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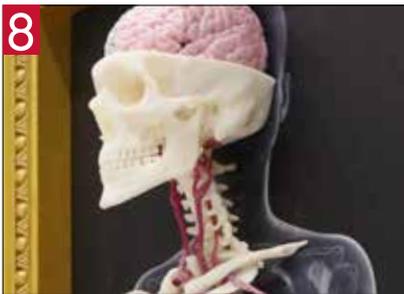
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FEATURES



5 LOOK AHEAD: IR: Changing How We Educate and Innovate



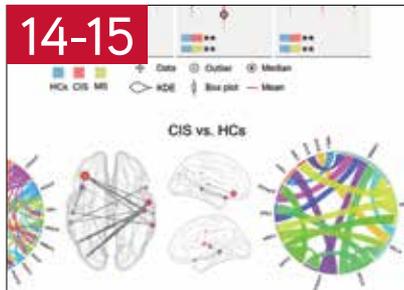
8 Defining Radiology's Role in the 3-D Printing Revolution



12 RSNA's IVP Program Evolves Over Three Decades



11 Radioisotope Shortage Possible for Nuclear Imaging



14-15 Research Breaks Ground in MS, Schizophrenia

UP FRONT

- 2** First Impression
- 3** Technology Forum
- 4** Patient Focus
- 4** Numbers in the News

RADIOLOGY'S FUTURE

- 16** R&E Foundation Donors

NEWS YOU CAN USE

- 18** Education and Funding
- 20** Journal Highlights
- 21** Value of Membership
- 22** Radiology in Public Focus
- 24** Annual Meeting Watch
- 25** *RSNA.org*

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ABR Names Wagner as President-Elect

Brent J. Wagner, MD, was recently named president-elect of the American Board of Radiology (ABR).

Dr. Wagner, a diagnostic radiologist with a subspecialty in body imaging, has been a member of West Reading Radiology Associates, a private practice in West Reading, PA, since 1998 and is currently its president. He is a former medical staff president of the Reading Health System.

He has served on the ABR board since 2011 and is currently a member of ABR's board of governors.

Dr. Wagner serves on the RSNA Professionalism Committee and is chair of Genitourinary Imaging for the *RadioGraphics* Editorial Board. He is also a member of the RSNA Research & Education Foundation Individual Giving Subcommittee.



Wagner

SIR Honors Gade with Becker Young Investigator Award

Terence P. Gade, MD, PhD, received the Society of Interventional Radiology (SIR) Foundation's Dr. Gary J. Becker Young Investigator Award during the recent SIR annual meeting in Washington, DC. The award recognizes promising young practitioners to encourage the pursuit of academic careers.

An assistant professor of radiology at the University of Pennsylvania Medical Center in Philadelphia, Dr. Gade is co-founder and co-director of the Penn Image-Guided Interventions Laboratory.

Dr. Gade received the 2012 Cook Medical Cesare Gianturco/RSNA Research Resident Grant and a 2014 Roentgen Resident/Fellow Research Award from the RSNA Research & Education Foundation. Dr. Gade is the first radiologist to receive the National Institutes of Health (NIH) Director's Early Independence Award for exceptional early career scientists, which allows recipients to move rapidly into independent research roles at U.S. institutions by essentially omitting the traditional post-doctoral training period.



Gade



In Memoriam



Adele Swenson

Former RSNA Executive Director Adele Swenson Dies

Former RSNA executive director Adele Swenson died Mar. 19, in Hillsboro, ND, at age 95.

Ms. Swenson served as RSNA executive director from 1971 to 1985, and shepherded the Society through major changes. She was instrumental in relocating the annual meeting from The Palmer House Hilton to its current location, McCormick Place in Chicago. She led the RSNA Board of Directors in establishing the Research & Education (R&E) Fund, later renamed the R&E Foundation, and under her leadership RSNA launched a second journal, *RadioGraphics*. During her 14 years of service, Ms. Swenson helped develop RSNA into the global society it is today.

"RSNA was blessed to have Ms. Swenson as executive director during a critical period of its history," Robert E. Campbell, MD, RSNA past president, said. "Adele approached her many innovative ideas with enthusiasm and skill, always concentrating on an unrelenting attention to details until success was accomplished, and she gracefully demanded a similar approach by her staff."

Born in Kindred, ND, Ms. Swenson attended Jamestown College in North Dakota on a full academic scholarship and earned a Bachelor of Arts degree in economics. Upon graduation she went to Washington, D.C., to work for the U.S. government, and eventually took a position with the Navy human resources department, where she worked with First Lady Eleanor Roosevelt on job training programs for veterans and women.

After working for a printing company in St. Paul, MN, Ms. Swenson took an administrative position with the Girl Scouts of the United States of America, later becoming executive director of the River Trails Girl Scout Council in Rochester, MN. It was her work there that drew the attention of RSNA Board members when they were searching for a new executive director in 1971.

A dedicated volunteer, Ms. Swenson worked with low-income children and seniors, and she managed her church's newsletter. She was recognized many times for her leadership and service, receiving the RSNA Gold Medal in 1984 and the American Association for Women Radiologists' Marie Sklodowska-Curie Award in 1989. In tribute to her service to the Society, RSNA awarded the Adele Swenson Research Resident Grant in 2010. Most recently she received the Harold Schafer Leadership Award in 2016 from the University of Mary in North Dakota, where she served on the board of regents.

"Adele's legacy is reflected in the RSNA executive directors who have followed her," Dr. Campbell said. "She accomplished all this with wisdom and modesty, never accepting credit for herself, but always directing credit to the Board of Directors, the many RSNA volunteers and her staff."

AUR Announces 2017 Honorees



Bradley

William G. Bradley, Jr., MD, PhD, and **Jocelyn D. Chertoff, MD, MS**, will receive gold medals from the Association of University Radiologists (AUR) during its annual meeting this month in Hollywood, FL.

Other award recipients from AUR's affiliated societies include former RSNA president **Ronald L. Arenson, MD**, who will receive the Society of Chairs of Academic Radiology Departments (SCARD) Visionary Leadership Award.

Dr. Bradley, distinguished professor emeritus at the University of California, San Diego, received an RSNA Gold Medal in 2003. He served on the RSNA Research & Education (R&E) Foundation Board of Trustees and is a co-chair of the R&E Foundation Inspire-Innovate-Invest Campaign. He also serves as a Refresher Course Committee track chair.

Dr. Chertoff, chair of radiology and professor of radiology, and professor of obstetrics and gynecology at the Geisel School of Medicine at Dartmouth University in Lebanon, NH, has served on the RSNA Outstanding Researcher/Educator Award Review Panel and as a faculty member at multiple RSNA annual meetings.

Dr. Arenson is the Alexander R. Margulis Distinguished Professor and chair of the Department of Radiology and Biomedical Imaging at the University of California, San Francisco. Dr. Arenson's lengthy service to RSNA includes serving as a member of the RSNA Board of Directors, and as RSNA president in 2015. He is a current member of the RSNA R&E Foundation Board of Trustees.



Chertoff



Arenson

Technology Forum

RSNA Radiology Reporting Standards Webinar



Kahn

RSNA Reporting Subcommittee Discusses Standards for Diagnostic Reporting in Radiology

An RSNA Structured Reporting Subcommittee (SRS) webinar in March stressed radiology reporting as a key component in how radiologists can demonstrate value-based care through data-rich, comprehensive and consistent structured reports.

The webinar served to bring together vendors with radiologists to promote the use of recently developed standards for structured reporting. It also assessed the plans of vendors to implement the standards in commercial reporting systems.

During the webinar, SRS chair Charles E. Kahn Jr., MD, MS, and vice chair Marta E. Heilbrun, MD, led an open discussion of reporting standards, the *RadReport.org* template library and the current state of structured reporting in

medical imaging. The discussion is part of ongoing efforts in outreach and collaboration to advance the use of standards for reporting and other aspects of clinical care and research in radiology.

RSNA has used the IHE® Management of Radiology Reporting Templates (MRRT) profile as the foundation for the *RadReport.org* template library. More than 250 templates are available for radiologists in the Select Template Library as well as almost 100 other member-submitted templates in the Open Template Library.

The MRRT templates represent examples of a wide variety of common radiology procedures. Radiologists can use the reports as the foundation for template-driven structured reporting in their practices. They provide flexible checklists of information to be recorded and generate consistent reports with computer-readable coded values for key concepts.

Patient Focus

RSNA's Radiology Cares Campaign

Among its charges, RSNA's Public Information Committee (PIC) develops tools and resources to assist in bringing the concept of patient-centered radiology to practice. Periodically, the PIC will contribute content to *RSNA News*' Patient Focus department to promote these concepts and resources to RSNA members.

Launched at RSNA 2012, the Society's Radiology Cares® campaign (RadiologyCares.org) is designed to help radiology professionals become more patient-centered in their practices and to optimize patient experience in radiology. Recognizing that patients are the primary focus of radiologic care, Radiology Cares provides resources, educational materials and other tools to help take patient-centered radiology from concept to practice. It also serves as a platform where radiology professionals can share success stories and exchange ideas about what it means to provide patient-centered radiologic care.

