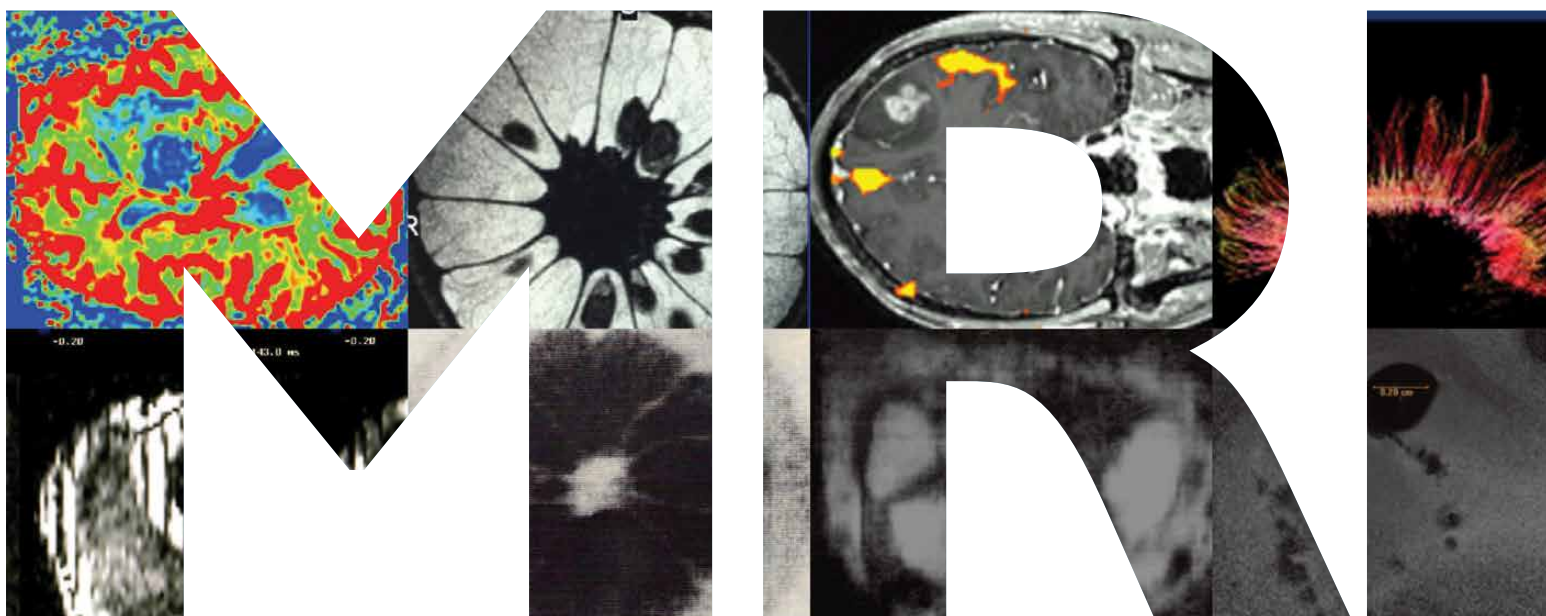


RadiologyUpdate

THE RUSSELL H. MORGAN DEPARTMENT OF RADIOLOGY AND RADIOLOGICAL SCIENCE

THE EVOLUTION OF



The advent of MRI at Johns Hopkins.
p. 16



A promising marker in MRI and new ways to see in real time.
pp. 10-11



Celebrating a one million milestone
p. 8

CHAIR'S MESSAGE

It's an honor for me to write this year's column as the official director of the Russell H. Morgan Department of Radiology and Radiological Science.

I am humbled to follow in the footsteps of the department's prior directors. Although I respect and honor the past, I believe we must embrace the future. The next decade in health care will bring unprecedented challenges. In the wise words of Peter Drucker, "The greatest danger in times of turbulence is not the turbulence; it is to act with yesterday's logic." As a department, we will need to think differently, challenge the status quo, learn to work in multidisciplinary teams to find innovative solutions and adapt quickly to our changing world. We recognize that challenges are also opportunities to excel in all three missions—clinical, education and research.

CLINICAL

The volume growth of the department over the last few years has been phenomenal. In fiscal year 2018, our department performed over 1 million imaging examinations! This growth will likely continue through the next few years as Johns Hopkins expands its footprint across Maryland, Washington, D.C., and beyond. Increased clinical volume coupled with a continual decline in reimbursements will require us to embrace technology to improve operational efficiency and effectiveness while maintaining or ideally improving quality and enhancing the patient experience.

- Sherman Gray, our billing administrator, is working with physician leadership, including Tony Lin, director of thoracic imaging, to pilot the use of automated coding software. This "smart" technology uses artificial intelligence to process reports and bill automatically, enabling our billing department to accommodate the increasing volume and hopefully increase collections.
- Peg Cooper, our operations administrator, and her team are also embracing technology to improve the patient experience, including self-check-in kiosks/tablets, patient self-scheduling and a new, advanced system for patient input called Bivarus, which reaches out to patients for feedback using text and email. We also have pilots using radio-frequency identification devices to better track and deploy technologists in The Johns Hopkins

Hospital, and track patient movement and flow in our new Skip Viragh Outpatient Cancer Building. At Johns Hopkins Medical Imaging, we are partnering with ICRAVE architects to help redesign our centers to better focus on patients and their needs.

- Ihab Kamel, clinical director of MRI; Cheryl Shoats, MRI manager; Peg Cooper; and I are partnering with GE to design an imaging command center focusing initially on magnetic resonance. This will allow us to modernize our workflow and scheduling, integrating magnetic resonance throughout our hospitals and our four outpatient imaging centers. Our goal is to do the right study the right way in the right venue, which minimizes patient wait times.
- Pam Johnson, the department's vice chair of quality and safety, leads our value-based performance improvement in the department and across the health system as the physician lead of the High Value Care Committee. Johns Hopkins has a strong commitment to ensuring appropriate use of diagnostic and therapeutic resources, and we believe that radiologists need to lead this work to ensure that patient care quality and safety are maintained. Her team works to reduce unnecessary tests and treatments. The team's efforts have decreased charges by over \$4 million since 2016 and hospital costs by over \$400,000. Additionally, Pam created a national organization, the High Value Practice Academic Alliance, which has grown to include 85 academic centers in the U.S. and Canada, and hosts a national high-value care conference in Baltimore each fall. It recently partnered with the American Hospital Association to help direct value-based performance improvement across its 5,000 hospitals.

