



Image courtesy of Sahar Saleem, MBBCH, MSc, MD

Paleoradiologists Unravel the Secrets of Ancient Mummies

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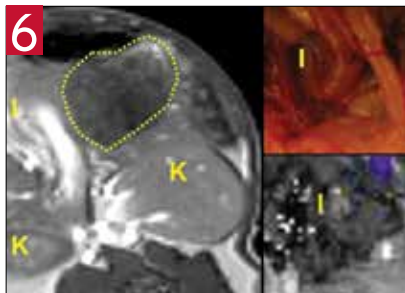
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R&E Foundation Announces New Education Grant Program

To address members' rapidly changing educational needs, the RSNA Research & Education (R&E) Foundation's Board of Trustees has developed a new education grant program that will take a fresh approach to how the Foundation solicits applications and funds grants. The first of the new grants will be awarded in 2019.

The program seeks to enhance the education of radiology faculty, radiologists and radiology support personnel through new educational content, educational products or other innovative means for RSNA to share with its members.

Grants will have specific topics of interest representing the current and future educational needs in radiology and will offer the opportunity for large, multi-year, multi-institution grants of up to \$525,000. The educational grants will allow for projects with smaller budgets and timeframes, as well as those focusing specifically on international education.

The grants are:

- Education Innovation Grant
- Education Development Grant
- Derek Harwood-Nash International Education Scholar Grant

More details, including the specific topics of interest and requests for applications, will be available in spring at RSNA.org/Grants-and-Awards.

Cohen Appointed Radiology Chair at Temple University

Gary S. Cohen, MD, has been appointed chair of radiology at the Lewis Katz School of Medicine at Temple University and radiologist-in-chief for Temple University Health System, Philadelphia.

A diagnostic radiologist with a subspecialty in vascular and interventional radiology, Dr. Cohen joined Temple's faculty in 1993. He most recently served as vice chair of diagnostic imaging, section chief of vascular & interventional radiology and co-director of the Liver Tumor Treatment Program.



Cohen

Roentgen Nominations Now Open

Nomination Deadline
April 2



Nominations are being accepted for the RSNA Roentgen Resident/Fellow Research Award, recognizing residents and fellows who have made significant contributions to their departments' research efforts as evidenced by presentations and publications of scientific papers, receipt of research grants or other contributions.

Nominations are limited to one resident or fellow per program in radiology, radiation oncology or nuclear medicine per year. The program director or department chair selects the nominee for each program.

The RSNA Research & Education (R&E) Foundation provides an award plaque for the department to display and a personalized award to present to the selected resident or fellow. The deadline for nominations is April 2. Learn about the nomination process and see a list of past recipients at RSNA.org/Roentgen-Research-Award.



Vinay Prabhu, MD, right, receives his 2017 RSNA Roentgen Resident/Fellow Research Award from **Nancy Fefferman, MD**.

Time to Renew Your Image Wisely® Pledge

Continue your commitment to safe imaging by renewing your Image Wisely® pledge or make a first-time promise to demonstrate your awareness about adult radiation protection.

Each year, those who renew their pledges at ImageWisely.org will receive a dated certificate validating their commitment to the campaign. Facilities with current pledges can download the Image

Wisely logo to promote their participation in the campaign.

The Image Wisely website provides updated news on radiation safety, regulations and standards, and access to free radiation safety cases to assess your understanding of radiation safety concepts and award continuing education credits.

The Image Wisely campaign is a joint partnership of RSNA, the American



College of Radiology, the American Society of Radiologic Technologists and the American Association of Physicists in Medicine.

RSNA Partnership with DuPage Medical Group Helps Staff Better Serve Members

An RSNA partnership with DuPage Medical Group helps new RSNA staff members understand radiologists' responsibilities so that they can, in turn, better support RSNA members.

For the past several years, new RSNA staff have had the opportunity to tour the outpatient radiology centers of DuPage Medical Group, which has locations around RSNA headquarters in Oak Brook, IL. Staff receive detailed tours of the imaging centers and speak with radiologists and technologists about their expertise. So far, 130 staff have

attended the tours.