Patient-Centered Radiology Model

In this era of healthcare reform, radiologists need to be meaningfully engaged in their patients' experiences throughout the continuum of their imaging care, and align their practice with the patients' needs and best interests. Radiologists need to nurture effective communications both with patients and other healthcare providers. This encompasses ensuring timely scheduling and appointments, quality service from compassionate staff, safe and comfortable imaging



examinations and procedures, accurate and timely reporting of results, increased visibility of the radiologist, as well as availability of the radiologist for results interpretation and explanation, along with transparent billing (see the PCR model, above). In a future Patient Focus article, we will delve into the components of the model.

Patient-Centeredness is a Process

As we move forward, we must remember that being patient-centered is not an all-or-nothing goal. Pursuing any of the measures in the model is a step in the right direction. To that end, radiologists can

access numerous resources from RSNA's Radiology Cares campaign, including patient-directed posters for patient waiting and consultation rooms, staff-directed posters for staff break rooms, customizable patient takeaway letters and patient-directed handouts and rack cards. Radiology professionals can also access a collection of articles and PowerPoint presentations focusing on the different facets of patient-centered radiology.

Taking Notice of Quality of Care

In this period of transition from volume to value, we need to continue doing what we have always been doing, but we also need to increase our visibility and demonstrate to patients that our practices are aligned with their best interests. We will succeed because, as illustrated by the RSNA Caring Quilt (RSNA.org/The-Caring-Quilt), many patients already realize that radiologists and their staff make a difference in their care, and they are grateful for it. We are privileged that patients entrust us with their imaging care

*Jennifer Kemp, MD, PIC member
Max Wintermark, MD, PIC Chair
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for Publications and Communications.*

Numbers in the News

3

The number of roles 3-D printing — which is revolutionizing radiology — plays in the clinic. Read the first in a series of articles on 3-D Printing on [Page 8](#).

45

Number of host countries visited by RSNA's International Visiting Professors Program since the first trip 30 years ago. Read more about the past three decades on [Page 12](#).

49

The percentage drop in the demand for the medical isotope Tc-99m among Medicare Part B recipients between 2006 and 2014. The reduction could offset the expected shortage in the isotope used in nuclear imaging scans. Read more on [Page 11](#).

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LOOK AHEAD

Interventional Radiology: Changing How We Educate and Innovate

BY JOHN A. KAUFMAN, MD

Interventional Radiology (IR) is in the midst of many exciting but fundamental changes. Among these are new training pathways and new approaches to innovation. In some respects, this may be one of the most important periods in IR since the initial foundational decades of the 1970s and 1980s. What happens in the next few years will set the course for IR for the future.

Education in IR is the most obvious and immediate major ongoing change. For over 20 years, IR education has been moving to increase emphasis on non-procedural patient care, and to increase the duration of training. In 2012, the American Board of Medical Specialties (ABMS) approved the creation of dedicated residencies in IR that would lead to a single certificate from the American Board of Radiology (ABR), the interventional radiology and diagnostic radiology (IR/DR) certificate. In essence, all of the member boards of the ABMS recognized the uniqueness of IR as a combination of imaging competency, procedural competency, and non-procedural patient care. The member boards also recognized the need for dedicated training to achieve these competencies, and that IR was a specialty of the ABR along with DR, radiation oncology, and medical physics.

Changing Education to Embrace IR

In 2015, the Accrediting Council of Graduate Medical Education (ACGME) approved the program requirements for residencies that will lead to certification in IR/DR, with a target date of full implementation (i.e., sunset of vascular and interventional radiology (VIR) fellowships) by 2020. The essential features of these residencies are that they will reside within departments of radiology, with two basic entry points and multiple opportunities for cross-over into straight DR residencies (and vice-versa).

One new entry point is the integrated residency, which includes three years of DR and two years of IR, for a total of



JOHN A. KAUFMAN, MD

Dr. Kaufman is director and professor of interventional radiology and holds the Frederick S. Keller Endowed Chair of Interventional Radiology at the Dotter Interventional Institute, Oregon Health & Sciences University, Portland. An active clinician, researcher and educator, Dr. Kaufman has numerous publications and multiple grants. Dr. Kaufman is a past president of the Society of Interventional Radiology. He is a contributor to *Radiology*.

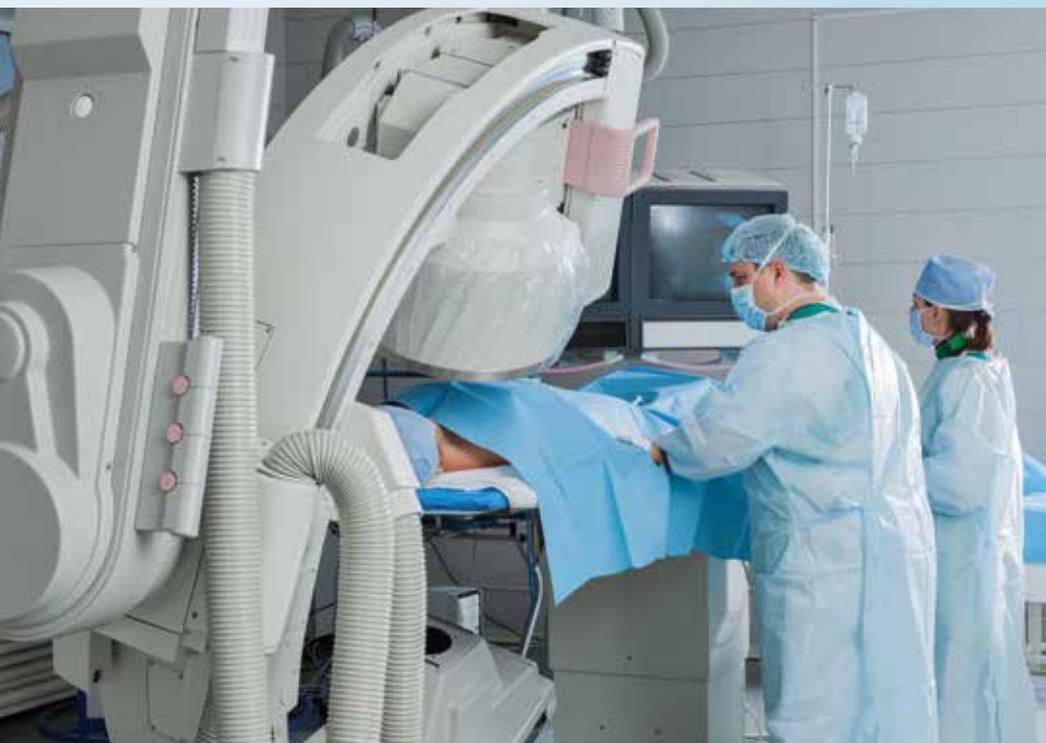
five years of training after internship. During the DR years, the residents seeking IR/DR certification and those seeking DR certification are in essentially the same program, taking the same required rotations, and taking the same ABR Core Examination. Starting in the R4 year the training begins to diverge, with the R5 year focused solely on IR or IR-related rotations. A key element of the R4 and R5 years will be training in outpatient and inpatient non-procedural patient-care skills. Residents seeking an IR/DR certificate will be interacting with patients more than their DR counterparts outside of the procedural suite, including clinic visits, inpatient rounds, arranging and providing consultations, and determining care plans. However, the common stem of training in DR permits great flexibility so that residents can change programs (internally only) should their interests change, and ensures that residents seeking the IR/DR certificate have DR competency.

This year, approximately two-thirds of existing VIR fellowships had ICGME-approved integrated residencies with positions in the National Resident Matching Program. Medical students competed for the roughly 120 integrated residency positions with more than four applicants for each spot. Interest in IR at the medical student level appears strong.

The second major entry point will be the independent residency. These programs are becoming approved now, but will not begin training residents until July of 2020. The independent residency will be open to residents who have successfully completed DR residency and are seeking additional training in IR. DR residents who complete an approved early specialization in IR (ESIR) curriculum during DR residency will need only complete one year of independent IR residency, while others will complete two years. The independent residencies will allow individuals who decide to enter IR after starting

“IR is undergoing a transformation to a more robust specialty. Changes in education will produce individuals with expertise in imaging, image-guided procedures and patient care.”

JOHN A. KAUFMAN, MD



Innovative approaches in interventional radiology have changed the care of entire categories of disease and patients and become a routine part of clinical care.



or completing DR training a pathway into the specialty. Equally important, the independent residency provides an excellent option for the resident who decides to train in a DR program that does not host an IR residency.

Final certification in IR/DR will require both a computerized and an oral examination, a distinguishing feature from final certification in DR. Successful candidates will be issued one certificate that includes competency in both interventional and diagnostic radiology. The ABR considers the IR/DR certificate as satisfying the DR certification requirements for all DR subspecialty certificates (such as pediatric radiology and neuroradiology).

New Approach Needed for Continued Innovation

Another fundamental change in IR is how innovation in the specialty is occurring. Creativity, improvisation and innovation have long been hallmarks of IR. Innovation in IR was first directed by a lack of basic equipment for invasive diagnostic and interventional procedures, and later by difficult clinical challenges. In most cases, devices and procedures were conceived as replacements for more morbid open surgical procedures. For example, balloon angioplasty as an alternative to surgical bypass, or tumor ablation as an alternative to surgical resection. In almost every instance, IR focused on treating existing or established pathology by providing a structural solution to the problem — opening something that was closed, destroying tissue that was harmful. The result of this approach to innovation has been a diverse portfolio of procedures that have changed the care of entire categories of disease and patients and become a routine part of clinical care.

