

FOCAL SPOT

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# 10 RAD WOMEN

A look at 10 MIR professors who are helping lead the way for women in radiology.

(From left: Geetika Khanna, MD, Pamela K. Woodard, MD, and Farrokh Dehdashti, MD)





David H. Ballard, MD, a TOP-TIER participant, uses 3D printing in his translational imaging work.

# Training the Next Generation of Imaging Scientists

by Kristin Rattini

For young scientists eager to make their way to the forefront of translational research and precision imaging, Mallinckrodt Institute of Radiology (MIR) offers a clear path. A leader in NIH funding, MIR is home to premier training programs and a history and culture of innovation that come together to spur revolutionary advances and drive discovery.

## Research Residency Track

Created in 1989, the Research Residency Track allows residents up to 48 weeks of dedicated research time, interspersed with clinical rotations and independent call during their four-year diagnostic radiology residency.

Participants convene along with TOP-TIER T32 trainees (*see below*) on Monday mornings for conferences dedicated to research-related topics. “The goal is to provide exposure to the infrastructure that will support their research,” says Pamela K. Woodard, MD, senior vice chair and division director of research facilities. “They learn how to work with Washington University’s Institutional Review Board and Office of Technology Management, write a grant, and navigate the patent and grant application processes.” Woodard directs the residency track, while Joseph E. Ippolito, MD/PhD, assistant professor of radiology and former resident on the track, serves as associate director.

## TOP-TIER

MIR is one of just five radiology residency programs in the U.S. to receive a prestigious T32 NIH five-year grant, with Samuel I. Achilefu, PhD, Richard L. Wahl, MD, and Pamela K. Woodard, MD, as principal investigators. Known as TOP-TIER, the program focuses on training physician-scientists

in clinical translational imaging research and bringing innovation to the practice of medicine. The interdisciplinary grant provides two training slots per year in years one and two, and three slots in years three through five. To encourage interaction between Washington University’s School of Medicine and the School of Engineering and Applied Sciences (SEAS), Provost Holden Thorp provided funding for an additional training slot for physician-scientist trainees with a mentor in SEAS. Each trainee in the program is assigned a basic science mentor and a clinical mentor, both of whom guide them in developing their own funded research.

“Translational imaging research extends into precision medicine,” says Woodard, the program’s director. “Physician-scientists in the program are studying imaging at the cellular level to understand the very mechanisms of the disease process that impact patient healthcare on an individual basis.”

TOP-TIER participant David H. Ballard, MD, was able to secure an RSNA Resident Grant for his research under Ippolito as a result of his training. Ballard’s work explores the use of 3D printing to translate images into pathology section molds for patients with renal cell carcinoma undergoing nephrectomy. “TOP-TIER aims to make us aware of opportunities when they arise,” says Ballard, “and to be able to utilize our resources and support to pursue them.”

## 21st Century Imaging Sciences Graduate Student Training Grant

MIR’s second NIH T32 training grant funds Washington University’s interdisciplinary Imaging Sciences Pathway (ISP). Since 2006, ISP has trained nearly 60 graduate

students from three schools — arts and sciences, engineering and medicine — in the underlying physics, biomechanisms and applications of biological imaging.

The cross-campus initiative encourages these “renaissance scientists” in developing imaging tools and strategies to aid in the treatment and prevention of disease. Participants can draw on the expertise of 30 mentors across 11 departments, including MIR faculty, as they conduct

multidisciplinary research that they present at the program’s annual Imaging Sciences Retreat.

“The ISP has become a magnet for recruiting both students and principal investigators,” says Joseph P. Culver, PhD, director of ISP and professor of radiology. “The collaboration among the three schools strengthens ties in imaging sciences across the university and is key to maintaining Washington University’s cutting-edge status.”

## MIR Secures Grant for PET Radiotranslation and Resource Center

by Kristi Luther

In September, Mallinckrodt Institute of Radiology secured a five-year, \$6.3 million grant for the PET Radiotranslation and Resource Center (PET-RTRC). The center develops and disseminates a broad portfolio of PET radiotracers used in preclinical and human imaging studies throughout the nation. The P41 grant — from the National Institute of Biomedical Imaging and Bioengineering, part of the National Institutes of Health (NIH) — is the first of its kind to focus in this area.

“This center was essentially started fifty years ago,” says Robert J. Gropler, MD, professor of radiology and senior vice chair and division director of radiological sciences. “All of these major, if you will, quantum leaps in technology development started with these types of center grants.”

In 1963, MIR was awarded \$300,000 from the National Heart, Lung, and Blood Institute (NHLBI) for the project titled: Cyclotron Produced Isotopes in Biology and Medicine. It was the first of its kind to focus on PET technological developments for biomedical applications. Then in 2005, MIR became one of the major centers and administrative hub for the NHLBI-sponsored Programs of Excellence in Nanotechnology, a five-year, \$12.5 million award to develop novel PET-based nanomaterials to facilitate precision medicine. So in many ways, the funding of the new PET-RTRC encompasses the continuation of a legacy of PET innovation and collaboration at MIR.

But the team at the PET-RTRC won’t be working alone. While the center will serve as headquarters and home for research and development, collaboration sites around the country will be an integral part of operations. MIR’s expertise with radiotracer design and development will be leveraged to shorten preclinical timelines and facilitate



Robert J. Gropler, MD, who serves as the center’s director, says it was “essentially started 50 years ago.”

preclinical studies of new radiotracers designed to expand the understanding of diseases.

“What these centers are designed to do is develop new technologies, using the expertise around the country to speed that development,” says Gropler. “And then you have the infrastructure to distribute the tracers around the country to interested users, as well as train them in how to use them.”

Securing funding for a center like this is highly competitive, but Gropler says MIR’s persistence and reputation sealed the deal. “When people think of PET and where it started, who has the most expertise, and who’s doing the most development, Washington University rises to the top every time.”

## Data Set, Game and Match

by Holly Edmiston

“We do a lot of work on information systems and imaging modalities to get data and organize it in ways it can be mined,” says Daniel S. Marcus, PhD, associate professor of radiology at Mallinckrodt Institute of Radiology (MIR). That is his simple explanation of a complex field called informatics.

Informatics arose in many different areas in response to the information explosion of the past decades, says Marcus, who directs both the Neuroimaging Informatics and Analysis Center and the Electronic Radiology Laboratory at MIR. The biggest field affected was bioinformatics, he adds.

Marcus has been at the forefront of this explosion and taming of data. He has been at Washington University his entire career, earning undergraduate degrees in biology and English literature, followed by a PhD in neuroscience. From 2001 through 2005, he was a bioinformatics specialist at the Howard Hughes Medical Institute at Washington University, during which time he joined the faculty as a research assistant professor of psychology.

Daniel S. Marcus, PhD, has been at the forefront of informatics, which mines complex data sets for scientific discovery.



Marcus moved to MIR in 2003, where he remains. In 2013, he became founder and president of Radiologics, a company headquartered in St. Louis that provides industry-leading software and services that are purpose-built for imaging-based clinical trial workflows.

“As a student in my lab, Dan was a talented neurophysiologist who studied visual perception in nonhuman primates,” says David Van Essen, PhD, the Alumni Endowed Professor of Neurobiology. After receiving his PhD, Marcus changed labs and began focusing on the implementation of a database for human neuroimaging studies.

“Dan’s efforts proved spectacularly successful,” says Van Essen. “It has been a tremendous pleasure to work very closely with him for the past eight years as our interests converged on neuroinformatics aspects of the Human Connectome Project.”

Managing scientific data in such large data sets and then extracting information from them to make scientific discoveries is no easy task. As scanners have gotten more advanced, images are becoming more complex and need fairly sophisticated algorithms to develop and process those images.

“On the research side, which is really our focus, data sets are getting bigger due to large, multicenter trials that are enrolling hundreds of people. That means we have longitudinal studies of thousands of images going on for a decade or more,” says Marcus, “and they’re only going to get bigger.”

Another use of informatics is in interfacing with electronic medical records and other systems to handle clinical data such as lab reports and patient outcomes. According to Marcus, informatics from multiple disciplines emerged on their own and to some degree are in their own “silos.” Much of the work he does is to develop interfaces between these discrete entities.

“We are doing more and more with retrospective analysis of clinic data to understand what’s happening with patients,” says Marcus. “Some of that is predictive, but we also are using biomarkers to diagnose patterns and determine what outcomes are likely to be.”

All of this data informs physicians in their treatment decisions for individual patients and all of it must be done in a manner that ensures trial participants’ privacy will not be compromised.

