RSNA News™

September 2017 Volume 27, Issue 9

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RSNA 2017 Distinguished Honorees

The RSNA Board of Directors has announced the Outstanding Educator and Outstanding Researcher who will be honored at the 103rd Scientific Assembly and Annual Meeting.

OUTSTANDING EDUCATOR

Dorothy I. Bulas, MD
Washington, DC

OUTSTANDING RESEARCHER

Mitchell D. Schnall, MD, PhD
Philadelphia, PA

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RSNA R&E Foundation Grant Applications Open Soon

The RSNA Research & Education (R&E) Foundation awards millions of dollars each year to promising researchers and educators in radiology. Many past recipients have credited an R&E grant for sparking a career in academic research and opening doors to additional funding from national resources.

If you have thought about applying, now is the time to start getting organized. The online application process will open in October, and deadlines for application begin in January. Visit *RSNA.org/Foundation* to read about current and past funded projects, discover the grants available and learn how to apply.

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In Memoriam

A. Everette James, Jr., MD

A renowned imaging expert and respected radiology leader, A. Everette James, Jr., MD, died March 14, 2017 in North Carolina. He was 78.

A native of North Carolina, Dr. James completed his medical degree at Duke University School of Medicine, Durham, NC. Following military service in Vietnam, Dr. James began his medical career as the director of radiological research laboratories at Johns Hopkins Medical School, Baltimore. In 1975, he was appointed chair and professor of the Department of Radiology and Radiological Sciences at Vanderbilt University School of Medicine, Nashville. He founded the Vanderbilt Center for Medical Imaging Research and transformed it into one of the premier radiology centers in the world. After stepping down as chair in 1991, he remained an adjunct professor at Vanderbilt and became a clinical professor at the University of North Carolina, Durham, NC.

Among his numerous leadership roles, Dr. James served as president of the Association of University Radiologists (AUR), the Society of Chairmen of Academic Radiology Departments and the American Roentgen Ray Society (ARRS). In 2003, he received gold medals from the AUR and the ARRS for his contributions to radiology.

His extensive professional involvement included serving as radiology representative to the American Medical Association, the American Association of Medical Colleges and the Administrative Board of the Council of Academic Societies. He was a long-time member of the National Council of Radiation Protection.

Dr. James authored more than 540 articles, more than 200 book chapters and 20 books. His research was published in *Radiology* and he served as an associate editor on the *Radiology* Editorial Board.

He presented the New Horizons Lecture at the RSNA annual meeting in 1976.

2017 RSNA Editorial Fellows Announced

Andrew Rosenkrantz, MD, has been named the 2017 RSNA William R. Eyler Editorial Fellow, and **David H. Ballard, MD,** is the 2017 RSNA William W. Olmsted Trainee Editorial Fellow.

Dr. Rosenkrantz serves as an associate professor of radiology and urology, as well as director of health policy and director of prostate imaging in the Department of Radiology at NYU Langone Medical Center, NYC.

He earned his medical degree from Albany Medical College, NY, and completed his residency in diagnostic radiology at the University of Maryland Hospital, Baltimore. He completed his fellowship in body imaging at NYU Langone Medical Center.

Presently, Dr. Rosenkrantz is an associate editor of the *Journal of Magnetic Resonance Imaging* and an assistant editor of the genitourinary imaging section of the *American Journal of Roentgenology*. He has published articles in and served as a reviewer for numerous journals including *Radiology*. Dr. Rosenkrantz earned the *Radiology* Editor's Recognition Award (with Special Distinction) in 2014, 2015 and 2016.

Dr . Rosenkrantz received the 2016 RSNA/AUR Education Scholar Grant and a 2008 RSNA Roentgen Resident/Fellow Research Award. He has presented at numerous RSNA annual meetings and is a current member of the RSNA Genitourinary Radiology Scientific Program Subcommittee. He will serve as chair of the subcommittee in 2018.

Dr. Ballard is a first-year resident in diagnostic radiology at Mallinckrodt Institute of Radiology at Washington University School of Medicine in St. Louis. He earned his medical degree and completed an internship in the Department of Surgery at Louisiana State University Health School of Medicine, Shreveport. He earned his Master of Science, exercise physiology, at McNeese State University, Lake Charles, LA.

Dr. Ballard is the co-founder of and served as deputy editor for the *American Medical Student Research Journal* from 2013 to 2015. He has published articles in numerous journals and serves as a reviewer for *Emergency Radiology*, *Diagnostic and Interventional Imaging* and *Cardiovascular Diagnosis and Therapy*.

Dr. Ballard was selected as a participant in the RSNA 2014 Introduction to Radiology Travel Award Program and has presented at the RSNA annual meeting.

Both fellows will work with *Radiology* Editor David A. Bluemke, MD, PhD, in Madison, WI, and *RadioGraphics* Editor Jeffrey S. Klein, MD, in Burlington, VT. The Eyler Editorial Fellowship lasts one month and the Olmsted Trainee Editorial Fellowship lasts one week. Each fellow will also visit the RSNA Publications Department at RSNA Headquarters in Oak Brook, IL. Dr. Ronsenkrantz will also work with the *Radiology* editorial team at RSNA 2017.

Rosenkrantz

Ballard

Kressel

Klein

Impact Factors Increase for RSNA Journals

In 2016, the RSNA journals *Radiology* and *RadioGraphics* showed gains in impact factor, according to the 2017 edition of Journal Citation Reports. An impact factor is a measure of the yearly average number of citations to articles published in a journal.

The latest impact factor for *Radiology*, edited by Herbert Y. Kressel, MD, is 7.296, up from 6.798 in 2015, with total citations up from 48,521 to 50,983. The impact factor for *RadioGraphics*, edited by Jeffrey S. Klein, MD, is 3.427, up from 2.523, with citations increasing from 8,820 to 10,286.

Radiology is ranked second among radiology, nuclear medicine and medical imaging journals. *RadioGraphics* jumped to 24 from its 2015 rank of 40.

Published regularly since 1923 by RSNA, *Radiology* has long been recognized as the authoritative reference for the most current, clinically relevant and highest quality research in the field of radiology.

Launched by RSNA in 1981, *RadioGraphics* is one of the premier education journals in diagnostic radiology.

RSNA Board of Directors Report

The RSNA Board of Directors met in June to approve the Society's 2017-2018 budget and to continue planning for the annual meeting and many other ongoing activities.

RSNA 2017
The 103rd Scientific Assembly and Annual Meeting program will be dedicated to the memory of Richard L. Baron, MD, RSNA past president. In recognition of his significant contributions to radiology, the Board also decided to award Dr. Baron a posthumous Gold Medal at the meeting. The Annual Oration in Diagnostic Radiology will be dedicated to Morton A. Bosniak, MD, and the New Horizons Lecture will be presented in memory of Sir Peter Mansfield, PhD.

A number of new features are planned for 2017, including a Fast 5 session that will precede the Thursday afternoon plenary session. In this fast-paced, engaging presentation, five speakers will be identified through crowd-sourcing to speak for five minutes each on topics related to the meeting theme: Explore. Invent. Transform.

A new cybersecurity session will be developed by the Medical Imaging & Technical Alliance (MITA) with speakers from MITA and the FDA.

3-D Printing SIG
The Board approved the 2017-2018 Plan of Work for the recently formed 3-D Printing Special Interest Group (SIG). The plan outlines goals for the group, including publication of a set of recommendations for creating 3-D printed models from medical images.

2018 Planning
RSNA continues to broaden its educational offerings with a new Spotlight Course planned for 2018 in Buenos Aires, Argentina. Course directors Jorge Soto, MD, of Boston and Mariano Volpacchio, MD, of Buenos Aires will develop the 2 ½ day course addressing topics in abdominal imaging. The course will be conducted in Spanish, and registration will open early in 2018.

Australia and the Nordic countries will be featured in the Country Presents program at RSNA 2018. The program allows selected countries to showcase a particular area of interest in medical imaging research and education in each country.

The RSNA/European Society of Radiology Symposium series continues with the RSNA/ESR Sports Imaging Symposium to be held at ECR 2018 and RSNA 2018. Course directors Laura W. Bancroft, MD, and Andrew J. Grainger, MRCP, FRCR, will develop the symposium.


Jackson

Education Center Adds Webinars
RSNA is developing new webinars to be held in 2018, covering a variety of clinical and non-interpretive topics. Each one-hour webinar will be eligible for CME credit.

Imaging Informatics Curriculum
The Board approved RSNA support for implementation of a national imaging informatics curriculum and course developed by Tessa Cook, MD, PhD, Nabile Safdar, MD, Katherine Andriole, PhD, and Michael Recht, MD, with grant funding from the Association of University Radiologists (AUR). The Society for Imaging and Informatics in Medicine (SIIM) has agreed to share costs. The course is geared toward fourth-year residents and will run as a week-long online course, which will be offered twice per year and will conclude with an exam. The first course will be held in October 2017, and will run on a trial basis for three years.

Streamlining the Annual Meeting Program
A workgroup was appointed by the Board to recommend modifications to optimize the educational components of the annual meeting. Among other things, the group will consider reducing duplication across various courses offered at the meeting, alternative ways to structure education course tracks, and the frequency and length of courses.

The charge also includes discussion of potential new course formats and strategies to label the difficulty of educational courses.

Support for NIBIB Panel on Gadolinium Deposition
RSNA agreed to provide support for an invitational workshop on gadolinium-based contrast agents for MRI, being convened by the NIBIB this fall. An objective of the conference will be to reach a consensus and produce a white paper on what is known and not yet known about gadolinium deposition.

QIBA Conformance Certification Pilot Program
The Board authorized a Quantitative Imaging Biomarkers Alliance (QIBA) collaboration with Accumetra to pilot a conformance certification program focusing on QIBA's CT Small Nodule Volumetry Profile. The pilot establishes a program to test and validate CT scanner and acquisition protocols for clinical sites and equipment manufacturers.

I look forward to seeing you soon at RSNA 2017.

Valerie P. Jackson, MD
Chair
RSNA Board of Directors

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3-D Printed Models Add Colorful New Dimension to Complex Surgery

BY RICHARD DARGAN

Just a few days after her daughter Jemma's birth, Stephanie Starks found herself living a nightmare. Jemma had dangerously low levels of oxygen in her blood and had been rushed to Phoenix Children's Hospital, where doctors discovered a life-threatening congenital defect in her heart. As doctors prepared for emergency surgery, Stephanie was frightened and confused.