EDUCATION

Our residency training programs include diagnostic radiology, nuclear medicine, molecular imaging (dual board certification in diagnostic radiology and nuclear medicine) and interventional radiology, which is new for the department. We will interview our first applicants for the interventional radiology program, directed by Kelvin Hong and Brian Holly, this fall and match the first class in spring 2019. Interest in radiology continues to grow among medical students, and we received nearly 700 applications this year, a 55 percent increase from 2014. Additionally, we



Dr. Karen M. Horton

matched the top applicant for the molecular imaging residency for four consecutive years since inception.

The residency and fellowship training programs continue to deliver exceptional clinical training and outstanding opportunities to participate in research. For example, in the last academic year, 78 percent of diagnostic radiology residents participated in research, publishing 30 articles and 11 book chapters, and delivering 47 presentations at national meetings. We also continue to engage residents in education, and 73 percent of them gave teaching presentations.

Recognizing that the role of radiologist has expanded beyond image interpretation, the program directors created six professional development tracks in noninterpretative practice that include a set of longitudinal metrics and result in special distinction at graduation. The areas of focus include educator, quality improvement, health policy, innovator/entrepreneur, high-value practice and business management, and each pathway has a dedicated faculty mentor. These tracks enrich training and enable residents to make meaningful contributions to the department and institution during their training. They also disseminate successful initiatives through presentation at national meetings, publications and creation of online resources.

RESEARCH

Our research faculty members continue to advance the frontiers of imaging applications in the detection and treatment of diseases. The impact of the faculty on biomedical research is reflected in the amount of National Institutes of Health (NIH) funding (\$21,010,284) received by faculty members. The department is ranked sixth nationwide in attracting NIH funds. My goals are to continue active support of our research mission and build upon our successes to benefit our patients.

To advance these goals, we held a radiology research retreat in February 2018 with sessions that focused on the critical areas of challenges faced by midcareer faculty members, discretionary funds, space, salaries, equipment and IT challenges. Over 90 faculty members attended the retreat. Based on the discussions and feedback, we are developing action items to address these challenges and identify new opportunities, including updating and renovating space and purchasing new equipment.

Our firm commitment to research is also reflected in our pilot funding programs. In 2016, we established the Rad BriteStar program that provides bridge funding and pilot funding support for research. We have also offered scanner time funds through departmental resources. Dr. Kamel and I have worked with Siemens to provide MRI scanner time to faculty members for research studies. Similarly, we have partnered with Toshiba to provide research support to faculty members. Through the Emerson Collective, I have advocated for radiology grants totaling \$800,000 that have been awarded to support radiology research. Overall, these research initiatives, amounting to approximately \$1.16 million, have provided research funding to more than 30 different faculty members using a peer review system established by the Radiology Research Executive Committee.

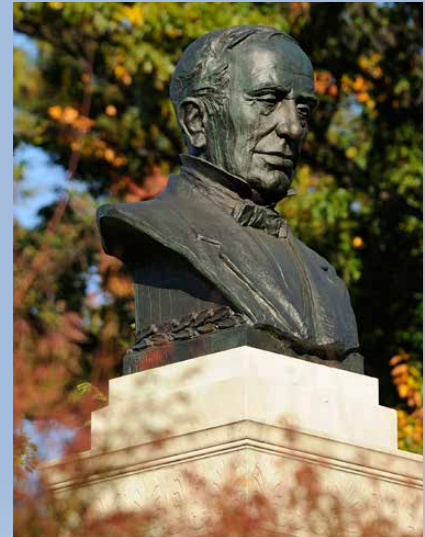
Our faculty members continue to attract prestigious grants, including a National Cancer Institute Outstanding Investigator Award (R35) and a Biomedical Technology Research Resource grant (P41). The P41 grant will allow for the national and international dissemination and application of novel molecular imaging agents developed through the funding. Within the past year, we have had two gold medal award winners, one from the World Molecular Imaging Society, and the other from the International Society for Magnetic Resonance in Medicine. I am also delighted to report that one of our most distinguished research faculty members, Zaver Bhujwalla, recently became the second recipient of the William R. Brody Professorship in Radiology.

In summary, I continue to have the utmost confidence that the research discoveries of our faculty will advance our ability to detect, understand and target multiple disease processes that will translate into effective treatments against these diseases.

—Karen M. Horton, M.D.
Professor and Director

The Russell H. Morgan Department of Radiology
and Radiological Science

Mr. Johns Hopkins
changed the course
of history with one
bold stroke of his
pen by signing a will
that would create
The Johns Hopkins
University.



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Seek advice from a tax professional before entering into a gift annuity agreement. Johns Hopkins gift annuities are not available in all states.



Stacey Baldwin



Andrew Menard

New Administrators Join the Ranks

LAST SUMMER, TWO IMPORTANT NEW ADMINISTRATORS joined the Department of Radiology and Radiological Science and Johns Hopkins Medicine. They are filling positions created by department administrator Marty Bledsoe's move to devote full-time attention to his role as president of Johns Hopkins Medical Imaging.

Stacey Baldwin, formerly administrator for the Department of Surgery, is serving as the new functional unit administrator for the Department of Radiology and Radiological Science. Andrew Menard, an administrator from Brigham and Women's Hospital—where he spent more than 15 years in radiology leadership, business development, operations and public policy—is filling the newly created leadership position as the department's chief administrative officer for the Johns Hopkins Health System.

Baldwin, whose efforts as department administrator are focused on radiology operations at The Johns Hopkins Hospital and the school of medicine, built a high-functioning team of leaders during her eight years in the Department of Surgery, while also managing operations, financial performance and strategic planning for 100 full-time faculty members, 300 staff members, and 100 residents and fellows. She also developed and engaged diverse, multidisciplinary teams to continuously improve the department's clinical, academic and research operations.

"When we interviewed candidates for this position from across the country,

Stacey clearly stood out from the rest," says Karen Horton, director of the Russell H. Morgan Department of Radiology and Radiological Science. "I am thrilled to have her on board."

In addition to her leadership and operations experience, Baldwin has a strong background in information technology, beginning her tenure at Johns Hopkins in the Department of Health, Safety and Environment, where she built a Web-based system to track employee injury claims.

Menard fills a new position that Horton created in response to the department's significant growth beyond The Johns Hopkins Hospital and the school of medicine—to include three other hospitals (Johns Hopkins Bayview Medical Center, Sibley Memorial Hospital and Suburban Hospital) and four outpatient centers in Maryland. He will focus on strategy related to radiology integration, vendor relationships and navigating the Maryland all-payer system.

