RSNA News™

May 2016 Volume 26, Issue 5

Cybersecurity Critical for Medical Imaging

ALSO INSIDE:

Advance Registration and Housing Open — See Page 23

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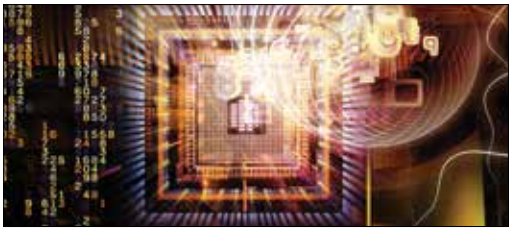

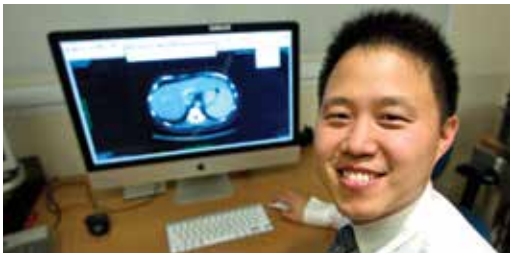

UP FRONT

RADIOLOGY'S FUTURE

NEWS YOU CAN USE

RSNA MISSION

The RSNA promotes excellence in patient care and healthcare delivery through education, research and technologic innovation.

Follow us for exclusive news, annual meeting offers and more!

RSNA 2016 Distinguished Honorees

The RSNA Board of Directors has announced the distinguished award recipients to whom the Society will pay tribute at the 102nd Scientific Assembly and Annual Meeting. They are:

Gold Medalists

Paul J. Chang, M.D.
Chicago

Burton P. Drayer, M.D.
New York

Robert J. Stanley, M.D.
Birmingham, Ala.


Chang


Drayer


Stanley

Honorary Members

Carlo Bartolozzi, M.D.
Pisa, Italy

Luis Donoso-Bach, M.D.
Barcelona, Spain

Osamu Matsui, M.D.
Kanazawa, Ishikawa, Japan


Bartolozzi


Donoso-Bach


Matsui

RSNA® 2016

High Impact Clinical Trial Session Will Debut at RSNA 2016

For the first time, RSNA 2016 will host a High Impact Clinical Trial (HICT) session featuring the latest cutting-edge clinical science and research. This session will provide a forum for practice-changing clinical research across radiology with the goal to present the most significant work in the field. The session will be co-sponsored by *Radiology*.

Each accepted abstract may be considered for simultaneous online publication in *Radiology*. A draft of the manuscript is needed by Sept. 12 to allow for rapid review.

Submissions should be presentations of the primary endpoint(s) of a trial; of new data or secondary analyses of a trial where the primary data has been presented previously; a new registry or new data/analyses from a registry; and the latest and "hottest" findings in translational imaging sciences that have immediate clinical implications.

Authors must submit:

- A structured abstract (purpose, methods, results and conclusions; 500 words maximum, plus optional inclusion of up to two tables and/or three figures).
- A signed letter that includes the author name, co-author(s), corresponding address, telephone and fax numbers, institutional affiliation, title of abstract, and a statement attesting to the fact that the research was primarily and substantially performed by the applicant.

HICT abstracts can be submitted beginning June 1. Deadline is Aug. 1 at noon central time. Authors of accepted submissions will be notified Aug. 15. For more informationn go to *RSNA.org/AnnualMeeting*.

Numbers in the News

111

Number, in millions, of health information security incidents attributed to hacking in 2015. Read more on the growing need for cybersecurity in imaging on Page 7.

36

The number of fellows representing 24 nations who have participated in the RSNA Derek Harwood-Nash Fellowship Program since it was founded in 1998. Read more on Page 9.

20

Number of residency programs approved under the American Board of Radiology's new Interventional/Diagnostic Radiology (IR/DR) Certificate. Read more about the historic transition on Page 11.

9.1

Potential number of audience members—in billions—reached by total RSNA 2015 media coverage tracked through February 12, 2015. Read more on Page 18.

Arenson Receives ESR Honorary Membership

RSNA immediate past-president **Ronald L. Arenson, M.D.,** received honorary membership in the European Society of Radiology (ESR) during the recent European Congress of Radiology (ECR) in Vienna, Austria.

Dr. Arenson is the Alexander R. Margulis Distinguished Professor of Radiology and chair of the Department of Radiology and Biomedical Imaging at the University of California, San Francisco, where he has worked since 1992.

RSNA sent five speakers as part of the RSNA/ESR joint course on Emergency Radiology. RSNA staff members were also at the meeting to assist international members and answer questions about the RSNA meeting, journals, membership and more.

Ronald L. Arenson, M.D., (*center*) received ESR Honorary Membership from ESR President Luis Donoso-Bach, M.D., (*left*) and ECR 2016 Congress President Katrine Riklund, M.D., Ph.D.

SIR Honors Ferris, Song, Vogelzang

The Society of Interventional Radiologists (SIR) awarded its gold medal to RSNA Past-President **Ernest J. Ferris, M.D., Ho-Young Song, M.D., Ph.D.**, and **Robert L. Vogelzang, M.D.**, during its recent annual meeting in Vancouver, British Columbia, Canada.

Dr. Ferris served as RSNA president in 1996, and was awarded an RSNA Gold Medal in 2001.

Dr. Song was awarded RSNA honorary membership in 2009.

Go to *RSNA.org/News* for biographies of the awardees.

Ferris

Song

Vogelzang

RSNA Launches Spotlight Course for International Education

RSNA will launch its first Spotlight Course, "Radiología de Urgencias: Curso Interactivo con Casos" ("Emergency Radiology: Interactive Course with Cases"), this summer in Cancún, Mexico. The course will be held June 2-4 at the Grand Fiesta Americana Coral Beach Cancún Resort & Spa.

The course supports RSNA's goal to provide quality education on important medical imaging issues in different regions of the world. Emergency radiology was selected based on an assessment of the educational needs of RSNA members in Latin America.

During the 2 ½-day program presented entirely in Spanish, participants will explore the use of emergency radiology as part of daily practice. The course will include general and breakout sessions, Cases of the Day, and interactive RSNA Diagnosis Live™ sessions, and will offer credits for CME.

Presented under the direction of Jorge Soto, M.D., of Boston University School of Medicine, and Guillermo Elizondo Riojas, M.D., Ph.D., of the University of Nuevo Leon in Monterrey, Mexico, the course will be taught by renowned radiology leaders, including instructors from Latin America, who will discuss issues of special relevance to the region.

For more information, visit *RSNA.org/Spotlight*.

R&E Grant Recipient is First Radiologist to Receive NIH Director's Early Independence Award

Terence Gade, M.D., Ph.D., a 2012 Cook Medical Cesare Gianturco/RSNA Research Resident Grant recipient, was recently awarded the NIH Director's Early Independence Award. The award is a mechanism for exceptional early career scientists to move rapidly into independent research positions at U.S. institutions by essentially omitting the traditional post-doctoral training period.

Dr. Gade, now assistant professor of radiology at the Hospital of the University of Pennsylvania, will receive $2 million over the next five years to further his initial Research & Education (R&E)-funded research on the use of hyperpolarized carbon-13 nuclear MR spectroscopy as a novel imaging technology to detect latent cancer cells that survive severe metabolic stress caused by current treatments.

Dr. Gade is the first radiologist to receive this award and credits the R&E Foundation for providing the much needed financial support that permitted him to carry out his initial research.

"This is the first time a radiologist has received this award and I think it demonstrates the progress we are making in radiology research, in large part due to pilot funding mechanisms like the RSNA R&E Research Resident Grant. I want to express my appreciation for the support of the Foundation and all those who make these grants possible."

Gade

Patient Focus

5 Tips for Practicing Patient-centered Radiology

John

Radiologists working to forge partnerships with their patients should be mindful of some of the key ways they can build on those relationships on a daily basis, according Susan D. John, M.D., chair of the Department of Diagnostic and Interventional Imaging and professor of Diagnostic and Interventional Imaging and Pediatrics at the University of Texas Medical School, Houston. Dr. John, a member of RSNA's Public Information Committee (PIC) and Public Information and Advisors Network (PIAN) suggests radiologists embrace these steps in their daily practice:

1. A radiologist should review the examination request before the patient arrives to ensure that the right study has been ordered and the patient has been appropriately prepared for the procedure.

2. Arrange for the patient to receive a personal greeting upon arrival in the department or imaging center, with clear explanation of what the patient should expect during and after the examination.

3. If delays occur, communicate clearly and frequently with the patient so that he/she knows what to expect and can plan accordingly.

4. Provide the patient with names and contact phone numbers for technologists and radiologists involved in their care to answer questions that might arise after the patient leaves the department. Make sure that these individuals or a surrogate are available if contacted.

5. Whenever possible, give the patient the opportunity to discuss the examination with a radiologist, either to explain preliminary results or to answer questions.

WEB EXTRAS

Access a full library of resources on patient-centered care at *RadiologyCares.org*.

THIS MONTH IN THE *RSNA NEWS* ONLINE VERSION

Get more of this month's news online at *RSNA.org/News*.

This month's feature story on cybersecurity in imaging features a podcast with Rik Primo, chair of the Medical Imaging & Technology Alliance (MITA) Cybersecurity Taskforce, discussing the 2015 NEMA/MITA white paper, "Cybersecurity in Medical Imaging."

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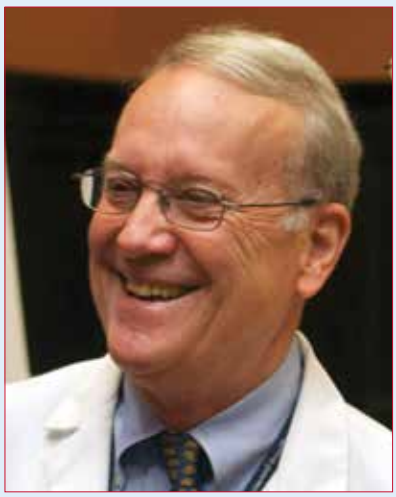
LOOK AHEAD

Machine Learning in Radiology

BY R. NICK BRYAN, M.D., PH.D.

Given the many scientific papers, newspaper and magazine articles, and even television ads about machine learning (ML), big data, data mining and artificial intelligence (AI), it is not surprising that *RSNA News* is featuring a Look Ahead article on this topic. After all, how can radiologists ignore IBM's Watson reading an X-ray during half-time of an NFL game?