This approach to innovation, however, is not sustainable. Devices that have additional capabilities, such as drug-eluting stents that both support the vessel wall and administer a therapeutic agent, are becoming more

common. The selection of materials that can be employed for devices is expanding beyond the historically limited choices to a broad range of sophisticated materials that includes biologics, flexible printable sensors and new absorbables. In the future, smart devices that not only alter a structure but also sense physiologic parameters, administer controlled therapies in response to certain triggers, and access remote data collection will allow us to treat established disease more effectively, and perhaps prevent the development of pathology. Drug-eluting stents should only deliver a drug when needed, but allow us to monitor flow without imaging.

Conception, prototyping, testing, validation and commercialization of these complex new devices and procedures will require a robust multidisciplinary collaborative approach. No individual can master all of the knowledge and skills needed to bring these new devices forward. Careful, thoughtful and purposeful identification of needs — focusing on earlier stages of disease than we currently treat — will be essential. Consideration of all aspects of a device or procedure has to happen at the outset, rather than late or at the end of the innovation process. In order to determine who will use a device and how it will be used, made, imaged, valued and followed, a multi-talented, multi-disciplinary team will be needed. The possibilities are staggering and the implications for IR are enormous in terms of the role of image-guided procedures in clinical care, but how we innovate has to change.

IR is undergoing a transformation to a more robust specialty. Changes in education will produce individuals with expertise in imaging, image-guided procedures and patient care. A new approach to innovation may allow a shift from interventions that replace other procedures to those that fundamentally alter the course of a disease. The future is never certain, but for IR it will certainly be exciting. 

Defining Radiology's Role in the 3-D Printing Explosion

BY RICHARD DARGAN

On March 4, 2017, radiologists, scientists and vendors gathered in Scottsdale, AZ, for the second meeting of the RSNA Special Interest Group (SIG) dedicated to 3-D printing and its implications for radiology.

“3-D printing is a direct extension of radiographic imaging and should be housed within the structure of radiology instead of having printers popping up everywhere like mushrooms.”

JONATHAN M. MORRIS, MD

RSNA 3-D Printing Special Interest Group

Learn more about the RSNA 3-D Printing Special Interest Group (SIG) at RSNA.org/3D-Printing-SIG; read about the SIG on Page 25.

As the SIG members discussed, debated and voted on important issues, one overarching theme emerged: radiology must play a leadership role in this diverse and growing field.

“3-D printing is a direct extension of medical imaging and should be housed within the structure of radiology instead of having printers popping up everywhere like mushrooms,” said SIG chair Jonathan M. Morris, MD, an assistant professor of radiology at the Mayo Clinic in Rochester, MN. “We need a centralized program in a hospital run by radiologists, because nobody knows images better than we do.”

The SIG meeting came amid a period of rapid expansion for 3-D printing in medicine. Applications in surgical preparation, patient-specific simulations and education are growing fast, and bioprinting is not reserved for science fiction, said Frank J. Rybicki, MD, PhD, a pioneer in 3-D printing and a SIG member who organized the meeting.

“We’re in the beginning of an exponential curve in growth in 3-D printing,” said Dr. Rybicki, professor and chair of the Department of Radiology, University of Ottawa, Canada. “Things are dramatically ramping up, and when 3-D printed models are reimbursed, the field will explode.”

The Birth of 3-D Printing

3-D printing is an adopted term for the design and generation of physical medical models that traces its roots to the 1980s, when U.S. inventor Chuck Hull patented a stereolithography apparatus.

Other pioneers like husband and wife team S. Scott and Lisa Crump and Andy Christensen advanced the field through

the 1990s. But penetration of 3-D printing into the clinic was slowed by a lack of computing and imaging power, according to Dr. Morris.

Over the past decade, in conjunction with improvements in computing and imaging power, radiologists began working closely with surgeons to tap into the technology’s potential. In 2008, Dr. Morris was part of a team at the Mayo Clinic that successfully performed an exceedingly complex surgical separation of conjoined twins. Pre-surgical 3-D models played a central role in helping surgeons prepare for the separation of vital organs.

“The 3-D model became the focal point of discussion for the surgeons when they got to planning the separation of the liver,” Dr. Morris recalled. “The surgeons liked that the model was the actual size and that it helped them understand the spatial relationships.”

A few years later, Dr. Rybicki and his team at Brigham and Women’s Hospital used 3-D printing in another groundbreaking surgery: the first full face transplant in the U.S. Once again, 3-D models were essential to the planning of a challenging and ultimately successful surgery.

“I immediately realized that 3-D printing was going to be a game changer for radiology, and medicine as a whole. RSNA realized it too,” Dr. Rybicki said.

Indeed, the RSNA annual meeting quickly became a barometer of the growing interest in the field. William Weadock, MD, a professor of radiology at the University of Michigan, started and managed a rapid expansion in didactic hands-on training courses at the meeting. This culminated at RSNA 2016 when

Editor’s Note: This is the first in a three-part series RSNA News is covering on the explosion in 3-D printing in radiology. The next two articles will cover 3-D printing/anatomic modeling of complex pathology and 3-D printing in virtual surgical planning.

several hundred square feet of prime real estate at McCormick Place's Lakeside Center were given over to an extensive display of 3-D printed models and printers.

"The displays were like something from the Smithsonian Institution," Dr. Weadock recalled. "The response was overwhelming; we had to expand the space on the first day because there were so many visitors."

3-D Printing Plays Three Critical Roles

While visual and tactile impact of 3-D printed models have captivated the media and the general public, in the clinic 3-D printing plays three major roles: surgical planning, patient-specific simulations and education, Dr. Morris said.

Surgical planning is enhanced by models that allow surgeons to understand a patient's anatomy before operating. For instance, models can show how a tumor might be encasing critical nerves that allow an arm or leg to function, and 3-D printed cutting guides help take the guesswork out of a procedure. For patient-specific simulations, physicians can have two custom stents made based on a patient's vascular anatomy and use one for a simulation. The additional planning can help reduce the significant expenses of operating room time.

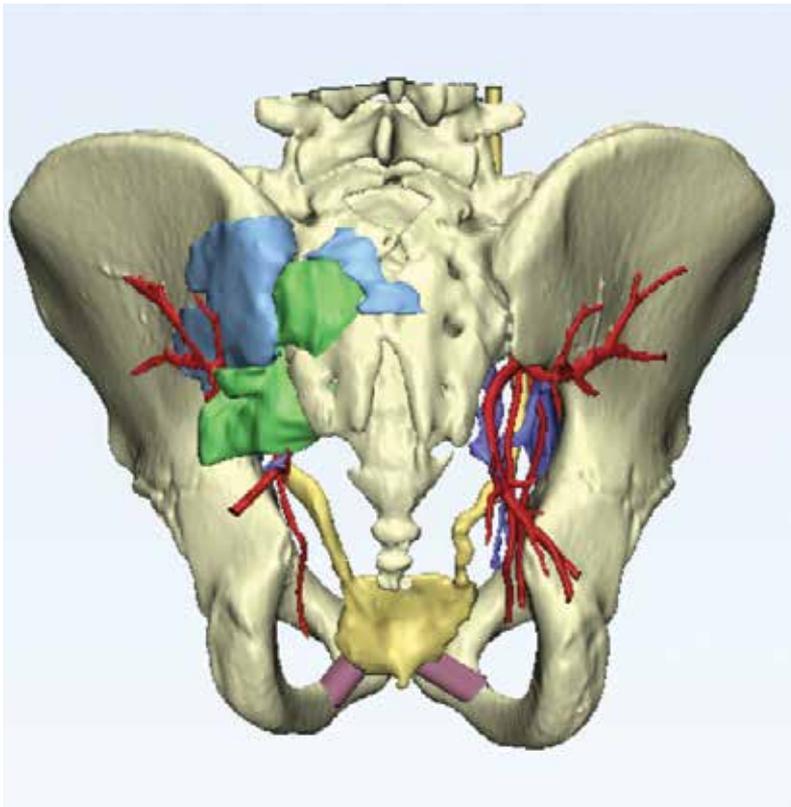
"With 3-D printing, you take things that are unknowns before you go into the operating room and make them known," Dr. Morris said. "You decrease time in the operating room, decrease morbidity for the patient and realize huge cost savings and better patient outcomes."

Education has also been significantly improved. Three-dimensional models help everyone on the team, from the scrub techs to medical trainees and all potential learners and can even show pathologists where a tissue sample originated. From the perspective of patient consent, 3-D printing has dramatically helped

Continued on Next Page

Right: One of the elaborate 3-D printed models displayed at RSNA 2016, courtesy of the Mayo Clinic in Rochester, MN.





Standard Tessellation Language (STL) file and 3-D printed pelvic chondrosarcoma model with vasculature and urinary structures. Images courtesy of the Mayo Clinic.



Jonathan M. Morris, MD, pictured above with Jane Matsumoto, MD, co-director of the 3-D printing lab at the Mayo Clinic, serves as chair of the RSNA 3-D Printing Special Interest Group.

Continued from Previous Page

patients to understand their diagnoses and potential interventions.

“The number of people one model can touch is truly remarkable,” Dr. Morris said. “This technology has really improved medical care at the Mayo Clinic.”

Once focused on non-medical domains, 3-D printing is now becoming integrated into medical care, and newer materials that form the models are being developed to better emulate human tissues, said Dr. Rybicki. Implantable, patient-specific printed tissue will soon start to appear, and bioprinting — the printing of models with human cells — is on the horizon.