"It is crucial to consider radiology across the entire health system and to start thinking as 'one radiology,'" says Horton. "We need a health administrator

who can take a high-level approach—someone who will 'think like a system' to find ways to integrate and harmonize best practices from all of our various sites. Andrew brings the ideal skill set to this important new position."

At Brigham and Women's, Menard managed strategic projects and implemented new technologies that helped change health care delivery. Among many other initiatives, he helped organize a consortium of academic centers to research imaging clinical decision support as part of the Medicare Imaging Demonstration. He also worked on the legislative and regulatory framework under the federal law known as the Protecting Access to Medicare Act.

During his last several years at Brigham and Women's, he worked extensively with colleagues from all Partners HealthCare hospitals on an initiative to align and coordinate their radiology departments. This work, which is still underway, involved imaging protocol and reporting standardization, information systems integration, personnel policy alignment and organizational rationalization.

Before joining Brigham and Women's, Menard worked as a corporate attorney focused on technology transfer, the business of health care and corporate transactions.

Baldwin and Menard are the perfect administrators to partner with Horton to successfully lead the department into the future. ■

A Change in the Patient Experience

WITH A NEW MANAGEMENT structure recently put into place, Johns Hopkins Imaging, LLC is strategically poised to continue the growth that has been its hallmark in recent years.

The seven-member team, which moved in April to new office space on Pratt Street in Baltimore's Inner Harbor area, is currently guiding the acquisition and staffing of two new sites and the consolidation of existing outpatient centers at Green Spring Station into one site in 2019, boosting capacity there by 30 to 40 percent.

"We have grown this year over last year by 38 percent," says Marty Bledsoe, president of Johns Hopkins Medical Imaging. Some of that growth is attributed to new business generated by the purchase and opening of a community radiology center in Bethesda in February 2017, he notes, adding, "Over the next year, we will replace almost all of the imaging devices that came with the acquisition at Bethesda, at a cost of about \$7 million to \$8 million."

Radiologists at the Bethesda location are part of the Community Radiology Division, the newest division in the department of Radiology. Radiology Director Karen Horton created the new division in February 2017. It includes radiologists who practice as clinical associates at Sibley Memorial Hospital, Suburban Hospital and the Bethesda outpatient center.

"As radiologists, we gain great value from our new connection with Johns Hopkins Medicine because it provides us access to the academic medicine setting and resources," says William Craig, director of the Community Radiology Division, whose team includes 10 body imagers, four interventional radiologists, three neuroradiologists and a variety of mammography specialists at the



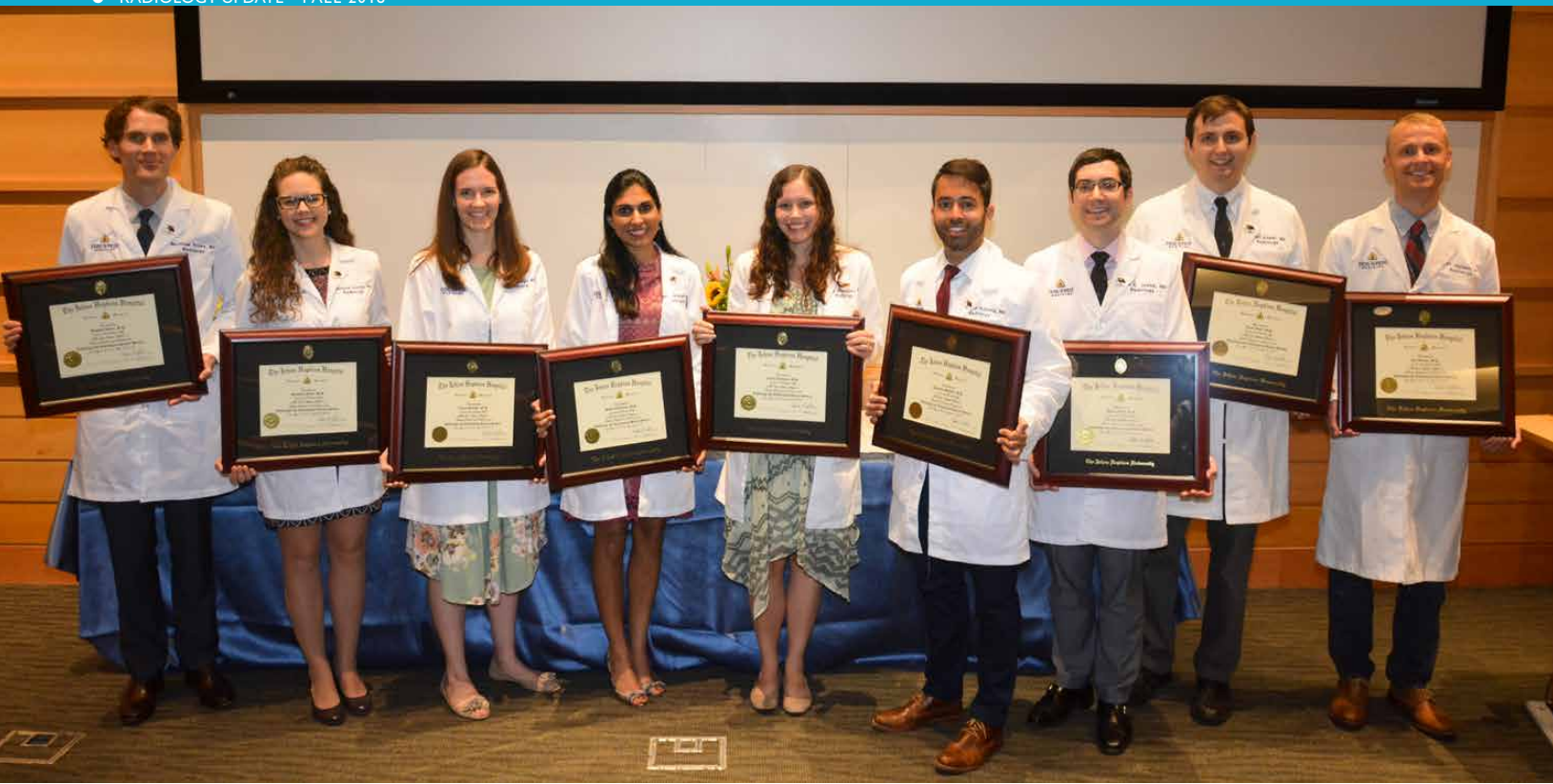
different locations. "Our goal is to provide the highest quality in imaging—the equivalent to what a patient would receive if seen at the Johns Hopkins campus in East Baltimore."