Marcus and his team are working to build an infrastructure that makes such analysis repeatable. They also

are working on ways to quickly move data obtained in the lab to the clinics where it can be used to help patients.

Last year he took a six-month sabbatical during which he served as a visiting professor at University College London. “They are doing a lot of very progressive work in clinical applications,” says Marcus. “It was almost like an exchange

program to educate and to learn.”

Of his career path, he says that writing computer code for neuroimaging projects is what started him down the path to informatics. “It’s been great fun and I’ve been exposed to more clinical operations over the past five years, which has been extremely rewarding.”

## Schindler Tapped to Grow Cardiac PET

by Holly Edmiston

“I was always torn between medicine and law,” says Thomas H. Schindler, MD, associate professor of radiology, of his early career options. But his father was a physician and that, combined with his natural inclination to help people, eventually nudged him toward medicine.

Schindler, who was born in Karlsruhe, Germany, attended medical school at the University of Leipzig. Despite writing his thesis on MR imaging in Europe, he began his career in pathology. But after a year, his interests shifted and he completed residencies in both radiology and cardiology at the University of Freiburg in Germany, as well as a cardiology fellowship in Basel, Switzerland. He ultimately chose cardiology as a specialty because its imaging and intervention in the cardiac catheterization lab allowed him to combine both interests.

In 2006, Schindler came to the U.S. as a postdoctoral fellow in cardiovascular PET in the Medical Intensive Care Unit at UCLA. Prior to joining Mallinckrodt Institute of Radiology’s division of nuclear medicine in January of this year, he was faculty at Johns Hopkins University for nearly five years, where he led its cardiovascular nuclear medicine group. He credits MIR director Richard L. Wahl, MD, with convincing him to come to St. Louis to expand the department’s cardiovascular imaging research and capabilities.

“I am delighted that we were able to recruit Tom to lead our cardiac nuclear medicine effort and to grow our clinical cardiac PET program,” says Wahl. “He is a globally recognized expert in cardiovascular nuclear medicine.”

The emergence of cardiovascular imaging as a subspecialty and the individualized treatment of coronary artery disease are key issues Schindler will address in his new role. Once the purview of cardiac surgeons, treating the heart successfully is now often done using interventional procedures. “It’s really becoming a team effort,” he says. “Interventionalists can actually open up any vessel now —



Thomas H. Schindler, MD, is a “globally recognized expert in cardiovascular nuclear medicine,” says MIR director Richard L. Wahl, MD.

there’s no barrier. Having to decide what is the best approach for a patient has gotten more difficult.” Schindler says he’s encouraged by the willingness of specialists at the School of Medicine to share the decision-making process. “Cardiac surgeons and cardiovascular imaging specialists need to talk to one another to find the best solutions for each patient in terms of long-term outcomes.”

Schindler’s research interests include PET assessment of cardiac perfusion and myocardial blood flow in coronary artery disease detection, and identification and characterization of inflammatory-infiltrative disease such as sarcoidosis, inflammation of the great vessels and various myocardial receptors.

In June 2018, Schindler received the prestigious Hermann Blumgart Award for lifetime achievement in cardiovascular nuclear medicine at the Society of Nuclear Medicine and Molecular Imaging’s annual meeting in Philadelphia. ▨

# Farm Strong

Making a Difference in One Man's Fight Against Cancer

by Holly Edmiston



**Christopher Plummer is the epitome of the laconic farmer. He doesn't talk much, he doesn't complain. He's a hard worker, and he's practical to a fault.**

**Plummer is also a cancer survivor. But you won't hear him describing his "battle" with the disease or "journey of recovery." It's just not his style.**

**When asked about his nine-year ordeal with melanoma, his answer is short and to the point: "I've been pretty lucky, and I've had some real good doctors."**



One of those doctors is Jack W. Jennings, MD, PhD, professor of radiology and chief of musculoskeletal imaging at Mallinckrodt Institute of Radiology (MIR). In February 2014, Jennings performed two procedures on Plummer.

“We went full guns on Chris with radiation and ablation because he’s a young guy and his cancer was progressing while he was on chemotherapy,” says Jennings, who also is director of musculoskeletal and spine intervention procedures at MIR. That treatment included cryoablation (tissue freezing) on his shoulder and radiofrequency ablation (tissue heating) and cement on his hip.

Following his treatment, Plummer underwent physical therapy to immediately begin walking on his hip and to help with a stiff shoulder. “Recovery wasn’t too bad at all,” he says. “Metastases are not a good thing to have, but ablation has really helped me.” It also seems to have worked. Plummer, now 38, has remained cancer-free since then.

Born into a farm family, Plummer makes his living herding cattle, and growing corn and beans on 1,000 acres in rural Illinois. But the physicality of the work takes a toll, and in a body that is also fighting off cancer, it can be especially debilitating.

“Chris is a remarkable person, having lived with metastatic melanoma since 2011,” says his radiation oncologist, Clifford Robinson, MD. “His tumors have primarily metastasized to bone, which has been a problem for him because he is incredibly active.”

It all started for Plummer in 2009, with an odd patch of skin on his back. It was diagnosed as



melanoma, the most dangerous type of skin cancer, but both he and his doctors thought he’d be fine once it was removed.

This proved not to be the case. Over the next four years, the cancer came back in various forms. It first appeared in Plummer’s lymph nodes, then his liver, spleen and gallbladder, portions of which were removed. Finally it progressed into the bones of his right shoulder and left hip.

Plummer saw several doctors and tried a variety of drugs during this time, but nothing seemed to stem the cancer’s spread. That’s when Robinson referred him to Jennings.

“Melanomas are highly resistant to standard radiation, and Chris was one of the first patients where I worked with Jack to combine radiation and cryoablation,” says Robinson, associate professor of radiation oncology. “The results have been amazing. Chris has had unprecedented control of his tumors, and he was still working the last time I saw him.”

**Above:** The patient’s cancer was progressing while on chemotherapy, so Jack W. Jennings, MD, went “full guns” with radiation and ablation.

**Left:** Radiation oncologist Clifford Robinson, MD, (right) says what Jennings provides patients is “nothing short of miraculous.”



This collaboration with Jennings may have been one of Robinson's first, but most decidedly not his last. "Jack and I frequently work together on patients with bone and spine metastases," he says. "The types of quality-of-life improving procedures he is able to provide for our patients is nothing short of miraculous."

Musculoskeletal (MSK) imaging predominantly deals with diagnosis, particularly of sports-related injuries. Once diagnosed, those cases are moved on to orthopedic surgery or physical therapy. Jennings' group is unique in the amount of interventional procedures it also performs.

"It's a real shift from how bone cancer was treated even five years ago," he says. "Then it was all palliative care; now, 30 to 40 percent of patients are treated for local tumor control."

MSK imaging's involvement in oncological intervention began with Louis A. Gilula, MD, founder and chief of musculoskeletal imaging at MIR for more than two decades. Gilula, who died in 2014, was Jennings' mentor and a recognized pioneer in pain management, offering patients therapeutic spine injections before they became commonplace. He was the first to perform vertebroplasty — a procedure that stabilizes compression fractures in the spine with

bone cement — on a cancer patient in Missouri.

"Patients with bone cancer suffer more than any other group of patients with cancer," says Ramaswamy Govindan, MD, chief of medical oncology at Washington University School of Medicine. "Unfortunately, it is a very painful, almost intolerable, amount of pain."

Because the skeletal system provides support for the rest of the body, the significance of metastatic disease in bone can't be overstated, says Govindan, who also works closely with Jennings. The types of modalities MSK imaging offers not only relieve pain, but also can help to strengthen bone and prevent further compression and collapse.

Although Plummer is healthy for now, both he and Jennings know it wouldn't be surprising for some new location of his cancer to pop up. Still, Jennings says, "Chris is a true life success story."

For his part, despite the ongoing possibility of recurrence, Plummer remains steadfast.

"When I went from stage 1 to stage 2, that was a little bit of a shock, but once you get used to it, it's not that big of a deal," he says. "You know it's there, but you get to where you don't dwell on it. It's just nice to be able to work." ■■■

"I've been pretty lucky, and I've had some real good doctors," says Chris Plummer, about his nine-year battle with melanoma.