One doctor told her Jemma had been born with only half a heart; another said she had "pulmonary atresia with intact ventricular septum." None of it made any sense, not even when a cardiologist tried to draw Stephanie a picture of her daughter's heart on a sheet of paper.

Then, shortly before surgery was set to begin, Stephen Pophal, MD, a pediatric cardiologist, popped his head into the waiting room and said to Stephanie, "I just want you to know, we have practiced this surgery on your daughter before." Stephanie was alarmed — "How do you practice a surgery?" she wondered — until Dr. Pophal led her to a room housing the hospital's state-of-the-art 3-D printer. There, she saw a color-coded model of a heart — her daughter's heart — and received a detailed explanation on how doctors were planning to address the problem.

Suddenly, the cloud lifted, and for the first time since she had arrived at the hospital, Stephanie felt reassured.

"At first, heart surgery is this unknown that you can't picture, like the scary monster under the bed," she recalled. "But when they show the 3-D model, it takes away so much of the fear. It changes everything."

Doctors agree that the 3-D model offers a valuable new tool to relay the complexity of surgery to patients.

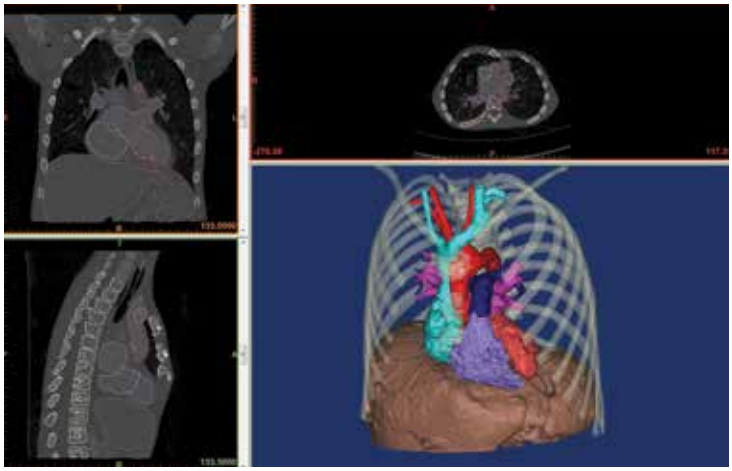
"We believe the color-coded model is great for communication with families," said Justin Ryan, PhD, research scientist in charge of the Cardiac 3-D Print Laboratory at Phoenix Children's Hospital, who made the 3-D replica of Jemma Starks' heart. "It's one thing to say 'your child has pulmonary atresia with major aortopulmonary collateral arteries,' but it is another to say 'this blue vessel that brings blood to your child's lungs is so narrow it is effectively cut off from this

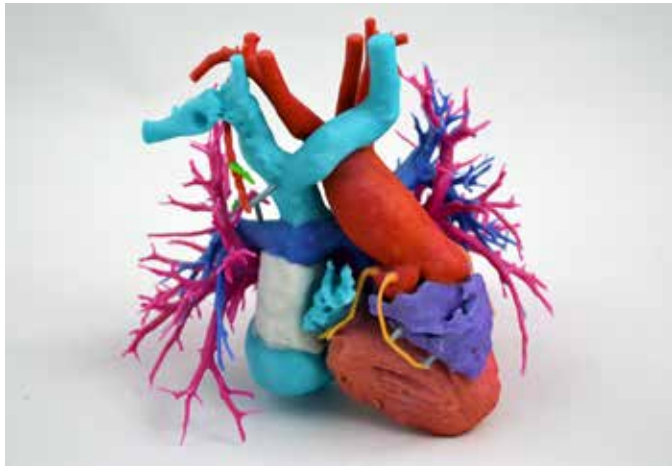
Continued on next page

Born with a congential heart defect, Jemma Starks (*left*) underwent surgery after research scientists at Phoenix Children's Hospital created a 3-D replica of her heart. Her parents, Stephanie and Rory, *above*, are big supporters of 3-D printed models and even display the model created for Jemma, now four years old (*right*), on the mantel above their fireplace. *Images courtesy of the Starks family.*

"At first, heart surgery is this unknown that you can't picture, like the scary monster under the bed. But when they show the 3-D model, it takes away so much of the fear. It changes everything."

STEPHANIE STARKS





3-D printed models are being used in a growing number of applications across different specialties to help physicians perform complicated surgery. *Above right:* a color-coded model of a heart was created with 3-D images (*left*) in the Cardiac 3-D Print Laboratory at Phoenix Children's Hospital. *Images courtesy of Phoenix Children's Hospital.*

RSNA 3-D Printing Special Interest Group (SIG)

The RSNA 3-D Printing Special Interest Group (SIG) meets regularly and held its most recent meeting in August with U.S. Food and Drug Administration (FDA) officials at FDA headquarters in Silver Spring, MD. For more information, go to *RSNA.org/3D-Printing-SIG.*

Continued from previous page

purple pumping chamber, and these green vessels shouldn't be there.'"

Jemma is now four years old and thriving, and Stephanie has become what she calls a "volunteer cheerleader" for 3-D printing. The Starks have two 3-D models of Jemma's heart on the mantle above their fireplace and Stephanie wears a miniaturized model of the heart on a necklace that is a way of "keeping my daughter's heart close to mine," she said.

Collaboration Critical to 3-D Printing

Jemma's case and others like it are further evidence that 3-D printing for medicine has arrived in a big way. Models are used in a growing number of applications across different specialties. Early adopters, like Frank Rybicki, MD, Jonathan Morris, MD, and Jane Matsumoto, MD, are senior leaders and central figures in the RSNA's 3-D Printing Special Interest Group (SIG), helping to pave the way for younger SIG members like Dr. Ryan. The RSNA 3-D Printing SIG was launched in November 2016.

"The 3-D printing community is extraordinarily collaborative," Dr. Ryan said. "I have known Drs. Morris, Rybicki, Matsumoto and other SIG leadership prior to the SIG creation. They are fantastic mentors and always eager to push collaboration and development among researchers."

Ryan

Morris

Matsumoto

Rybicki

3-D Printing Showcase at RSNA 2017

In addition to many hands-on courses related to 3-D printing, the 3-D Printing Showcase will include theater poster presentations on 3-D printing throughout the week and a demo area with additional information. The 3-D Printing Showcase will be located in the Learning Center at McCormick Place.

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To date, Dr. Ryan's lab has produced more than 400 heart models for surgical planning, medical education and family consultation. The hospital's full color printer can differentiate structures like vessels and valves and even depict arterial plaque and clots. If ultrasound reveals prenatal defects, Dr. Ryan can the provide surgeons with models well in advance of surgery. Models are often repurposed for interventionalists, who sometimes refer to them as their "Google Maps."

"It's a good feeling when, after viewing a model, a surgeon has a thought on how to treat that patient a bit differently," Dr. Ryan said. "It's a culmination of translational research that is now being used in a truly personalized manner."

Cutting Guides Chart Surgical Course

Other 3-D printing applications for surgical planning are booming. The use of patient-specific surgical cutting guides has grown so rapidly that 2017 is known among some clinicians as "the year of the guides," according to Dr. Morris, co-director of the 3-D Printing Lab at the Mayo Clinic in Rochester, MN.

Dr. Morris and colleagues create and use the guides primarily in restorative surgical procedures for head and neck cancer patients who have had tumors removed from their facial bones. Surgeons often harvest bone from the fibula, the non-weight-bearing bone of the lower leg, to fill voids in the face and the jaw. Prior to 3-D printing, determining the right size and shape of the bone involved a fair amount of guesswork, but 3-D printing allows the doctors to perform virtual surgery using CT scans, making practice cuts on the computer ahead of time. They can then build a cutting guide that fits only that patient. Even the metal plates that hold the bone in place can be customized for the patient.

The Mayo team — a collaboration among radiologists, 3-D printing experts, biomedical engineers, surgeons and others — has also used cutting guides for patients with large, primary bone tumors in their femurs to help save the hip and the knee joint and preserve the leg.

"Everything fits together like a hand in a glove," Dr. Morris said. "The results are so amazing, our surgeons do not want to go back to the older methods."

Throughout the growth of 3-D printing, physicians have developed novel ways to use models. Pathologist Joseph Maleszewski, MD, PhD, associate professor at Mayo Clinic School of Graduate Medical Education, first deployed 3-D prints as a way to preserve the clinic's specimens, some of which date back to the 1950s, and create a teaching library for medical students and others.

"Once we scan and archive a sample, we have it forever, and it doesn't require all the space and chemicals or create the biohazard issues presented by actual specimens," he said.

Pathologists are also using printed models in their interactions with patients, bringing what Dr. Maleszewski calls "a completely new dimension to patient care."

"There's a saying that a picture is worth a thousand words," he said. "The 3-D model increases that to the third degree."

RSNA 3-D Printing Special Interest Group Leads the Way

The combination of increasing demand and falling prices for models is likely to accelerate the growth of 3-D printing, Dr. Rybicki said, creating challenges for radiology leaders working to establish practice standards and ensure that the highest quality models are used for appropriate applications — ideas that the RSNA SIG has focused on since its inception.

"The SIG has had wonderful feedback and support from the RSNA senior leadership, and we are planning to disseminate our initial recommendations document," he said. "It remains important for the SIG to provide stewardship in best practices for medical 3-D printing as enthusiasm and importance in the field continues to grow."

Once standards and a framework of appropriateness are established, reimbursement can enter the discussion, according to Dr. Rybicki. While the sentiment building around 3-D printing is important, Dr. Rybicki emphasized that data will ultimately move the needle on reimbursement. A key upcoming study is 3-D Hearts Enabling a Randomized Trial, or 3-DHEART, a multi-site clinical trial of 400 pediatric congenital heart patients in which Dr. Ryan is a primary investigator.

With the support of the 3-D printing companies Stratasys and 3D Systems, researchers will analyze the impact of 3-D printed hearts based on MRI or CT scans of young patients. The primary focus of the two-year study is to see if the 3-D models reduce the need for cardiopulmonary bypass surgery.

"We're very excited to see what the results will be on bypass rates," Dr. Ryan said. "We will also be capturing 24 secondary metrics, like time in and time out, morbidity and readmission rates."

Boston Children's Hospital is also running a contemporary, single-site clinical trial regarding the utility of 3-D printing at their sire.

Important advances lie ahead and collaboration will be central to transforming technology into better and more efficient patient care.

"Our emerging leaders will be those who can best understand and communicate this, and the senior leaders today will have to provide the mentorship to nurture and guide the great level of enthusiasm for the field," Dr. Rybicki said.