At both new locations, and with future Johns Hopkins Medical Imaging sites, says Bledsoe, "we'll really be changing the patient experience. Our management team has spent many hours listening to our patients about what they like and don't like, and how they envision the ideal mammography experience. Their vision will vastly change the experience we provide them."

For instance, the traditional waiting room will give way to a more casual, "café-type" feel, and "we're going to emphasize health and wellness, and create more of a spalike atmosphere," says Bledsoe, adding, "We're not changing what we do but how we do it. It's tremendously exciting." ■

Our management team has spent many hours listening to our patients about what they like and don't like, and how they envision the ideal mammography experience. **Their vision will vastly change the experience we provide them.**

—MARTY BLEDSOE



Residency Programs: ‘On Track’ for Professional Development

THE ROLE OF RADIOLOGIST has expanded beyond interpreting images. At any one time, today’s radiologists may be called upon to act as educators, policy advisers, consultants, inventors, quality improvement leaders, champions of high-value care or business managers, notes Pamela Johnson, former radiology residency director and vice chair of quality and safety in the Department of Radiology and Radiological Science.

To better prepare radiology residents to become experts in these areas of noninterpretative practice, the department has created six professional development tracks during the last three years, which are already beginning to bear fruit: Not only are participating residents seeing their own training enriched, these residents are benefiting the department and the wider medical

community with new initiatives they present at national meetings or through publication.

Elie Portnoy, the first resident in the High-Value Health Care Track, designed to enhance residents’ skills as radiology consultants and to provide a better understanding of how to implement value-related quality improvement, spent several weeks on daily rounds with the

internal medicine team to find the best way to ensure appropriate use of imaging. One outcome: A reading station was created in the medical stepdown unit for senior residents to spend several half-days a week interpreting cases while being accessible to any medical resident at The Johns Hopkins Hospital to review cases or discuss the best imaging test for an inpatient. During the fourth year, all residents will participate in the Resident Consultant Service, a weekday phone service for answering questions from referring clinicians regarding the most appropriate imaging study or protocol. “Any doctor can call to discuss what test to order if they aren’t sure. The ordering doctors love it,” says Johnson.

To date, three residents have participated in the Health Policy Track. They have organized and participated in lobbying activities along with the American College of Radiology (ACR)

Regardless of whether residents pursue academic medicine or private practice, **these skill sets are necessary for graduates to become valuable members** of a radiology practice and national leaders in the field of radiology.

—PAMELA JOHNSON

on the state level in Annapolis and in Washington, D.C., and have also created a Resident and Fellow Section in the Maryland division of the ACR, publishing their experience in the *Journal of the American College of Radiology*.

The three residents who have been part of the Clinician Educator Track “have designed and implemented new didactic curricula and done a lot with creating online educational material,” including an engaging website with quizzes for medical students and residents, says Johnson.

Residents in the Quality Improvement Track hone the skills needed to design and implement quality improvement initiatives, working closely with the Technology Innovation Center and representing the department on the House Staff Patient Quality and Safety Committee. And those in the Entrepreneur/Innovator Track aim to create new medical devices and technologies. Working in the Carnegie Center for Surgical Innovation, the Center for Bioengineering and Design, or the Technology Innovation Center, their ultimate goal is to generate a publication, an invention disclosure or a patent license application.

Radiology faculty member involvement has been integral to the success of these programs, Johnson

notes. For example, Katarzyna Macura was involving residents in the Maryland Radiology Society and lobbying events long before policy advocacy became a formalized program in the residency, and she serves as the faculty director for this pathway. More recently, faculty directors were appointed to direct and enhance the other programs. Jeff Siewerdsen in biomedical engineering and Robert Liddell in interventional radiology took

the innovator track to new heights by creating a Clinical Innovators Program for residents in radiology and other specialties. The program teams up clinical trainees with research labs and innovation teams in the Department of Biomedical Engineering. It also hosts a number of seminars to expose trainees to principles

of informed innovation and to connect them with Johns Hopkins University and Johns Hopkins Medicine resources to foster research and innovation.

Johnson is grateful for the residents and faculty members whose contributions have made these pathways successful and sees continued growth for all six residency tracks in the years ahead.

“Regardless of whether residents pursue academic medicine or private practice,” she says, “these skill sets are necessary for graduates to become valuable members of a radiology practice and national leaders in the field of radiology.” ■

6 Professional Development Tracks for Residency

- Research (long-standing)
- Clinician Educator
- High-Value Health Care
- Health Policy
- Entrepreneur/Innovator
- Quality Improvement



Pamela Johnson



Lil Solnes

A Transition in Leadership

As of June 30, Pamela Johnson transitioned from her role as residency director to focus on her work as vice chair of quality and safety in the Department of Radiology and Radiological Science. Lil Solnes, who served as associate program director of the residency program since March 2017, has now moved into the director role.

Solnes joined Johns Hopkins in 2014 in the Division of Nuclear Medicine (where she was program director for the residency program). She holds an M.D./M.B.A. from Columbia University. She completed her radiology residency at NewYork-Presbyterian/Columbia University Medical Center and subsequently completed neuroradiology and nuclear radiology fellowships. She was an assistant professor at NewYork-Presbyterian/Weill Cornell Medical Center prior to joining Johns Hopkins.

To ensure a smooth transition, Johnson will serve as associate director of the radiology residency program, and she will continue to oversee resident quality improvement projects.

Celebrating a **One Million Milestone**

THE FIRST TIME The Johns Hopkins Hospital used an X-ray machine for patient care was in September 1896—seven years after the hospital opened—on a female shooting victim who had a bullet lodged in her spine. History tells us two residents used the brand-new, hand-cranked X-ray to find the bullet's location. In 1906, the department performed 1,000 exams in one year. Now, 122 years later, Johns Hopkins is celebrating another breakthrough in the Department of Radiology and Radiological Science—1 million exams performed in one year.

To mark the occasion, Barbara Zink, the patient receiving the 1 millionth exam, was greeted with bright turquoise balloons, giant chocolate chip cookies, and pink and blue bags at the Johns Hopkins Medical Imaging Center in Columbia, Maryland.

“Your yearly mammogram is not always easy,” says Zink. “But Johns Hopkins’ care is excellent, the treatment is wonderful and I’m always greeted with a smile, so it makes everything better.”

Jennifer Ching, the senior mammography technologist who performed Zink’s exam, says she strives to get the best images possible. “Being part of a process that can change a person’s life and contributing to their health and well-being is my passion, and it’s surreal to be making history today.”

Karen Horton, director of radiology and radiological science for Johns Hopkins Medicine, thinks this is just the beginning. “Radiology will continue to grow as we strive to integrate radiology throughout the Johns Hopkins Health

System and into the community. Our goal is to provide high-tech imaging in a high-touch environment, always putting the patient’s needs and referring physician’s needs first,” she says.