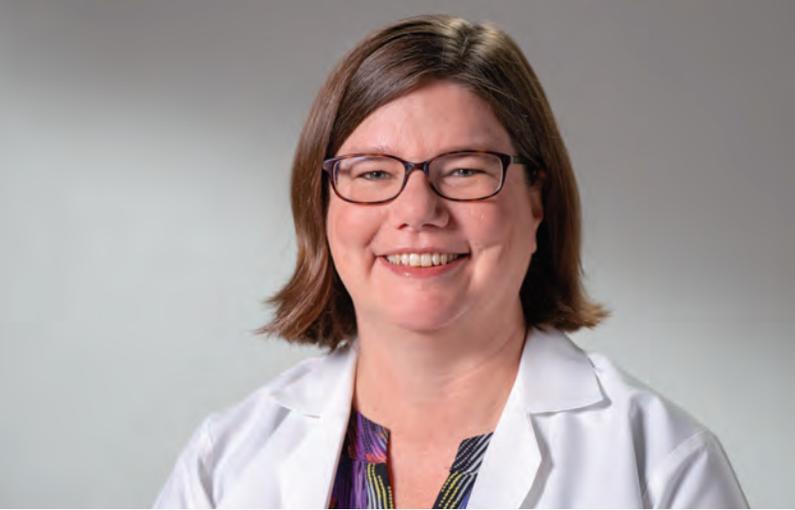
# Rad Women

Since the early 19th century, when Marie Sklodowska Curie began conducting what would eventually become pioneering research on radioactivity, women have been driving ideas and innovation in the field of imaging. At Mallinckrodt Institute of Radiology, the story continues, thanks in large part to these ten trailblazing professors of radiology.



An MIR faculty photo circa 1962 includes Lily Ann Hanes (back row, third from left). A year later she became MIR's first female chief resident in radiation oncology. Hanes, who was pregnant when she applied for a residency spot, was told by then director Hugh M. Wilson, MD, that she would need her husband's permission before he would consider it. Hanes pushed back and Wilson ultimately let it drop.

Source: "Imaging & Innovation: A History of Mallinckrodt Institute of Radiology"



**Tammie L.S. Benzinger, MD**, is a neuroradiologist and serves as chief of MRI Service. Benzinger's research group, part of MIR's Neuroimaging Laboratory, studies Alzheimer's disease and related dementias. She uses PET and MRI imaging to investigate biomarkers she believes will become significant tools in detecting and diagnosing degenerative brain diseases before symptoms occur. In 2018, Benzinger, who is also a professor of neurological surgery, received the Women in Neuroradiology Leadership Award from the American Society of Neuroradiology and the Distinguished Investigator Award from the Academy for Radiology and Biomedical Imaging Research.

**Farrokh Dehdashti, MD**, was named senior vice chair and division director for nuclear medicine in 2017. Dehdashti is an innovative translational researcher with a focus on applying PET imaging to the diagnosis and treatment of cancer. She is credited with conducting first-in-man studies of several novel PET diagnostic compounds related to cervical, breast and prostate cancers. Dehdashti showed that a PET imaging agent can be used as a noninvasive, reliable method to determine whether a patient's breast cancer depends on estrogen or progesterone hormones for its growth and, consequently, whether hormone-blocking therapies are likely to be effective.

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**When I was applying to medical school my grandmother had dementia** I was very disturbed with the diagnosis and the interactions with the doctors and the medical staff at her nursing home. The chart just said "this patient has dementia." It didn't capture who she was or who she had been. When I applied to medical school, I knew I wanted to work on Alzheimer's disease.

**Radiology uniquely supports women** I think radiology has uniquely supported women and been professional in its environment for as long as I've been in this field. It amazes me the stories my husband [also a physician] tells about the conversations that go on, the things that happen in other departments. I have never seen any of that. Last year I was on a panel to talk about obstacles you face as a woman in medicine, and I really struggled. I could only come up with one incident, and that was as a medical student.

**There's a community among women here** One of the nice things about the women here at Mallinckrodt is that in each section when I would rotate through as a resident, they would reach out to me. They're still my friends here on the faculty now, and they are amazing.

**I developed terms for my own maternity leave** When I came here in 2001, I was eight months pregnant. I asked the chief residents what the maternity policy was and they didn't know. So I researched it, including what I thought the university supported, and wrote my own plan.

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**The field of radiology always fascinated me** I was interested in radiology from the first time I was exposed to it during medical school. It allows one to peel back the surface of the body and look deep inside.

**There are more women now than when I did my residency** More importantly there are currently more women in the leadership positions, especially in academic institutions. It's very important that women are in a position to decide and negotiate on issues that affect women.

**Try to stay calm and carry on** I had many mentors and teachers over the years and learned something from each of them. I learned to stay calm in clinic, as your nervousness can affect everyone around you — patients, trainees and technologists. This can lead to a less than optimal environment and make everyone prone to mistakes.

**I believe it is important to teach** I admired my teachers and mentors so much that I wanted to inspire others as they had inspired me. I believe it is important to teach and encourage your trainees. But you need to realize that, ultimately, they are responsible for their own learning and never spoon-feed them.

**Women are nurturers by nature** We need to be careful not to accept too much responsibility that can affect both our personal life and academic career. So sometimes it is okay to say no.



In 2017, **Tamara Hershey, PhD**, the James S. McDonnell Professor of Cognitive Neuroscience, was named chief of the Neuroimaging Laboratory at MIR. She succeeded imaging legend Marcus E. Raichle, MD, who established the interdisciplinary research lab during the 1970s. For the last eight years, Hershey, also a professor of psychiatry, has been the principal investigator on the largest and longest-running study of neurological complications of Wolfram Syndrome. Her research in the field of cognitive and clinical neuroscience has been continuously funded by the NIH for over 17 years and increasingly involves multisite and international collaborative studies.

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**The pursuit of imaging sciences** I was drawn to neuroimaging when it was in its infancy as a research tool for understanding brain-behavior relationships. My PhD training was in neuropsychology, and the idea that we could use neuroimaging tools — at that point PET — to understand what neural systems were engaged in specific cognitive processes or what neural systems were affected by disease states was very exciting.

**Where we've been, where we're going** Over the past 20 years, I have seen more women actively seek, be awarded and succeed at leadership positions of all types. We have a long way to go still at achieving equity, but it is heartening to see the direction of these trends.

**My teachable moment** When I first pitched a study to Joel Perlmutter [the Elliot H. Stein Family Professor of Neurology] over 20 years ago, he repeatedly asked me what question I was trying to answer. He kept asking until I had peeled back all the layers of obfuscation and we came to the most interesting kernel of inquiry. Then he helped me build it back up into a study that made sense. I still strive for this intellectual clarity for all of my work.

**Alternate career choice, wardrobe included** If I hadn't gone into science I would probably be an English professor specializing in 18th century British Literature, complete with cardigan and elbow patches.

In 2017, **Geetika Khanna, MD**, was named chief of pediatric radiology for MIR, at the same time assuming the role of radiologist-in-chief at St. Louis Children's Hospital. Khanna, who earned her medical degree from the All India Institute of Medical Sciences in New Delhi, is also the diagnostic imaging chair for the renal tumor committee of the Children's Oncology Group, a National Cancer Institute-supported co-operative group that conducts clinical trials in pediatric oncology. She has authored many clinical and translational research publications and is assistant editor for the journal *Pediatric Radiology*.

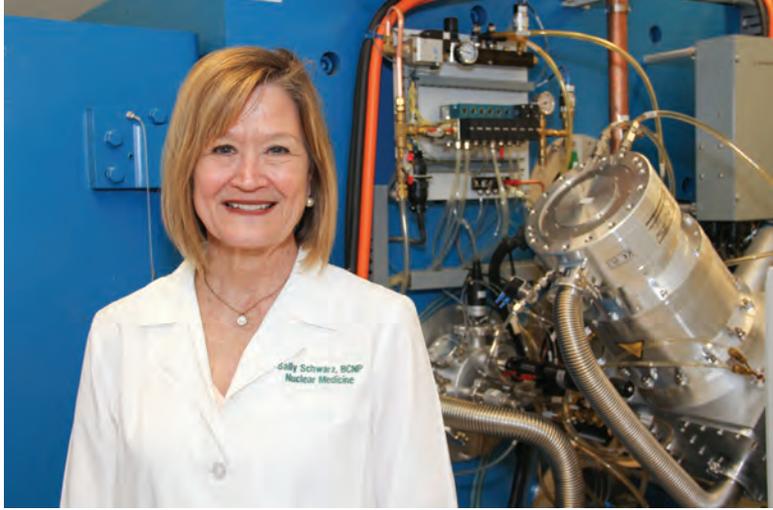
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**Radiology was a family business for me** My mother, an academic radiologist in India, was a major influence in my life. We often heard stories of barium enemas and other GI studies at the dinner table. Though I never really thought about it consciously, I found myself excited about radiology early in medical school and decided to follow in the footsteps of my mother and eldest sister.