Pathologist Joseph Maleszewski, MD, PhD, an associate professor at Mayo Clinic School of Graduate Medical Education, scans a heart for 3-D reconstruction. Dr. Maleszewski is pictured with Melanie C. Bois, MD, a cardiovascular fellow. *Image courtesy of the Mayo Clinic.*

Radiology Confronts Reality of

BY MICHAEL HART

Based on recent cyberattacks, radiologists may look back on the summer of 2017 as a time when cybersecurity made the transition from a back-burner issue to a very real threat.

While there have been isolated incidents of ransomware attacks, this summer two major ransomware attacks impacted industries across the globe, including thousands of hospitals and clinics.

In May, ransomware known as WannaCry or Wana Decryptor, was blamed for crippling computers across the U.K., including at the British National Health Service.

A second attack in June attributed to Petya, a variant of ransomware, began in the Ukraine and quickly spread to more than 60 countries including the U.S. One example: a global transcription service was disrupted, forcing physicians at some U.S. hospitals to rely on handwritten notes.

While cyberattacks generally have been on the rise in the past decade, ransomware incidents are more of a recent trend, particularly within healthcare. In a ransomware attack, victims are notified that their files are encrypted and they must pay a ransom (online currency) to unlock or access them. It is possible that hackers are just now discovering the financial potential of ransomware within healthcare, experts say.

"Criminals and bad actors will go where the money is and where there is the least risk," according to Kevin McDonald, a director in the Mayo Clinic Office of Information Security. He is presenting several cybersecurity sessions at RSNA 2017 (see sidebar) focusing on threats to radiology and methods for securing data and imaging devices.

Healthcare is often considered a "soft target," an observation backed up by statistics. Risk Based Security, a consulting firm focused on cybersecurity, reported that U.S. companies and institutions experienced 4,149 cyber breaches in 2016, exposing 4.2 billion records; 9.2 percent of those breaches were in the healthcare sector, according to the 2015 report.

In response to the growing threat, the Health Care Industry Cybersecurity (HCIC) Task Force released its final report to the U.S. Congress, identifying healthcare cybersecurity as a key public health concern and outlining steps to guard against attacks.

Healthcare a Frequent Target for Cyberattacks

Radiology, experts say, has been in a state of denial about cybersecurity. But the recent attacks are forcing radiology and healthcare in general to face the issue, beginning with the factors that have made the industry vulnerable to begin with — particularly aging, outdated equipment.

"Healthcare is still running Windows XP systems for regular computer use, but also for many medical devices," said Lee Kim, director of privacy and security for the Healthcare Information and Management Systems Society (HIMSS), noting that the XP operating system is no longer supported by Microsoft patches and updates.

Generally, healthcare institutions are not as diligent as they could be with necessary patches and updates, Kim said. The same is true with anti-virus applications, the protection of third-party software like those supplied by Adobe and Java, and credentialing protocols.

Simultaneously, electronic devices continue to proliferate in radiology and healthcare in general and not all are overseen by the institutions' IT departments.

"Today we have mobile phones and radiologists can even use these devices to read images," Kim pointed out. "If a doctor loses that device or if it is not password-protected, that can cause a security breach or other problems."

In general, the healthcare industry has been fast to adopt technology advances to benefit patients, but has not always worked as quickly to safeguard that technology against security vulnerabilities, McDonald said.

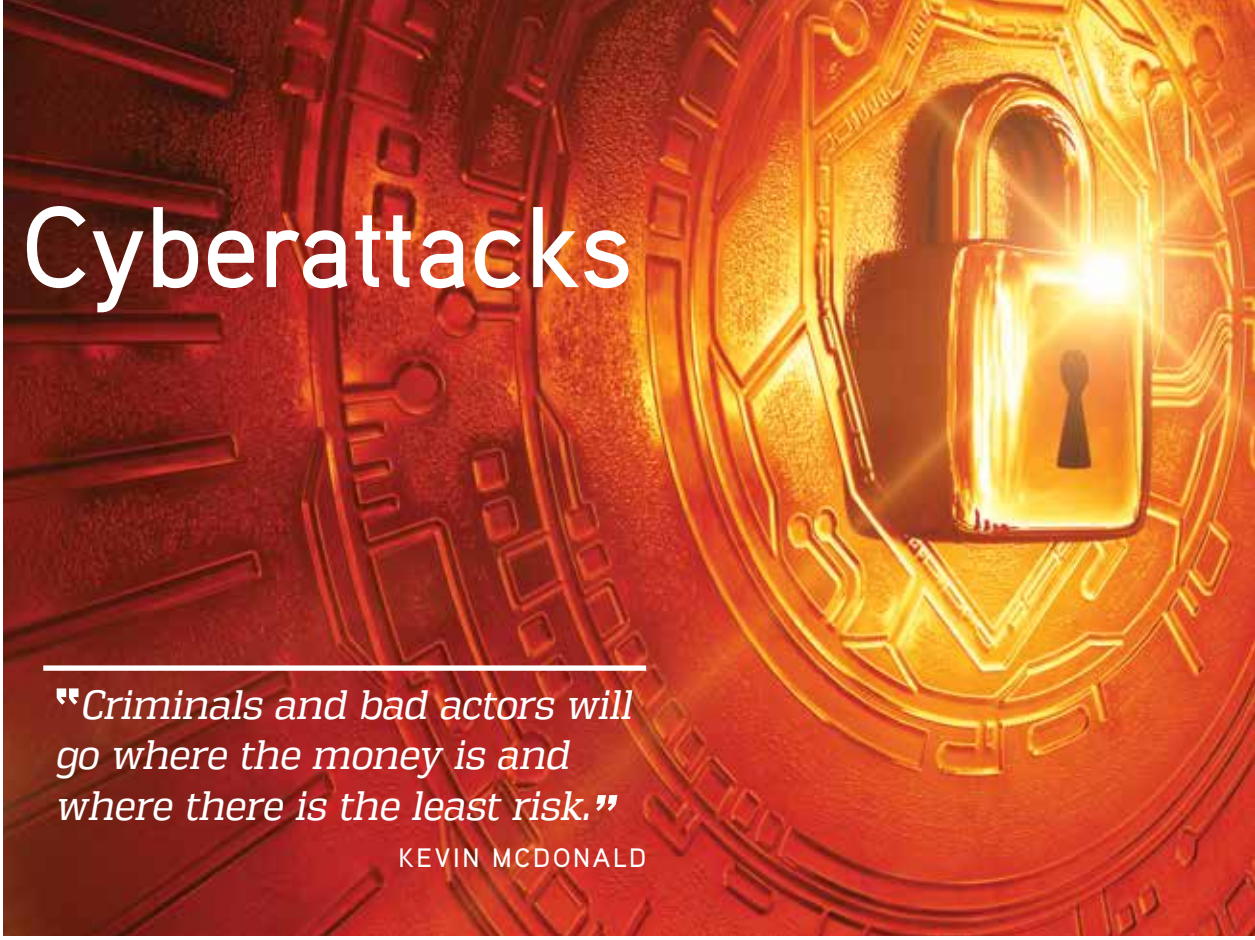
"The idea that we can build a big wall around our hospitals or dig a deep enough moat around them is just not correct anymore," McDonald said.

Cybersecurity Sessions Planned for RSNA 2017

- "Cybersecurity for Imaging Departments and Imagers — Threats, Vulnerabilities and Best Practices: Parts 1 & 2," *Kevin McDonald and Christopher J. Roth, MD*
- "Medical Device Security in a Connected World," *Kevin McDonald*
- "Knowing if Your Imaging Systems are Secure and Keeping Them That Way," *J. Anthony Seibert, PhD*
- "Executive Management and Culture Change Techniques to Support Privacy and Security," *Jim Whitfill, MD*
- "What You Can Do for Your Organization to Combat Insider and External Threats," *Lee Kim, BS, JD*
- "Highest Yield Privacy and Security Best Practices for Imagers: Minicourse Summary," *Christopher J Roth, MD*
- "Cybersecurity," *Patrick Hope* and *James Jacobson*

Add these and all RSNA 2017 courses to My Agenda at *Meeting.RSNA.org.*

Global Cyberattacks



"Criminals and bad actors will go where the money is and where there is the least risk."

KEVIN MCDONALD

McDonald

Kim

Cultural Barrier to Cybersecurity

The greatest threat created by ransomware or other cyberthreats to patients, of course, is the delay or even inability to provide care. Risks range from the theft of patient data to the disruption of life-saving imaging equipment and beyond.

"What would happen if your CTs and MRIs are not operable and a patient with a head injury came into your emergency room?" McDonald asked rhetorically.

And while the expansion of CT, MRI and ultrasound has increased the need to secure the integrity of these images, which often contain sensitive protected health information (PHI), the mindset exists that imaging devices do not need to be protected.

That can present problems since a healthcare institution's cybersecurity is only as strong as its weakest link.

In fact, the HCIC report points out that "the biggest barrier to cybersecurity program maturity in health care is the cultural barrier."

The report lists six imperatives, ranging from a uniform, industry-wide set of governance measures to increased security and resilience of medical devices to enhanced awareness and education — along with dozens of specific recommendations.

McDonald and Kim also suggested recommendations for radiology, based largely on common sense.

First, and most simply, McDonald said, "Make sure all your operating systems are patched and up to date."

Second, do not invite problems.

"If you are sitting at a work station that runs your MRI and has internet access, you really shouldn't be browsing risky websites in your spare time," McDonald said.

Third, do not act in isolation. It is vital that there is an institutional imperative to maintain substantial cyber defense mechanisms. While the most immediate concern of radiologists may be the uninterrupted flow of information to assure patient care, the reality is that cybercriminals are looking for the easiest way into an institution's electronic infrastructure.

Kim said, "The hackers go after the soft spots, so nowadays security is everybody's responsibility."

Finally, radiologists must advocate with their institutional leaders to prioritize cybersecurity.

"It can be a tough job just surviving today in healthcare, and being able to afford the tools to do this and to hire the people who have the skills you need can be hard," McDonald said.

It could be that these recent high-profile incidents accompanied by the release of the HCIC report will launch a new era in cybersecurity.

"I do believe we will reach a palpable level of maturity in terms of cybersecurity in the next five years, in terms of awareness and security training among radiology users," Kim said.

WEB EXTRAS

Access the Health Care Industry Cybersecurity (HCIC) Task Force final report at *www.phe.gov*.