Last year, Sibley Memorial Hospital and Suburban Hospital integrated with the Johns Hopkins Department of Radiology and Radiological Science at The Johns Hopkins Hospital and Johns Hopkins Bayview Medical Center. The department also acquired an imaging center in Bethesda, adding to the existing Johns Hopkins Medical Imaging centers in White Marsh, Green Spring Station and Columbia. This means when patients come in for an X-ray, mammogram, CT scan, MRI or other imaging exam at any Johns Hopkins radiology location, they will receive the same quality of care. ■



CONVERSATION SERIES

Leading Change: Perspectives from Outside of Medicine

It is a rare opportunity to listen and learn from the ‘best of the best’ and then apply their strategies into our world to improve the experiences of our ‘guests.’

—ELLIOT FISHMAN

THE RUSSELL H. MORGAN DEPARTMENT OF RADIOLOGY AND RADIOLOGICAL SCIENCE

presented the fifth installment of the series “Leading Change: Perspectives from Outside of Medicine.” The series invites business leaders to speak to the Johns Hopkins community about their expertise offering high-quality services and experiences to customers, and how that can be translated to medicine.

Over the past five years, the series has brought speakers from diverse backgrounds to Johns Hopkins, including Jen-Hsun Huang (CEO and co-founder, Nvidia), William Brody (president, Salk Institute, and former president, The Johns Hopkins University), Ed Catmull (president of Walt Disney Animation Studios and Pixar), Anna Griffin (senior vice president of corporate marketing, CA Technologies), Horst Schulz (former CEO, Ritz-Carlton, and current CEO, Capella Group), Marla Kaplowitz (CEO of MEC Inc.) and Keith Grossman (publisher at Bloomberg Media). The speakers in the 2017–2018 series who represented a wide range of professional experience are listed at right.

We welcome your attendance at future lectures. The first speaker for the 2018–2019 program was David Isbitski, chief evangelist for Alexa at Amazon, who spoke on Oct. 17.

For more information, please contact Kia Harris at 410-955-5173 or kiaharris@jhmi.edu. ■

All lectures are held in Chevy Chase Bank Auditorium located in the Sheikh Zayed Tower, 1800 Orleans St., Baltimore, Maryland 21287. The conversations start promptly at 5 p.m. and are followed by a question-and-answer session.

2017–2018 Lecture Series:



Jeremy Snepar

Founder & CEO, New York Code and Design Academy
“An Entrepreneur’s Approach to Problem-Solving”



Paul Greenberg

Executive Vice President & General Manager at 45th & Dean and FYI Network (A+E Networks)
“Change Leadership—Successfully Managing Change in Turbulent Times”



Kimberly Powell

Senior Director, Deep Learning in Healthcare at NVIDIA
“What Health Care Can Learn from Self-Driving Cars”



Brian King

Global Officer—Digital, Distribution, Revenue Management & Global Sales at Marriott International
“Digital is Hospitable”



Tina Wells

CEO and Founder Buzz Marketing Group
“Meet Gen Z”



Reed Jobs

Director, Health, at Emerson Collective
“A Golden Age: Biotechnology Companies in the 21st Century”

Breaking Barriers to Bring Hope

DIFFUSE INTRINSIC PONTINE GLIOMA (DIPG) is a brutal killer of young children. It strikes the base of the brain and is inoperable. Its only symptom prior to diagnosis is sudden nausea. No child survives DIPG. Chemotherapies could offer a ray of hope, but so far, no one has found the right drug.

“There could be miracle drugs out there already, but no one knows about them because the drugs can’t get past the blood-brain barrier to treat the cancer,” says Monica Pearl, an associate professor of radiology and radiological science in the Division of Interventional Neuroradiology. In hopes of improving the odds for the 300 or so children diagnosed each year with DIPG, Pearl is focusing on overcoming the blood-brain barrier, a familiar and formidable foe to those seeking answers to diseases of the brain.

The blood-brain barrier is a sieve of sorts, a semipermeable membrane between the capillaries filled with blood rich in oxygen and nutrients on one side, and needy neurons on the other. For the large and complex molecules common to chemotherapy drugs, the blood-brain barrier is an impenetrable obstacle—a pharmaceutical boneyard.

But still, researchers press on. They can now snake tiny catheters through the circulatory system to reach these previously unreachable diseases, like DIPG in the brain and retinoblastoma in the eye. A few years ago, Pearl and James Handa, an ophthalmologist at the Johns Hopkins Wilmer Eye Institute, used such a catheter to deliver chemotherapy via the ophthalmic artery to put retinal cancers into remission.

That promising result led Pearl to turn her attention to the brain and DIPG. But intra-arterial drug delivery remains controversial because researchers must often inject these powerful drugs with no real guarantee they will reach their targets. The locations are so remote that, as of yet, there is no real-time imaging method to see what is happening to those drugs.

“That is where radiology can help resolve the controversy,” Pearl says. “We’re using MRI in new ways to see in real time how well such drugs are being delivered to these very hard-to-reach places.”



Pearl is using MRI in new ways to see in real time how drugs are being delivered to very hard-to-reach places in the brain.

Pearl and her Johns Hopkins research colleagues Piotr Walczak, Miroslaw Janowski and Meiyappan Solaiyappan have developed a hybrid imaging platform. The first part is an iron-rich tracer, known as ferumoxytol, which works beautifully in magnetically sensitive MRI. The second component, gadolinium, is a sort of dye that improves the contrast quality of the images. Areas with high concentrations of these two substances stand out brilliantly during scanning.

When combined with mannitol, a drug that “opens” the blood-brain barrier, Pearl says, clinicians are able to watch in real time as their injections infuse brain tissue in animal testing to see exactly where and how deep their injections are going.

While her technique has to be tested in humans, this newfound ability to visualize activities deep within the brain as they happen could greatly improve the predictability and consistency of drug injections, Pearl says. She hopes soon to use it to help deliver potentially lifesaving chemotherapies to some very sick children and incorporate this technique into the next phase of clinical trial for children with DIPG.

“If our technique is approved, we will be able to see exactly where the drugs are going and know with certainty which drugs are working for kids who don’t have a lot of hope otherwise,” Pearl says. “Rarely does radiology get more rewarding than that.” ■

A New Era in **Regenerative Imaging**

RADIODTHERAPY IS A COMMON and effective means to treat breast cancer, but it often leaves patients with painful scarring known as radiation-induced fibrosis. Of the 100,000 U.S. women who get lumpectomies and radiation each year, as many as 30 percent will experience fibrosis.