"We appreciate DuPage Medical Group and their staff for giving their time to speak with RSNA staff about what radiologists do and what they need to provide high-quality patient care," said Sally Nikkel, assistant executive director, RSNA finance and administration.

RSNA member, Rajit S. Shetty, MD, of DuPage Medical Group, also speaks with the staff and answers questions.



RSNA staff tours of DuPage Medical Group are scheduled throughout 2018.

"From a radiologist's perspective, it is beneficial to interact with RSNA staff and offer them a glimpse of what a radiologist's day looks like," Dr. Shetty said. "This helps RSNA staff understand what is important to members so they can develop programming and activities that support our educational and clinical needs."

Tours are scheduled throughout 2018 for new and established employees.

RSNA Members Earn Advanced Quality Certificates

Four physicians received Advanced Level Quality Certificates from RSNA in 2017, bringing the total number of recipients to 20 since the first certificates were awarded in 2014.

Earning the certificate requires successful completion of Quality Essentials Certificate Courses in four domains: Quality Improvement in Your Practice, Staff and Patient Safety, Customer Satisfaction and Radiologist Performance Improvement; as well as exhibition of a Quality Storyboard at an RSNA annual meeting as a primary author. (Please note, Quality Storyboards will be renamed Quality Improvement Reports beginning in 2018. The guidelines for these submissions will remain the same.)

To learn more about the RSNA Quality Improvement Certificate Program, including the Advanced Level Quality Certificate program, go to RSNA.org/Quality-Improvement-Certificate-Program.

| Name | Institution | Quality Storyboard Title |
|---------------------|--|--|
| Suhny Abbara, MD | University of Texas Southwestern Medical Center | A Comprehensive CT Radiation Dose Reduction and Protocol Standardization Program in a Complex, Tertiary Hospital System Using Iterative Phantom and Clinical Testing and a Novel Web-based Information Distribution System |
| Alan M. Kantor, MD | Lincoln Medical & Mental Health Center (Bronx, New York) | Adapting the Universal Protocol in a Diagnostic Radiology Department to Help Prevent Wrong Patient, Wrong Site, and Wrong Examination Events |
| Colleen H. Neal, MD | University of Michigan Health System | Improving Breast MRI Wait Times: A Model for Transitioning Newly Implemented Diagnostic Imaging Procedures into Routine Clinical Operation |
| Ben C. Wandtke, MD | University of Rochester Medical Center | Closing the Loop: A Radiology Follow-up Recommendation Tracking System |

Wang Awarded RANZCR Gold Medal

Shih-chang Wang, MD, was awarded the 2017 gold medal at the recent Royal Australian and New Zealand College of Radiologists (RANZCR) annual meeting.

A recognized expert in liver cancer therapy, Dr. Wang served as the Parker-Hughes Professor of Diagnostic Radiology at the University of Sydney, Australia, and as head of breast radiology at Westmead Breast Cancer Institute, in Westmead, Australia, before retiring in 2013. He also established the National Breast Screening Program in Singapore.



Wang (right)

Apply Now for RSNA Editorial Fellowships

RadioGraphics Radiology

Applications are being accepted for the RSNA William R. Eyler Editorial Fellowship and the RSNA William W. Olmsted Editorial Fellowship for Trainees. The fellowships offer the opportunity to work with *Radiology* Editor David A. Bleumke, MD, PhD, in Madison, WI, or *RadioGraphics* Editor Jeffrey S. Klein, MD, in Burlington, VT. The Eyler fellowship lasts three weeks and the Olmsted fellowship lasts one week.

Each fellow will also visit the Publications Department at RSNA Headquarters in Oak Brook, IL. The Eyler Fellow will work with the *RadioGraphics* editorial team at RSNA 2018.

Apply by May 1 to be considered for the William R. Eyler Editorial Fellowship and April 1 for the William W. Olmsted Editorial Fellowship for Trainees.

To learn more and to apply, visit RSNA.org/RSNA_Editorial_Fellowships.aspx.

In Memoriam



Willman

Juergen K. Willmann, MD, professor of radiology at the Stanford University School of Medicine, died Jan. 8 in Palo Alto, CA. He was 45.

Recognized for his work in targeted contrast microbubbles, Dr. Willmann was working on the first clinical imaging trials in humans, in which the microbubbles were used to detect breast and ovarian cancer and target the delivery of drugs.