**Radiologists form an integral part of the patient care team** An important part of my residency was going to patient floors with the attending to discuss imaging findings with the primary team. In pediatric radiology, we do daily rounds with the ICU teams. This helps the team make informed decisions, and helps us connect with the clinicians outside of the dark reading room.

**Mentors who made a difference** Atchawee Luisiri at Cardinal Glennon (in St. Louis) and Yutaka Sato at University of Iowa are at the top of the list. Dr. Luisiri was and Yutaka is an excellent academic pediatric radiologist and clinician with sought after expertise. They also taught me to have passions outside of work.

**Speaking of outside passions** I took up Tae Kwon Do, pushed myself through to a brown belt, and was working towards my black belt. Right now, I need to focus on family and work commitments, but hope to return to it someday.



**Sally W. Schwarz, RPh, BCNP**, first arrived at MIR in 1976, at the behest of pioneering radiochemist Michael J. Welch, PhD. Less than a decade later Schwarz became co-director of MIR's cyclotron facility, and two years after that was named director of PET radiopharmaceutical production at Washington University. In 2015, she was elected president of the Society of Nuclear Medicine and Molecular Imaging, becoming the first pharmacist and fourth woman to hold the position. Schwarz continues to be known as one of the world's most recognized authorities on radiopharmaceuticals.

**Cary L. Siegel, MD**, joined Washington University faculty in 1993 and currently is head of gastrointestinal and genitourinary radiology within the abdominal imaging section at MIR. Siegel is a fellow in the Society of Abdominal Radiology and serves as a committee member of the ACR Appropriateness Criteria for women's imaging, the American Board of Radiology certifying exam/maintenance of certification exam, the RSNA Genitourinary Scientific Exhibits Committee and the National Cancer Institute Renal Cell Task Force for the NIH.

### **Nuclear medicine was a new area of radiology**

The field was growing in the 1970s, and there was a need to educate pharmacists in the field of nuclear medicine. I had been introduced to a few radiopharmaceuticals in my undergraduate program, but not those used for imaging.

**I was at the forefront of this career** During my nuclear pharmacy training, I realized that this non-traditional pharmacy role was going to be an opportunity for me to grow and make a difference as this field continued to grow. There were only about 100 nuclear pharmacists in the U.S. at the time.

**The field of nuclear pharmacy for women** The number of women in the field of nuclear pharmacy has increased since I began in 1976. Today, 28% of Board Certified Nuclear Pharmacists are women.

**I became involved in FDA regulatory requirements** In 2009, I was asked to present the new FDA (Food and Drug Administration) regulatory path requirements at the Society of Nuclear Medicine's mid-winter meeting. From that time forward, I have continued to be involved in regulatory issues and have shared this expertise with my colleagues.

**Designing woman** If I didn't choose a career in pharmacy, I would have chosen design – interior or women's clothing. I love textures and color.

### **The technology of radiology fascinated me**

I have good 3D image perception, an important skill for a radiologist. I also like the patient contact we have during fluoro studies, ultrasound procedures and CT-guided biopsies. During my medical school training I did research in radiology and a radiology elective, and the radiologists seem to truly enjoy their jobs.

### **Radiology has changed for both men and women**

We are now much more focused on creating a family-friendly work environment for childcare issues, elderly parents who may need some additional support, and scheduling the clinical work and call schedules around our complex schedules and duties.

### **Women need to find a good work/life balance**

It's important to work hard and read in the evenings/weekends, but exercise and having fun with friends, colleagues and family are important too. Make friends during residency who you can lean on for advice and help when the going gets tough.

**My approach to mentoring is to give honest advice** I hope the residents feel that I am approachable to discuss a wide range of issues and I will be non-judgmental and hold their confidence.

**Did you know** I was a champion barrel racer in my youth.



**Marilyn J. Siegel, MD**, was MIR's first female chief resident in radiology and, later, its first female professor of radiology. Siegel, who also is a professor of pediatrics, is sought after worldwide for her expertise in pediatric radiology. As a result, she has been invited to speak in South America, the Middle East, the Philippines, Thailand, Japan, China, Australia, Africa and in 44 of 50 U.S. states. Siegel has written 15 books, including "Pediatric Sonography," a definitive guide to the use of ultrasound in pediatric patients, now in its fifth edition.

**A standout residency moment was a call from Ron Evens** He told me I was going to be a chief resident (1976-77). That meant I would be the first female chief resident at MIR. Ron was a women's libber before the movement became organized.

**Every day is a teachable moment** I'm co-director of the Siteman Cancer Center Imaging and Response Assessment Core (IRAC). As IRAC's principal diagnostic radiologist, I oversee the interpretation and measurement of CT and MRI studies, which puts me in a unique position to help oncologic investigators optimize their use of imaging technologies at Washington University.

**CT pioneer Stuart Sagel was a mentor** He got me interested in writing, which led to a career in academics and my long-standing interest in education. He also stimulated my interest in CT and supported my membership application for the SBCT, where I became the first pediatric radiologist and woman president.

**Mentoring is a stepwise approach with multiple meetings** The mentee and I come up with a research idea. Then we review the basic steps of protocol development: background, hypothesis, aims, study design, data collection, analysis. At that point, the mentee takes over and drafts a response for each part of the protocol. Once the approach appears solid and feasible, the study begins. To mentor means encouraging involvement and ownership from the start to the end of the project.

In 2017, **Sharlene Teefey, MD**, went to Masaka, Uganda, to launch a program that teaches midwives at remote village health centers how to use ultrasound equipment. This was the first of many trips she's made on behalf of The Safe Birth Project, an initiative sponsored by St. Louis-based charity Microfinancing Partners in Africa. Teefey, whose areas of clinical interest include abdominal imaging, Duplex and color Doppler sonography, and musculoskeletal sonography, has been working with the organization for five years and currently serves on its board.

**After my first year in internal medicine, I switched to radiology** As a fourth-year medical student, I spent a month at the University of Utah to gain exposure to radiology. I was already accepted at the Mayo Clinic for a residency in internal medicine, but was so impressed that a patient's 'story' could be told from a radiograph. Fireworks went off in my mind and I knew I wanted to become a radiologist.

**I learn from my patients every day** I saw a young patient many years ago whose physician ordered a specific ultrasound exam; results were normal. I asked the patient several questions, had her point to her site of pain, then scanned her again. I found a significant abnormality that would have had a very negative impact on her long-term outcome had I not rescanned. The beauty of ultrasound is that it is an interactive modality.

**My defining moment came early in my career** I went to Palau as a medical student and it profoundly changed me. I promised myself that I would circle back and find an organization that works with impoverished families. Microfinancing Partners in Africa fulfilled that need. Its mission is to provide grants for microfinancing projects in Africa to empower those living in extreme poverty through access to services and education.

**Did you know** I hiked to Mount Everest 12 years ago, on the 50th anniversary of the first American ascent.



In October, **Katie D. Vo, MD**, was named section chief of neuroradiology at MIR. As director of Advanced Stroke and Cerebrovascular Imaging since 2004, Vo works closely with the MR service, the neurology stroke service and the ER service. She also was the primary clinical neuroradiologist for the Dominantly Inherited Alzheimer Network. In addition, for more than a decade Vo has served as director for MIR's diagnostic neuroradiology fellowship program, which has received top ABR ranking.

In 2017, **Pamela K. Woodard, MD**, was named senior vice chair and division director of radiology research facilities, becoming the first female division director at MIR. Among Woodard's other roles, she is director of the Center for Clinical Imaging Research, head of Advanced Cardiac Imaging (MR/CT), and also a professor of biomedical engineering. She has four submitted patents and one issued patent surrounding natriuretic peptide receptor imaging, and currently plays a key role in two startup companies.

**Being a radiologist is like being a detective** I find it fascinating that a radiologist could look inside a living person's body and make diagnoses of diseases. I enjoy the detective work of searching for clues on the imaging that may account for a patient's symptoms.

**My ABR oral exam experience was one for the books** I was seven months pregnant with my first child when I flew to Louisville, Kentucky, for the oral exam scheduled for the next morning. Unfortunately, I missed the last connecting flight in Cincinnati because of bad weather. I spent a long time convincing the airline to put me in a cab and drive me 100 miles to Louisville.

**I have a responsibility to be a role model** Vijay M. Rao, current president of RSNA and my residency director at Thomas Jefferson University, was a tremendous influence in my career. She balances her work and personal life beautifully, which showed me that it is possible to have both a successful academic career and a quality family life.