While I'm not a computer scientist, I suspect that the radiology community is more interested in the clinical practice implications of this technology than the technology itself. Having practiced radiology and managed clinical practices for over 40 years, I will build on that experience to discuss ML and its role in tomorrow's radiology practice.



Bryan

What is Machine Learning?

Not unexpectedly, radiologists and computer scientists think about ML quite differently. The radiologist might ask,"Can a machine learn to do what we, as radiologists, do?" An important corollary question is, "Can we teach a machine what we know and to do what we do?" Yet the central question of contemporary ML is, "Can a machine learn more than what we now know and use this new knowledge to make decisions?"

To a computer scientist, ML means much more than programming, or "teaching" a computer to perform a specific, known task. In 1959, Arthur Samuel, a pioneer in ML and AI, defined machine learning as the "field of study that gives computers the ability to learn without being explicitly programmed." Machine learning implies algorithms that can learn from and make predictions based on new data.

Implications for Radiology

In general, ML algorithms create computational models based on example inputs in order to derive data-driven predictions or decisions. In radiology, the main decision-making task performed is one of classification—given the images and available clinical information, what is the most likely diagnosis? Innumerable machine learning algorithms perform such classification tasks, though they differ in specific implementation, mathematical basis and logical organization. While knowledge of the task (diagnostic) performance of these algorithms is critical to the practicing radiologist, knowledge of programming details is not necessary. Whether an algorithm utilizes neural networks, support vector machines, clustering analysis, Bayesian networks, sparse coding, genetic algorithms, random fields, or 'deep learning,' its value to the radiologist is dependent on how accurately a given application makes diagnoses.

R. NICK BRYAN, M.D., PH.D.

Even as a small child, Robert Nicolas (Nick) Bryan knew that he wanted to be a doctor; moreover, he knew that he wanted to study the brain. Throughout his multi-faceted career, Dr. Bryan maintained an interest in original research, particularly in the field of neuroradiology.

Dr. Bryan retired in 2014 from the University of Pennsylvania Perelman School of Medicine, where he was named the Eugene P. Pendergrass Professor and Chair of Radiology and retains an emeritus position. After retiring, he founded Galileo CDS, Inc., which develops clinical decision support software for radiology practices.

He continues his research, teaching and clinical activities on a part-time basis. Dr. Bryan is currently principal investigator for four major long-term studies, all relative to brain structure as reflected by MRI.

Dr. Bryan served as 2002 RSNA President and as president of the American Society of Head and Neck Radiology and the American Society of Neuroradiology (ASNR). Among his many honors, Dr. Bryan was awarded gold medals from RSNA and ASNR.

Fortunately ML algorithm performance can be documented through statistical metrics with which radiologists are familiar, such as receiver operating characteristic (ROC) analysis. When the area under the curve (AUC) of an ML algorithm applied to a radiologic task approaches that of a radiologist, the machine will have learned something we now know and will be able to make decisions based on that knowledge. At that point, consideration should be given to incorporating that algorithm into clinical practice. When, and if, the AUC of an ML algorithm exceeds that of a radiologist, the machine will have learned more than what we now know and will be able to make decisions we cannot now make. At that point, we may be compelled to incorporate that algorithm into our practice. Incorporating these analytical tools into our practice, however, does not mean replacing radiologists. Rather, they will complement our quite remarkable human skills and potentially make us more efficient with fewer errors.

"Supervised" vs. "Unsupervised" Learning

As with humans, ML algorithms can "learn" through different processes. A useful, if overly simple, dichotomy in ML processes is supervised versus unsupervised learning. In the former, example inputs (chest X-rays) and desired outputs (the chest X-rays' respective diagnoses: normal/lung cancer) are given to the computer by a supervisor (or teacher) and the computer learns general rules that discriminate between the possible diagnoses. Simplistically, the machine learns from what is known. We do the same thing with human trainees by showing them diagnosis-proven cases. Both ML algorithms and radiologists learn better (i.e., increase their diagnostic accuracy) by increasing the number of training cases, thousands of which are needed to train a human or a computer. Hence the need for long residency/fellowship training or big data in radiology.

In unsupervised learning, the inputs (chest X-rays) might be the same, but no labeled outputs are provided. The computer has to figure out what the possible diagnoses are and how to discriminate amongst them. In this model, the machine is trying to learn from what is unknown in the data. This leads toward data mining and knowledge discovery. Supervised learning is often more expedient and takes advantage of our extensive prior knowledge of radiologic diagnoses, but is obviously limited in finding new patterns of disease. Academic radiologists participate in unsupervised learning when we are searching for a new disease pattern, which is a harder task and often takes more input cases than learning and making a known diagnosis. There is a semi-supervised middle ground and the earliest ML algorithms used

in radiology will almost certainly be based on supervised or semi-supervised learning technology, with less supervised data mining technology operating on even bigger data sets possibly yielding new diagnostic capabilities.

Identifying Patterns in Big Data

Intimately related to ML, particularly in relationship to image data, is the concept of patterns—a set of observations, ideally measurements, of any object. In the case of radiologic images, the most basic pattern is that of the relative intensity (reflected by brightness or darkness) of every signal (e.g., radiodensity, T1, echogenicity) measured for every spatial pixel or voxel, at every time point of a set of images. Those measurements comprise the raw data of an image and result in a complex pattern. Even with relatively low-resolution, single-modality examinations, image data fits into the "large data" category (e.g., non-contrast enhanced CT scan of the head [1.0 to 50 MB]); with higher resolution, multi-dimensional studies being big data (e.g., coronary CTA [200 MB to 2 GB]); and the patterns within population studies such as the Alzheimer Disease Neuroimaging Initiative (multi-modality brain MRI scans with DTI and fMRI [TB]) basically defying human comprehension.

The human visual system is remarkable and radiologists learn and remember very complex patterns and use them every day to make clinical decisions and diagnoses. Modern imaging technology, however, is creating image data sets that exceed human pattern recognition capabilities. Computers and ML technology feast on such data and are rapidly becoming capable of learning incredibly complex, multi-dimensional patterns derived from large normal and diseased populations. That data may be used to diagnose known diseases, such as Alzheimer's disease, but potentially could also define new patterns for diseases such as schizophrenia.

Machine Learning as an Emerging Tool

Many ML algorithms are now being developed for specific radiologic diagnosis with ROC AUCs exceeding that of house staff and approaching that of board-certified radiologists. These algorithms are relatively low level and/or narrowly task specific. This piecemeal development of ML applications takes advantage of subspecialty expertise in building disease and task models. ML programs will expand into clinical practice in a piecewise fashion, at first meeting small niche tasks, but eventually coalescing into more powerful, broadly applicable diagnostic tools.

The paucity of ML tools in radiology will rapidly change with the increased ability of ML algorithms to participate in radiology's most critical decision processes—the detection and diagnosis of disease. For instance, ML algorithms incorporated into computer assisted detection/diagnosis (CADD) products are now detecting pulmonary nodules, diagnosing colonic polyps and screening for breast cancer, with much more to come. In the not so far future, ML will play a central role in radiology, becoming part of routine workflow and providing daily real-time clinical diagnostic support. I predict that within 10 years no medical imaging study will be reviewed by a radiologist until it has been pre-analyzed by a machine.

But I do not foresee Watson taking over our jobs. The human visual system and brain have extraordinary abilities to work with incredibly noisy data, assimilate disparate information, intuit unexpected insights, conjure alternative scenarios and solve incredibly complex problems that are common in medicine, but well beyond any known computer solutions. Much of life and radiology is not that complicated, however, and in that more simple space is where technological advances first occur. Many simple tasks radiologists perform can and will be performed by computers, and ML will expand these capabilities into our central task of image interpretation.

> *"In the not so far future, machine learning will play a central role in radiology, becoming part of routine workflow and providing daily real-time clinical diagnostic support. I predict that within 10 years no medical imaging study will be reviewed by a radiologist until it has been pre-analyzed by a machine."*
>
> R. NICK BRYAN, M.D., PH.D.

Machine Learning Improves Quality, Efficiency

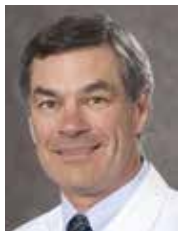
The main factors driving change in radiology are the demand for improved quality and greater efficiency. ML technology can reduce human errors and more rigorously analyze our increasingly complex imaging examinations. The demand for imaging services continues to increase while reimbursement rates decrease. To meet demand and maintain compensation, radiologists already read at least 20 percent more cases per day than they did 10 years ago and view more than twice as many images. In terms of human visual psychometrics, we are operating at near capacity. Further gains in clinical efficiency will require new technologies such as ML algorithms that preview images and create draft reports for the radiologist. Academic radiology departments are currently evaluating such prototype systems. Cleverly integrated into imaging workflow and with appropriate human oversight, ML technology will allow the radiologist to work more efficiently and produce better quality reports.

Cybersecurity Increasingly Critical for Medical Imaging

BY ED BANNON

Cybersecurity is not just for laptops, servers and desktop computers anymore. Any Internet-connected device—including medical equipment containing patient information—is a potential target for hackers, cyber criminals and even nation states, experts say.

The expansion of digital CT scans, MRIs and ultrasound has increased the need to secure the integrity of these images, which often contain sensitive protected health information (PHI) and can be used for Medicare fraud, identity theft and other illegal activity.


Seibert


Primo

"In radiology, a denial exists that imaging devices are not in need of security," said J. Anthony Seibert, Ph.D., professor and associate chair of informatics in the Department of Radiology at the University of California Davis Health System, Sacramento. "That mindset needs to be overcome."

Although many clinics and medical centers have effective cybersecurity programs, many others have not acknowledged the seriousness of the threat to PHI.

More than 111 million health information security incidents in 2015 were attributed to hacking, up from just 1.8 million in 2014, according to the U.S. Department of Health and Human Services (HHS) Office for Civil Rights report. Although only five breaches accounted for 97 percent of those incidents, any security breach can cause serious repercussions.

"You don't want to be the data center in the news for being hacked," said Rik Primo, chair of the Medical Imaging & Technology Alliance (MITA) Cybersecurity Taskforce. MITA, a division of the National Electrical Manufacturers Association (NEMA), released the NEMA/MITA 2015 "Cybersecurity for Medical Imaging" white paper at RSNA 2015, which offers numerous related resources.