Access the June 2017 article, "Health Care Industry Cybersecurity Task Force Report: Analysis and Recommendations," by Lee Kim, at *www.himss.org*.

Machine Learning Focus of RSNA/AAPM Symposium

BY MIKE BASSETT

When considering potential topics for the 2017 RSNA/American Association of Physicists in Medicine (AAPM) Symposium, Paul E. Kinahan, PhD, gravitated to the growing excitement surrounding artificial intelligence (AI).

More specifically, he was interested in probing the convergence of radiology and AI and addressing some of the fears radiologists have voiced about the rapid growth of the technology. Many are wondering: will AI eventually render radiologists' jobs superfluous and unnecessary?

"The answer to that question is clearly 'no'," said Dr. Kinahan, vice chair of radiology research and head of the Imaging Research Laboratory at the University of Washington, Seattle. "On the other hand, aspects of artificial intelligence or deep learning or machine learning (ML) will certainly help elevate the productivity and accuracy of radiology."

While there is often confusion over the terms, Dr. Kinahan explains that AI is essentially the simulation of intelligent behavior in computers while ML refers to the algorithm or method used in AI. Deep learning is an area of ML research with the objective of moving ML closer to AI.

Dr. Kinahan will moderate this year's symposium, "Machine Learning in Radiology: Why and How?" to be held Tuesday, Nov. 28 at RSNA 2017. Presenters are Keith Dreyer, DO, PhD, vice chair of radiology and director of the Center for Clinical Data Science at Massachusetts General Hospital in Boston, and associate professor of radiology at Harvard Medical School, and Antonio Criminisi, PhD, a principal researcher at Microsoft in the United Kingdom.

One issue Dr. Kinahan plans to focus on during this year's symposium is how AI will fit into the "whole big data question."

"There's lot of room for applying AI and machine learning methods to medical images themselves, but we would really like to see how we are able to integrate with the other data such as electronic medical records (EMRs) or pathology data for example," he said.

That type of integration is not without obstacles.

"We are deeply siloed into our own big data components, and radiology is one of the biggest," Dr. Kinahan said. "How these big pockets of data get connected will almost certainly rely on assistance from artificial intelligence."

While healthcare has been quick to adapt new technologies overall, that's not the case with AI and ML, Dr. Dreyer said. "Healthcare has been late to the market in this area."

Of course, incorporating AI or ML is easier said than done and presents a number of challenges — many of which Dr. Dreyer plans to discuss during his presentation, "Harnessing Artificial Intelligence."

"It starts with raw data and constructing that information into data sets, applying the correct AI algorithms, creating models, testing inference engines that are created and validating them," Dr. Dreyer said. "Then we must translate them into clinical practice, go through regulatory approval followed by productization and commercialization."

"Right now, we can count on one hand the number of AI medical imaging solutions that have made it through the FDA," Dr. Dreyer continued. "And even fewer are in clinical practice, primarily because of the challenges involved."

Dr. Criminisi will speak about one of those solutions during his presentation, "Assistive AI for Cancer Treatment."

Quantifying the extent and size of a tumor such as a glioblastoma can be difficult, imprecise and time consuming, Dr. Criminisi said. But Microsoft's InnerEye research project uses state of the art ML techniques to automatically detect, segment and measure both healthy tissue and anomalies, among other functions.

"AI-powered software tools like InnerEye will significantly reduce the time radiation oncologists need for radiotherapy planning," Dr. Criminisi said.

The tool will also help radiologists track and measure the progression of cancer and other diseases and help surgeons plan complex surgeries, he added.

"This is the fruit of a decade-long research project that is now being translated into a practical and impactful software tool," he said. "The aim is to increase the productivity of expert practitioners such as oncologists, radiologists and surgeons, while at the same time reducing costs for healthcare providers."

Kinahan

Dreyer

Criminisi

Contrast-Enhanced Spectral Mammography More Effective than MRI in Newly Diagnosed Breast Cancer

BY STEPHAN BENZOKER

Contrast-enhanced spectral mammography (CESM) outperformed MRI in evaluating the extent of breast cancer, with a significantly better positive predictive value (PPV) and fewer false positive findings, according to a recent *Radiology* study published ahead of print.

CESM is quicker, less expensive and better tolerated by most patients, according to the study. If these findings are confirmed, more women would have a high quality diagnostic option in cases where MRI is not available or when contraindications for MRI exist.

Lee-Felker

The retrospective study examined 52 women, average age of 50 years, who were recently diagnosed with unilateral breast cancer, to compare CESM and contrast-enhanced MRI in the detection of index and secondary cancers.

CESM had a slightly lower sensitivity than MRI (94 percent vs. 99 percent), significantly higher PPV (93 percent vs. 60 percent), and significantly fewer false positive findings (five vs. 45), according to the study.

"Contrast-enhanced spectral mammography detected similar rates of sites of cancer compared to MRI and demonstrated significantly fewer false positives than the MRI, meaning that CESM could potentially be even better than MRI," said lead author Stephanie Lee-Felker, MD, assistant clinical professor in the Department of Radiology at UCLA Medical Center.

Though MRI is the most sensitive modality, it possesses drawbacks, including a tendency to render false positives and present additional indeterminate imaging findings that doctors are obligated to biopsy or follow.

"The reason we chose this specific population — patients who have a new cancer diagnosis undergoing imaging extent of evaluation to inform optimal treatment strategy — is that this is an area where breast MRI underperforms," Dr. Lee-Felker said. "We wanted to investigate a modality that can potentially do better."

In the study, the 45 MRI false positives led to multiple additional core needle biopsies and nine surgical biopsies, which translated to months of treatment delays.

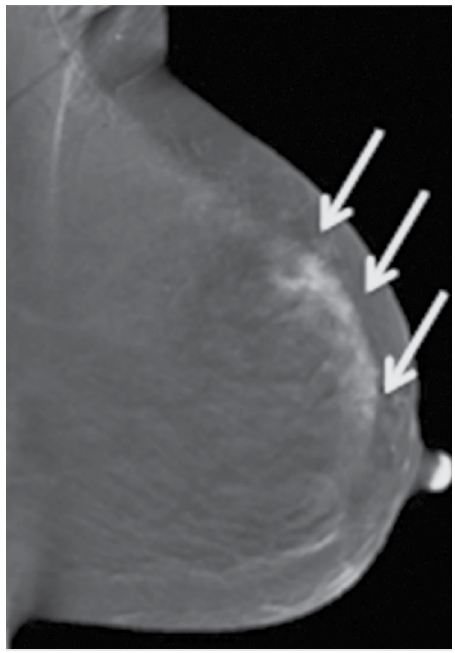
"Ten women decided to get mastectomies after hearing that additional findings were detected on their MRI," Dr. Lee-Felker said. "But in none of those cases was additional cancer actually found."

In terms of limitations, Dr. Lee-Felker stressed that the study was relatively small and that women with either obvious additional presumed disease or without additional suspicious lesions at MRI did not undergo CESM and were not included in this study.

She cautioned that CESM may not be suitable for some women with impaired kidney function or who are allergic to the contrast agent. She also noted that CESM uses radiation, which MRI does not.

"More research definitely needs to be done," Dr. Lee-Felker said. "But if these women have the opportunity to have contrast-enhanced spectral mammography that basically provides the same or better information, they don't have to feel like they are missing out on a very important test," she noted.

"Contrast-enhanced spectral mammography has a lot of potential as well as many applications that were not addressed in this study," Dr. Lee-Felker said.



A 43-year-old woman who presented with spontaneous bloody left nipple discharge. Contrast-enhanced spectral mammographic image shows clumped NME in segmental distribution in upper outer quadrant of left breast (*arrows*). Ductal carcinoma in situ (DCIS) was diagnosed with MRI–guided core-needle biopsy.

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WEB EXTRAS

Access the study, "Newly Diagnosed Breast Cancer: Comparison of Contrast-enhanced Spectral Mammography and Breast MR Imaging in the Evaluation of Extent of Disease," at *RSNA.org/Radiology*.

Exploring Chicago:

So Many Things to Do During RSNA 2017

BY BROOKE KEANE

Chicago is a world-class city with activities, tours and events to enrich your visit during RSNA 2017. Working with Bloomingdale's and Hosts Chicago, a Hosts Global Alliance Member, RSNA has put together a diverse collection of organized tours and events to make your annual meeting experience one to remember. Highlights are detailed below. For a complete listing and reservations, visit *RSNA.org/Tours-and-Events*.

SATURDAY, NOVEMBER 25

The Pearl Fishers Opera

7:30 p.m. | $140

From its leading men and leading lady, Bizet's "The Pearl Fishers" demands the ultimate in vocal beauty for this sweepingly romantic drama that's turned countless opera newcomers into ecstatic fans.

SUNDAY, NOVEMBER 26

Chicago City Highlights with Willis Tower Skydeck (French)

8:30 a.m. | $67

Experience Chicago on a three-hour tour. An expert guide will provide a wealth of knowledge on Chicago's Gold Coast, Museum Campus, the Magnificent Mile, the Merchandise Mart and more. (Also offered in English at 9:30 a.m.)