**Things have changed for women but there's still a lot to be done** Twenty years ago, I was the first woman to join the neuroradiology faculty at MIR. We now have four women who comprise 30% of faculty in the section. I believe we still have much to do to recruit more women into academic radiology. We can do it if we can provide proper mentorship, role models and a flexible work environment.

**French twist** I'm a foodie and would love to be a French pastry chef. I love the creativity and precision in making French pastries and desserts.

**I never thought being a physician wasn't possible for a woman** I was fortunate in that I met women physicians at a very young age. My father, who was in hospital administration at the New England Baptist Hospital in Boston, introduced me to women who were physicians. Somewhere there is a photograph of me as a baby being held by Dr. Tenley Albright, a woman surgery resident, who is remarkable in many ways. She won a gold medal in Olympic figure skating and, at the age of 82, works as a director of MIT's Collaborative Initiatives Foundation.

**The choice was clear** I hadn't thought of radiology at all as a possible specialty until I had Dr. Charles Putman as an attending on my internal medicine rotation at Duke. He was double boarded in radiology and internal medicine, so I initially told him I wanted to be double boarded in both too. He told me that with the expanded requirements for both, it would be better to focus and do one specialty well. I was amazed at what he could tell about the patient from imaging, so I picked radiology and never looked back.

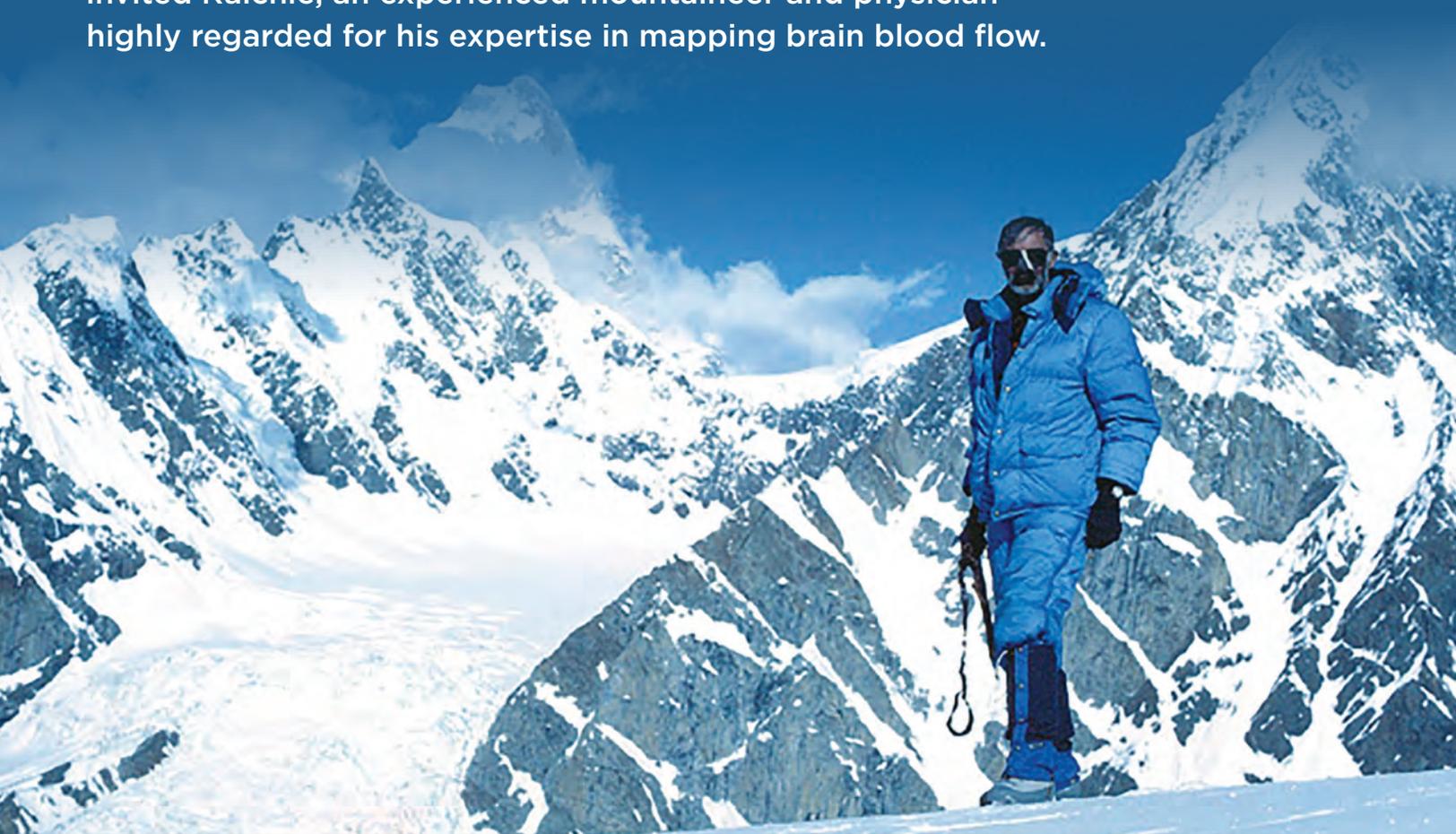
**Medicine as a whole has changed for women** When I began my fellowship at MIR in 1995, I think the expectation globally was that a woman might work as a physician, but wouldn't be either a leader or pushing the edge of her field. Back then, there were no women department chairs at Washington University School of Medicine and no women division directors in radiology. That has changed.

**Christiane Amanpour may have caught a break** I briefly entertained being a foreign news correspondent. In college I was the news director at WXDU 88.7 FM, a campus radio station at Duke University.

# Mysteries Explored

## Opening Up the Human Brain to Scientific Explanation

In a 1987 expedition, Marcus E. Raichle, MD, climbed 18,000 feet above sea level, scaling the icy Karakoram Mountains of Pakistan. There, amidst heavy snow and high winds, Raichle and 18 researchers injected radioactive xenon. A crude scanner measured the gas as it diffused through their bodies, accurately recording blood flow in the mountaineers' brains. Their objective was to better understand acute mountain sickness, a syndrome affecting climbers that causes headaches, vomiting, cerebral and pulmonary edema and, occasionally, death. The British expeditionists' earlier treks already had linked the syndrome to the brain's uptake of oxygen. On this journey, they invited Raichle, an experienced mountaineer and physician highly regarded for his expertise in mapping brain blood flow.



by Tamara Bhandari

Thirty years later, Raichle is still unraveling clues to the brain by studying its blood flow and oxygen use. This blood flow — laden with oxygen and nutrients — fuels the brain, with the busiest areas burning through fuel the fastest.

Raichle, now 81, the Edith L. Wolff Distinguished Professor of Medicine and a professor of radiology, neurology, neurobiology and biomedical engineering, is a central figure in the history and science of brain imaging. He is noted for developing positron emission tomography (PET) techniques, explaining principles underlying functional magnetic resonance imaging (fMRI) and capturing some of the first snapshots of the brain at work.

## New Imaging Techniques

“If you were to write a history of brain imaging, there’d be a pop-out box about Marc Raichle at multiple spots,” says Steven Petersen, PhD, the James S. McDonnell Professor of Cognitive Neuroscience in Neurology and longtime collaborator. “Every five or 10 years, he’s done something seminal.”

Raichle joined faculty at the School of Medicine’s Mallinckrodt Institute of Radiology (MIR) in 1971, just before the science of brain imaging took off. Michel M. Ter-Pogossian, PhD — a physicist who would develop the PET scan a few years later — recruited him. They met at a scientific conference in London. Raichle had studied brain blood flow as a postdoctoral researcher, and a clerical error had resulted in a conference invitation being issued to him instead of his adviser.

At the time, Raichle was serving as a major and flight surgeon at the U.S. Air Force School of Aerospace Medicine in Texas, pursuing his interest in brain blood flow and screening pilots who had experienced medical problems impairing their ability to fly. Never one to turn down an opportunity, he hopped a military plane and attended the conference.

“There was no imaging at the time, but Ter-Pogossian had a detecting system to measure the regional oxygen metabolism of the brain, and he said he’d build me an even bigger, better one if I came to WashU after I finished my military service,” Raichle says. “So I said to my wife, Mary, ‘Let’s do this. This

could be fun. We’ll stay for a couple years and then go on home to Seattle.”

Soon after Raichle arrived in St. Louis, Ter-Pogossian and others at MIR designed and built the first PET scanner and used short-lived radioactive materials called radiotracers to map organ function in living animals including humans. Raichle’s job was to develop protocols and algorithms to apply the new imaging technique to the human brain. Over time, he figured out how to separate important activity in the brain from background noise, and how to align images of different people’s brains so corresponding areas could be matched up and studied.