“It is really painful. They feel miserable all the time,” says Jeff Bulte, a professor of radiology who is working to make life a little better for those women.

New regenerative therapies (using fatty tissues from elsewhere in the body and injected into the breast) have shown promise for this condition that was once considered irreversible. In particular, research has found that grafts enhanced with a type of cells known as stromal vascular fraction, or SVF, cells do particularly well in grafting trials. SVF cells contains a favorable mix of stem cells, progenitor cells and immune cells. The technique is not foolproof, however, and accurately determining the fate of SVF cells after grafting has proved elusive.

“It would be great to be able to track these cells to ensure proper grafting and to monitor what happens to them afterward,” Bulte says. “Together with a plastic surgery practice, we are about to conduct our first-in-human clinical trial of just such a technique using MRI.”

Bulte’s approach relies on fluorine-19, a substance not typically found in the body (save fluoridation of the teeth, where it is well-known for preventing cavities). While fluorine-based MRI is not new, having been developed more than four decades ago, Bulte and his team have adapted it to the new purpose of tracking the fate of SVF cells.

The process begins by harvesting fatty tissues from the same patient elsewhere in the body, then separating the SVF cells by enzymatic digestion and centrifugation. Bulte then adds a fluorinated MRI tracer, labeling the cells with fluorine. The fluorinated SVF cells are then injected into the radiation-

damaged breast tissue of a patient.

When examined using MRI, fluorine will show up on the scans as “hot spots,” as Bulte puts it. In essence, he has developed a way to quickly and noninvasively see exactly where the grafted SVF cells end up.

“Fluorine is a marker that allows us to observe what happens to the injected SVF cells. Do they get to the right spot? How many go there? How long do they live? Do they go elsewhere?” Bulte says. Then, when the SVF cells die, as all cells do eventually, the inert, nontoxic fluorine simply evaporates from the body as if it were never there and the SVF cells disappear from MRI scans.

Beyond that, Bulte and his group can use MRI to optimize the injection process to find the best injection site, injection volume and cell dose, and fine-tune how fast or slow to inject the cells.

Bulte’s research is timely. The medical world is currently amid something of a boom in immune cell therapies that could benefit from the same or similar imaging techniques. Then there is the much-discussed potential for stem cell therapies, which loom large but are still nascent at this time, Bulte says. His first human patient is in the pipeline.

“This study of SVF is just an example of what fluorine-based MRI can do,” he says. “If we show it works for this specific form of cell therapy, this could be just the beginning of a new era in regenerative imaging for all sorts of cell therapies.” ■



We are about to conduct **our first-in-human clinical trial** of just such a technique using MRI.”

—JEFF BULTE

Bulte is using fluorine-based MRI in new ways.

Enhancing the Department's Education Mission **Through Philanthropy**

Newly Endowed Lectureship The Inaugural Nagi F. Khouri, M.D., Breast Lecture

THE RUSSELL H. MORGAN Department of Radiology and Radiological Science celebrated the inaugural Nagi F. Khouri, M.D., Breast Lecture in October 2017 at the Johns Hopkins Hospital. The guest lecturer was Elizabeth Morris, M.D., chief of the Breast Imaging Service, Larry Norton Endowed Chair and professor of radiology at Memorial Sloan Kettering Cancer Center, and professor of radiology at Weill Cornell Medical College. Morris presented “Personalized Medicine: Risk-Adjusted Breast Cancer Screening.”

The Khouri Breast Lectureship

is an endowed fund made possible by the generous support of Khouri's longtime patient and friend, Sophie Desmarais. Following in the footsteps of her philanthropic parents, Paul and Jacqueline Desmarais, Sophie Desmarais embodies their vision and commitment to provide financial support to fuel medical education around the world. “This lectureship is a meaningful way to honor Dr. Khouri and his outstanding career,” says Karen M. Horton, M.D., director of the department. “The Department of Radiology and Radiological Science is deeply grateful to Mrs. Desmarais for her investment in this important educational

resource to support the next generation of specialists helping women with breast issues.”

Khouri is the Carol Ann Flanagan Professor in Breast Imaging and associate professor of radiology and oncology at Johns Hopkins. With a prestigious career spanning more than three decades, he is recognized nationally and internationally as a pioneer who is largely responsible for advancing the science of breast imaging into a full-fledged specialty within the field of radiology.

Khouri joined the department faculty in 1975 and was appointed as the director of the Chest Service in 1976. In 1986, he decided to dedicate his career to the budding breast imaging field. Throughout his career, Khouri has maintained an impressive research portfolio. He has published extensively, authoring several book chapters and 49 peer-reviewed articles. Khouri is known globally for providing compassionate, patient-centered care. He is an advocate for training, serving as a mentor to students, residents, fellows and junior faculty members. ■



Karen Horton,
Elizabeth Morris and
Nagi Khouri



Front row, from left, Pam Johnson, Karen Horton, and Riva and Al Shackman. Back row, from left, Christopher Bailey, Emily Ambinder and Roberto Salas Fragomeni.

Inaugural Shackman Radiology Resident Research Conference

IN JULY OF 2017, THE RUSSELL H. MORGAN DEPARTMENT OF RADIOLOGY AND RADIOLOGICAL SCIENCE celebrated the inaugural Shackman Radiology Resident Research Conference generously funded by the Riva and Albert B. Shackman, M.D., F.A.C.R. Fund for Resident Education and Research. This newly established endowment benefits the next generation of residents by providing financial resources for their education and training, including an annual research award. Residents Emily Ambinder, M.D.; Christopher Bailey, M.D.; and Roberto Salas Fragomeni, M.D. presented at the conference.

Dr. Shackman is a retired radiologist who completed medical school at the University of Michigan in Ann Arbor in 1948. He was recruited to Johns Hopkins as a resident in 1950 by Russell H. Morgan, M.D. Dr. Shackman became chief resident in 1953, and in 1954, he was offered a full-time faculty position. He chose to work part time for the department in order to join Richard Hanchett, M.D., a prior Johns Hopkins resident, in private practice. In 1961, he co-founded Drs. Copeland, Hyman & Shackman, a private

radiology practice in Maryland. Dr. Shackman served in numerous leadership roles throughout his career. During his years as a private practice physician, Dr. Shackman continued as a part-time faculty member in the department until his retirement in 2015.