MONDAY, NOVEMBER 27

Millennium Park Walking Tour (Spanish)

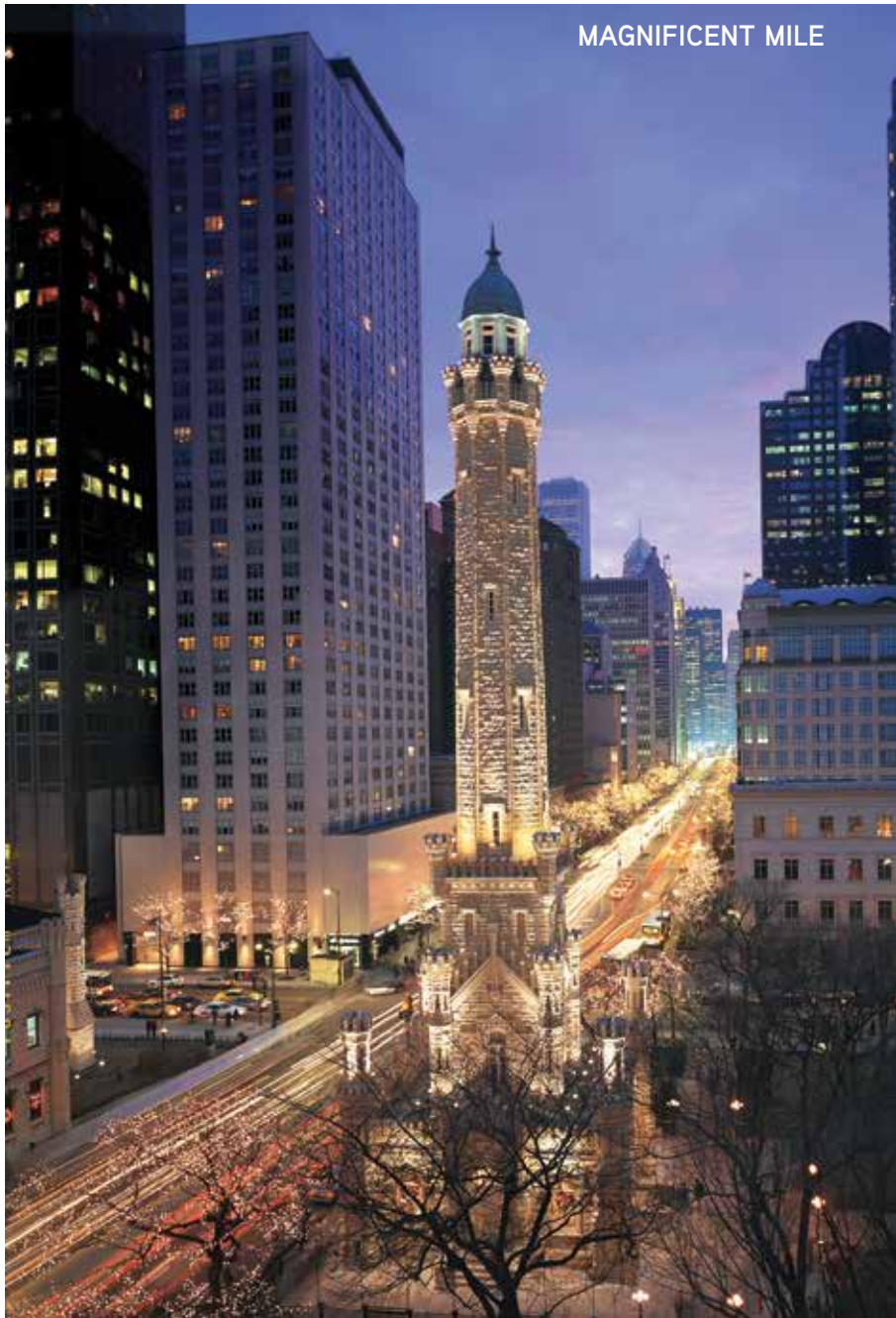
8:30 a.m. | $35

Millennium Park is an award-winning center for art, music, architecture and landscape design. A guided tour will highlight the works of world-renowned architects, planners, artists and designers. (Also available in French at 9 a.m. and English at 9:30 a.m.)

Glass Blowing at Ignite

9:30 a.m. | $165

Ignite Glass Studios is one of Chicagoland's most exciting and innovative special event venues. Each participant will enjoy a hands-on experience creating either a glass bowl or paperweight that is theirs to keep.



MAGNIFICENT MILE

Courtesy of Choose Chicago

Bloomingdale's Culinary Event with Guest Chef

1 p.m. | $80

Visit Bloomingdale's Home & Furniture Store and enjoy a demonstration with a local Chef from one of Chicago's world renowned restaurants. Each registered guest will receive a Bloomingdale's reusable bag and a $25 gift card for attending this event.

TUESDAY, NOVEMBER 28

Architectural Walking Tour (English)

8:30 a.m. | $35

Stretch your legs, grab a camera and set off by foot to experience Chicago's greatest landmarks. Your expert guide will keep you on your toes during an exciting 2 ½ -hour walk through the Loop. (Also available in French at 9 a.m. and Spanish at 9:30 a.m.)

Behind the Scenes Field Museum and Lunch

10 a.m. | $155

The Field Museum houses nearly 23 million specimens and artifacts, but less than 1 percent of those are on display to the public. Explore the storerooms, libraries and working laboratories that house these unique collections during a behind-the-scenes tour.

Holiday Lights Trolley Tour

5:30 p.m. | $48

Kick off the holiday season with an entertaining two-hour, lightly narrated tour aboard a famous Chicago Trolley through the festive lights and enchanting sights of wintertime in Chicago.

WEDNESDAY, NOVEMBER 29

Shopping at Aurora Outlet Mall

9 a.m. | $50

Chicago Premium Outlets is more than just a great collection of the finest designer labels and brands, it's Chicagoland's discount shopping destination.

Create Your Own Deep Dish Pizza at Lou Malnati's

1 p.m. | $165

Considered by many the oldest family name in Chicago pizza, Lou Malnati's is as rich in history as its cuisine is in flavor. Guests will learn the art of creating the perfect deep dish, originally crafted in 1943 at Chicago's first deep dish pizzeria.

Neuroimaging Technique Aids Understanding of Treatment-Resistant Depression

BY NICK KLENSKE

More than 300 million people worldwide suffer from depression, according to a 2017 report by the World Health Organization.

Of that number, approximately 30 percent have treatment-resistant depression (TRD), meaning they do not respond to standard antidepressant medications. Compared to patients with non-treatment-resistant depression (non-TRD), TRD patients suffer from lower recover/remission rates, increased recurrences and higher mortality rates.

"As the neuropathophysiology of TRD is unknown, clinical evaluation and treatment planning has been based on the subjective judgment of psychiatrists," explains Zhiyun Jia, MD, PhD, professor at the Nuclear Medicine & Medical Imaging Center, West China Hospital, Sichuan University, Chengdu. "This prompted us to use the objective imaging method to investigate the possible neuropathology of TRD and its differences from non-TRD."

Few imaging studies have examined the distinct neuropathology of TRD, which involves various abnormalities in different brain regions.

In new *Radiology* research, Dr. Jia and colleagues used a sensitive neuroimaging technique, magnetic transfer imaging (MTI), to explore the possible neuropathology of TRD and compare it with that of non-TRD in patients with a major depressive disorder (MDD). MDD is characterized by at least two weeks of low mood that is present across most situations.

"MTI is a unique, sensitive neuroimaging technique that lets us explore structural brain alterations at the macromolecular level," Dr. Jia said.

> *"MTI is a unique, sensitive neuroimaging technique that lets us explore structural brain alterations at the macromolecular level."*
>
> ZHIYUN JIA, MD, PHD

The Neurology of Treatment-Resistant Depression

The study comprised 69 patients with MDD and 41 healthy control subjects.

Following the use of standard antidepressant medication, each patient was classified into a TRD or a non-TRD group based on their response to the treatment (30 with TRD; 39 with non-TRD).

Using MTI, the team obtained MT-weighted and non-MT-weighted images from all patients. These images were then used to calculate magnetization transfer ration (MTR) maps. Following data pre-processing, these maps were compared to explore macromolecular differences at the whole brain level among TRD, non-TRD and healthy controls.

The results showed that, relative to non-TRD patients, TRD patients exhibited significantly lower MTR in the task-positive network regions, including the bilateral precentral gyrus and left middle occipital lobe. The TRD patients also showed lower MTR in the default mode network regions, including the left precuneus and left temporal lobe.

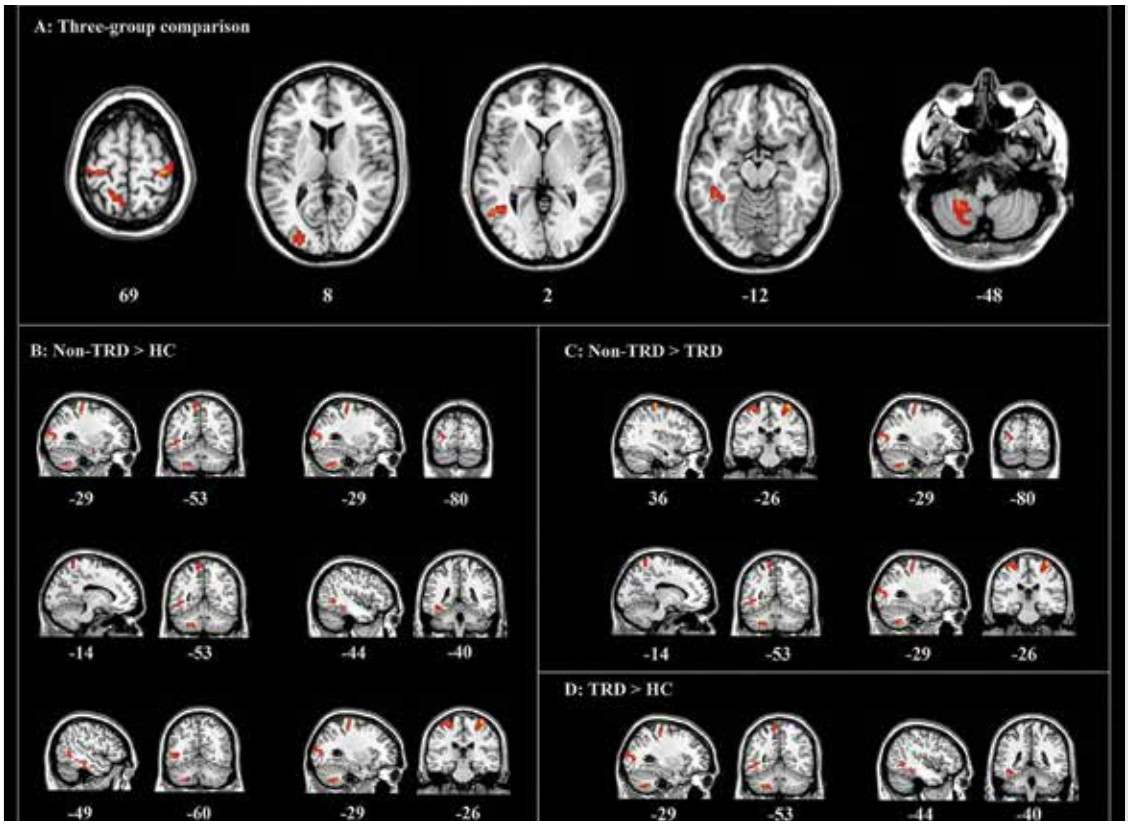
"Because MTR reflects macromolecular concentrations in brain tissues, these results indicate that treatment resistance in major depression might be induced by abnormal insufficiency of macromolecular substances in the task-positive network and the default mode network regions," Dr. Jia said.