All of these possibilities start with imaging, and that is what brought dozens of radiologists together in March. Radiology leaders want to ensure that best practice is incorporated to protect patients during what Dr. Rybicki expects will be “a dramatic increase in 3-D printing operations.”

In that spirit, the attendees approved the declaration to support the use of U.S. Food and Drug Administration-approved software to generate 3-D models.

“This technology fits in exactly with what we do,” Dr. Weadock said. “We are a service organization, we deal with all different parts of a hospital and we’re built for the quality control of images.” ❏



Rybicki



Weadock

Report Warns of Radioisotope Shortage for Nuclear Imaging Procedures

BY MIKE BASSETT

A new report warns of a worsening shortage of key medical isotopes used in nuclear imaging scans following the shutdown of an aging Canadian nuclear reactor in late 2016. If the shortage is realized, doctors could be forced to delay procedures that rely on these isotopes.



The recent shutdown of Canada's National Research Universal reactor in Chalk River, Ontario, above, could create a shortage of medical isotopes used in nuclear imaging scans.

Issued in January 2017 by the National Academies of Sciences, Engineering, and Medicine, the report warns of a shortage of Molybdenum-99 (Mo-99) and Technetium-99m (Tc-99m) following the October 2016 shutdown of Canada's National Research Universal reactor in Chalk River, Ontario, which produced a major share of the world's medical radioisotopes.

Chalk River stopped producing Mo-99, which is used to create the radioisotope Tc-99m that is commonly used in diagnostic imaging scans for cancer, heart disease and other illnesses. The reactor, built in 1957, was shut down primarily due to serious age-related breakdowns and safety and security concerns.

The U.S. government-commissioned report concluded that the Chalk River shutdown has created a "substantial likelihood of severe Molybdenum-99 and Technetium-99m shortages," at least until other global suppliers complete planned expansions later in 2017 and 2018, said committee leader, S. James Adelstein, PhD, Paul C. Cabot Distinguished Professor of Medical Biophysics at Harvard Medical School.

"Until these other suppliers get these new facilities online, there are enough historical and technical reasons to think it is highly probable something will happen to disrupt the supply," Dr. Adelstein said.

The report urges the U.S. government to work with the Canadian government to "ensure that there is an executable and

well-communicated plan in place to restart the supply of Molybdenum-99 from Canada."

According to the report, the three existing global Mo-99 suppliers, ANSTO in Australia, Mallinckrodt in the Netherlands, and NTP in South Africa, have announced plans to expand their supply capacities. If these plans are realized, by the end of 2017 supply capacities would increase enough to offset the lost supply capacity represented by Chalk River.

When the Chalk River reactor closed for repairs in 2009, causing a shortage of radioisotopes, the search began across the globe for an alternative. Canada is pursuing the use of cyclotrons to produce Tc-99m, while the U.S. government in 2009 began assisting efforts to develop domestic capabilities to supply Mo-99 without the use of highly enriched uranium targets.

Supply Likely to Last through 2017

Nevertheless, Sally Schwarz, MS, RPh, BCNP, president of the Society of Nuclear Medicine and Molecular Imaging, and professor of radiology at the Mallinckrodt Institute of Radiology at Washington University, is confident the specialty of nuclear medicine will be able to handle a disruption in the supply of Mo-99 through 2017.



Adelstein

She pointed out that an analysis from the Association of Imaging Producers & Equipment Suppliers — which represents many of the major pharmaceutical and imaging equipment companies in nuclear medicine in Europe — shows that there is enough reactor capacity to provide for the reliable international supply of Mo-99 through 2017.

"I think if there was any major problem there would be very limited reduced availability because of the existing supply," Schwarz said. "It's a different situation from 2009. Suppliers are opening new reactors and managing the process on a global level, so I'm very optimistic that it's under control."

However, Kathryn Morton, MD, a professor in the Department of Radiology at the University of Utah, who is board-certified in nuclear medicine and served on the committee that produced the January 2017 report, said that a decline in demand for nuclear medicine studies could complicate the issue.

On the committee, Dr. Morton studied the Tc-99m demand among Medicare Part B recipients between 2006 and 2014 and found that Tc-99m diagnostic radiopharmaceutical utilization declined by about 49 percent in that population.

The drop in demand could affect future decisions about expanding production or developing alternative sources of Tc-99m, she said. **R**

RSNA's International Visiting Professors Program Evolves Over Three Decades

BY PAUL LaTOUR

Anne C. Roberts, MD, admits that she is hooked on the RSNA International Visiting Professors (IVP) program, having traveled to three countries to date: Nigeria in 2008, Nepal in 2012 and Ghana in 2016.



The IVP team donned traditional garb during their 2016 trip to Mongolia: *Left to right: Musturay Karcaaltincaba, MD, RSNA past-president Theresa C. McLoud, MD, and Carlos Torres, MD.*



During the 2009 RSNA IVP trip to Beijing, China, Professor Raquel Del Carpio-O'Donovan (*center*) discussed a case with residents.

"The program is a great way to experience how medicine is practiced somewhere else in the world," said Dr. Roberts, chief of vascular and interventional radiology and professor of clinical radiology at the University of California San Diego School of Medicine. "Once you are there and are talking to the students and teaching them, it's an addictive sort of experience. And you're learning things for yourself as well."

Dr. Roberts is not the only radiologist who has made more than one trip on an RSNA IVP team since the Society sent the first visiting professor, Edmund A. Franken, Jr., MD, to Kenyatta National Hospital in Nairobi for six weeks in 1987. It is through the hard work of such dedicated volunteers that the IVP program has continued to flourish over the last three decades.

RSNA established the IVP program in 1986 with financial support from Agfa Healthcare and Fujifilm Medical Systems as a way to promote international education in radiology. Originally, the program offered one professor the opportunity to visit a single radiology teaching institution in a developing country for up to three months. But finding radiologists who were able to take leave for that length of time became more difficult as the program developed.

In 1999, RSNA revised the IVP program by expanding its scope and scaling the trips back to 10-14 days. Teams of two or three visiting professors now visit radiology teaching institutions and often lecture at radiology society meetings in developing or newly developed countries.

Beginning this month in Indonesia, the IVP program is sending teams to six nations in 2017, the most trips in a single year since 2002. Visiting professors will also travel to



Roberts



McLoud

Mexico, Sri Lanka, Malaysia, Latvia and Peru. Indonesia is the 45th host nation to participate in the program.

Host Nations Receive Training

In addition to education, the IVP visits often produce an array of tangential benefits for the host nations and societies.

One example is Dr. Roberts' recent trip to Ghana where she lectured at the Ghana Association of Radiologists (GAR) annual meeting. According to GAR President Edmund Brakohiapa, MD, the country had only one subspecialist and 40 general diagnostic radiologists prior to the IVP visit.

As a result of the IVP team visit, Dr. Brakohiapa said at least two GAR members will be traveling to Europe and Canada for subspecialty training.

"I believe the IVP training has helped stimulate the desire of our members for subspecialty training," said Dr. Brakohiapa, a lecturer in the Department of Radiology at the University of Ghana School of Medicine and Dentistry in Accra. "The depth of knowledge from such fellowship training was apparent in the quality of teaching given by the visiting professors."

A Mutually Beneficial Relationship

As it turns out, radiologists in host nations are not the only ones who learn during IVP

trips. Before Theresa C. McLoud, MD, left for the IVP trip to Mongolia in 2016, she said she needed a lot of information herself.

“I’m a traveler, but Mongolia was a major unknown. There were so many points of interest — the people, the terrain, the history and, of course, how radiology is practiced,” said Dr. McLoud, who served as RSNA president in 2008.

This thirst for knowledge played a major role in Dr. McLoud’s initial involvement with the IVP program. She also traveled to Argentina in 2009.

An educator at heart, Dr. McLoud, vice chair of education in the Department of Radiology at Massachusetts General Hospital (MGH), said a primary goal while serving as RSNA president was to focus on international relations and education and RSNA’s role in teaching across the globe. When her term on the RSNA Board of Directors ended, the IVP program allowed her to continue to take an active role in international education.

Dr. McLoud said it is rewarding to see the opportunities RSNA IVP teams can create for radiologists in host nations.

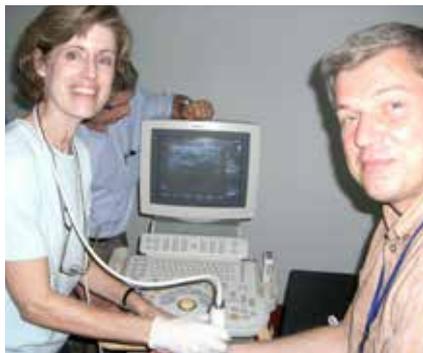
For example, the IVP team that traveled to the Philippines in 2016 had a considerable impact on the country’s radiologists, said Stephanie Jennifer H. Pe, MD, a former member of the Philippine College of Radiology Board of Directors, who helped organize the IVP trip.

“The local radiologists were very much inspired by the direct interaction with the visiting professors, who unselfishly shared and exchanged their expert knowledge and wisdom,” said Dr. Pe. “We hope the

professors also took home with them some nice memories that would reaffirm and encourage their continued efforts in advancing the field of radiology.”