In 1988, an editor at the prestigious journal *Nature* called to ask about a project that Raichle, Petersen, cognitive psychologist Michael Posner, PhD, and others were working on: visualizing language processing in the brain. “In my long career, it is the only time *Nature* has ever called me up and said, ‘We hear that you’re doing X and we’d be interested in publishing it,’” Raichle said.

Using PET, the team monitored patterns in people’s brains as they read a word — hammer, for example — spoke the word, heard the word, and finally associated it with another word — such as nail.

By comparing the images, the researchers zeroed in on the brain areas that were active at each step. Put boldly, they took snapshots of the brain thinking.

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## Prominent neuroscientists told Raichle his ideas couldn’t be right.

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“Marc opened up the human brain to scientific analysis,” Posner says. “It used to be that most of the understanding of brain physiology was based on nonhuman animals or on people with brain injuries. The idea that you could analyze human brain networks in normal, living people? That was just a dream. It wasn’t possible. Marc more than anyone else made it possible.”

Raichle built his own lab near the Ter-Pogossian lab. Eventually, their two labs at MIR merged into the NeuroImaging Laboratories, now consisting of 33 faculty and over 100 trainees and staff.



Marcus Raichle, MD, now 81, is a central figure in the history and science of brain imaging.

## A Scientific Firestorm

Raichle's next major accomplishment was providing the data that explains how fMRI detects brain activity. And he was roundly castigated for it at the time.

In 1986, Raichle and Peter Fox used PET scanning to show that when a part of the brain increases its activity, blood flow to that area increases but oxygen usage does not. This results in an increase in oxygen in active areas. It's a case of supply increasing more than demand.

A few years later, Japanese researcher Seiji Ogawa discovered that changes in oxygenation are readily detected by MRI. In a sudden flurry of insight in the early 1990s, neuroimaging scientists put the puzzle pieces together — brain activity causes a change in blood oxygen concentrations, changing oxygen levels alter the magnetism of the blood, shifts in magnetism can be detected by magnetic resonance imaging — and fMRI was born.

Ogawa is rightly credited with founding fMRI, and Raichle and Fox had provided a key piece to the puzzle. But just a few years before, when their research was published, it had threatened to derail their careers.

"Prominent neuroscientists told Dr. Raichle that his ideas couldn't be right and that he'd better correct the error or his career would go down the tubes," says Avi Z. Snyder, MD, PhD, a professor of radiology who has worked with Raichle for many years.

"But," Snyder adds, "the existence of fMRI proves that Marc was right and they were wrong."

A noninvasive technique that does not require radiation, fMRI is now the most powerful tool we have to understand how the brain behaves. Researchers use fMRI to gain new insights into language, learning, emotion and memory — and to figure out how the brains of people with disorders such as schizophrenia or dementia differ from those of healthy people.

## Hidden Architecture

As the science of brain scanning progressed, researchers noted that the brain never quiets down. As a person lies quietly in a scanner, daydreaming, waves of activity pulse through his or her brain.

"Marc wasn't the first to observe resting state activity, but he was the first to really understand that it's not just noise," Snyder says.

"Most of what the brain is doing is nonconscious," Raichle says. "So often people say something 'feels right' to them and conclude that it must be true. But your brain just made that judgment for you, and the reason it did so is probably totally opaque to you."



**Left:** President Barack Obama meets with the 2014 Kavli Prize recipients John O'Keefe, PhD (left) and Marcus E. Raichle, MD, in the Oval Office.

As he scrutinized the images of the areas that decrease their activity when people shift their attention to a task, Raichle realized something else: The areas weren't random. The same collection of regions always seemed to be involved — in the middle of the top of the brain, just above the eyes and on either side near the back.

In a seminal 2001 paper, Raichle and colleagues showed that these discrete brain regions formed a functional network — the default mode network — that plays a critical role orchestrating the background activity of the brain. Disruptions to this system have been noted in people with Alzheimer's disease and autism spectrum disorder.

Other researchers found that similar networks control all the major brain functions, including movement, vision and attention. Moreover, these linkages can be found even when they do not seem to be in use. The technique of identifying functional networks while at rest is known as resting state functional MRI, and it is used in neurosurgical planning. Doctors need to pinpoint precisely where critical brain functions such as language and motor function are located so they can plan a surgical route to spare them, as each person's brain is slightly different. With resting state fMRI, patients need only spend a few minutes in a scanner to give surgeons the information they need.

Raichle was awarded the prestigious Kavli Prize for neuroscience in 2014, which garnered him a trip to the White House to meet President Barack Obama. In a half-century of work, Raichle has unearthed a hidden substructure of the brain, quantified the subconscious and brought the human brain into focus.

And he isn't done yet.

## Sugar: The Next Frontier

Raichle handed over management of the NeuroImaging Laboratories to Tamara Hershey, PhD, a professor of psychiatry and radiology, more than a year ago. But he still directs research projects from a corner lab office. Wooden shelves filled with books on every aspect of the brain line one wall, many of them written by friends and colleagues. To one side hangs a picture of Raichle on a Pakistani mountainside, bundled against the cold, triumphantly holding a homemade banner emblazoned



With Manu S. Goyal, MD, (above, right), Raichle currently is studying how the default mode network and glycolysis relates to aging and Alzheimer's disease.

with “Mallinckrodt Institute of Radiology.” In the midst of all this, Raichle — tall, slim and energetic — sits casually on the edge of a desk and talks about sugar.

“We've traditionally thought of glucose like coal: It arrives in cars to the brain and gets shoveled into the furnace to produce energy,” Raichle says. “But that's only part of what happens to glucose in the brain. It's also deeply involved in biosynthesis, neuroprotection and plasticity — the ability to form new connections between neurons as you learn new things.”

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## Raichle's work with glycolysis may turn out to be his next major contribution.

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With Andrei G. Vlassenko, MD, PhD, and Manu S. Goyal, MD, Raichle is studying how the default mode network and glycolysis — the breakdown of glucose molecules — relates to aging and Alzheimer's disease. The default mode network, which uses a lot of glucose, maps neatly onto the areas that degenerate most quickly in Alzheimer's disease. With Hershey and others, Raichle is studying what effect high blood glucose levels have on glycolysis, and why diabetes is linked to Alzheimer's disease.

“Marc has a unique ability to notice things other people overlook and then think deeply about what they really mean,” Hershey says. “He's made revolutionary contributions to science already. His work with glycolysis is at a relatively early stage, but it may turn out to be his next major contribution.”

*Excerpted with permission from Outlook, the magazine of Washington University School of Medicine.*



# EVENS SOCIETY ALUMNI WEEKEND

If the Evens Society's mission is to foster a sense of family and community among current and future alumni of Mallinckrodt Institute of Radiology, then the society's inaugural alumni weekend was a huge success. The two-day event kicked off with a Friday evening welcome reception at the top of The Chase Park Plaza. Nearly 200 attendees greeted colleagues and classmates from years past, surrounded by panoramic views of downtown St. Louis and the ethereal glow of hot air balloons in nearby Forest Park. The next morning's CME lectures (led by radiology rock stars, according to one alum) were followed

by afternoon tours of MIR's campus and favorite spots in St. Louis. But the jewel in the weekend's crown was Saturday evening's gala dinner and Evens Society Honors. Shortly after dessert, MIR director and event host Richard L. Wahl, MD, took the stage to welcome guests and offer introductory remarks for each of the evening's six legendary honorees. As they walked up to the podium to accept their medals, each recipient received a rousing standing ovation from the crowd. All in all, the weekend was a testament to the lasting legacy of MIR and the joy of "coming home."

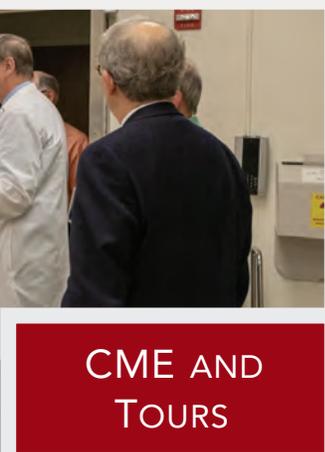
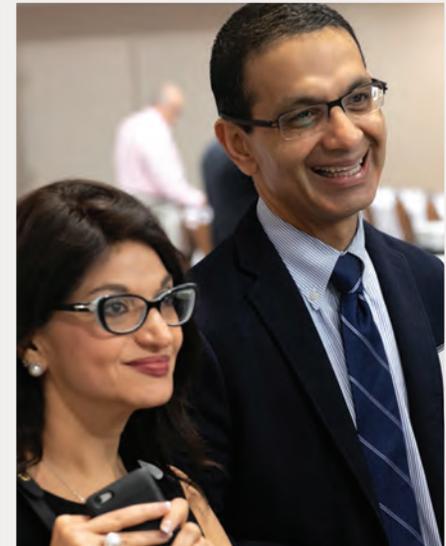


The 2018 Evens Society Honorees (from left): Barbara S. Monsees, MD, Robert J. Stanley, MD, Franz J. Wippold, MD, Robert G. Evens, MD, R. Gilbert Jost, MD, and Dennis M. Balfe, MD.