"In addition, the left laterality of our results might imply that damage to the left hemisphere is more often associated with depressive symptoms than damage to the right hemisphere," added fellow researcher Qiyong Gong, MD, PhD, also a radiologist at Huaxi MR Research Center (HMRRC), Department of Radiology, West China Hospital of Sichuan University. "This finding is in line with recent hypotheses on brain asymmetry."

The finding of different macromolecular manifestations between TRD and non-TRD could prove influential in explaining why some patients respond effectively to antidepressant drugs while others respond poorly, even when there are no signs of brain morphometric changes. The study

WEB EXTRAS

Access the study, "Magnetization Transfer Imaging of Treatment-resistant Depression," at *RSNA.org/Radiology*.



Different MTR in voxel-based analysis comparisons among patients with treatment-resistant depression (TRD), those with non-TRD, and healthy control subjects (HC). Images are presented in neurologic convention. The overall results indicated differences in MTR in the bilateral precentral gyrus, left cerebellum posterior lobe, left middle occipital lobe, left precuneus, and left temporal lobe between the three groups. Patients with TRD had lower MTR in the bilateral precentral gyrus, left middle occipital lobe, and left precuneus than did patients with non-TRD and had higher MTR in the left cerebellum posterior lobe and left temporal lobe than did healthy control subjects. Patients with non-TRD had higher MTR in the left cerebellum posterior lobe, left middle occipital lobe, left precuneus, left temporal lobe, and left precentral gyrus than did healthy control subjects. Statistical inferences were drawn based on a voxel-level statistical threshold of P < .050 (Alphasim corrected).
(*Radiology* 2017; 284;2;InPress) ©RSNA 2017. All rights reserved. Printed with permission.

Jia

Gong

also provides structural evidence to prior functional MRI studies that showed a disrupted functional relationship between task-positive network and the default mode network in TRD.

This *Radiology* pilot study will likely spur further research, according to the researchers. They expect these findings to generate hypotheses regarding the macromolecular mechanisms for future investigations.

Research Continues on Treatment-Resistant Depression

The research adds to the developing field of psychoradiology, a new frontier in neuroimaging that could play a major role in guiding diagnostic and treatment decisions in patients with psychiatric disorders.

Researchers plan to continue their work in TRD using other imaging modalities such as diffusion imaging and functional imaging in order to further explore the resistant mechanisms.

"We plan to integrate multimodal images to investigate correlations and differences between different imaging modalities," Dr. Jia said. "We will also try to apply machine learning methods to find critical brain imaging markers that could potentially help identify TRD at the individual level for possible clinical translation."

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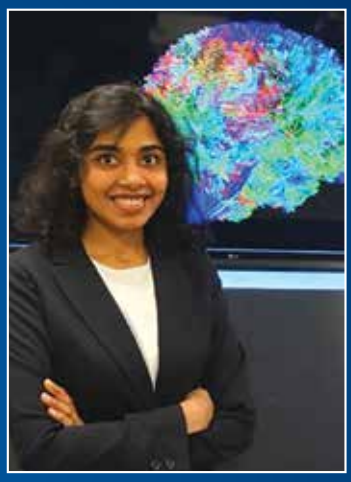
"I am very fortunate to belong to a department which values academic research and encourages me to pursue my research interests," said Dr. Rajagopalan, a third-year radiology resident at Indiana University, Bloomington. "Having been selected for the academic track, I continue to work on research projects under the mentorship of Andrew J. Saykin, PsyD, the director of the Center for Neuroimaging and leader of the Alzheimer's Disease Neuroimaging Initiative Genetics Core."



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Donor Recognition, Benefits at RSNA 2017

The RSNA Research & Education (R&E) Foundation recognizes donors at the RSNA annual meeting each year. To be listed on the Donor Wall and receive special recognition and additional benefits at RSNA 2017, please make your gift by September 30. Visit *RSNA.org/Donate* to support the Foundation.

Annual Gift Amount	**Recognition/Benefit**
$300 and above	Name on the Donor Wall Access to the Donor Suite
$5,000, $2,500, and $1,500	Recognition as a Presidents Circle Donor Photo on the Donor Wall
	Invitation to the Distinguished Donor Reception Express boarding pass for taxis and shuttles

Donor Recognition year: October 1, 2016 – September 30, 2017

Journal Highlights

The following are highlights from the current issues of RSNA's two peer-reviewed journals.

10 Things You Might Not Know about Iron Oxide Nanoparticles

Amid mounting concerns about nephrogenic sclerosis and gadolinium deposition in the brain, the search is underway for a safer alternative to gadolinium chelates for clinical MRI.

Two ultra-small superparamagnetic iron oxide nanoparticles (USPIOs) are currently being used for clinical MRI applications: the FDA-approved iron supplement ferumoxytol (Feraheme) and ferumoxtran-10 (Combidex/Sinerem), which is undergoing renewed clinical trials in Europe.

Radiology

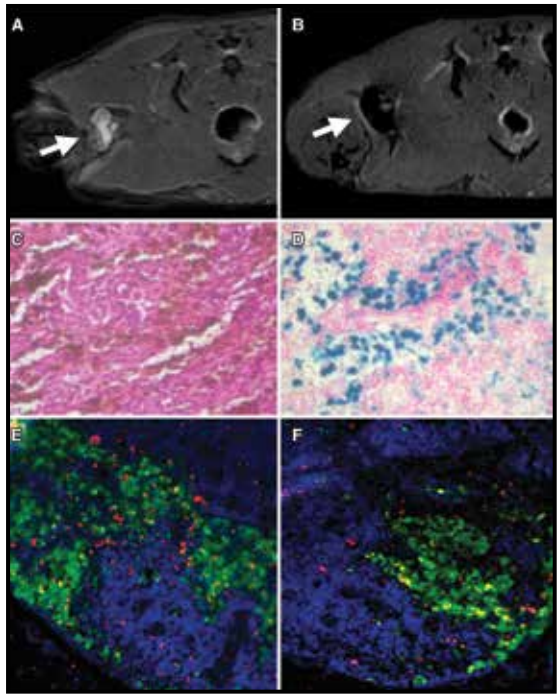
As these agents are starting to be used by a new generation of radiologists, important clinical questions have re-emerged, including those that have been answered in the past.

In an online *Radiology* article, Heike E. Daldrup-Link, MD, PhD, of Stanford University, CA, addresses these newly resurfaced questions and offers 10 key insights into the use of iron oxide nanoparticles for clinical MRI, including:

- USPIOs can cause immune responses through the classic Gell-Coombs pathway or complement-activated pseudo-allergy.
- Dual-contrast MRI studies can be obtained after injecting iron oxides and then gadolinium chelates or vice versa.
- Ferumoxytol enhancement of lymph nodes is not due to macrophage phagocytosis.

Since USPIOs are not associated with a risk of nephrogenic sclerosis, they can serve as a safer contrast agents compared with gadolinium chelates for MR angiography, tissue perfusion studies and atherosclerotic plaque and tumor imaging, the author concludes.

"USPIOs are especially beneficial for patients with renal insufficiency or patients with uncertain creatinine laboratory values," the author writes. "New developments in USPIOs may spur new personalized diagnostic tests and theranostic (combined diagnostic and therapeutic) procedures."



Ferumoxytol-enhanced MR imaging of a normal lymph node with histopathologic correlation. A, Axial T2-weighted fast spin-echo (5700/25) image through the lower abdomen of a Sprague-Dawley rat shows normal lymph node in the right inguinal region (*arrow*). B, At 24 hours after intravenous injection of fluorescein isothiocyanate (FITC)-conjugated ferumoxytol at a dose of 30 mg iron per kilogram, the lymph node shows marked signal loss (*arrow*). C, Corresponding hematoxylin-eosin histopathologic slice shows normal lymph node architecture (magnification, ´40). D, Prussian blue staining shows iron containing cells (arrows; magnification, ´40). E, F, Confocal microscopy of the same lymph node shows numerous cells with intracellular FITC ferumoxytol (green) and only few macrophages (red, stained with rhodamin-labeled anti-CD68 mAb; blue = DAPI [49,6-diamidino-2-phenylindole]; magnification, ´40). Not all macrophages contain FITC-ferumoxytol and numerous cells that do contain FITC-ferumoxytol are apparently not macrophages.
(*Radiology* 2017;284:3:InPress)

This article meets the criteria for *AMA PRA Category 1 Credit*™. SA-CME is available online only.


Levine


Kressel

Listen to *Radiology* Editor Herbert Y. Kressel, MD, deputy editors and authors discuss the following articles in the July issue of *Radiology*.

Radiology PODCASTS

- "Prostate Cancer: Diffusion-weighted MR Imaging for Detection and Assessment of Aggressiveness — Comparison between Conventional and Kurtosis Models," Tsutomu Tamada, MD, Vinay Prabhu, MD, MS, Jianhong Li, MD, James S. Babb, PhD, Samir S. Taneja, MD, and Andrew B. Rosenkrantz, MD.
- "Diffusion-Tensor Imaging of the Physes: A Possible Biomarker for Skeletal Growth — Experience with 151 Children," Maria A. Bedoya, MD, Jorge Delgado, MD, Jeffrey I. Berman, PhD, Nancy A. Chauvin, MD, David Zurakowski, MS, PhD, Raul Ramirez-Grueso, PhD, Aikaterini Ntoulia, MD, PhD, and Diego Jaramillo, MD, MPH.


Klein

Listen to *RadioGraphics* Editor Jeffrey S. Klein, MD, and authors discuss the following article in the July-August issue of *RadioGraphics* at *RSNA.org/Page/RadioGraphics/Views*.

RadioGraphics PODCASTS

- "Beyond the Bowel: Extraintestinal Manifestations of Inflammatory Bowel Disease," Jeffrey D. Olpin, MD, and colleagues.

Continued on next page

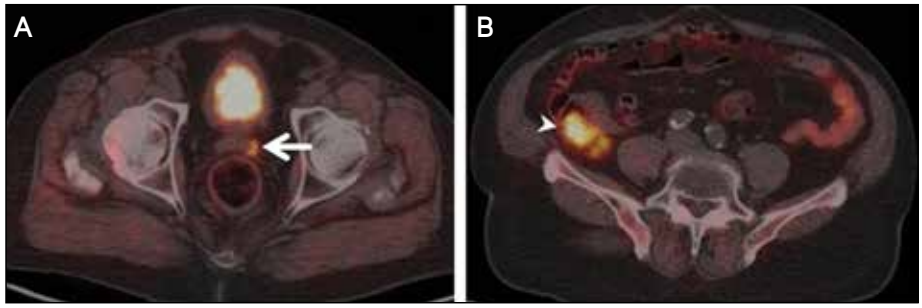
Continued from previous page

Clinical Imaging in Prostate Cancer

Conventional imaging of prostate cancer has limitations in staging, restaging after biochemical relapse, and response assessment. PET has a rapidly evolving role in the assessment of prostate cancer, particularly in the scenario of biochemical relapse.