And when the IVP team visited Mongolia, they met radiologist Undrakh Erdenebold, MD, MSc, head of the radiology department at Intermed Hospital, in Ulaanbaatar, Mongolia, who subsequently applied and secured a two-year-long neuroradiology fellowship at the University of Ottawa in Ontario, Canada, with neuroradiologist Carlos Torres, MD, FRCPC. When Dr. Erdenebold returns to Mongolia, he will be able to share the knowledge he gained during his training with the current and future generations of radiologists in his country. Dr. McLoud said that would not have happened if not for the connections created through the IVP trip.

“It is the philosophy of ‘teach the teachers’ and then they’ll teach the others,” Dr. McLoud said. 



The 2007 IVP trip to Uganda with team members Sharlene A. Teefey, MD, and Brian F. Mullan, MD.



During their 2016 IVP trip to Ghana, Dorothy I. Bulas, MD, and Anne C. Roberts, MD, (bottom row, center [l-r]) gave presentations and taught intensive seminars to radiology residents (above), and attended conferences and meetings.

2017 RSNA IVP Trips

The RSNA International Visiting Professors (IVP) program for 2017 kicks off with a first-time visit to Indonesia this month. Indonesia is the 45th nation visited by the IVP program since its inception in 1987.

This year’s host nations also include Latvia, Malaysia, Mexico, Peru and Sri Lanka. The six nations are the most visited in one year by the IVP program since 2002.

The Malaysian trip is jointly organized by RSNA and the Asian Oceanian Society of Radiology (AOSR), marking the first such collaboration in the IVP program’s history.

INDONESIA, MAY 1-10

Perhimpunan Dokter Spesialis Radiologi Indonesia (PDSRI) / Indonesian Society of Radiology
Maheen Rajput, MD, U.S.

Robert M. Steiner, MD, U.S.

Athanasios D. Gouliamos, MD, Greece

MEXICO, JULY 31-AUG. 11

Mexican Federation of Radiology and Imaging (FMRI)

H. Carisa Le-Petross, MD, U.S.

Frederico F. Souza, MD, U.S.

SRI LANKA, AUG. 22-SEPT. 3

Sri Lanka College of Radiologists

Andrea S. Doria, MD, Canada

Jeffrey C. Weinreb, MD, U.S.

MALAYSIA, SEPT. 27-OCT. 10

College of Radiology Academy of Medicine in Malaysia

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(RSNA Sponsored Speaker)

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Sang Il Choi, MD PhD, Korea

(AOSR Sponsored Speaker)

C. C. Tchoyoson Lim, MMed, Singapore

(AOSR Sponsored Speaker)

LATVIA, SEPT. 28-OCT. 8

Latvian Radiology Society

Erik K. Paulson, MD, U.S.

Uei Pua, MBBS, Singapore

Giulia A. Zamboni, MD, Italy

PERU, NOVEMBER (TBD)

Peruvian Society of Radiology

James J. Abrahams, MD, U.S.

For more information on the RSNA IVP program, go to RSNA.org/IVP.

fMRI Shows Neural Disruptions in Schizophrenic Patients with Auditory Hallucinations

BY EVONNE ACEVEDO

In patients with schizophrenia who experience auditory verbal hallucinations (AVH), functional MRI (fMRI) demonstrates symptom-specific disruptions in resting-state neural networks, according to a recent study in *Radiology*.

These results may further the understanding of pathophysiological correlates of AVHs in schizophrenia, said study author Hong Yin, MD, professor and director in the Department of Radiology at Xijing Hospital in China.

Published online ahead of print, the study will appear in an upcoming issue of *Radiology*.

“In our study, we showed that resting-state network biomarkers might be an effective indicator of AVH vulnerability in schizophrenia and provide a novel strategy for diagnosis and therapy,” Dr. Yin said.

AVHs are considered one of the most prominent features in schizophrenia, affecting 60 percent to 90 percent of patients.

In their cross-sectional study, researchers used independent component analysis to compare resting-state networks in 17 patients with first-episode, untreated schizophrenia who experienced AVH to resting-state networks in 15 schizophrenia patients without AVH and 19 healthy control subjects.

Results showed symptom-specific abnormal disrupted co-activation within the auditory, default mode, executive, motor and frontoparietal networks, with pronounced findings in the auditory cortex, supramarginal gyrus, insula, putamen, dorsolateral prefrontal cortex, angular gyrus, precuneus and thalamus. Researchers also noted a positive correlation between the degree of co-activation within the motor network and the severity of the hallucinations.

“With independent component analysis and dual regression, our findings indicate mainly increased brain activity in regions that involve auditory processing, language production and monitoring, and sensory information filtering in AVHs in schizophrenia, creating a predisposition toward

false perceptual inference,” according to Dr. Yin and colleagues.

Using functional imaging data, the research team created maps demonstrating network connectivity differences among the patients with schizophrenia who experienced AVH, patients with schizophrenia without AVH, and healthy controls.

“The thalamus is characterized by enhancing certain inputs but suppressing others in schizophrenia, showing impaired thalamic filtering of external speech from internal speech,” the researchers added. “We found decreased thalamic volume in patients with schizophrenia with AVH, a higher level of left thalamic co-activation within the executive network, and a lower level within the motor network. More intriguingly, an electrophysiological study seems to link the disruption of thalamo-auditory cortical projection and AVH.”

Identifying Schizophrenia Biomarkers in Resting-State Networks

There are two main categories of research on AVH with fMRI, Dr. Yin explained. The first type, state study, is conducted during a hallucination and is used to directly measure brain alterations associated with symptom occurrence. The second type, trait study, is used to compare the neural features of patients with AVH to those without AVH, whether or not they experienced hallucinations during imaging.



Yin

“None of the patients in our study reported the presence of AVH during MRI,” Dr. Yin noted. “We therefore defined the current research as a trait study.”

The co-activation level of resting-state networks helped to distinguish patients with schizophrenia who experienced AVH from those without AVH, the research team found.

“We observed that patients with AVH demonstrated significantly increased co-activation in the right auditory cortex,” the researchers noted. “Also, there is evidence of altered connectivity between the superior temporal gyrus — the auditory cortex — and language- and/or memory-related cerebral structures, including the inferior frontal gyrus and the hippocampus.”

Hyperactivity in the auditory cortex might be related to its interaction with the language and/or memory processing areas, the authors concluded.

Dr. Yin’s team also detected increased co-activation in the putamen within the executive network and insula within the auditory network.

“In general, the insula and putamen involve speech production. Lower volume and disconnectivity of the putamen have been found in patients with schizophrenia with AVH,” Dr. Yin said. “Our results suggest the putamen as a possible verbal hallucinogenic source for AVH, on the basis of evidence of the putamen involving speech initiation and execution.”

WEB EXTRAS

Access the *Radiology* study, “Disturbed Brain Activity in Resting-State Networks of Patients with First-Episode Schizophrenia with Auditory Verbal Hallucinations: A Cross-sectional Functional MR Imaging Study,” at [RSNA.org/Radiology](https://rsna.org/Radiology).

Functional Brain Patterns act as “Fingerprint” for MS Patients

BY EVONNE ACEVEDO

MRI can help to map functional connectivity in the brains of patients with multiple sclerosis (MS) and those with clinically isolated syndrome (CIS), which carries a high risk of progressing to MS.

“Similar to human fingerprints, patterns of functional brain networks are unique for each person, and thus characterizing individual functional brain networks is of great significance for understanding inter-subject variability in cognition and behavior,” said Jinhui Wang, PhD, an investigator at the Center for Cognition and Brain Disorders at Hangzhou Normal University in China.

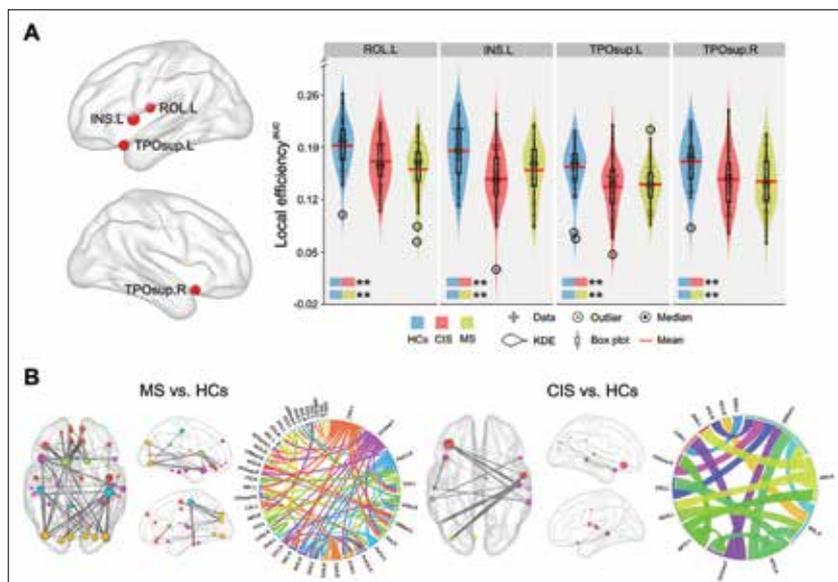
In a study in the February 2017 issue of *Radiology*, Dr. Wang’s team investigated functional brain networks of 34 patients with MS, 34 patients with CIS and 36 demographically-matched healthy controls. The researchers found a decrease in whole-brain network connectivity efficiency and regional connectivity in the patients with MS compared to healthy controls. They also discovered that impaired regional connectivity was already detectable in the patients with CIS.