Security breaches occur when hackers conduct reconnaissance on a network by looking for the Internet Protocol (IP) address of medical equipment that appears to be vulnerable. Once hackers exploit a vulnerable medical device, they can leverage that device as a "jumping off" point to access the rest of the facility's network.

In the process, the hacker could accidentally, or deliberately, cause the medical device to malfunction. While no life-threatening scenario like this has ever been documented, it is theoretically possible, if adequate cybersecurity counter measures are not in place, Primo said.

Cybersecurity Should be Part of Workplace Culture

Because of hacking threats, radiologists operating equipment linked to a computer network should help their healthcare organization's management integrate cybersecurity into the workplace culture, Primo said.

He describes an optimal cybersecurity program as one that creates an "ecosystem of shared awareness and responsibility" among medical device manufacturers, IT departments and radiologists.

Medical device manufacturers play their role by instituting security by design, which integrates security measures into the medical device from its inception. This practice makes it harder for hackers to compromise a system.

To guide healthcare providers, and especially imaging departments through the security process, the Healthcare Information and Management Systems Society (HIMSS) and NEMA jointly published a document, "Manufacturer Disclosure Statement for Medical Device Security," or MDS2. The document standardizes the information that radiologists should expect of device manufacturers to explain the security features and vulnerabilities of imaging equipment when they are implementing the highly recommendable IEC/ISO 80001-1 Cybersecurity Risk Management Process Standard in their departments.

> "Some of the measures we take to prevent cyber threats also prevent us from getting instantaneous access to all the images we use to optimize patient care."
>
> J. ANTHONY SEIBERT, PH.D.

The best-designed system, however, can be subverted by users who are not really aware of cybersecurity threats, Primo said. He has been shocked to hear of laptops stolen from medical offices with PHI stored on the laptop's non-encrypted hard drive.

Dr. Seibert said radiologists get frustrated with security software when it slows down the network. "Some of the things we do to prevent threats also prevent us from getting instantaneous access to all the images we use to optimize patient care," Dr. Seibert said. The best security systems are seamless to the users, because when security systems start to harm performance or become onerous to the users, the users find ways to circumvent security protocols, which usually create an opening for hackers.

But Dr. Seibert believes this seamlessness can be achieved in the future through technological advances such as biometric scans to replace passwords and near-field communication devices, which require physical proximity to operate a device.

Educating personnel on cybersecurity risks is another key step to ensure that staff members understand the need for sometimes tedious security measures, Dr. Seibert said.

Embedding IT Staff Can Keep Hackers Out

The third component to a healthy cybersecurity ecosystem is the IT staff. Not only should the IT staff build a firewall to keep hackers out, they should be running system scans to detect intrusions, Dr. Seibert said. Because those system scans are notorious for slowing down operations, the IT department at Dr. Seibert's institution built part of its network isolated from the Internet to eliminate the need for constantly scanning security software.

Primo recommends embedding IT staff in technology-heavy departments such as radiology. Rather than being called when a problem emerges, an embedded IT staff member is better positioned to prevent problems, teach users the corrrect use of the IT application, suggest improvements, and coach staff through security procedures.

"It's an ecosystem of shared responsibility," he said. "If just one person in the chain fails to do what is right, cybersecurity can be compromised. It's all about people, processes and technology."

WEB EXTRAS

Access the NEMA/MITA white paper, "Cybersecurity for Medical Imaging," at *NEMA.org*.

Access the HIMSS/NEMA Manufacturer Disclosure Statement for Medical Device Security (MDS2) at *HIMSS.org*.

MITA Chair Discusses Cybersecurity Recommendations

Rik Primo, chair of the Medical Imaging & Technology Alliance (MITA) Cybersecurity Taskforce, discusses the 2015 NEMA/MITA Cybersecurity white paper and the urgent need for patient information protection in informatics and technology in this podcast: *podcast.nema.org*.

Derek Harwood-Nash Fellowship Opens Doors for International Radiologists

BY PAUL LATOUR

When he arrived to study at a U.S. hospital in 2015, Kamal Subedi, M.B.B.S., encountered an environment far different from that of his native Nepal.

"Exposure to radiology services at a U.S. hospital was overwhelming," said Dr. Subedi, a radiologist in the Department of Radiology at Tribhuvan University Teaching Hospital in Kathmandu, Nepal. "The state-of-the-art technology and expertise in every subspecialty of radiology was truly impressive."

As a 2015 Derek Harwood-Nash International Fellow, Dr. Subedi studied musculoskeletal radiology and MRI at Case Western Reserve University & University Hospitals in Cleveland.

"Every day was a new learning experience," said Dr. Subedi, crediting department chair Pablo Ros, M.D., Ph.D., for being extremely welcoming and helpful during his eight-week fellowship. Fellowships run from six to 12 weeks, depending on how long recipients can be away from their home institutions.

Dr. Subedi said Nepal is gradually catching up with advancements in radiologic technology, but remote areas still lack basic imaging facilities such as X-ray and ultrasound. In contrast, Tribhuvan University Teaching Hospital is a busy institution that caters to patients from all across Nepal. The radiology department has 11 full-time radiologists and utilizes a 128-slice CT scanner, a 0.3T MRI, digital X-ray, ultrasound, mammograghy, digital fluoroscopy and an angiography and interventional suite.

However, PET is still not available anywhere in the country and Dr. Subedi does not have access to high-field MRI or PACS.

"Radiology education and research could be taken to new heights in Nepal if we had access to PACS," he said, adding that Nepal still lacks subspecialty-trained radiologists.

Despite the need for more advanced technology, the valuable lessons Dr. Subedi learned in the U.S. will be highly beneficial in Nepal. One example: He used both 1.5T and 3T MRI while learning musculoskeletal MRI at Case Western Reserve University & University Hospitals, while his facility in Nepal uses only 0.3T MRI.

"The fine details that we see in high-field MRI systems is difficult to appreciate in low-field strength magnets, but I learned the level of detail we need to focus on while reporting musculoskeletal MRI," Dr. Subedi said. "I have gained further confidence in musculoskeletal MRI reporting which will definitely help both our patients and radiology residents in Nepal."

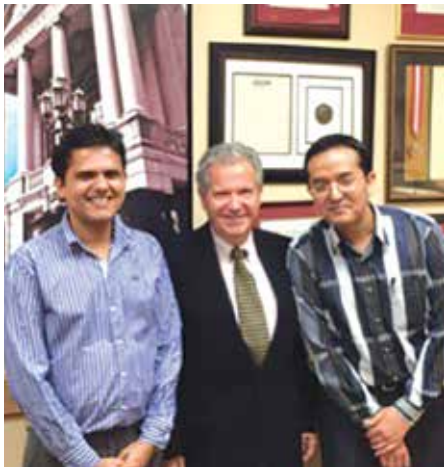
Dr. Subedi is hopeful that his facility will soon acquire a high-field strength magnet so that he can further put his knowledge into practice.

Harwood-Nash was Goodwill Ambassador for Radiology

Dr. Subedi is just one of a growing roster of physicians who have benefitted from the RSNA fellowship named for former RSNA Board of Directors member Derek C. Harwood-Nash, M.B. Ch.B., D.Sc., who died in October 1996. Dr. Harwood-Nash was a long-time goodwill ambassador for radiology, who encouraged worldwide cooperation among radiologists.

RSNA's Committee on International Radiology Education (CIRE) established the Derek Harwood-Nash International Fellowship in 1998. Since then, 36 fellows representing 24 nations have participated in the program. The program began with one participant, expanded to two in 2004, added a third in 2013 and a fourth in 2016.

"The fellowship has truly become a tribute to everything Derek Harwood-Nash embodied," said Kristen K. DeStigter, M.D., chair



Kamal Subedi, M.B.B.S., (*left*) studied musculoskeletal radiology and MRI at Case Western Reserve University & University Hospitals in Cleveland, under the supervision of department chair Pablo Ros, M.D., Ph.D., (*center*); at right: Swachchhanda Songmen, M.D., from Nepal.

Dr. Subedi took some of the lessons he learned studying radiology in the U.S., through the RSNA Derek Harwood-Nash Fellowship, back to the Department of Radiology at Tribhuvan University Teaching Hospital in his native Nepal (*above*).

> "The fellowship helps create career opportunities in focused areas for those who then contribute to the growth of our profession. It's heartening to witness these fellows giving back."
>
> KRISTEN K. DESTIGTER, M.D.

of CIRE and former chair of the Derek Harwood-Nash Fellowship Subcommittee. "It's the kind of program I perceive he would want to see. The fellowship helps create career opportunities in focused areas for those who then contribute to the growth of our profession. It's heartening to witness these fellows giving back."

From the beginning, the program has been a success. In 2014, CIRE began to measure outcomes by establishing an evaluation process for fellows to complete at three stages upon returning to their home institutions: one year, two years and three years.

Although just one group has completed the first stage of the process, Dr. DeStigter said the data collected have been impressive:

- Fifty-seven percent of recipients' time at their home institutions was spent practicing the clinical subspecialties covered during the fellowships.
- Thirty percent of their time was spent teaching in that subspecialty in their home country.
- Thirteen percent of their time was spent doing research in that subspecialty. That research yielded an average of six lectures per fellow, the teaching of more than 130 residents and 20 active research studies, resulting in seven published articles. Each fellow also submitted one abstract accepted for an international meeting.

In addition, Dr. DeStigter said the fellows had performed almost 6,000 patient studies or procedures in their subspecialty areas.

"That means that thousands of patients have received the benefit of this subspecialty training immediately upon the fellows' return to their home country," Dr. DeStigter said. "Not only are we impacting these fellows from an academic perspective, but we're also impacting patient care and health services delivery in their home countries. RSNA can be really proud of this."

2016 Fellow Plans to Aid Pediatric Care in India

One such example comes from a physician who plans to bring back to her native India lessons learned during her six-week 2016 Derek Harwood-Nash Fellowship.

Sniya V. Sudhakar, D.N.B., F.R.C.R., who is studying pediatric neuroradiology at the University of Toronto in April,

Subedi

DeStigter

Sudhakar

would like to translate the knowledge and experience she gains into better patient care for the large pediatric population of her home institution, the Christian Medical College in Vellore, India.

"Pediatric neuroradiology is one of the most dynamic and challenging fields of medicine and has a very steep learning curve. It would take years of dedicated study and experience to become adept in it. I want to explore this opportunity of training to advance and enhance my knowledge and experience in the field," Dr. Sudhakar said, adding that the University of Toronto is considered the mecca of pediatric neuroradiology.