Department Director Karen M. Horton, M.D., is deeply grateful to the Shackmans for their generous endowment, which will support the educational and training needs of the residents now and in the future. Horton commented, “Riva and Al’s commitment is inspiring, and we are thankful for their loyalty to the Johns Hopkins radiology family.” ■



From left, Riva Shackman, Ted Bayless, Jaye Bayless and Al Shackman

Bringing Knowledge to the Doctors

This was my opportunity **to give back** to the department that has meant so much to me over the years.

—ERICH LANG



Erich Lang

WHEN ERICH LANG, M.D., WAS a resident at Johns Hopkins from 1956 to 1959, radiology was not the complex field it is today. During these years, the focus was on X-rays—radioactive imaging—from which the field derives its name.

Today, almost 60 years later, the field is virtually unrecognizable from the one in which he trained. Throughout his career, Dr. Lang experienced the emergence of computed tomography, positron emission tomography, MRI, ultrasound, fluoroscopy, and other imaging technologies and their influence. At every turn, there was something new to learn—new technology or an update. “Keeping up is a continual and expensive effort,” Dr. Lang says. So he took an important step to make the effort easier for today’s radiologists. Dr. Lang endowed the Erich K. Lang, M.D. Education and Research Fund in the Russell H. Morgan Department of Radiology and Radiological Science at Johns Hopkins, which recently hosted the inaugural Erich K. Lang Lecture.

“When teaching or learning new techniques, you have two choices: You can send the doctors to the knowledge, or you can bring the knowledge to the doctors,” Dr. Lang says. “It’s more efficient to do the latter. I want to make it easier for radiologists to learn the newest technologies and methods.”

Dr. Lang, a retired radiologist, completed medical school at the Medical University of Vienna in Austria and received a master’s of science degree from Columbia University in New York. He spent much of his career in Louisiana, where he served as a professor and chair of radiology at Louisiana State University in New Orleans. Dr. Lang served on faculty at Tulane University before he returned to Johns Hopkins in the early 1990s, where he spent seven years as a faculty member in radiology and urology. He also was as professor of radiology at the State University of New York Downstate College of Medicine in Brooklyn, New York, and at the University of Medicine and Dentistry of New Jersey.

As an interventional radiologist, his specialty was focused on vascular-interventional radiology and oncologic interventional



Erich Lang in 1981 at Louisiana State University Charity Hospital.

uroradiology. Dr. Lang was inspired by Hugh Jewett, M.D.; Dave Sabiston Jr., M.D.; Henry Bahnson, M.D.; John MacAfee, M.D.; and Lee Phillips, M.D., his mentors in urology, vascular surgery and vascular radiology. These doctors introduced him to research in these disciplines, leading to his early publications.

Throughout his years as a radiologist, Dr. Lang found each new technology a revelation. However, keeping up with the latest technologies and techniques can be a challenge, particularly for junior faculty members. With university departments operating on thin budgets, the time and expense of sending

doctors to national conferences and other educational opportunities can be prohibitive.

The inaugural Erich K. Lang, M.D., Lecture was held in January, and with Dr. Lang's generosity, there will be annual lectures for many years to follow. The featured 2018 lecturer was Elliot Fishman, M.D., director of diagnostic imaging and body CT, who spoke about emerging 3-D CT imaging techniques for the kidney.

At 89 and living in New Orleans, Dr. Lang is still closely involved in the field of radiology and interested in the work at Johns Hopkins. "This was my opportunity," he says, "to give back to

the department that has meant so much to me over the years."

Radiology Director Karen M. Horton, M.D., is deeply grateful to Dr. Lang for his generous investment in this important educational resource to support the department's mission to train the next generation of radiology and radiological science professionals. Horton commented: "Dr. Lang has a long relationship with our department and has been a tremendous mentor throughout his career. He understands firsthand how an investment like his will help to launch the next generation of specialists in our field." ■



The Advent of MRI at Johns Hopkins

BY BOB GAYLER



NUCLEAR MAGNETIC RESONANCE (NMR) WAS an analytical method used in chemistry decades before imaging was added, in research first reported in *Nature* in 1973 by Paul Lauterbur

at the State University of New York at Stony Brook. (Three decades later, in 2003, he and Sir Peter Mansfield at the University of Nottingham in England received the Nobel Prize in Physiology or Medicine for their pioneering work in NMR imaging.) Once the tool became common for medical applications, its name was tweaked to become “magnetic resonance imaging,” or MRI, to avoid any negative associations with radioactivity.

Early U.S. vendor development was by General Electric, Fonar, Picker and Technicare, a spinoff of Ohio Nuclear. These were the early applicants for Food and Drug Administration approval, which was provided in 1984 and 1985.

At Johns Hopkins, Henry Wagner, director of nuclear medicine, and Martin Donner, radiology director, saw the potential for the new imaging technology and had discussions with Robert Heyssel, president of The Johns Hopkins Hospital (1983–92), and Richard Ross, dean of the medical



From top: 1986 MRI building courtyard, to facilitate delivery of magnet by crane as well as to provide protected space for magnetic field before magnetic shielding was available. MRI magnet during delivery. 1.5 Tesla GE MRI scanner, Room 1, MRI building.

As Donner's point person for the state hearings, I had developed a stack of material in my office in Nelson that was 4 feet high.

—BOB GAYLER

school (1975–90). There was early agreement that the technology should be acquired, despite the then-unprecedented cost of \$3 million to \$5 million. Ross insisted that the acquisition be used half of the time for research, and he committed the medical school to sharing the cost with the hospital.

At that point, planners thought clinical use of MRI would focus primarily on the brain, with cardiac applications a close second. There was much discussion about whether the MRI unit(s) should be in the newly formed neurosciences functional unit, in the Department of Medicine (with cardiology managing) or in the Department of Radiology. Radiology had a strong track record of managing computed tomography and a committee formed with George Zuidema, director of surgery; Robert Ney, director of endocrinology; David Grant, from hospital facilities; and me, representing radiology. After multiple meetings and discussion, in 1983, management of MRI operations was assigned to the Department of Radiology, with the creation of a multidisciplinary oversight group to assure equitable research opportunity.

The next major hurdle was to get regulatory approval from the state of Maryland. At that time, hospital equipment costing more than \$250,000 required a certificate of need (CON). This was a three-step process, requiring paperwork and an oral presentation to a local group, then to a regional group, then to a statewide group. No money could be committed until the final

approval. Johns Hopkins, the University of Maryland and several large hospitals in the area submitted applications. After the first two steps were completed, things were looking positive for Johns Hopkins and Maryland, but then Union Memorial Hospital used a tactic requiring judicial review. This markedly slowed down the process for everyone. By then, Johns Hopkins had an agreement with Technicare for two scanners for the price of one (with one unit to be used for research and one for clinical operations), an architectural firm with complete construction documents and a site.

