$3,678,370 grant from the National Institutes of Health for “Aerobic Glycolysis: A Marker of Brain Resilience to Aging and Alzheimer’s Disease.” Vlassenko and **Marcus Raichle, MD**, the Alan A. and Edith L. Wolff Distinguished Professor of Medicine, received a five-year \$3,729,728 grant

from the National Institutes of Health to study “Aerobic Glycolysis in the Development of Alzheimer’s Disease.”

Pamela K. Woodard, MD, professor of radiology; **Samuel I. Achilefu, PhD**, the Michel M. Ter-Pogossian Professor of Radiology; **Richard L. Wahl, MD**, the Elizabeth E. Mallinckrodt Professor of Radiology, together received \$933,700 for a five-year grant from the National Institutes of Health for “Training Opportunities in Translational Imaging Education and Research,” also known as TOP-TIER. The new, interdisciplinary clinician-scientist postdoctoral training program will prepare residents and fellow trainees on how to bring preclinical imaging innovations to patients and the practice of medicine.

Dmitriy A. Yablonskiy, PhD, professor of radiology, received a \$2,655,602 grant from the National Institutes of Health to research “In vivo MRI Biomarkers of Microstructural Correlates of Brain Pathology in Preclinical and Early Alzheimer Disease.”



MIR’s diagnostic radiology chief residents for 2017-2018 are: Andrew Wallace, MD, Megan Lee, MD, and Robert Stone, MD.

Appointments/ Promotions

Joseph J. Ackerman, PhD
Professor of Radiology

Matthew Covington, MD
Assistant Professor of Radiology

Kathryn Fowler, MD
Associate Professor of Radiology

Brian A. Gordon, MD
Assistant Professor of Radiology

Seung Kwon Kim, MD
Associate Professor of Radiology

Yongjian Liu, MD
Associate Professor of Radiology

Hilary L. Orlowski, MD
Instructor in Radiology

Demetrios (Jim) Raptis, MD
Assistant Professor of Radiology

Qing Wang, PhD
Instructor in Radiology

Lectures

Samuel I. Achilefu, PhD, Michel M. Ter-Pogossian Professor of Radiology and chief of optical radiology, presented “Radionuclide Stimulated Photodynamic Therapy of Cancer” at the International Photodynamic Association (IPA) World Conference on June 10 in Coimbra, Portugal. Achilefu also lectured at the 2017 annual meeting of the Society of Nuclear Medicine and Molecular Imaging on June 10 in Denver, Colorado.

Tammie Benzinger, MD, PhD, associate professor of radiology, presented “Time Course of Amyloid and Tau Deposition in Autosomal Dominant Alzheimer’s Disease” at the Alzheimer’s Association International Conference, July 17 in London, England.

Robert C. McKinstry, MD, PhD, professor of radiology and Senior Vice Chair and Division Chief of Diagnostic Imaging, was selected to participate in the Anne G. Osborn International Outreach Professor Program of the

American Society of Neuroradiology (ASNR). The main objective of the outreach program is to facilitate the exchange of neuroradiology knowledge and techniques, and to teach in developing countries. Outreach professors perform case and teaching-file reviews, and participate in direct teacher-to-student “view-box/workstation” education. McKinstry taught in Pretoria and Johannesburg, South Africa, August 28 through September 8.

In Memory

Richard Baron, MD, Class of 1980, a former abdominal radiology fellow and a former instructor, died on May 4, after suffering an apparent heart attack. Baron also earned his medical degree from Washington University School of Medicine in 1976.

Khanna Named Chief of Pediatric Radiology



Geetika Khanna, MD, professor of radiology, has been named chief of pediatric radiology for Mallinckrodt Institute of Radiology. Khanna, who

served as interim chief for the past year, also assumes the role of Radiologist-in-Chief for St. Louis Children’s Hospital. She succeeds Robert C. McKinstry, MD, PhD, who is now Senior Vice Chair and Division Chief of Diagnostic Imaging.

“Geetika is a tremendous leader, a go-to physician, and was the top candidate for the job after a national search” says Mallinckrodt director Richard L. Wahl, MD. “We were very fortunate to have recruited Geetika from the University of Iowa in 2008. Under her direction and expertise with pediatric body imaging, the MRI practice was modernized, and the application of MRI has been expanded.”

A previous recipient of MIR’s Distinguished Teaching award, Khanna has authored many clinical and translational research publications, is assistant editor for Pediatric Radiology, has served as the site principal investigator for a number of National Institutes of Health funded clinical trials, and plays an important role in the Children’s Oncology Group.

Khanna earned her medical degree from the All India Institute of Medical Sciences in New Delhi, India. She trained in diagnostic radiology at Saint Louis University School of Medicine and at the University Iowa College of Medicine, where she also completed a pediatric radiology fellowship.

Hershey Named NIL Chief; Only Second In Lab's 40-Year History

Tamara Hershey, PhD, a professor of radiology and psychiatry, has been named as lab chief of the Neuroimaging Laboratory (NIL) at Mallinckrodt Institute of Radiology. She succeeds Marcus E. Raichle, MD, the Alan A. and Edith L. Wolff Distinguished Professor in Medicine, who established the interdisciplinary research laboratory during the 1970s.

Hershey, who also holds joint appointments in neurology and in psychological and brain sciences, will direct the lab where her career began.

"Tamara essentially 'grew up' in the rich and diverse intellectual environment of the NIL," says Richard L. Wahl, MD, director of Mallinckrodt Institute of Radiology. "Her research in the fields of cognitive and clinical neuroscience has been continuously funded by the National Institutes of Health for over 17 years and increasingly involves multisite and international collaborative studies."