While at Toronto, Dr. Sudhakar works in the university's Hospital for Sick Children, known as SickKids. The facility's radiologist-in-chief is Manohar Shroff, M.D., F.R.C.P., who was instrumental in Dr. Sudhakar's path to the fellowship and who knew Dr. Harwood-Nash.

"Dr. Shroff mentioned how fortunate he was to meet the legend and how Dr. Harwood-Nash was instrumental in his own pursuit of pediatric neuroradiology. Having a keen interest in pediatric neuroradiology and its history, I realized this was a tremendous opportunity," said Dr. Sudhakar, who began her fellowship April 15.

Along with Dr. Sudhakar, the other 2016 fellowship recipients are Abraham Inikori, M.D., of Nigeria, and Wai Wai Htun, M.B.B.S., M.Med.Sc., of Myanmar. Dr. Inikori will study body imaging at the University of Virginia Health System from Aug. 1 to Oct. 21. Dr. Htun will study CT/MRI at the Lahey Hospital & Medical Center in Burlington, Mass., from Sept. 5 to Nov. 25.

Applicants Sought for 2017 Derek Harwood-Nash Fellowship

Applications for the 2017 Derek Harwood-Nash International Fellowship Program are being accepted through July 1.

Interested candidates must be promising international radiology scholars who have completed radiology training, are embarking on a career in academic radiology (i.e., have held a faculty position for three to 10 years), and who demonstrate that their specific educational goals can be met most appropriately by a course of study in a North American institution.

Qualified candidates must also specify how the knowledge and experience gained from this fellowship will benefit and improve the practice of radiology in both the home institution and the radiologic community. English proficiency is required.

Applications are available at *RSNA.org/DHN.*

New ABR Certificate Represents Historic Transition for Interventional Radiology

BY RICHARD S. DARGAN

After years of planning, the new American Board of Radiology (ABR) Interventional Radiology/Diagnostic Radiology (IR/DR) certificate is rolling out ahead of schedule. Several residency programs have been approved, and the first residents could be taking the certification exam as soon as 2018, according to radiology leaders.

The American Board of Medical Specialties (ABMS) approved the IR/DR certificate to recognize IR as a unique medical specialty in 2012. At that time, the first match between applicants and programs was not expected until 2017, but close work between radiologists and professional societies enabled the date to be moved up a year.

"Already, 20 programs have been approved and seven went into this year's match in March. None of us in IR expected that," said John A. Kaufman, M.D., M.S., director of the Dotter Interventional Institute at the Oregon Health & Science University in Portland and past chair of of the ABR-Society of Interventional Radiology (SIR) Primary Certificate Task Force. "We're way ahead of schedule."

"When people first heard of this, it sounded daunting," said Matthew A. Mauro, M.D., chair of the Department of Radiology at the University of North Carolina School of Medicine in Chapel Hill, N.C., where he also holds the Ernest H. Wood Distinguished Professorship. "Now that we've had a few years with a lot of public relations work and talks at the society level, people have embraced it and we're really on a roll," said Dr. Mauro, who is also the RSNA Board of Directors liaison for information technology and annual meeting and serves on the ABR Board of Governors.

An Important Step for Interventional Radiology

The new IR/DR certificate joins diagnostic radiology, radiation oncology and medical physics as one of four primary certificates offered by the ABR. As such, it represents an important step for a specialty that has grown in reach and complexity since vascular radiologist Charles Dotter, M.D., performed the first angioplasty in 1964. A one-year fellowship in vascular and interventional radiology (VIR) was created in the 1990s, but as the years passed, the short duration of the fellowship and heavy emphasis on the procedural aspects of IR became increasingly viewed as inadequate to meet the demands of the profession.

"For 15 to 20 years, the interventional radiology community has recognized that our training needed more non-procedural components than had originally been envisioned," Dr. Kaufman said. "The first certification in VIR took place in 1994, and by 2000 we were already looking at new training alternatives."

"The major impetus behind the IR/DR certificate was to develop an improved curriculum to meet the needs of IR in the present and future," Dr. Mauro said. "The current model offers only 12 months of training, which is not enough for the longitudinal experience of patient follow up."

Mauro

Kaufman

SIR first proposed primary certification in 2007. After ABR approval, IR leaders approached ABMS on two occasions (2009 and 2012) where, as Dr. Kaufman recalled, they were able to allay concerns about a "land grab," or an expansion in the scope of the practice.

"The new certificate did not expand the scope of practice for IR, which was very important when we went to ABMS for approval," he said. "All that has changed is the length of training and the emphasis on non-procedural patient management."

The new plan offers two IR residency formats: a five-year Integrated Program and a two-year Independent Track. The Integrated IR Residency is available to medical students who apply through the National Resident Matching Program (NRMP) Main Match and begin residency training in the postgraduate second year. The curriculum is concentrated on DR in the first three years and IR in the last two.

The Independent IR Residency, available to graduates of a DR residency, is two years in length.

"The new format is designed to be as flexible and inclusive as possible," Dr. Kaufman said. "It will accommodate students who might be coming out of medical school and those starting in DR who want to transition into IR."

The training requirements leading to the new certificate in IR/DR will be more rigorous compared to those of the subspecialty in VIR, Dr. Mauro said. There will be additional training in IR, critical care medicine and periprocedural care.

> "The major impetus behind the IR/DR certificate was to develop an improved curriculum to meet the needs of IR in the present and future."
>
> MATTHEW A. MAURO, M.D.

First IR/DR Oral Exam Will be Held in 2017

The Accreditation Council for Graduate Medical Education (ACGME) approved the first group of IR Integrated Residency programs in November 2015. NRMP assigned unique match numbers for each of these programs and made them eligible to participate in this year's Main Residency Match for IR. Many other programs will receive accreditation in the coming months,

but notification will be too late to allow for 2016 participation.

"A handful of programs have been approved to enter the Match for this year, and next year we expect that significantly more programs will participate in the Main Residency Match," Dr. Mauro said.

"One thing that is very exciting is that programs that have not had IR fellowships have created new slots for this specialty," Dr. Kaufman said. "That tells us the program is appealing to people."

Graduates of an IR Residency will qualify to take the IR/DR examination offered by the ABR. The examination structure includes a DR Core Examination in month 36 of training and a certification exam that includes computer-based and oral examinations three months after training is completed.

"The IR/DR exam will be longer and more involved than the DR exam because there are two competencies being tested," Dr. Kaufman noted. "Everyone will take the same core exam for diagnostic competency, while the oral component will take care of IR procedural competency."

The first IR residents could graduate and sit for the IR/DR certificate examination as early as 2018 if current R3 residents transfer to the IR residency this summer, Dr. Kaufman said, explaining that the program does not allow external transfers. However, 2017 graduates of VIR fellowships will take the IR/DR oral examination, and those will be the first IR/DR certificates awarded.

Radiologists who hold a subspecialty certificate in VIR will be given IR/DR certificates at no additional cost if Maintenance of Certification (MOC) requirements, likely including practice quality improvement projects in IR, are up to date, Dr. Kaufman said.

VIR Fellowship to be Phased Out

The DR certificate will continue to be offered, and trainees currently enrolled in VIR fellowships will be able to complete their training and seek certification according to the processes now in place. Students interested in practicing IR can still seek certification in DR with a subspecialty in VIR. Those who have begun DR training also may have an opportunity to transfer into the IR/DR certification process by transferring to an IR residency. However, the VIR fellowship will be phased out in the next five to seven years as the new IR/DR certificate transitions into the sole IR certificate issued by the ABR.

Although the Diagnostic and Interventional Radiology Enhanced Clinical Training (DIRECT) pathway is still in effect, no new programs will be approved to allow training in this pathway. Once VIR fellowships are phased out, no new applicants will be permitted into the DIRECT pathway.

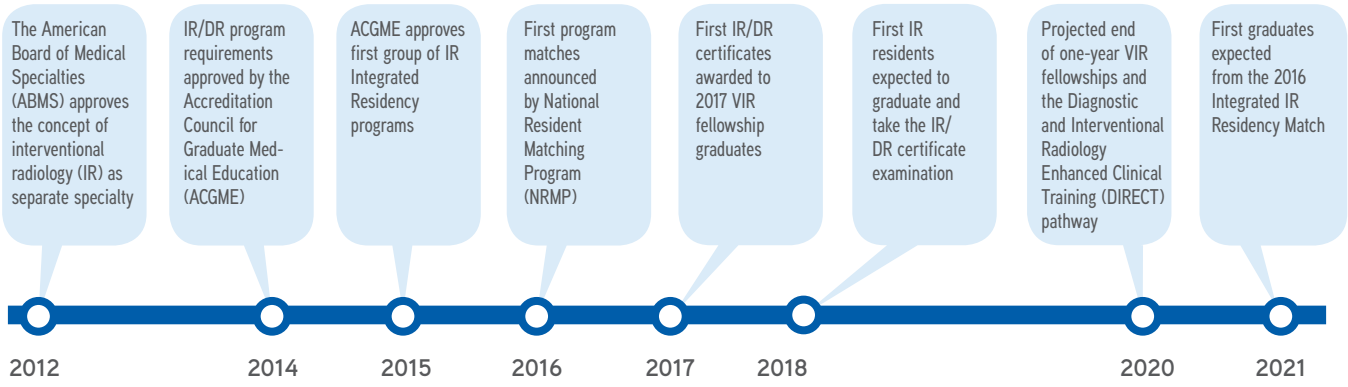
"This new IR/DR certificate will result in much better prepared and trained radiologists and a higher quality of care for patients," Dr. Mauro said.

WEB EXTRAS

For more information on the American Board of Radiology (ABR) Interventional Radiology/Diagnostic Radiology (IR/DR) certificate, go to *theabr.org*.

The first interventional radiology (IR) residents could graduate and sit for the IR/Diagnostic Radiology (DR) certificate examination as early as 2018.

Timeline to Interventional/Diagnostic Certification



Molecular Imaging Technique Advances Cancer Research

BY CINDY LENART

Using a grant funded by the RSNA Research & Education (R&E) Foundation, one researcher demonstrated the promise of a new imaging technique—beta radioluminescence imaging (beta-RLI)—in producing high-contrast functional images of cancers including cutaneous melanomas and head and neck squamous cell carcinomas.