WELCOME  
RECEPTION







GALA DINNER



**Christine Peterson, MD**, is an associate professor of radiology in body imaging at Penn State Health Milton S. Hershey Medical Center in Hershey, Pennsylvania. She says her instructors and mentors at Mallinckrodt Institute of Radiology (MIR) inspired her to become a professor. As she instructs and counsels the next generation of radiologists, Peterson draws not only on their examples but on the lessons she learned during a major health crisis in her life.

## What attracted you to radiology?

Radiology is so diverse, in terms of the disease processes and body systems that it evaluates. I really liked that it was so broad compared to other specialties. I eventually specialized in abdominal imaging for the same reason; the abdomen is a more diverse landscape.

## Why did you choose MIR for your residency training?

I applied initially because I had heard it was such a good program. But when I came for my interview, I was struck by how Mallinckrodt had a much more relaxed atmosphere than I expected. People didn't wear their CVs on their sleeves. During one of my interviews, we talked mostly about where to get a good pedicure in Houston! I was not used to that interest in me as a person. That atmosphere was totally in keeping with my style of learning and how I like to be.

## Which instructors made the greatest impression on you?

There were so many of them, but Sanjeev Bhalla and Cooky Menias in particular had — and still have — a hugely positive influence on me. Sanjeev taught me comfort with uncertainty. He had answers to 98 percent of the questions or cases we looked at. But occasionally he would be stumped, too. He taught me not to be devastated by it and how to have an approach for dealing with it.

## You went straight into teaching after MIR. What attracted you to teaching?

I had fabulous mentors and wanted to be like them. In particular, David Rubin is someone I emulate. He was one of the smartest radiologists I ever met but he was also very nice, with a good sense of humor. I wanted to do my best for him. He and my other Mallinckrodt instructors were so approachable, and it's something I perpetuate in my own teaching.



Christine Peterson, MD, with husband Colin Peterson, son Dylan, daughter Astrid and son Shane, Thanksgiving 2016.

## How has your health crisis influenced the way you approach your work?

In December 2010, I had a big brain tumor removed. The cortex part of my brain that remembers facts was fine, but I had brain-stem issues that affected swallowing, walking, talking, all those basic functions. It took a year to recover. It was eye-opening on many levels, from the ease of getting appointments scheduled to having a resident try to normalize and dismiss something that was very concerning for me.

## PROFILE

### CHRISTINE PETERSON, MD

#### 2006 // Abdominal Imaging Fellow

Mallinckrodt Institute of Radiology,  
Washington University School  
of Medicine

#### 2005 // Diagnostic Radiology Resident

Mallinckrodt Institute of Radiology,  
Washington University School  
of Medicine

#### 2000 // MD

University of Texas School of Medicine

#### 1996 // BS

Washington University, St. Louis

The hardest and most disconcerting thing was the total lack of control — people in the hospital telling me what to do and when. I think about that every day now in my practice. When I look at a CT or MRI, I keep in mind that this is a real person whose life might have been totally fine right before this scan and they have an entire life that is not about this illness. A few years ago, that person was me.

### You're celebrating your tenth anniversary at Penn State Health. How has the program evolved in that time?

We've made it much more resident-centered and learning-centered than it was. We hired an adult education specialist who has been instrumental in suggesting different teaching approaches that might speak more to adult learners. Our faculty is very intellectually curious; I value that. We have a culture of being open to things changing and keeping a fresh outlook on curriculum and our approach.

### What is your day-to-day like in your position as associate professor of radiology?

I spend about half of my time doing administrative duties and half on clinical time. I perform mostly CT and MRI, and a little fluoroscopy and ultrasound. My department has been very supportive of my clinical time; I did not go to med school and Mallinckrodt to be a full-time administrator. That said, my favorite and most important administrative role is as program director for residents. I try to emulate Dennis Balfe, who was such a fabulous resident director for me in my first year at Mallinckrodt. He was so accessible and such a fantastic resource for us residents.

### What are your interests beyond radiology?

I really enjoy cooking. Not baking, though—that requires too much precision. I like to improvise, throw in a pinch of this and that. Now that my three children are ages 9 and 11, they are old enough to have enough attention and interest and manual dexterity to participate in the kitchen, too. They like making waffles every morning and stuffed shells for dinner. They take over the kitchen and I clean up the messes later. //



Christine supervises in the kitchen as the Peterson kids assemble stuffed shells, a family favorite.

## Honors/Awards

**Samuel I. Achilefu, PhD**, the Michel M. Ter-Pogossian Professor of Radiology, **Tammie L.S. Benzinger, MD, PhD**, professor of radiology, **Farrokh Dehdashti, MD**, senior vice chair and division director for nuclear medicine, **Zhude Tu, PhD**, professor of radiology, and **Suresh Vedantham, MD**, professor of radiology, each received the Distinguished Investigator Award from The Academy for Radiology & Biomedical Imaging Research.

**Samuel I. Achilefu, PhD**, the Michel M. Ter-Pogossian Professor of Radiology and vice chair for entrepreneurship and innovation at MIR, received the Carl and Gerty Cori Faculty Achievement Award.

**Tammie L.S. Benzinger, MD, PhD**, professor of radiology, received the 2018 Women in Neuroradiology Leadership Award from the American Society of Neuroradiology (ASNR). The ASNR also honored **Akash P. Kansagra, MD**, assistant professor of radiology, neurological surgery and neurology, with the 2018 Comparative Effectiveness Research Award for "Science of Systems

of Care: Simulating Care Delivery and Patient-Centered Health Outcomes in Acute Ischemic Stroke."

**Sanjeev Bhalla, MD**, professor of radiology and vice chair for education, was granted membership to the Fleischner Society, a highly selective international, multidisciplinary medical society for thoracic radiology dedicated to the diagnosis and treatment of diseases of the chest.

**Jamal J. Derakhshan, MD, PhD**, assistant professor of radiology, received the 2018 ASNR/RSNA Research Scholar Grant for "Improved Non-contrast Brain Perfusion Imaging Using Integrated Tagging in bSSFP."

**David S. Gierada, MD**, professor of radiology, **Cheryl R. Herman, MD**, assistant professor of radiology, and **Suresh Vedantham, MD**, professor of radiology, were named American College of Radiology fellows.

**Robert J. Gropler, MD**, professor of radiology and senior vice chair and division director of radiological sciences, was named editor-in-chief of *Circulation: Cardiovascular Imaging*.

**Joy A. Haven, PhD**, executive director of business affairs for MIR, received the Category 3 Association of Administrators in Academic Radiology (AAARAD) award for Advancement of the Radiology Profession through excellence in published papers, presentations or liaison work with other professional radiology groups.

**William D. Middleton, MD**, professor of radiology, received the Joseph H. Holmes Clinical Pioneer Award from the American Institute of Ultrasound in Medicine. The award honors individuals who have significantly contributed to the growth and development of medical ultrasound.

**Steven P. Poplack, MD**, professor of radiology, was installed as the Ronald and Hanna Evens Endowed Chair in Women's Health by The Foundation for Barnes-Jewish Hospital at an installation ceremony and dinner on November 7, 2018.

**Barry Siegel, MD**, professor of radiology, was named a fellow of the Society of Nuclear Medicine and Molecular Imaging. He is one of 14 fellows who were recognized in June for distinguished service to the society as well as exceptional achievement in scientific discovery and innovation, educational efforts or clinical practice of nuclear medicine and molecular imaging.

**Pamela K. Woodard, MD**, professor of radiology, has been appointed to the Board of Chancellors of the American College of Radiology.



**Richard L. Wahl, MD**, the Elizabeth E. Mallinckrodt Professor of Radiology and director of MIR, received the 2018 Georg Charles de Hevesy Nuclear Pioneer Award given by the SNMMI for outstanding contributions to the field of nuclear medicine.