For the last three years, Hershey has been the NIL's associate director. Currently the NIL has over 30 faculty members representing three departments with 100 staff, students and postdoctoral fellows.

"The NIL consists of faculty from multiple disciplines who perform collaborative and creative systems neuroscience using neuroimaging," says Hershey. "They are creative, independent thinkers who, under Dr. Raichle's direction and guidance, became a self-organized and cohesive community, providing a unique environment for the mentorship of students and junior faculty."

In her new role, she plans to establish a more formal interdepartmental executive steering committee to help guide and support the NIL, and develop policies to increase transparency and equity. Her long-term goals are to make it easier for junior faculty to be mentored



within the NIL, improve interdepartmental cooperation that supports the NIL and to strengthen the NIL's role as an intellectual hub for the WU neuroimaging community.

Hershey earned her undergraduate degree from Earlham College in Richmond, Indiana, in 1988, and her doctorate in clinical psychology (neuropsychology track) from Washington University in 1996.

Entrepreneurship in the Realm of Research

Navigating an idea from "bench to bedside" can test the fortitude of the most seasoned researcher. So imagine what it can do to those new to the process. The good news: now there's help.

MIR's Entrepreneurship and Innovation seminar series helps budding inventors at Washington University School of Medicine take their idea from concept to commercialization, step by step. The second lecture in the series, "Turning Innovation into Entrepreneurship," provided those attending with information on the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants available through

the National Institutes of Health. The event, held on September 7, attracted 33 researchers, also included a unique perk. Attendees could meet one-on-one with an NIH program director to discuss their idea in 15-minute time slots, like entrepreneurial speed dating for researchers.

Hongyu An, DSc, associate professor of radiology and the associate director of the Center for Clinical Imaging Research at MIR, was among the attendees. New to the process, she is eager to learn.

"I didn't even know the questions to ask much less how to approach the process," says An, who "has some pretty

cool ideas on how to use MRI to guide radiotherapy for cancer treatment."

Dong Zhou, PhD, instructor in radiology, also attended the seminar. While the general information was similar to prior presentations, "it was beneficial to hear specific questions, such as those about conflict of interest, answered by NIH reps," he says. "And the one-on-one meeting was very useful to ask them innovation-related questions." 

A LOOK BACK

Up In The Air

Thirty years ago, in the name of scientific research, Marcus Raichle, MD, professor of radiology and neurology, left the comforts of home and the MIR Tower to climb the frigid peaks of the Karakoram Range in Southeast Asia. He flew to London and traveled with the Birmingham Medical Research Expeditionary Society to Islamabad, Pakistan.

It was the society's fifth climb and they wanted to see if the drug acetazolamide could alleviate high altitude sickness when taken in large doses. Their goal? The top of Gondoro Peak, elevation 18,500 feet.

"I skied for many years but never climbed anything of this sort before," says Raichle, the Alan A. and Edith L. Wolff Distinguished Professor of Medicine, who celebrated his 46th anniversary at MIR this year. "When we got up and were on slopes and glacier fields, we got a quick set of lessons on how you behave — and how to use ice axes when you start sliding down the mountain."

After 11 days of often treacherous climbing, the tenacious group finally reached their goal. "I'm standing on this peak on the Pakistani-China border and I had this T-shirt with me that says, 'Mallinckrodt Institute of Radiology' on it," says Raichle. "So I cut it up and put it together as a little flag. I recently found the dang thing." Then he adds with a smile: "Maybe I should frame it? It does have a little history." //

A View of interior Pakistan from the plane.

B A group of Pakistani men were their porters.

C Raichle (center) standing atop Gondora Peak.

D The group climbs a peak above their mountain camp.

E Raichle just before his trek out of Hushe valley into mountains.

F Descending the peak.

G A fellow scientist records Raichle's muscle strength.

H Raichle undergoing a brain blood flow study.



A



B



C



FOCAL SPOT

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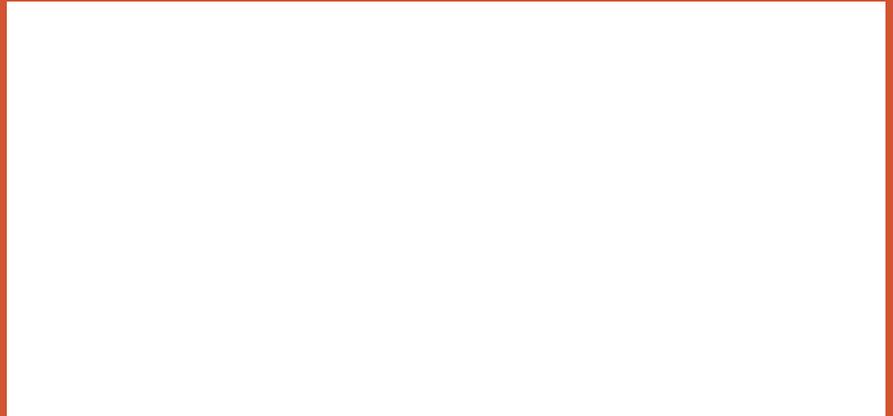
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MIR Physicians of
Washington University



R. Gilbert Jost, MD, (left) former director of MIR, along with Teresa Carson (center), assistant to the chair at MIR, and Richard L. Wahl, MD, (right), director of MIR and Department of Radiology chair, at Jost's retirement reception.