Although surgery is the best treatment for many cancers, the wide surgical margins and the close proximity of vital anatomic structures often mean that surgical resections cannot be performed without causing potentially devastating cosmetic and functional consequences.

As a resident at Stanford University Medical Center, Martin T. King, M.D., Ph.D., hypothesized that if the true pathological extent of an underlying lesion could be characterized non-invasively, smaller surgical margins could be used—yielding better outcomes for the patient.

Dr. King used a 2013 RSNA Research Resident Grant to study the molecular imaging technique Cerenkov luminescence imaging (CLI), which can produce high resolution functional images of ^{18}F-fluorodeoxyglucose (FDG)-avid tumors intraoperatively with relatively inexpensive optical imaging equipment. But when preliminary research demonstrated that CLI held one major limitation—relatively low photon sensitivity—Dr. King proposed using a new imaging technique.

"Whereas we initially proposed validating CLI for ^{18}FDG-guided surgery, we proposed a new modality, beta-RLI, and sought to compare this modality to CLI in vitro and in vivo," Dr. King said.

> *"Although investigators have utilized beta probes for the intraoperative imaging of ^{18}F-FDG-avid tumors, beta-RLI provides a larger imaging field of view as well as optical image overlay."*
>
> MARTIN T. KING, M.D., PH.D.

Beta-RLI vs. Cerenkov Luminescence Imaging

Advantages:
- Increased photon sensitivity
- Decreased acquisition time (two 10-second acquisitions vs. single 300-second acquisition)
- Visualization of both melanotic and amelanotic tumors

Disadvantages:
- Decreased spatial resolution
- Increased background signal
- Need for two serial image acquisitions

According to Dr. King, the technique incorporates a scintillator for improved photon sensitivity as well a gamma rejection strategy for more preferentially imaging beta particles. He hypothesized that this method would provide enhanced photon sensitivity compared with CLI.

Potential Clinical Applications for Beta-RLI

For the research, which was published in the September 2015 issue of the *Journal of Nuclear Medicine*, Dr. King and colleagues used in vitro phantoms to characterize the photon sensitivity and resolution of CLI and beta-RLI. Researchers also conducted a series of in vivo experiments with xenograft mouse models using both amelanotic (A375, UMSCC1-Luc) and melanotic (B16F10-Luc) cell lines. The B16F10 and UMSCC1 cell lines were transfected with the luciferase gene (Luc). CLI images were acquired over 300 seconds and beta-RLI images were acquired using two 10-second acquisitions.

Researchers correlated ^{18}F-FDG activities, as assessed by PET, with tumor radiances for both beta-RLI and CLI techniques and also compared tumor signal-background ratios (SBR) between these modalities for amelanotic and melanotic tumors.

Based on the in vitro experiment, beta-RLI was 560 times more sensitive than CLI, although the spatial resolution was inferior to that of CLI. In the in vivo studies, tumor signals were less apparent after partial resection and almost indiscernible after full resection for both modalities, Dr. King said. Furthermore, the melanotic B16F10 tumors were readily apparent on beta-RLI but not on CLI, possibly due to light absorption by the dark pigment.

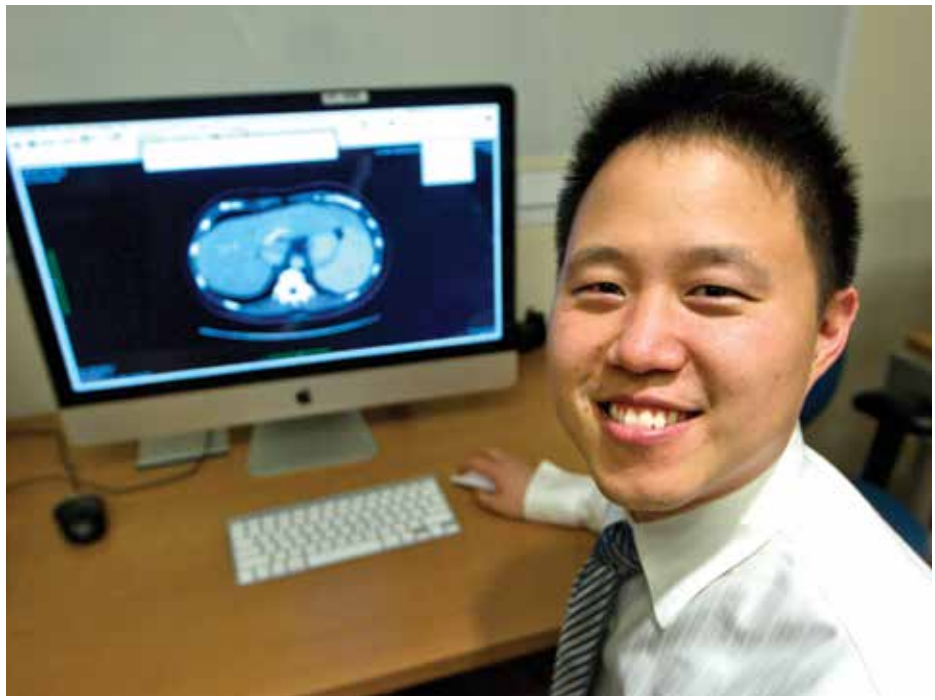
"Although investigators have utilized beta probes for the intraoperative imaging of ^{18}F-FDG-avid tumors, beta-RLI provides a larger imaging field of view as well as optical image overlay," Dr. King said.

Although the beta-RLI technology is still in the testing phase, Dr. King said the potential for clinical use definitely exists. "It could be an emerging technique in the future," he said. "Further engineering developments are needed to realize the full clinical potential of this modality."

R&E Offers Flexibility to Investigators

Considering the complexity of academic research, Dr. King is grateful that his RSNA grant provided the protected time and the flexibility to take his study in a new direction.

"This research study is one example of how research directions may change based on results from preliminary experiments," he said. "By providing investigators with flexibility, RSNA gives researchers an opportunity to pursue exciting research opportunities that may have not been present at the time of grant preparation."



Martin T. King, M.D., Ph.D.

"Dr. King's work published in last year's *Journal of Nuclear Medicine* caught the attention of the imaging research community," said Lei Xing, M.D., Ph.D., a professor of radiation oncology/radiation physics at Stanford who supervised Dr. King's project. "I am expecting important accomplishments from him in the years to come."

Currently, Dr. King is completing a brachytherapy fellowship in the Department of Radiation Oncology at Memorial Sloan Kettering Cancer Center in New York. In August, he plans to assume a faculty position at Brigham and Women's Hospital in Boston.

WEB EXTRAS

Access the September 2015 study, "β-Radioluminescence Imaging: A Comparative Evaluation with Cerenkov Luminescence Imaging," by Dr. King and colleagues in the *Journal of Nuclear Medicine* at *jnm.snmjournals.org*.

INNOVATE

GRANTS IN ACTION

NAME:
Martin T. King, M.D., Ph.D.

GRANT RECEIVED:
RSNA Research Resident Grant (2013)

STUDY:
Non-invasive Detection of Surgical Margins with Cerenkov Luminescence Imaging in Head and Neck Cancer

CAREER IMPACT:
"The RSNA grant has profoundly influenced my academic career aspirations. I am excited to continue my career as a future faculty member at an academic institution, and I will forever be indebted to my initial research funding opportunity provided by the RSNA Research Resident Grant."

CLINICAL IMPLICATION:
"We have created a new imaging technology—beta-radioluminescence imaging (RLI)—which has shown to have better photon sensitivity than Cerenkov luminescence imaging. With future engineering developments, beta-RLI has the potential for aiding physicians in localizing ^{18}FDG-avid tumors at the time of surgery."

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YOUR DONATIONS IN ACTION

Bridging the Gap Between Radiology and Nuclear Medicine

Thomas A. Hope, M.D. (*center*), with technologists Vahid Ravanfar (*left*), and Hope Williams (*right*).

With a 2015 Philips Healthcare/RSNA Research Seed Grant, Thomas A. Hope, M.D., assistant professor at the University of California, San Francisco, and the San Francisco Veterans Affairs Medical Center, is studying the ability of Ga-68 DOTA-TOC PET/MRI to predict early treatment response to Y-90 radioembolization in patients with bulky hepatic metastasis.

"I am a radiologist and a nuclear medicine physician having done fellowships in both nuclear medicine and body MR," Dr. Hope said. "My goal as an academic radiologist is to bridge the gap between radiology and nuclear medicine and I believe PET/MRI to be the perfect modality in which to do this."

Ga-68 DOTA-TOC is a somatostatin analog used to image neuroendocrine tumors using PET, allowing for accurate quantification of uptake.

Continued from Previous Page

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Meet the New R&E Grant Committee Chairman

Recently, Umar Mahmood, M.D., Ph.D., took on the position of chair of the Research & Education (R&E) Foundation Grant Program Committee. Dr. Mahmood, who received his first RSNA Research Resident Grant for the project, "Multiple Wavelength Optical Imaging for Simultaneous in vivo Imaging of Two Different Enzyme Activities," in 2000, discusses the importance of grant funding in radiology research and the advice he shares with applicants pursuing funding.

What attracted you to chairmanship of the R&E Grant Program Committee?
Dr. Mahmood: If you look at the history of radiology, you clearly see that our field is defined by our collective innovation. The R&E Foundation, through grant funding, is the multiplier that allows innovation to grow and keep radiology vibrant. The Foundation provides initial funding for so many radiologists who go on to receive National Institutes of Health (NIH) and other grants, and who continue to make advancements for decades after their R&E funding period ends. We collectively benefit by the work that these grant recipients have accomplished in bringing new ideas into practice.

How has your R&E research journey come full circle from grant recipient to Grant Program Committee chair?
Dr. Mahmood: Receiving an R&E grant validated my research endeavors, but much more importantly, the process of submitting the grant provided invaluable experience in grant writing. It was a vital transition in mindset from researcher to principal investigator. Over the years I have been fortunate to work with—and supervise—some really bright, creative, hardworking people who have received seed, fellow, resident and medical student grants. These experiences make me a strong advocate for the applicants and an enabler of their longer-term success.

Umar Mahmood, M.D., Ph.D., (*ctr*) with 2015 Scholar Grant recipients at RSNA 2015.

What advice would you share with young people about pursuing a career in research?
Dr. Mahmood: Give it a try! It can be fun, exciting, creative and fulfilling. Research provides intellectual stimulation and part of what makes it fun is that you can discover something that hasn't been seen before. Surround yourself with good advisors and mentors, develop a strong research team, and start exploring.