Dr. Wang explained that functional brain networks can be modelled as a collection of nodes linked by edges, with nodes representing brain regions and edges representing inter-regional statistical interdependence of regional time signals.

The team employed resting-state functional MRI (fMRI), which Dr. Wang said offers advantages over conventional task fMRI studies that require participants to perform cognitive tasks.

“Conventional task-activation studies typically have a poor signal-to-noise ratio because the task-evoked signal changes are often small relative to the noise,” Dr. Wang said. “The noise considered in task studies has two sources — true noise and spontaneous neural activity. The latter is dominant and the signal of interest in resting-state fMRI studies.”

For that reason, resting-state fMRI studies have approximately three times higher signal-to-noise ratio than task-ac-



Between-group differences in nodal local efficiency (A) and interregional functional connectivity (B). Four regions were detected to show decreased nodal local efficiency in patients with MS and CIS compared with the healthy controls (HCs) but non-significant differences were observed between the patient groups. For interregional functional connectivity, a distributed component was identified to show decreases in the patients with MS compared with the HCs. A similar but spatially more focused component was further observed for the CIS patients versus the HCs. (*Radiology* 2017;37:3:719-736) © RSNA 2017. All rights reserved. Printed with permission.

tivation studies. Resting-state fMRI also facilitates more accurate data comparisons while making participation easier on patients.

“This is crucial for clinical studies because many patients are not capable of accomplishing complicated tasks accurately due to their cognitive dysfunctions or physical impairments,” Dr. Wang said.

In patients with CIS, whole-brain network efficiency remained largely intact, but the researchers observed regional network alterations.

“Compared with healthy controls, patients with CIS exhibited significantly lower values of nodal local efficiency in the superior temporal parts of the bilateral temporal pole and the left rolandic operculum and the insula,” Dr. Wang explained.

“Relative to healthy controls, the functional connectivity decreased to a lesser extent in both the amplitude and number

for patients with CIS than those with MS, in spite of non-significant differences between the two groups,” Dr. Wang said. “This implies the potential of the disrupted functional connectivity observed here in the early intervention of MS.”

Recent studies have shown that connectivity patterns can act as a “fingerprint” to accurately identify individuals and predict brain activity, Dr. Wang said. For patients with brain disorders, studies are also increasingly demonstrating that the functional connectome can provide biomarkers for individual diagnosis and prognosis.

“For instance, we have demonstrated that baseline functional brain networks can predict short-term clinical outcomes after pharmacological therapy for patients with a major depressive disorder,” he said. “Accordingly, neuroimaging-based functional network mapping has great potential in guiding personalized therapeutic regimens.”

WEB EXTRAS

Access the *Radiology* study, “Functional Brain Network Alterations in Clinically Isolated Syndrome and Multiple Sclerosis: A Graph-based Connectome Study,” at RSNA.org/Radiology.

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- Basic Overview of Health Services Research
- Health Economic Evaluation: General Methods and Applications for Radiology
- Efficiency, Communication and Preparedness in Emergency Radiology
- Health Policy, Reimbursement and Adding Value in Health Systems: An Overview of Issues in Radiology
- Comparative Effectiveness Research in Radiology – Collective Module Summary

These online courses are free to RSNA members and non-members. Each module provides *AMA PRA Category 1 Credit™*, except for "Comparative Effectiveness Research in Radiology – Collective Module Summary." They can be found in the eLearn section of the RSNA Education website at RSNA.org/Education.



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R&E Study Sections Meet to Score Applications

Each spring, the Research & Education (R&E) Foundation hums with activity as hundreds of submitted grant applications are processed and reviewed. The success of the R&E grant program relies heavily on the committed study section members who volunteer their time and expertise to review and score the applications.

In 2017, 95 volunteers were selected to serve as reviewers on the R&E study sections. Study section reviewer assignments

are made by matching each study section member's areas of expertise and experience to the keywords selected by applicants to describe the areas and topics of their education/research plans.

In March, the Radiology Research Faculty Study Section met at RSNA headquarters; and the Radiology Research Trainee, Radiation Oncology Research and Education study sections held virtual meetings. During the study section

meetings, reviewers discuss applications in detail and score them using the National Institutes for Health (NIH) scoring system. Along with the Medical Student Grant Review Panel, the study section members reviewed and scored 255 grant applications.

Final funding decisions were made by the R&E Foundation Board of Trustees in April and grants approved for funding will begin on July 1.

Education and Funding Opportunities

RSNA Clinical Trials Methodology Workshop

Application Deadline
June 15

Over the course of the 6 ½-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.

The workshop will be held at the Marriott Resort in Coronado, CA, Jan. 6-12, 2018.

Applicants will undergo a competitive selection process for course entrance. Accepted participants are responsible for all travel expenses and hotel accommodations. There are no fees associated with the workshop. Online applications and additional information can be found at RSNA.org/CTMW.

Applicants Sought for 2018 Derek Harwood-Nash Fellowship

Application Deadline
July 1

Applications for the 2018 Derek Harwood-Nash International Fellowship Program are being accepted. 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.

Accepted candidates will receive support for travel and living expenses as well as learning resources during the fellowship. Applications are available at RSNA.org/DHN.

Advanced Course in Grant Writing

Application Deadline
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 Science Foundation, or equivalent, grant application. The course, held at RSNA headquarters in Oak Brook, IL, will consist of four 1 ½-day sessions:

- Session I: Oct. 6-7, 2017
- Session II: Nov. 10-11, 2017
- Session III: Feb. 9-10, 2018
- Session IV: April 20-21, 2018

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

Introduction to Academic Radiology for Scientists (ITARSc)

Application Deadline
July 1

RSNA has expanded its Introduction to Academic Radiology (ITAR) program to include postdoctoral fellows in the imaging sciences and biomedical engineering. Postdoctoral fellows and early-stage researchers 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 2017.

The program consists of a combination of dedicated programming for ITARSc participants and shared sessions with participants of the ITAR program. 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

**Application Deadline
July 15**

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

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

Successful applicants will be assigned to a seminar held during either the RSNA annual meeting in Chicago, Nov. 26-Dec. 1, 2017 or the ARRS annual meeting in Washington, DC, April 22-27, 2018.

A \$1,000 award will be made to the departments of accepted applicants to be used to help advance the applicants' academic careers. There are no fees associated with this program.

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



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.

Volunteers Sought for RSNA/AAPM Physics Module Updates



The RSNA Education Center is seeking physician volunteers to assist in updating the RSNA/American Association of Physicists in Medicine (AAPM) Online Physics Modules, which are presented by RSNA and AAPM.

Free to RSNA and AAPM members, the modules explore important concepts identified in the AAPM curriculum and are designed to supplement physics curricula at radiology residencies and serve as a resource for continued self-study by radiologists.

The RSNA Education Center has begun updating the physics modules as part of a yearly maintenance process.

Of the 45 RSNA/AAPM Online Physics Modules, seven have been updated: PACS, MRI: Quality/Bioeffects/Safety, MRI: Siting and Environmental Protection, Image Perception and Performance

Evaluation, Basic Radiation Biology, Basic Ultrasound Imaging and Display, Radionuclide Dosimetry and Nuclear Regulations.

Each module was professionally developed by a team that included a minimum of one physicist and one radiologist.

Volunteer physicians are needed to peer review modules. Peer review is scheduled to take place in mid-summer 2017. A minimum of one radiologist, one physicist and one resident is required for each peer review team.

Additionally, there will be an opportunity this coming fall to be a part of a 2018 author update team.

For more information about participating, contact physics@rsna.org.



Journal Highlights

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

Financial Forecasting and Stochastic Modeling: Predicting the Impact of Business Decisions

For radiologists whose role it is to oversee the delivery of imaging services and the interpretation, communication and curation of imaging-informed information, business decisions influence where and how they practice, the tools available for image acquisition and interpretation, and ultimately their professional satisfaction.

In a review article in the May issue of *Radiology* (RSNA.org/Radiology), co-authors Geoffrey D. Rubin, MD, MBA, and Bhavik N. Patel, MD, MBA, of the Duke University School of Medicine in

Durham, NC, discuss the financial drivers that healthcare organizations base investment decisions on and the central role that stochastic financial modeling should play in support of strategically aligned capital investments.

Stochastic modeling through Monte Carlo simulation is a readily accessible and mastered technique that accommodates uncertainties and provides unique insights to inform and refine decision making.

"Radiologists will benefit immeasurably

by learning the basics of financial modeling, but building robust models and executing statistically supported forecasts is a skill that will likely be implemented by business managers or analysts. Regardless, radiologists bring unique insights to decisions and thus should not delegate the responsibility of scrutinizing the quality and validity of a financial model's structure, including its inputs, assumptions, and interrelationships," the authors write.

Radiology

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

Radiologic-Pathologic Correlation of Primary and Secondary Cardiomyopathies: MR Imaging and Histopathologic Findings in Hearts from Autopsy and Transplantation

Areas of late gadolinium enhancement (LGE) in cardiomyopathies correspond to histopathologic findings of interstitial expansion, such as fibrosis, abnormal protein deposition, infiltration of inflammatory cells, necrosis of cardiomyocytes, and granulomas. However, correlating histopathologic and cardiac MRI findings — those of diffuse myocardial disease in particular — is sometimes difficult.

In the May-June issue of *RadioGraphics*, (RSNA.org/RadioGraphics), Hiromi Hashimura, MD, PhD, of the National Cerebral and Cardiovascular Center in Osaka, Japan, and colleagues describe the cardiac MRI findings of cardiomyopathies assessed in whole-heart autopsy or transplantation specimens from individuals with various primary or secondary cardiomyopathies, with a focus on LGE imaging.