## Appointments/ Promotions

**Diane S. Abou, PhD**

Instructor of Radiology

**Jonathan C. Baker, MD**

Associate Professor of Radiology

**Tammie L.S. Benzinger, MD, PhD**

Professor of Radiology

**Mikhail Y. Berezin, PhD**

Associate Professor of Radiology

**Karen A. Caudill, MD**

Assistant Professor of Radiology

**Sarah E. Connolly, MD**

Assistant Professor of Radiology

**Jamal J. Derakhshan, MD, PhD**

Assistant Professor of Radiology

**Rami W. Eldaya, MD**

Instructor of Radiology

**Malak Itani, MD**

Assistant Professor of Radiology

**Pavan K. Kavali, MD**

Assistant Professor of Radiology

**Richard Laforest, PhD**

Professor of Radiology

**Tsen-Hsuan "Abby" Lin, PhD**

Instructor of Radiology

**Chris D. Malone, MD**

Assistant Professor of Radiology

**Michelle M. Miller-Thomas, MD**

Associate Professor of Radiology

**Barbara S. Monsees, MD**

Professor Emerita of Radiology

**Hilary L. Orlowski, MD**

Assistant Professor of Radiology

**Cyrus A. Raji, MD, PhD**

Assistant Professor of Radiology

**Joshua S. Shimony, MD, PhD**

Professor of Radiology

**Franz J. "Jay" Wippold, MD**

Professor Emeritus of Radiology

**Maria Zulfiqar, MBBS**

Instructor of Radiology

## Lectures

**Tammie L.S. Benzinger, MD, PhD,**

professor of radiology, presented "Operationalizing the NIA-AA AD Research Framework: MRI and PET Issues" and "Role of Amyloid-PET in a Multimodal Workup of Dementia" at the Annual Alzheimer's Association International Conference in Chicago, Illinois, on July 21-26, 2018.

**Tamara G. Hershey, PhD,** professor of psychiatry, neurology, and radiology, presented "Impact of DKA on cognition in children" at the annual Endocrine Society meeting in Chicago, Illinois on March 17-20, 2018; and "Longitudinal neuroimaging in Wolfram Syndrome" to the Wolfram Syndrome International Association in Paris, France, on June 11-12, 2018.

**Michelle M. Miller-Thomas, MD,** associate professor of radiology, presented "Advanced Neuroimaging for Presurgical Planning" at Medical Imaging Grand Rounds at the University of Arizona in Tucson on March 21, 2018.

**Joshua S. Shimony, MD, PhD,** professor of radiology, presented a four-part series entitled "Introduction to Diffusion Tensor Imaging (DTI)" at the Neuroimaging Informatics and Analysis Center (NIAC) Summer Lecture Series.

**Qing Wang, PhD,** instructor of radiology, presented "Quantification of White Matter Cellularity in Preclinical and Early Symptomatic Alzheimer Disease Using Neuro-Immune Imaging" at the annual Alzheimer's Association International Conference in Chicago, Illinois, on July 21-26, 2018.

## Grants

**Adam Q. Bauer, PhD,** assistant professor of radiology, secured a four-year, \$2,114,849 grant from the NIH for "Optogenetic Mapping of Cell Specific Connections in the Mouse Brain After Stroke."

**Tammie L. S. Benzinger, MD, PhD,** professor of radiology, and **Beau M. Ances, MD,** the Daniel J. Brennan Professor of Neurology, received a five-year, \$3,583,474 grant from the NIH for "Imaging Tauopathy in the Dominantly Inherited Alzheimer Network (DIAN)."

**Delphine L. Chen, MD,** associate professor of radiology, received a two-year, \$388,500 grant from The Foundation for Barnes-Jewish Hospital for "Imaging PARP Levels to Predict DNA-Damaging Agent Treatment Responses in Pancreatic Cancer."

**Joseph P. Culver, PhD,** professor of radiology, physics, and biomedical engineering, received a four-year, \$2,675,079 grant from the NIH for "Wireless High-Density Diffuse Optical Tomography for Decoding Brain Activity."

**Abhinav K. Jha,** assistant professor of radiology and biomedical engineering, secured a \$429,875 grant from the NIH for "Transmission-Less Attenuation and Scatter Compensation in Myocardial Perfusion Spect with List-Mode Data."

**Sheng-Kwei Song, PhD,** professor of radiology, and **Hiroko Yano, PhD,** assistant professor of neurological surgery, neurology, and genetics, secured a two-year, \$427,625 NIH grant for "Establishing Diffusion Basic Spectrum Imaging as a New Biomarker for Huntington's Disease Progression."

# The Unexpected Path of a Breast Imaging Pioneer

by Holly Edmiston

Barbara S. Monsees, MD, who retired this past July and is now professor emerita of radiology at Mallinckrodt Institute of Radiology (MIR), first decided to specialize in pediatrics. But after two years she realized that the best part of her day was going to radiology, where she could figure out what was wrong with the children in her care.

“It was satisfying to get a better understanding of what was going on with the patients,” she says. “And I loved looking at images, which often provided ‘aha’ moments.”

Growing up, Monsees loved science and always knew it would play a role in her eventual career choice. After earning an undergraduate degree in biology from Brandeis University, Monsees left the East Coast to attend medical school at Washington University, where she remained for the entirety of her career. Her decision to stay in St. Louis was twofold.

“The radiology residency program at Washington University was fantastic,” Monsees says. The other reason

was that her husband, Thomas, had started an electrical engineering business. Together the couple raised two sons, James and Nick, and in February, Monsees welcomed her first grandchild, Nick’s daughter Madeleine.

Early in her radiology career, while a member of the musculoskeletal imaging section (then called bone and joint), Monsees became interested in breast imaging. At the same time, there was strong support for building a breast program at MIR, both from then director Ronald G. Evens, MD, and vice chair for the division of diagnostic imaging R. Gilbert Jost, MD.

“Barbara Monsees is the reason that Mallinckrodt Institute of Radiology is one of the international leaders in breast imaging and women’s health,” says Evens.

Originally housed within the musculoskeletal section, breast imaging was just one of many types of imaging Monsees performed. While there, she started hearing about the development of breast screening programs nationwide and determined it was important to begin such a program in St. Louis.

“It took years to create that first program,” she says. To sell the idea, she and fellow radiologist Judy M. Destouet, MD, conducted seminars at corporate sites to explain why screening was important. “It was very much an education process for women, employers and primary care doctors.”

Launched in August 1986, MIR’s first outreach programs took place in three locations: Barnes-Jewish Hospital, a fixed site in downtown St. Louis, and on the first mammography van. “We were the first to introduce [the van] and then other people followed suit,” says Monsees.

“Barbara and Judy identified the great potential for mammography in the early 1980s and encouraged — sometimes with great force — me and the university to make important investments in this new imaging technique,” says Evens.

In 1993, shortly after Destouet left for a new position in Baltimore, MIR created its first breast section, with Monsees as its head. The section started with mammography, added ultrasound, and then core needle-guided biopsies using stereotactic and ultrasound guidance. Breast MRI came later.

**Left:** Speaking at the Evens Society Gala Dinner in September. Monsees was one of six inaugural recipients of the Evens Society Honors.





**Clockwise from top left:** An MIR portrait of Monsees from 1994; with a mammography scanner circa 1980; from a 2014 video produced by Horizon of Hope to promote breast screenings; with MIR alumna Emily Smith, MD, at Monsees' retirement party in July.

Today, breast interventional procedures — such as percutaneous biopsy to obtain a tissue diagnosis and localization procedures to guide surgical excision — are considered the standard of care.

“Barb is bright, decisive, compassionate, and above all, a superb clinician. During a period of rapid change in Mallinckrodt’s breast imaging program, we were indeed fortunate to have her at the helm,” says former MIR director Jost.

About five years ago, Monsees stepped down as chief of breast imaging and was succeeded by Catherine M. Appleton, MD, associate professor of radiology. She is beyond pleased with Appleton’s leadership and looks forward to remaining in the loop regarding current issues in breast imaging. Those include continuing to determine

best practices for when and how to screen, identifying who is at high risk and how to tailor screening for those subgroups, and looking for ways to monitor response to therapy in the treatment of cancer.

Monsees has received numerous awards over the course of her career. Of particular note are the 2011 Gold Medal from the Society of Breast Imaging and this year’s Lifetime Achievement Award from the Barnes-Jewish Hospital Medical Staff Association.

“It’s her work ethic that has set her apart and has allowed her to achieve rock-star status in the field of breast imaging,” says Appleton. “The number of lives she has saved and those she has touched through teaching is immeasurable.” 

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Spirits were high as the balloons over Forest Park at the inaugural Evens Society Alumni Weekend, held September 16-18 at The Chase Park Plaza in St. Louis.