Why do you believe it is important to be involved in RSNA?
Dr. Mahmood: As radiologists, we benefit from our collective contributions to the field. As with any puzzle, many different pieces must be connected to achieve the desired outcome. I have always found RSNA to be encouraging and supportive. With its multi-faceted approach to advancing the specialty, RSNA provides many ways to find your own puzzle piece and use it to help complete or even define radiology's greater picture.

Radiology in Public Focus

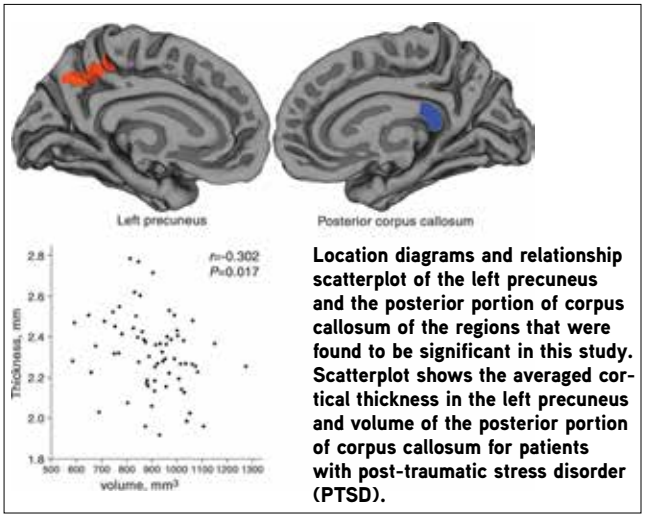
Press releases were sent to the medical news media for the following articles appearing in recent issues of *Radiology*.

Imaging Shows Impact of PTSD in Earthquake Survivors

Patients with post-traumatic stress disorder (PTSD) demonstrated alterations of cerebral structure, including increased cortical thickness in the right superior temporal gyrus, right inferior parietal lobule, and the left precuneus, and decreased volume of posterior corpus callosum, according to new research.

Shiguang Li, M.D., from the West China Hospital of Sichuan University in Sichuan, and colleagues recruited 67 patients with PTSD and 78 adult survivors without PTSD seven to 15 months after a devastating earthquake in western China. Averaged data from the brain regions with volumetric or cortical thickness differences between groups were extracted in each individual to examine correlations between morphometric measures and clinical profiles.

The total scores of the Clinician-Administered PTSD Scale, which reflects PTSD illness severity, were positively correlated with cortical thickness in the left precuneus. Also, region-of-interest analysis demonstrated that the volume of posterior corpus callosum in patients with PTSD was smaller than in healthy survivors, and it was negatively correlated with cortical thickness in the left precuneus in patients with PTSD.



Location diagrams and relationship scatterplot of the left precuneus and the posterior portion of corpus callosum of the regions that were found to be significant in this study. Scatterplot shows the averaged cortical thickness in the left precuneus and volume of the posterior portion of corpus callosum for patients with post-traumatic stress disorder (PTSD).

(*Radiology* 2016;279;1:InPress) ©RSNA 2016. All rights reserved. Reprinted with permission.

"We demonstrated a potential structural neural basis of default-mode network alterations in patients with PTSD that was related to clinical symptom severity. These findings significantly advance mechanistic understanding of early brain changes that determine whether severe emotional trauma will lead to PTSD," the authors write.

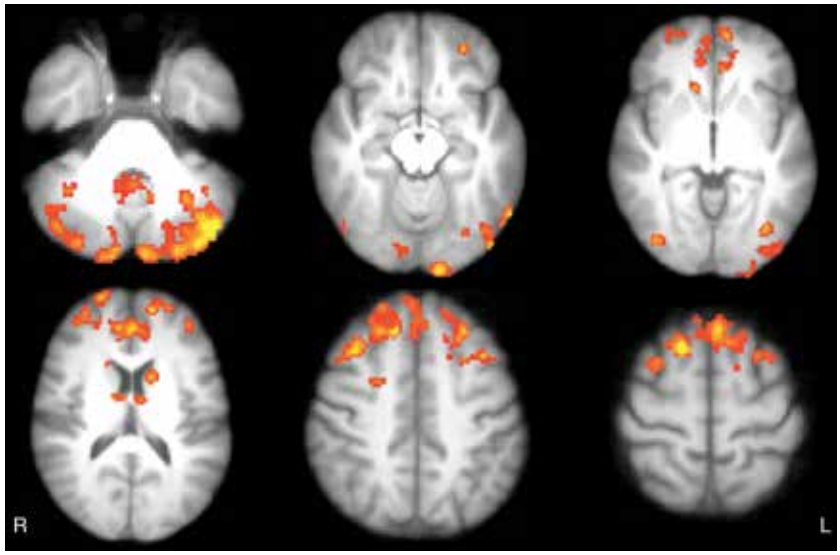
Video Games Improve Brain Connections in Multiple Sclerosis Patients

A video game–based cognitive rehabilitation program may be an effective option for improving the cognitive abilities of patients with multiple sclerosis (MS), according to new research.

Laura De Giglio, M.D., Ph.D., of Sapienza University of Rome, and colleagues found that the program induces functional modification of thalamocortical functional connectivity (FC) in areas mainly located in the cingulum, precuneus, and bilateral parietal cortex, in the cerebellum and in the left prefrontal cortex.

Researchers evaluated 24 patients with MS and cognitive impairment, randomly assigning them to either an intervention or a wait-list group. Repeated measures analysis of variance was used to test efficacy of the intervention. The thalamic resting-state network was identified with a seed-based method; both first-level and high-level analyses were performed using software tools.

"Results show the relevance of thalamic regulation of the brain networks involved in cognition and suggest that changes in thalamic resting-state network connectivity may represent a functional substrate for cognitive improvement associated with a video game–based cognitive rehabilitation program," the authors write.



Axial statistical maps show areas of reduced thalamic functional connectivity (FC) in patients with MS compared with that in healthy subjects. Patients exhibited significantly lower FC in clusters located in the cerebellum, frontal and occipital cortices, caudate nucleus, and thalamus, bilaterally. Unpaired *t* test, cluster-level $P < .05$, family-wise error (FWE) corrected.

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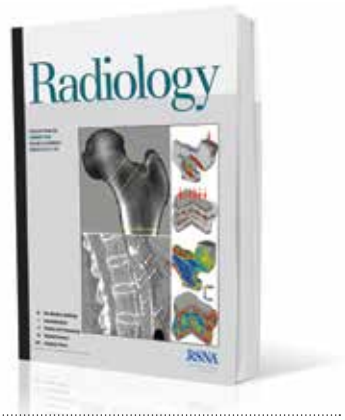
Media Coverage of RSNA



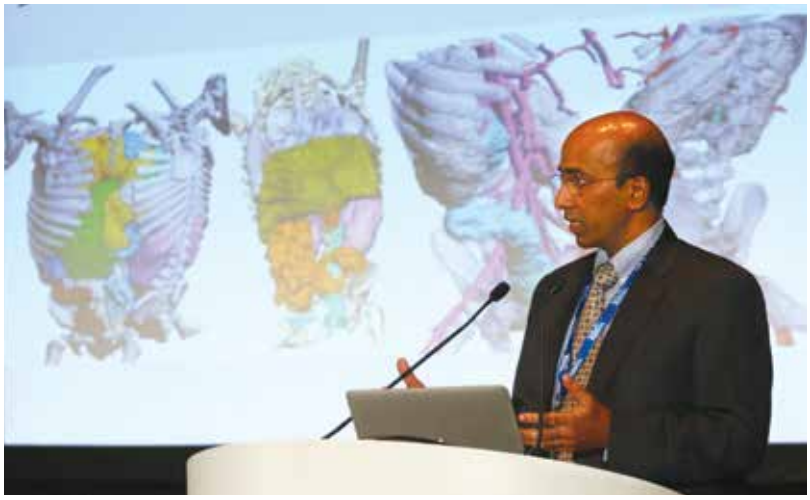
In January, 13,234 RSNA-related news stories were tracked in the media. These stories reached an estimated 6.7 billion people.

Coverage included Yahoo! News, *Chicago Tribune,* HealthDay, *The Washington Post, CNN.com, Daily Mail (UK), The Telegraph,* Yahoo! Finance, KTLA-TV (Los Angeles), WBBM-AM (Chicago), Doctor Radio, WUSA-TV (Washington, D.C.), KDKA-TV (Pittsburgh), New England Cable News, WebMD, Bloomberg News, *MSN.com, ABCNews.com, NBCNews.com, CBSNews.com, Philly.com, Reuters, The Denver Post, Health.com,* ScienceDaily, MedPage Today, *Radiology Today* and *Auntminnie.com.*

RSNA 2015 Media Coverage Reaches 9.1 Billion

Total RSNA 2015 media coverage tracked through February 12, 2015, has resulted in 24,793 media placements with a potential audience reach of more than 9.1 billion.

Notable placements for RSNA 2015 include: *The Washington Post, TIME, U.S. News & World Report,* Yahoo! News, *The Huffington Post, Cosmopolitan,* International Business Times, *The Daily Mail (UK), The Daily Telegraph (UK), The Mirror (UK), Boston Globe, Archaeology,* Voice of America, CNBC, Univision, New England Cable News, NPR, US Radio, WLNY-TV (New York), KTLA-TV (Los Angeles), KTTV-TV (Los Angeles), WFLD-TV (Chicago), WBBM-TV (Chicago), WGN America, WUSA-TV (Washington, D.C.), WRC-TV (Washington, D.C.), KGO-TV (San Francisco), WBBM-AM (Chicago), WLS-AM (Chicago), Discovery News, CNN Money, *ABCNews.com, CBSNews.com,* NBC Right Now, Reuters, Bloomberg News, Healthday, Xinhua News Agency, UPI, WebMD and *Reddit.com.*



RSNA 2015 press conferences, including one presented by Rajesh Krishnamurthy, M.D., on the use of CT imaging and 3-D printing technology in the surgical planning for separation of conjoined twins, helped drive media coverage of RSNA 2015 sessions.

May Public Information Outreach Activities Focus on Stroke Awareness Month

In recognition of American Stroke Month in May, RSNA is distributing public service announcements (PSAs) focusing on stroke imaging, interventional treatments for stroke and the importance of immediate stroke treatment.