The authors also review the histopathologic findings that correspond to areas with and without LGE, and the current T1 mapping techniques used to overcome the drawbacks of LGE imaging, including quantification of native T1 values and the extracellular volume fraction.

LGE MRI cannot depict the diffuse changes and does not enable quantitative

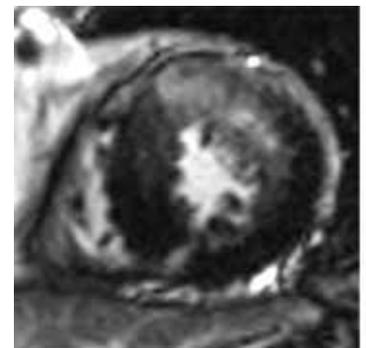
evaluation of the increased interstitial space because on inversion-recovery MR images, the inversion time is adjusted to null the signal from normal-appearing or the least enhancing regions of the myocardium.

"Thus, the absence of LGE does not always indicate normal myocardial tissue," the authors write.

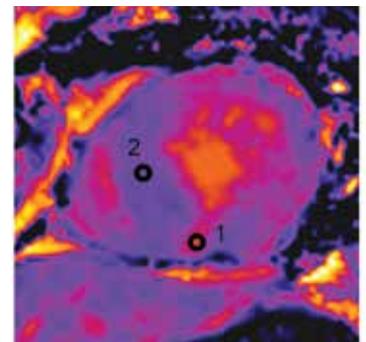
This article is accompanied by an Invited Commentary by Jonathan D. Dodd, MD, of St. Vincent's University Hospital and University College Dublin School of Medicine in Ireland, and David J. Murphy, MD, of Brigham and Women's Hospital, Boston.

Cardiac MRI findings and measurements in a patient with hypertrophic cardiomyopathy. (a) Short-axis late gadolinium enhancement (LGE) MRI shows patchy areas of LGE from the interventricular septum to the anterior wall at the midventricular level. (b, c) On the corresponding extracellular volume (ECV) (b) and native T1 (c) maps, the ECV (47 % circle 1 in b) is markedly increased and the native T1 (1415 msec, circle 1 in c) is moderately elongated in the area with LGE. In the corresponding area without LGE in the interventricular septum, the ECV (31 %, circle 2 in b) is slightly increased and the native T1 (1280 msec, circle 2 in c) appears to be minimally elongated.

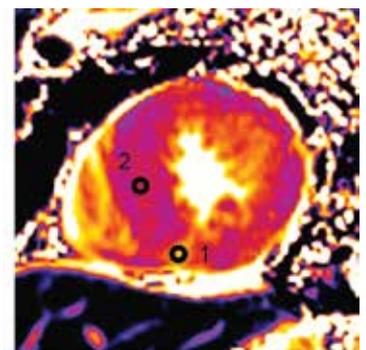
(*RadioGraphics* 2017;37;3:719-736) © RSNA 2017. All rights reserved. Printed with permission.



a.



b.



c.

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



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



- “Impact of in Vivo High-Field-Strength and Ultra-High-Field-Strength MR Imaging on DNA Double-Strand-Break Formation in Human Lymphocytes,” Annika Reddig, MS, and colleagues.
- “Is There Long-term Signal Intensity Increase in the Central Nervous System on T1-weighted Images after MR Imaging with the Hepatospecific Contrast Agent Gadoteric Acid? A Cross-sectional Study in 91 Patients,” Johannes Kahn, MD, and colleagues.
- “No Signal Intensity Increase in the Dentate Nucleus on Unenhanced T1-weighted MR Images after More than 20 Serial Injections of Macrocyclic Gadolinium-based Contrast Agents,” Alexander Radbruch, MD, and colleagues.
- “Clearance of Gadolinium from the Brain with No Pathologic Effect after Repeated Administration of Gadodiamide in Healthy Rats: An Analytical and Histologic Study,” Adrian P. L. Smith, PhD, and colleagues.



Listen to *RadioGraphics* Editor Jeffrey S. Klein, MD, and authors discuss the following article in the April-May issue of *RadioGraphics* at RSNA.org/RG-Podcasts



- “Contrast-enhanced US-guided Interventions: Improving Success Rate and Avoiding Complications Using US Contrast Agents” by Dean Y. Huang, FRCR, EBIR, and colleagues.

For Your Calendar

MAY 4-7

Jornada Paulista de Radiologia (JPR)
São Paulo, Brazil
Visit the RSNA booth
• JPR2017.org.br/en

MAY 18-20

RSNA Spotlight Course: MSK Interactivo con Casos
Bogotá, Colombia
• RSNA.org/Spotlight

JUNE 8-10

InterAmerican College of Radiology (CIR) Refresher Course
Cancún, Mexico
Visit the RSNA booth
• webcir.org

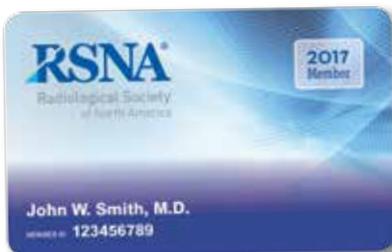
JUNE 10

American Medical Association/Medical Student Section
2017 Medical Specialty Showcase and Clinical Skills Workshop
Chicago
Visit the RSNA booth
• AMA-ASSN.org

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

Value of Membership

Members Receive Free Registration to World's Premier Radiology Meeting



All RSNA members receive free advance registration for RSNA 2017 — a \$950 value — as well as early hotel reservations, free self-assessment module (SAM) credits and discounted registration for the Virtual Meeting.

Register by Oct. 27 to receive the discounted registration fee. After Oct. 27, registration will be processed at an increased fee.

Have colleagues who would like to attend? Encourage them to join RSNA and attend RSNA 2017 — 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.

Radiology in Public Focus

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

National Dose Levels Established for 10 Common Adult CT Examinations

Using data from the world's largest CT dose index registry, researchers have established national dose levels for common adult CT examinations based on patient size.

Healthcare facilities can optimize these exam protocols so that dose is commensurate with the size of the patient, avoiding unnecessary radiation exposure, according to new research.

Results established patient-size based diagnostic reference levels (DRLs) and achievable doses (ADs) for the 10 most common CT head, neck and body examinations.

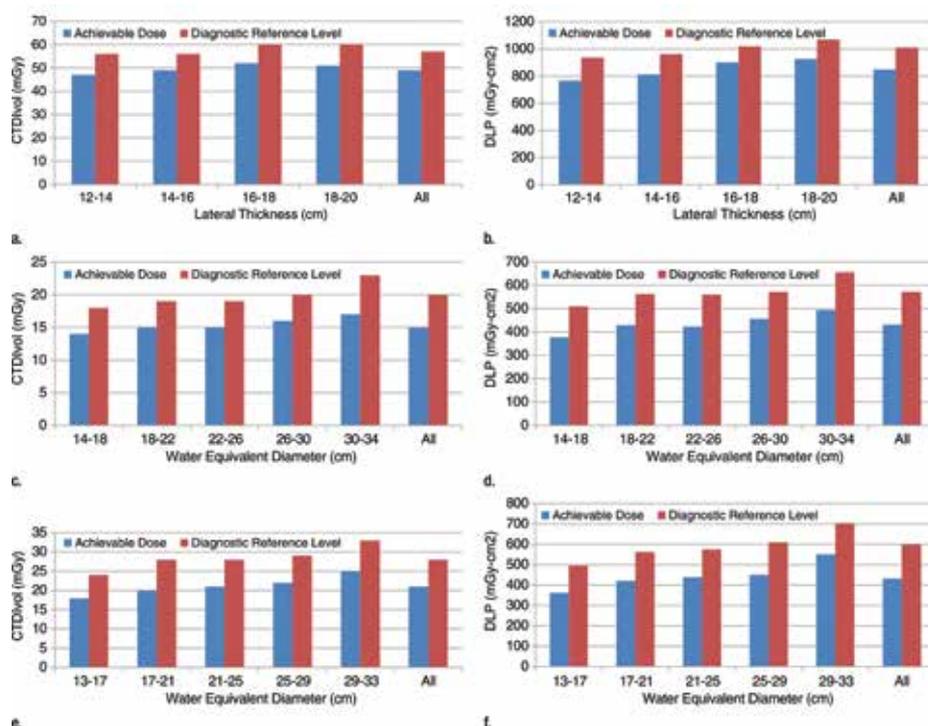
While the impact of patient size on radiation dose is well established, national DRLs previously provided only one value for each examination based on a standard-size phantom representing an average patient, a single patient size or data averaged across all patient sizes.

Kalpna M. Kanal, PhD, of the University of Washington School of Medicine, Seattle, and colleagues examined actual patient data from the American College of Radiology (ACR) CT Dose Index Registry to develop size-based DRLs that enable healthcare facilities to compare their patient doses with national benchmarks and more effectively optimize CT protocols for the wide range of patient sizes they examine.

"This extensive participation and totally automated complete capture of all patient examinations enabled the development of robust, clinically based national DRLs and ADs," Dr. Kanal said.

Dr. Kanal and colleagues accessed more than 1.3 million ACR CT Dose Index Registry examinations conducted in 2014 at 538 healthcare facilities throughout the U.S., located in primarily metropolitan and suburban areas as well as community hospitals.