While fluorine 18 (^{18}F) fluorodeoxyglucose (^{18}F-FDG) is the most widely available PET tracer, it has limitations, particularly in indolent prostate cancer. In the past decade, several PET tracers with specific molecular targets have reached the clinical domain, including ^{18}F–sodium fluoride (^{18}F-NaF), ^{11}C-choline, ^{18}F-choline, gallium 68–prostate-specific membrane antigen ligands (^{68}Ga-PSMA), and ^{18}F-fluciclovine, a tracer recently approved by the U.S. Food and Drug Administration.

In an article in the September-October issue of *RadioGraphics* (*RSNA.org/RadioGraphics*), Kathryn L. Wallitt, MBBS, BSc, Charing Cross Hospital, London, and colleagues review the mechanisms of action of the clinically available PET tracers. The authors review the role



^{18}F-Choline PET/CT for evaluation for relapse in a 74-year-old man with a rising PSA level after external beam radiation therapy. Axial fused PET/CT images (*b obtained higher than a*) show recurrence in the left seminal vesicle (*arrow on a*), as well as an unusual site of disease in peritoneal deposits in the right paracolic gutter (*arrowhead on b*). For the peritoneal deposits, the findings at histopathologic examination of the specimen from biopsy helped confirm the recurrence.

RadioGraphics

of these tracers in the imaging of prostate cancer with reference to relevant guidelines and discuss the benefits and limitations for each tracer and the optimum clinical scenario for use. The authors also identify the molecular targets of these tracers and describe the required preparation and common image acquisition procedures.

"A particular strength of PET imaging is early detection of disease in patients with biochemical relapse, a strength that provides the opportunity for a personalized approach or precision medicine with localized salvage therapy or the treatment of oligometastatic disease, with the intention of possible cure or improved outcomes," the authors conclude.

Further research into the optimal clinical utility of these PET tracers and their cost-ef-ectiveness is awaited and will likely be reflected in the clinical guidelines in the future, the authors write.

This article meets the criteria for *AMA PRA Category 1 Credit™*. SA-CME is available online only.

Radiology in Public Focus

Press releases were sent to the medical news media for the following articles appearing in recent issues of *Radiology*.

Radiologists Seek Greater Involvement in Patient Care

Despite constraints of time and workload, radiologists are looking for ways to become more directly involved in the care of their patients, according to the findings of a recent survey of radiologists published in *Radiology*.

Communication between patients and radiologists is a key element of patient-centered care, a major focus of the RSNA for more than a decade. Such care, which focuses on the patient's needs and preferences, is fundamental to radiology's shift from a volume- to a value-based system.

Engaging with patients via social media and moving radiology reading rooms into the clinic present opportunities to help bridge the divide between radiologists and patients, researchers said.

"Patient-centered radiology is a lot more than giving results to patients," said study lead author Jennifer L. Kemp, MD, from Diversified Radiology in Denver. "There are many other things we can do within the continuum of patient care, from scheduling all the way through billing, to improve the patient's experience."

Dr. Kemp and colleagues from the RSNA Patient-Centered Radiology Steering Committee surveyed RSNA members on various aspects of patient-centered radiology. Of the 694 respondents, 611, or 89 percent, agreed that promoting awareness of radiology's role in patients' overall healthcare is important to how they practice.

However, only 31 percent of radiology practices regularly promote awareness of radiology's role in patients' overall healthcare. Only 21 percent of respondents said their radiology practices commonly deliver imaging results to patients in person. The majority of respondents — 421, or 73 percent — reported that time and/or workload frequently prevented them from communicating directly with patients, which potentially hampers both optimal patient-centered care and radiologist satisfaction.

Kemp

Dr. Kemp noted that social media offers busy radiology practices one avenue to direct communication with patients.

"Social media is where our patients are these days and where they get a lot of their medical information," Dr. Kemp said.

Radiologists could also consider better integration into clinical practice settings by moving radiology reading rooms into patient clinics.

WEB EXTRAS

Access the study, "Patient-centered Radiology: Where Are we, Where Do We Want to Be, and How Do We Get There?" at *RSNA.org/Radiology*.

Radiology in Public Focus

Study Suggests Intracranial Pathology Not Necessary for Gadolinium Deposition in Brain Tissues

Some research has suggested that minute traces of gadolinium are often retained in the brain tissue of patients years after undergoing MRI. But new *Radiology* research suggests that gadolinium retention may be more widespread and may be present in many more, or possibly all, patients exposed to gadolinium-based contrast agents.

"It's estimated that approximately 400 million doses of gadolinium have been administered since 1988," said the study's lead researcher, Robert J. McDonald, MD, PhD, staff neuroradiologist at the Mayo Clinic in Rochester, MN. "Gadolinium contrast material is used in 40 to 50 percent of MRI scans performed today."

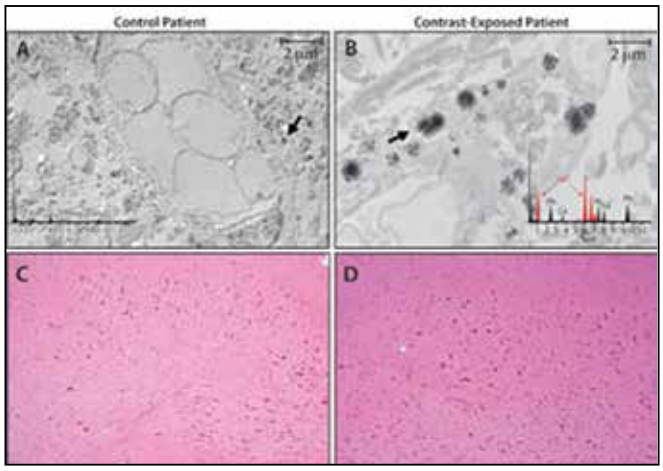
Scientists previously believed gadolinium contrast material could not cross intact blood brain barrier.

"By late 2014, the first evidence emerged that gadolinium was depositing within brain tissues. However, many of these patients had underlying medical conditions, such as brain tumors, that could adversely affect the blood brain barrier," Dr. McDonald said. "We were curious if this deposition might be related to the integrity of the blood brain barrier, so we studied patients with normal brain pathology and presumably an intact blood brain barrier."

The study involved an analysis of post-mortem neuronal tissue samples from five patients who had undergone four or more (up to 18) gadolinium-enhanced MRI exams between 2005 and 2015 and 10 patients who had undergone MRI exams without gadolinium. The median age at the time of death was 68 years in the contrast agent-exposed group and 79 years in the control group. All patients in the current study were exposed to gadodiamide (Omniscan).

WEB EXTRAS

Access the *Radiology* study, "Gadolinium Deposition in Human Brain Tissues after Contrast-enhanced MR Imaging in Adult Patients without Intracranial Abnormalities," at *RSNA.org/Radiology*.



Tissue localization and cellular response to gadolinium deposition. A, B: Micrographs from transmission electron microscopy (0.2 percent lead citrate stain; original magnification, × 10,000) show cellular localization of gadolinium in dentate nuclei tissue samples from, A, control patient 7 and, B, gadolinium-exposed patient 1. X-ray spectra are shown in inset of each respective panel for selected electron-dense foci (*arrows*); gadolinium peaks in spectra are indicated by red overlay. C, D, Photomicrographs from light microscopy (hematoxylineosin stain; original magnification, ×100) of dentate nuclei samples from, C, control patient 7 and, D, gadolinium-exposed patient 1.

During the patient autopsies, a small amount of brain tissue was obtained from each patient and studied with transmission electron microscopy, mass spectroscopy and x-ray spectroscopy. The analysis revealed dose-dependent gadolinium deposits in four neuroanatomical regions of the brain in patients who underwent contrast-enhanced MRI. At the time of autopsy, all study patients had normal brain pathology.

"Our results suggest current thinking with regard to the permeability of the blood brain barrier is greatly oversimplified, as gadolinium appears to accumulate even among patients with normal brain tissue and no history of intracranial pathology," Dr. McDonald said. "It will take additional research to understand how and why this deposition is occurring."

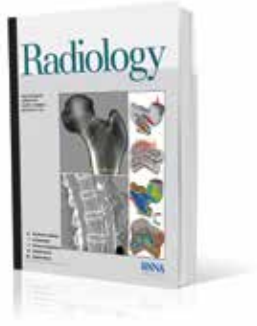
Direct Your Patients to *RadiologyInfo.org*

RadiologyInfo.org
For patients

Did you know that RSNA and ACR developed *RadiologyInfo.org* to provide your patients with easy-to-understand information about the procedures and exams you perform?

Direct your patients to *RadiologInfo.org* for more than 230 patient-friendly articles that describe x-ray, CT, MRI, ultrasound, radiation therapy and more. Your patients will also find various disease/condition articles as well as screening and wellness topics.

Check out *RadiologyInfo.org*'s newest additions: Venous Insufficiency (Varicose Veins) and Magnetoencephalography.



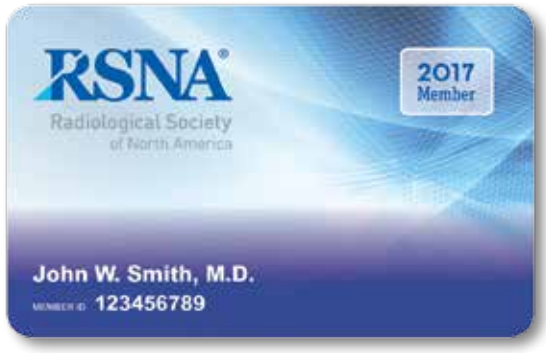
Media Coverage of RSNA

In April, 348 RSNA-related news stories were tracked in the media. These stories had an estimated audience reach of 333 million.

Coverage included *The Huffington Post,* Yahoo! Finance, WGN-AM (Chicago), *Houston Chronicle*, *Philly.com*, ScienceDaily, *San Francisco Chronicle,* HealthDay, *Auntminnie.com*, *Drugs.com, Diagnostic Imaging and Health Imaging & IT*.