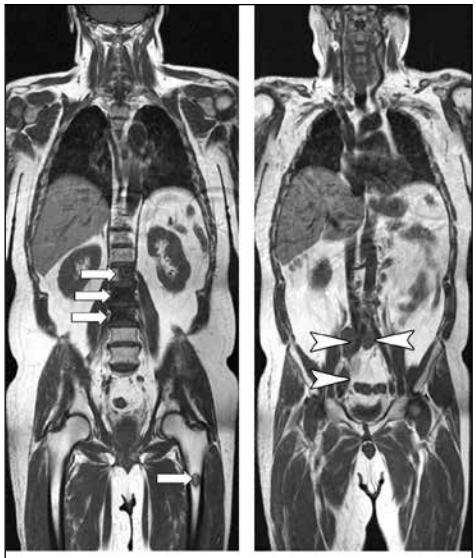
The 60-Second Checkup audio program focusing on stroke symptoms and treatment will also be distributed to nearly 65 radio stations across the U.S.

RadiologyInfo.org Launches New "Radiology and You" Section

RadiologyInfo.org recently introduced a new section, "Radiology and You," to help patients better understand their overall radiologic experience and the role of radiologists in their medical care. The section offers articles such as, "How to Read Your Radiology Report," which provides an overview of the different sections of a radiology report and describes what they mean and how to interpret them. Be on the lookout for more articles coming soon.

RadiologyInfo.org
For patients

Journal Highlights



Whole-body MR images in a 71-year-old man with castration-resistant prostate cancer (prostate specific antigen level, 27.2 ng/mL) evaluated before the shift to chemotherapy and comparison with bone scintigraphy and CT are shown. (*a, b*) Coronal T1-weighted MR images show multiple bone metastases (*arrows in a*) and abnormal lymph nodes (*arrowheads in b*).
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The following are highlights from the current issues of RSNA's two peer-reviewed journals.

Whole-Body MRI: Musculoskeletal Applications

Whole-body MRI has been evaluated in many oncologic and rheumatologic indications and is emerging as a powerful tool for early diagnosis, quantification of extent, therapeutic decision and treatment monitoring.

In the May issue of *Radiology (RSNA.org/Radiology)*, Frédéric E. Lecouvet, M.D., Ph.D., of the Centre du Cancer and Institut de Recherche Expérimentale et Clinique, in Brussels, Belgium, provides an overview of technical aspects of whole-body MRI and practical recommendations for the interpretation of whole-body MRI studies. The author reviews currently established and potential indications for whole-body MRI in oncology and rheumatology and discusses the diagnostic performance, advantages and drawbacks of the technique, as well as its potential roles in comparison to other imaging modalities.

Whole-body MRI, including anatomic and diffusion weighted sequences, offers an intrinsically "hybrid" approach of metastases and hematologic cancers as it provides morphologic and functional information in a unique examination, and enables objective measurements of response, representing a promising imaging biomarker.

"Whole-body MRI remains a focus of ongoing research and continuous advances, generating wide enthusiasm in multiple teams around the globe, leading to improvements in the technique and highlighting new indications," the author writes.

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

Whole-Body Clinical Applications of Digital Tomosynthesis

With the development of flat-panel detector mammography, radiography and fluoroscopy systems, digital tomosynthesis (DT) recently has been introduced as an advanced clinical application that removes overlying structures, enhances local tissue separation, and provides depth information about structures of interest by providing high-quality tomographic images.

In an article published in the May-June issue of *RadioGraphics* (*RSNA.org/RadioGraphics*), Haruhiko Machida, M.D., Ph.D., of the Tokyo Women's Medical University, and colleagues review DT imaging techniques, describe whole-body clinical applications of DT, and discuss clinical utilities and limitations of DT.

With recent technological advances, DT easily, swiftly and flexibly provides tomographic images of high quality and clinically acceptable low radiation dose in any region of the body with arbitrary patient posture. In the clinical setting, the use of DT is increasing and it is beginning to be recognized as an essential diagnostic tool.

"Understanding the appropriate acquisition techniques in DT based on the examination purpose and the clinical utilities, and limitations of DT is useful to maximize the efficiency and appropriate utilization of this imaging modality, which leads to reduction of radiation exposure and improvement of diagnostic quality, patient care, workflow, and cost-effectiveness," the authors write.

This article is accompanied by an Invited Commentary by Andrew D. A., Maidment, Ph.D., an associate professor of radiology at the University of Pennsylvania.

Post-traumatic follow-up of scaphoid fracture. Digital tomosynthesis radiograph clearly shows delayed union or nonunion of the fracture (*arrow*), even in this fine and complex osseous structure. On the conventional radiograph, the fracture appeared partly or completely healed.
(RadioGraphics 2016;36; InPress) ©RSNA 2016. All rights reserved. Printed with permission.

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


Radiology EXTRA PODCASTS

Listen to *Radiology* Editor Herbert Y. Kressel, M.D., deputy editors and authors discuss the following articles in the March issue of *Radiology* at *RSNA.org/Radiology-Podcasts.*

- "Fast Characterization of Suspicious Lesions Detected at Breast Cancer X-Ray Screening," Sebastian Bickelhaupt, M.D., and colleagues.
- "Delayed Growth in Incidental Pancreatic Cysts," Olga R. Brook, M.D., and colleagues.
- "Hyperpolarized Metabolic MR Imaging of Myocardial Changes after Ischemia-Reperfusion," Sebastian Kozerke, Ph.D., and colleagues.

Nominate *Radiology* Articles for the 2015 Margulis Award

The Nominating Committee for the Margulis Award for Scientific Excellence is accepting nominations from readers for *Radiology* articles published between July 2015 and June 2016. The main selection criteria are scientific quality and originality. Please send your nomination, including the article citation and a brief note highlighting the reasons for the nomination, to Pamela Lepkowski, assistant to the editor, *plepkowski@rsna.org*. The deadline for nominations is June 10, 2016.

At RSNA 2015, then-RSNA President Ronald L. Arenson, M.D., (*left*), presented Jeffrey W. Prescott, M.D., with the RSNA Alexander Margulis Award for his research.

Access Online Tutorials for RSNA Journals

Go to *RSNA.org/Journals* to watch a number of related RSNA tutorials, including:

- **SA-CME Test Help:** Learn how to Find and Complete the SA-CME Tests for *Radiology* and *RadioGraphics.*
- ***Radiology/RadioGraphics* Features:** Learn how to navigate the homepage for *Radiology* and *RadioGraphics*, while discovering its useful features.
- **Managing your Account:** Learn how to access your account to add favorite articles, manage your alert and search settings, update your personal information and more.
- **RSNA Image Viewer:** Learn how to compare, magnify and archive images with RSNA's image viewer tool for both *Radiology* and *RadioGraphics.*

Radiology
RadioGraphics

RadioGraphics Offers ABR Core Exam Study Guide

Access the *RadioGraphics* American Board of Radiology (ABR) Diagnostic Radiology Core Exam Study Guide Article Index for help in preparing for the ABR Diagnostic Radiology Core Exams at *RSNA.org/RadioGraphics*. In 2016, ABR exams are scheduled in June, October and November. For more information on the ABR exam, go to *theabr.org*.

Education and Funding Opportunities

Free to Members: Online Educational Courses from RSNA 2015

RSNA is releasing a host of new online educational courses captured at RSNA 2015, covering a wide variety of subspecialty topics and areas of interest.

Click the "Browse New" button to immediately view the newest content in RSNA's learning library. Users can also browse and sort by content area, activity type, keyword and author.

The online courses include the session presenter's talk, presentation slides and embedded videos. The recordings are enhanced with a word-by-word transcript and bookmarking feature. A built-in search feature allows users to find salient terms and topics. Earn CME credit by completing the multiple-choice test at the end of each course with a score of 80 percent or better. Users may retry any test not passed during a first attempt. Feedback is provided after each user response, facilitating an engaging and responsive learning experience.

Check *RSNA.org/Library* for updated online educational courses throughout the year.

NEW FOR 2016:

Final call for Applications: RSNA/ASNR Comparative Effectiveness Research Training (CERT) Program

Applications accepted on a space-available basis

Applications are now being accepted for this interactive training program, jointly sponsored by the RSNA and the American Society of Neuroradiology (ASNR). The goal of the CERT program is to provide an introduction to the methodology and tools for performing CER. Led by a faculty of well-established leaders in the field, the CERT will cover technology assessment, risk benefit analysis, cost-effectiveness evaluation, decision analysis, meta-analysis and systematic review delivered in a combination of online modules; a 1½ -day, in-person workshop (Oct.13 to 14); Web-based didactic lectures and small-group, Web-based grant proposal review discussions over the course of a year, beginning in July 2016.

Accepted participants are responsible for all travel expenses and hotel accommodations. There are no fees associated with this workshop/course. For more information, visit *RSNA.org/eLearn.*

RSNA Clinical Trials Methodology Workshop

Jan. 7–13, 2017
Marriott Resort
Coronada, CA
Deadline for Application
June 15

Over the course of this 6½-day workshop, participants will learn how to develop protocols for the clinical evaluation of imaging modalities. Each trainee will be expected to develop a protocol for a clinical study, ready to include in an application for external funding. A dynamic and experienced faculty will cover topics including:

- Principles of clinical study design
- Statistical methods for imaging studies
- Design and conduct of multi-institutional studies
- Sponsorship and economics of imaging trials
- Regulatory processes

Applicants will undergo a competitive selection process for course entrance. Familiarity with basic concepts and techniques of statistics and study design is required of all applicants. Once admitted, trainees participate in group and individual learning, including preparative readings, didactic sessions, one-on-one mentoring, small group discussions, self-study and individual protocol development.

Accepted participants are responsible for all travel expenses and hotel accommodations. There are no fees associated with this workshop/course. Online applications and additional information can be found at *RSNA.org/CTMW*.

Questions about these programs can be directed to *dor@RSNA.org* or Rachel Nelson at 1-630-368-3742.

For Your Calendar

JUNE 2–4
RSNA Spotlight Course: Radiología de Urgencias: Curso Interactivo Con Casos
Grand Fiesta Americana Coral Beach
Cancún Resort & Spa
Cancún, Mexico
• *RSNA.org/Spotlight*

JULY 31–AUG. 3
Association for Medical Imaging Management (AHRA)
Nashville
Visit the RSNA Booth
• *AHRAonline.org*

FIND MORE EVENTS AT *RSNA.org/Calendar.aspx*.