Data from the 1.3 million CT exams provided median values, as well as means



Graphs show head, neck, and cervical spine achievable doses (ADs) and diagnostic reference levels (DRLs). (a) AD and DRL for head and brain without contrast material—volume CT dose index (CTDIvol). (b) AD and DRL for head and brain without contrast material—dose-length product (DLP). (c) AD and DRL for neck with contrast material—CTDIvol. (d) AD and DRL for neck with contrast material—DLP. (e) AD and DRL for cervical spine without contrast material—CTDIvol. (f) AD and DRL for cervical spine without contrast material—DLP. (*Radiology* 2017;InPress) © RSNA 2017. All rights reserved. Printed with permission.

and 25th and 75th DRL percentiles for volume CT dose index (CTDIvol), dose-length product (DLP) and size-specific dose estimate (SSDE).

DRLs are typically set at the 75th percentile of the dose distribution from a survey conducted across a broad user base using a specified dose-measurement protocol. ADs are set at the 50th percentile of a dose distribution based on the fact that roughly 50 percent of facilities have already achieved doses at or below this value.

The use of DRLs has been shown to reduce the overall dose and the range of

doses observed in clinical practice, Dr. Kanal said. In terms of using the benchmarks established in their research, she stressed that DRLs should be used to determine if a facility's dose indexes are unusually high, and are not to be used as target doses.

Ideally, facilities should analyze and compare their median and size-grouped dose indexes with the respective size-based ADs and DRLs. If size-grouped dose indexes are not available, they should compare their overall median indexes with the average DRLs and ADs across all patient sizes.

New on *RadiologyInfo.org*

Visit *RadiologyInfo.org*, the public information website produced by RSNA and ACR, to read new patient information on facet joint block. Also, watch these new "Your Radiologist Explains" patient-focused videos:

- Cardiac MRI
- Cardiac screening
- Voiding cystourethrogram
- Pediatric sedation and anesthesia

RadiologyInfo.org
For patients

Mammography Trends Show Improved Cancer Detection, More Biopsies

Comparison of Breast Cancer Surveillance Consortium (BCSC) benchmarks published in 2005, reveals clinically meaningful changes in diagnostic mammography performance metrics during the past 10 years, according to a new study.

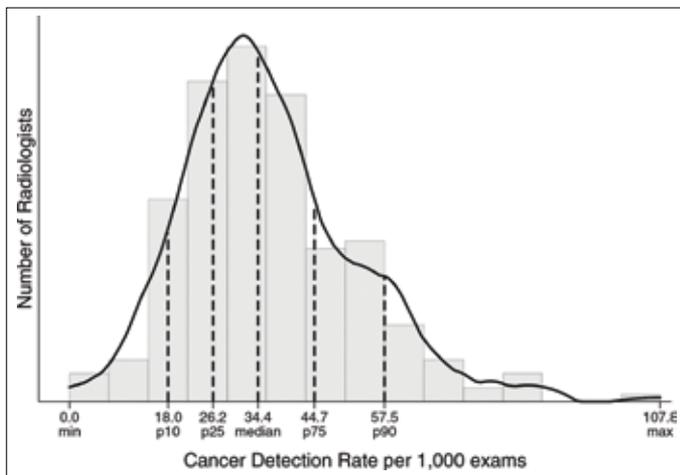
Brian L. Sprague, PhD, from the University of Vermont Cancer Center in Burlington, and colleagues found the abnormal interpretation rate increased from 8 percent to 12.6 percent, thereby decreasing positive predictive value (PPV) from 31.5 percent to 27.5 percent. However, the cancer detection rate increased from 25.3 to 34.7 per 1,000.

The researchers obtained data from six BCSC registries of mammogram indication and assessments for women undergoing diagnostic digital mammography and linked with cancer diagnoses from state cancer registries. The study included 401,548 examinations conducted from 2007 to 2013 in 265,360 women.

They found less than 70 percent of radiologists within acceptable ranges of PPV of a biopsy recommendation (PPV2) and PPV of biopsies performed (PPV3).

“These performance measures can serve as national benchmarks that may help transform the marked variation in radiologists’ diagnostic performance into targeted quality improvement efforts,” the authors write.

Radiology



Distribution of diagnostic mammography imaging performance metrics by radiologist cancer detection rate, abnormal interpretation rate, positive predictive value (PPV)2, PPV3 sensitivity and specificity. Dashed lines indicate location of 10th, 25th, 50th, 75th and 90th percentiles. Solid line represents smoothed curve fit to each histogram with kernel density estimation. (Radiology 2017;283:1:59-69) © RSNA 2017. All rights reserved. Printed with permission.

Media Coverage of RSNA

RSNA 2016 annual meeting media coverage tracked through February 14, 2017, has resulted in 20,444 media placements with a potential audience reach of more than 10.5 billion.

Notable placements for RSNA 2016 include: *The Huffington Post*, *Los Angeles Times*, *TIME*, Yahoo! News, *U.S. News & World Report*, *Chicago Tribune*, *National Geographic*, *Newsweek*, *The Washington Post*, TODAY, Voice of America, WGN America, Doctor Radio, WNBC-TV (New York), CNN, CBS News, NBC News, Univision, KABC-TV (Los Angeles), WBBM-TV (Chicago), *The Globe and Mail*, *Daily Mail* (UK), *The Telegraph* (UK), *Forbes*, *Business Insider*, BBC News, *SPACE.com*, Yahoo! Sports, Fox News Channel, *Smithsonian*, *Economic Times*, *Psychology Today*, *Scientific American*, *Orlando Sentinel*, *Miami Herald*, UPI, Reddit, WebMD and Google News.

In January, 10,056 RSNA-related news stories were tracked in the media. These stories reached an estimated 6 billion people.

Coverage included *Newsweek*, *Mirror* (UK), *Daily Mail* (UK), *Houston Chronicle*, *San Francisco Chronicle*, *The Arizona Republic*, *The Miami Herald*, Yahoo! Finance, *Philly.com*, WABC-AM (New York), KCAL-TV (Los Angeles), WBBM-TV (Chicago), KDKA-TV (Pittsburgh), HealthDay, *Drugs.com*, MedPage Today, *Medical News Today*, *Auntminnie.com* and *Radiology Today*.

May Public Information Outreach Activities Focus on Stroke Awareness

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 featured on radio stations across the U.S.



New! Annual Meeting Packages Designed with You in Mind

RSNA has introduced several new registration options to best meet your needs. Visit RSNA.org/Registration-Packages for a personalized registration recommendation.

Important Dates for RSNA 2017

- May 3** Member Registration and Housing opens at 10:30 a.m. Central Time (CT)
- June 7** General Registration and Housing opens at 10:30 a.m. CT
- June 14** Exhibitor Registration and Housing opens at 10:30 a.m. CT
- July 18** Online Program opens
- 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 one night's room and tax.
- November 26 -December 1** 103rd Scientific Assembly & Annual Meeting



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 to make travel plans as early as possible. Please visit RSNA.org/Visas for information on visas and travel to the United States.

RSNA 2017 HICT Session Call for Abstracts Opens June 1

The process for submitting abstracts for the High Impact Clinical Trial (HICT) session at RSNA 2017 opens June 1. The session features the latest cutting-edge clinical science and research. It will provide a forum for practice changing clinical research across radiology with the goal to present the most significant work in the field.

Submissions qualifying for consideration include:

- First presentations of the primary endpoint(s) of a trial
- Presentations 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
- The latest and “hottest” findings in translational imaging sciences that have immediate clinical implications

Submission deadline is Aug. 1 at noon Central Time. Authors of accepted submissions will be notified Aug. 15. For more information, go to RSNA.org/AnnualMeeting.



RSNA 3-D Printing Special Interest Group Adds Value to RSNA Membership

In response to breakthrough 3-D printing technology and its implications for radiology, RSNA recently introduced its 3-D Printing Special Interest Group (SIG), an engaged community that will add value to your RSNA membership. Radiology is at the intersection of patient care in 3-D printing, which crosses all subspecialties of medicine.

The SIG will focus on maintaining a prominent role for radiologists in this diverse and growing specialty and will seek to provide physicians and allied health scientists with optimized education and research programs.

- The SIG will focus on providing education, increasing exposure of 3-D printing and its use within the radiology community, and developing quality standards.
- SIG members will have their own network for communicating and sharing files.
- The RSNA annual meeting will provide opportunities to attend educational programming, learn about applications for 3-D printing, and network with colleagues.

Current RSNA membership is required to join the 3-D Printing SIG along with a \$40 annual fee. RSNA members in good standing may call the RSNA Membership Department at 1-877-776-2636 or apply online at RSNA.org/Membership.

Learn more about the 3-D Printing SIG at RSNA.org/3D-Printing-SIG.

Read an article about the SIG on Page 8 of this issue.



COMING
NEXT
MONTH

Next month, *RSNA News* will feature the first of a three-part series on precision imaging in radiology.



INSPIRE | INNOVATE | INVEST

The Campaign

for Funding Radiology's Future®

INVEST

Keep radiology vital. Join the Campaign for Funding Radiology's Future®. We are raising **\$17.5 million** to ensure the future of radiology. Your investment will inspire promising researchers and drive innovation.

Invest in the Campaign at [RSNA.org/Campaign](https://www.rsna.org/Campaign)

INSPIRE-INNOVATE-INVEST



FOUNDATION