As Donner's point person for the state hearings, I had developed a stack of material in my office in Nelson that was 4 feet high. Johns Hopkins had engaged two well-known law firms to manage the process, in addition to using in-house legal talent. Since it looked like we were facing an indeterminate delay, Donner decided to try to change the process by appealing directly to the Maryland legislature. This was successful, and the CON process was changed to a licensure process. With that, all of the requesting hospitals could proceed, and construction at Johns Hopkins began in 1986.

The site selected for the first MRI units had to be large in three dimensions. A senior faculty parking area was selected and approved. The politics of that were a testimony to Donner's diplomacy.

No Easy Process

Installation of MRI scanners presents special challenges. A thick concrete foundation that can support the weight

is essential. (The concrete can contain iron reinforcing bars since the location of the bars will not change, and the magnet shim can be set up to compensate for the iron.) Absence of vibration is also very important.

Large air-conditioning units, often situated on the roofs of hospitals, emit vibrations that are transmitted through the walls of the building. At Johns Hopkins, the CMSC building had too much vibration for MRI installation, but the adjacent Alfred Blalock Building had less transmitted vibration, which could be buffered.

When installing MRI units, access for magnet delivery must be carefully planned. Cranes can deliver the magnet to floors above grade, but the crane must have access. The highest magnet at Johns Hopkins is on the fifth floor, but magnets have been placed higher elsewhere. When installing a magnet, it's important to note that it must not be close to moving metal structures, including motor vehicles, subway trains, elevators or forklift trucks.

Since the first MRI units were installed at Johns Hopkins, many more have been added to the East Baltimore campus. In 2005, planners on campus embarked on a multiyear effort to expand and upgrade existing MRI units with the newest, state-of-the-art equipment. Today, the MRI technology first imagined half a century ago is used to provide the highest quality of patient care, research and education at sites across Johns Hopkins Medicine. ■

ALUMNI RECEPTIONS

The Johns Hopkins Radiology Alumni Reception at RSNA



In November 2017, the Russell H. Morgan Department of Radiology and Radiological Science held its annual alumni reception at R29 in The Franklin building in Chicago. The gathering reflected the ever-growing size, diversity and strength of the Johns Hopkins radiology community.

A global network of alumni were in attendance, as were numerous Johns Hopkins faculty members, residents and fellows who want to stay connected with the department. They newly appointed director, Karen M. Horton, M.D., welcomed guests and provided a department update. Attendees enjoyed delicious food and specialty drinks, including “Horton’s Hello,” “the Bledsoe Bowtie” and “the EPIC Double Upgrade.” ■

The Johns Hopkins Alumni Cocktail Reception at SIR

The Division of Interventional Radiology in the Russell H. Morgan Department of Radiology and Radiological Science held its annual alumni reception in March at Hotel Indigo in Los Angeles. The event was an opportunity for alumni, current faculty members, residents and fellows to catch up and network with former colleagues and friends.

Division Chief Kelvin Hong, M.D., welcomed guests and provided a division update. Program highlights included remarks from Sanjay Misra, M.D., in memory of Mitchell Weiss, M.D., a fellow Johns Hopkins alumnus who tragically passed away in 2017, and regional alumni R. Torrance Andrews, M.D., and Tina Hardley, M.D., who shared reflections of their medical journeys post-Johns Hopkins. ■



SAVE THE DATE:

Tuesday, March 26, 2019, in Austin, Texas

A New Model for Collaboration

LAST OCT. 8–9 IN BALTIMORE, NEARLY 200 clinicians, house staff members and administrators from 70 medical centers attended the inaugural research and education conference of the High Value Practice Academic Alliance (HVPAA), co-founded by Johns Hopkins radiologist Pamela Johnson.

The conference featured innovative work from 50 institutions in the U.S. and Canada. Some 140 podium and poster presentations described quality improvement projects that focused on delivering better patient care by reducing unnecessary health care practices.

“This is a new model for collaboration, one that transcends cross-institutional competition, geographic constraints and specialties,” says Johnson, vice chair of quality and safety in radiology at Johns Hopkins and organizer of the conference. “Academic medical centers have no choice but to step up to the plate, refine practice within their institutions and lead large-scale improvement by disseminating results. We have

to demonstrate to patients that we are accountable for delivering the improvements needed in the U.S. health care system.”

Through monthly calls, collaborative publications and multi-institution quality improvement projects, HVPAA members share knowledge about breakthroughs and setbacks in their efforts to eliminate unnecessary tests, procedures and treatments, and improve patient care.

“This conference is a testament to the fact that providers all over the country are thrilled to join together and share experiences so that improvements can be advanced efficiently and effectively across the country,” says Johnson. “Medical centers are learning from each other, and experienced centers are mentoring those new to high-value care.”

Training the next generation of physicians is a priority for the HVPAA and was an important feature of the conference. The organization also directs a yearlong high-value care professional development program for 75 house staff members across the U.S.

In an effort to reduce wasteful spending and improve the patient



Pamela Johnson, HVPAA co-founder and organizer of the conference, right, with Yoshimi Anzai, associate chief medical quality officer, University of Utah Health.

experience, the Centers for Medicare and Medicaid Services will require all providers ordering radiological imaging tests to follow its appropriate-use criteria beginning January 2020.

“Providers who fail to follow the criteria will be identified and require preauthorization for future imaging orders,” Johnson told a packed room during a half-day continuing medical education session at the conference. It was led by 15 Johns Hopkins radiology faculty members and aimed at teaching nonradiologists the appropriate guidelines for ordering tests.

Building on the success of the 2017 conference, HVPAA hosted its second national conference on Sept. 21–23 as a venue for information sharing and strategizing to improve health care value on a national scale. More than 200 presentations were shared from 56 academic medical centers, and registration surpassed last year’s meeting, with 250 faculty members and house staff from 70 medical centers participating in this year’s meeting. ■

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bit.ly/IUOaHSb, along with comments from current residents or recent graduates. Read the great things that our trainees are saying about the Johns Hopkins Diagnostic Radiology program bit.ly/2xwdESp. If you would like to participate in this process in the future, simply register as a Doximity member at this link: bit.ly/2PN3Yu7.



For more information or to schedule an appointment, call 443-997-7237.

Ways to Give...

For those interested in making a tax-deductible contribution in support of any program or research project in the Russell H. Morgan Department of Radiology and Radiological Science, please contact the Development Office at 443-287-7958 or cvera3@jhmi.edu, or visit hopkinsmedicine.org/radiology.

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