RSNA Advanced Course in Grant Writing

Deadline for Application
July 1

Applications are now being accepted for this course designed to assist participants—generally junior faculty members in radiology, radiation oncology or nuclear medicine programs—prepare and submit a National Institutes of Health, National Sciences Foundation, or equivalent, grant application. The course, held at RSNA Headquarters in Oak Brook, Ill., will consist of four 1.5-day sessions:

- Session I: Sept. 23-24, 2016
- Session II: Oct. 28-29, 2016
- Session III: Jan. 27-28, 2017
- Session IV: April 7-8, 2017

Accepted participants are responsible for travel expenses for each session. Hotel accommodations will be provided by RSNA. There are no fees associated with this workshop/course. For more information and an application, go to *RSNA.org/AGW*.

NEW FOR 2016:

Introduction to Academic Radiology for Scientists (ITARSc)

Deadline for Application
July 1

RSNA is expanding its Introduction to Academic Radiology (ITAR) program to include postdoctoral fellows in the imaging sciences and biomedical engineering. Postdoctoral fellows in these specialties who received their degrees within the past six years are invited to apply for this opportunity to participate in a dynamic program held during RSNA 2016.

Program Objectives:

- Introduce participants to the scope of research in the radiologic sciences
- Highlight the important role of postdoctoral degrees in the radiologic sciences
- Identify keys to success for postdoctoral scientists in imaging research
- Introduce participants to successful radiology researchers who may serve as future mentors

The program includes a combination of dedicated programming for ITAR for Scientists (ITARSc) participants and shared sessions with participants of the ITAR program. There are no fees associated with this workshop/course. For more information and an application, go to *RSNA.org/AGW*. Selected participants will receive a $1,000 stipend to offset travel and hotel costs as well as free registration for the RSNA Annual Meeting.

Application forms are available at *RSNA.org/ITARSc*.

RSNA/AUR/ARRS Introduction to Academic Radiology Program

Nominations/Application
Deadline: **July 15**

Sponsored by RSNA, the American Roentgen Ray Society (ARRS) and Association of University Radiologist (AUR), the Introduction to Academic Radiology program:

- Exposes second-year residents to academic radiology
- Demonstrates the importance of research in diagnostic radiology
- Illustrates the excitement of research careers
- Introduces residents to successful clinical radiology researchers

Successful applicants will be assigned to either a seminar held during the RSNA annual meeting in Chicago, Nov. 27 to Dec. 1, 2016, or the ARRS annual meeting in New Orleans, Louisiana, April 30 to May 5, 2017.

A $1,000 award will be made to the departments of accepted applicants to be used to help advance the applicant's academic career. There are no fees associated with this workshop/course.

For more information and to download an application/nomination form, go to *RSNA.org/ITAR*.

Annual Meeting Watch

News about RSNA 2016

Advance Registration and Housing Open

For more information about registering for RSNA 2016, visit *RSNA.org/Register,* e-mail *reginfo@RSNA.org,* or call 1-800-381-6660 or 1-630-571-2670 x7862.

International Visitors — Act Now For Visa

If you must apply for a temporary non-immigrant visa to attend the annual meeting, you are advised to apply as soon as travel to the U.S. is decided and no later than three to four months in advance of the travel date. RSNA offers a personalized official letter of invitation for RSNA 2016 attendees. Information is available at *RSNA.org/International_Visas.*

RSNA® 2016

Important Dates for RSNA 2016

April 27	RSNA and AAPM Member Registration and Housing Open at 10:30 a.m. Central Time (CT)
June 1	Non-Member Registration and Housing Open at 10:30 a.m. CT
Nov. 4	Final Discounted Registration Fee and Housing Deadline at 5 p.m. CT
Nov. 5	Increased Registration Fee Applied, $150 for most categories
Nov. 27 – Dec 2	102nd Scientific Assembly & Annual Meeting

Registration Fees - On or Before November 4

ANNUAL + VIRTUAL MEETING PACKAGE *	ANNUAL MEETING ONLY	VIRTUAL MEETING ONLY	
$100	**Free**	**$100**	RSNA/AAPM Member
$25	**Free**	**$25**	RSNA Member-in-Training, RSNA Student Member
$300	**Free**	**$300**	Non-Member Student
$500	**$200**	**$300**	Non-Member Resident/Trainee
$500	**$200**	**$300**	Radiology Support Personnel
$1200	**$900**	**$300**	Non-Member Physician/Physicist
$1200	**$900**	**$300**	Hospital or Facility Executive and Industry Personnel
$625	**$325**	**$300**	One-day Technical Exhibits Only

*Register for the RSNA Annual + Virtual Meeting Package and get access to both the physical meeting at McCormick Place and the Virtual Meeting.

Value of Membership

RSNA Offers Affordable Membership

Receive Free Registration to World's Premier Radiology Meeting

An RSNA membership entitles members to free advance registration for 2016—a $900 value—as well as early hotel reservations and free self-assessment module (SAM) credits.

Register by Nov. 4 to receive a discounted registration fee and meeting badge mailed in advance. International members must register by Oct. 14 to receive these materials in advance.

After Nov. 4, registration will be processed at the increased fee and conference materials must be picked up at McCormick Place.

Know a colleague who would like to attend? Encourage them to join RSNA and attend the world's premier radiology meeting—for free. Apply or renew at *RSNA.org/Membership*. For more information, contact *membership@RSNA.org* or 1-877-RSNA-MEM (1-877-776-2636) or 1-630-571-7873 outside the U.S. and Canada.

RSNA.org

Updated RSNA Journal Apps Now Available

The mobile applications for* Radiology *and* RadioGraphics *have been updated to improve functionality.

New features include:

- Optimization for the iOS 9 mobile operating system
- New and improved graphical user interface
- New support for videos in articles

For more information about the apps, go to *RSNA.org/Journal-Apps*.

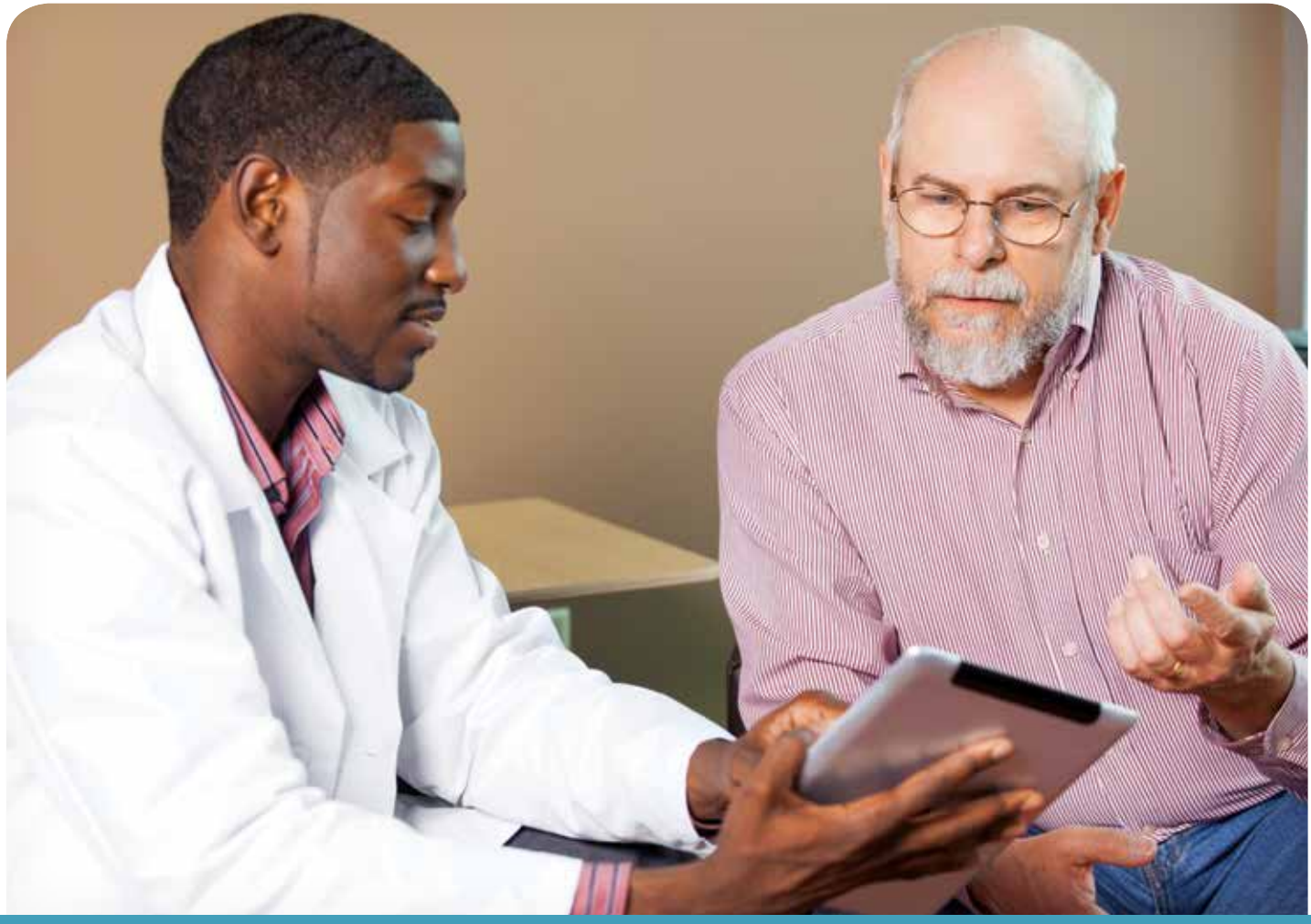
The *Radiology/RadioGraphics* mobile apps allow immediate access to full-text journal articles for RSNA members and subscribers with personal and institutional subscriptions. Non-subscribers can access all abstracts free of charge.

The journal applications include the ability to view current and past full-text articles with high-resolution images; watch and listen to related video and audio podcasts; bookmark articles for future viewing; search by author, title and article content; take SA-CME tests; and share content through social media tools.

The apps are compatible with iPhone, iPad and Android phones and tablets.

COMING NEXT MONTH

Next month, *RSNA News* explores burnout in radiology: the causes, impact and solutions recommended by experts in the field.



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- Screening & Wellness section
- Mobile-friendly design
- Patient safety information
- Available in English & Spanish

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ACR® American College of Radiology