Value of Membership

Group Billing Makes Membership Renewal Easy



Group billing offers radiology institutions and practices a hassle-free way to pay for all their doctors' membership dues with one invoice. Administrators appreciate the ease of use and efficient turnaround the service provides, eliminating the need to wait for each doctor to submit an individual invoice. Because paying individual dues for a large practice could take months, group billing is a time saver.

"Since making the switch a few years ago, I only send in one invoice during each membership renewal cycle," said one administrative assistant about the service. "Rather than paying individually for 20 people, it's much more efficient on both ends to just pay one bill. It's very simple and organized."

Currently group billing serves over 100 groups of varying sizes, ranging from two radiologists in one practice to a hospital with 113 doctors. Groups can pay via credit card or check and memberships activate as soon as the payment is applied.

Whether members choose to renew themselves, take advantage of auto-renewal or participate in group billing, RSNA continues to maximize efficiency and ease of use in the renewal process.

Contact RSNA membership staff at *membership@rsna.org* to set up your group billing account.

Education and Funding Opportunities

NIH Grantsmanship Workshop

The NIH Grantsmanship Workshop introduces participants to the process of preparing a competitive research or training grant application. Designed for junior faculty in academic centers who wish to pursue a career in radiologic research, this didactic workshop is led by faculty who are leading researchers and have extensive experience in the grant application process. Topics covered include elements of a good grant proposal, understanding the review process, and planning the proposal.

The workshop takes place Saturday, Nov. 25, from 1 to 5 p.m. at McCormick Place in Chicago. Workshop attendees must be registered for the RSNA annual meeting. Go to *Meeting.RSNA.org* and add the workshop to My Agenda.

For more information, contact the Department of Research at *DOR@rsna.org* or 630-368-3742.

Register to assure your seat

Creating and Optimizing the Research Enterprise (CORE) Workshop

Registration is open for the 2017 Creating and Optimizing the Research Enterprise (CORE) workshop to be held Oct. 20-21 at RSNA headquarters in Oak Brook, IL. This free workshop focuses on strategies for developing and advancing imaging research programs in radiology, radiation oncology and nuclear medicine departments.

New sessions include "Big Data and AI: The Role for Radiology and How to Get Involved" and "Imaging Research Entrepreneurship."

The CORE program features a combination of presentations, case studies and group discussions.

For more information and to register, go to *RSNA.org/CORE.*

Writing a Competitive Grant Proposal Workshop

March 16 – 17, 2018
RSNA Headquarters
Oak Brook, IL

Registration is now open for the Writing a Competitive Grant Proposal Workshop designed for researchers in radiology, radiation oncology, nuclear medicine and related sciences who are interested in actively pursuing federal funding. This 1 ½-day program is guided by a faculty of leading researchers with extensive experience in all aspects of grant applications and funding. The program will focus on developing specific aims to be included in a grant application. Participants will be provided tools for getting started in the grant writing process and developing realistic expectations. The registration fee is $225. For additional information and to register online, visit: *RSNA.org/CGP*. Contact the Department of Research with questions at *DOR@rsna.org* or 630-368-3742.

RSNA.org

Welcome to the New RSNA Online Education Platform

Your Online Source for Quality Radiology SA-CME Education

RSNA's newly upgraded online education platform, RSNA Education, features an enhanced mobile-friendly user interface including over 600 courses to help you fulfill your MOC requirements and improve your practice. Access to the platform and much of the content is free to RSNA members. This comprehensive resource offers access to educational SA-CME activities including:

From the RSNA journals
- *RadioGraphics*
- *Radiology*
- *Radiology* Select

From the RSNA Annual Meeting
- Refresher courses
- Cases of the day
- Essentials courses

For Your Practice
- Ethics and Professionalism modules
- Comparative Effectiveness Research modules

For Residents and Residency Programs
- 45 Physics modules – Prepares residents for the physics portion of the CORE Exam

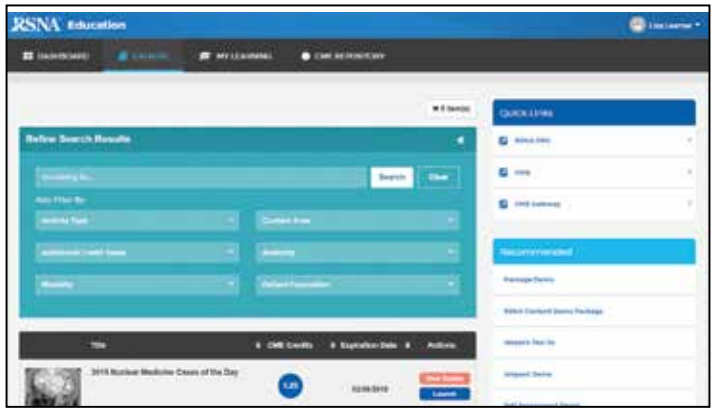
Flemming

Visit *RSNA.org/Education* to explore the new platform and access this incredible resource of over 600 RSNA courses.

> *"The new platform delivers a straight forward, clean interface that allows for 'one-stop' shopping and provides access to the educational resources RSNA offers."*
>
> DONALD J. FLEMMING, MD
> RSNA EDUCATION COMMITTEE VICE CHAIR

The RSNA CME Repository tracks members' credits earned through RSNA programs. Access the repository using the CME Repository tab from the menu bar.

The RSNA Education Dashboard highlights new and featured courses.



Interested in a *RadioGraphics* CME Course on a specific part of the anatomy? Or looking for a course on a specific patient population? Use the enhanced search tool to filter content and find exactly what you need.

Annual Meeting Watch

Plan your RSNA 2017 Experience

When you plan your trip to Chicago, remember to add the extras that will make your experience complete.

Meeting Central — Go to *Meeting.RSNA.org* to browse the annual meeting program, view the exhibitor list and build your personal agenda. Meeting Central is your essential resource for navigating RSNA 2017.

Bistro RSNA — The Bistro offers a full menu and ample seating for lunch during the meeting, and brunch will be available on Thursday. Reserve tickets in advance for $22 per meal at *bistroticket.com/rsna*.

5K Fun Run — Run, jog or walk in the 2017 Fun Run to support education and radiology research. Your tax-deductible donation benefits the RSNA Research & Education (R&E) Foundation and participants receive a commemorative T-shirt. The 5K Fun Run is sponsored by Konica Minolta Healthcare.

Virtual RSNA 2017 — Register for the Virtual Meeting, offering more than 100 live-streamed and on-demand courses, scientific presentations and education exhibits. CME credit is available for many sessions and registered attendees will have access to all content until 4 p.m. Central Time on Feb. 28, 2018.

RSNA Tours and Events — RSNA partners with Hosts Chicago, a Hosts Global Alliance member, and Bloomingdale's to provide a variety of opportunities to experience all that Chicago has to offer. For more information visit *RSNA.org/Tours-and-Events*.

Discovery Theater — Offering a variety of programs from musical acts to educational presentations, the Discovery Theater is a great place to relax and learn. Visit Meeting Central for a schedule of events.

Reserve Your Hotel Room Now Through RSNA

We're here for you before, during and after the event with discounted rates so you can enjoy your stay. Register at *RSNA.org/Register* to view hotel rates and availability.

Secure your reservations early for the best selection and access to these great benefits:

- Discounted rates
- Easily modified reservations
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Hotel reservations booked through RSNA's official hotel partners are the only approved method to guarantee RSNA's discounted rates. Do not risk your credit card or hotel reservation — using unauthorized hotel solicitors can have unfortunate and expensive consequences. Please be aware of and report any unauthorized solicitation to *housing@rsna.org*.

RSNA's official hotel partners:

- Experient is the official hotel partner for the RSNA annual meeting. For more information, visit *RSNA.org/Register.*
- E.S.A. Voyages is the official international travel partner for groups, providing a variety of international travel packages including airfare and hotel. For more information, contact *esa@esavoyages.fr.*
- ACE is the official travel partner for groups coming from China and Taiwan, providing travel and hotel packages. For more information, contact *stephaniezhu@acemarketing.com.cn.*

RSNA 2017 Registration Packages

RSNA offers several new registration options to best meet your needs. Visit *Meeting.RSNA.org* for a personalized registration recommendation.

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Explore. Invent. Transform.
November 26 to December 1

Oct. 27 Registrations after this date will incur an added $150 fee for most categories.

Oct. 28 Canceling a hotel reservation as of this date will result in the forfeiture of the hotel deposit equal to the first night's room and tax.

November 26 -December 1 103rd Scientific Assembly & Annual Meeting

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United Airlines offers discounts from 2 percent to 10 percent off applicable fares. Discounts apply on United Airlines and flights operated by United or other airlines branded United Express. International discounts are allowed on flights operated and/or marketed on the following carriers, provided such flights are booked by a travel agency or United Reservations.

- Flights via the Atlantic: Air Canada, Austrian Airlines, Tyrolean Airways, Brussels Airlines, Lufthansa Airlines, Swiss International Airlines.
- Flights via the Pacific: United codeshare flights operated by All Nippon Airways.

Applicable terms and restrictions apply. Book online at *United.com/MeetingTravel* and enter offer code ZXNX941696, or call United at 1-800-426-1122 and provide the offer code. A service fee applies for phone reservations.

Delta Airlines offers special discounts on most fares; restrictions may apply. Discounts are applicable to U.S./Canada originating passengers. Book online at *Delta.com/Meetings* and enter Meeting Event Code NMPES, or call Delta at 1-800-328-1111 and provide the event code. A service fee applies for phone reservations.

International Visitors

RSNA is deeply committed to serving all of our members and supporting the vital work being done in North America and abroad to further advance the science of radiology. The pursuit and exchange of science and education is an important part of our goal to improve patient care.

Over 11,000 international attendees participated in RSNA 2016 and RSNA continues to invite radiologists from around the world to take part in our programs and resources.

RSNA encourages all international travelers to the annual meeting and other educational programs to make travel plans as early as possible. Please visit *RSNA.org/Visas* for information on visas and travel to the United States.

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Book your trip with TravelStore and experience the personalized service that has made it one of the best travel management companies in the U.S. TravelStore has a special offer for RSNA attendees. Book air travel through TravelStore by Sept. 28 to be entered in a drawing for a $500 USD travel credit toward future airfare on United Airlines. Call 1-800-850-3220 between 8 a.m. and 5:30 p.m. PST and mention code AM2017.

COMING NEXT MONTH

Next month, *RSNA News* will report the results of the annual American Medical Group Association (AMGA) salary survey, including expert commentary.

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For Business

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Dr. Deborah Manjoney
Wisconsin Vein Center & MediSpa

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