Dr. Willmann completed his medical degree at Albert Ludwig University of Freiburg, Buchenbach, Germany. He completed his residency at the University of Zurich in Switzerland.

After completing his residency, Dr. Willmann became an assistant professor and clinical attending physician at the University of Zurich. He and his wife, Amelie Lutz, MD, came to Stanford for research fellowships.

He was recognized for his work in cancer detection and imaging technologies with a 2017 Distinguished Investigator Award from the Academy for Radiology & Biomedical Imaging Research.

Dr. Willmann published studies in *Radiology* and served as RSNA faculty at several RSNA annual meetings.

Numbers in the News

17.5

The number, in millions, raised by the RSNA Research & Education Foundation during its five-year fundraising campaign. Read more on [Page 9](#).

15

Percent of both medical school graduates and graduate medical education trainees who are minorities. Read more about diversity and inclusion in radiology on [Page 12](#).

1896

The year the first radiographs of mummies were produced. Since then, the role of imaging has become increasingly critical to paleoradiologists investigating these ancient relics. Read more on [Page 10](#).

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My Turn:

Radiology Embarks on a New Era in Publishing

BY DAVID BLUEMKE, MD, PHD

Ten years ago, we predicted that *Radiology* would transition from a hardcopy journal to an online publication. Yet our concept of “online” was monolithic — limited by the technology of the time — simply meaning content would be available on the internet. Today the world is polythetic. We receive information on multiple platforms, and the way we consume information has become more personalized.

In this context of information flux, *Radiology* must determine how to best get useful medical and scientific information to imaging physicians and scientists in our field. In the coming months we will take several steps to improve the information that you receive through these new initiatives.

Targeted Editorials

If you are a general radiologist but need to keep up with developments throughout the imaging field, your reaction to an article on the brain connectome may be bewilderment at the density and complexity of the science. Our scientific authors are super-specialized experts in their domains. The technical requirements of their fields are enormous. As a result, our authors write articles that appeal to highly specialized reviewers. Thus, we have started to solicit “targeted editorials” for key articles that we publish. These editorials will briefly explain the significance of the research and highlight its strengths and weaknesses.

Faster Publication Times

Authors have always struggled with publishing information in a timely fashion. Even the U.S. federal government has realized that the time to publish and release information from clinical trials is too long. NIH guidelines specify that results must be reported within 12 months of concluding a trial. Yet, data analysis alone may take many months and publishing in *Radiology* may take many more. We are highly committed to reducing time to publication, while providing a forum for the world’s leading research in the field of radiology.

Improved Delivery of Digital Content and New Print Format

Our current production model is designed around a monthly print issue. If you receive our monthly table of contents by email, the list of 30 or more articles scrolls almost endlessly off the bottom of the largest “plus size” mobile phone.

We will start delivering organized, weekly content for our mobile readers. We have already streamlined notifications. Further improvement will continue over the next 12 months and mobile offerings will extend to enhanced use of podcasts and social media. An updated print format in 2018 is aimed to provide readers with an improved visual experience.

Images in Radiology

Our authors generate some of the most interesting and innovative medical images in the world. Beginning in 2018, Images in *Radiology* will be a new journal feature, highlighting state-of-the-art radiologic imaging depicting interesting and relevant diagnoses. Submissions for this feature are being solicited at this time.

Subspecialized Journals

Radiology delivers high-quality content for our readers by being very selective regarding the material that is published. About 3,000 original research articles are submitted each year; only about 5 to 10 percent are accepted. A substantial portion of rejected material is excellent quality but pertains to a specialty radiologist. To that end, the RSNA Board has approved the development of three new subspecialty journals on the topics of imaging of cancer, cardiothoracic disease, and artificial intelligence/machine learning in imaging. Each new online-only journal will have its own editor and editorial board of specialists, and planning for the journals is underway. The journals will launch in 2019.

I look forward to continuing the tradition of excellence that *Radiology* is known for while ensuring the journal meets the needs of today’s radiologists.



Dr. Bluemke is editor of Radiology and a professor in the Department of Radiology at the University of Wisconsin – Madison (UW – Madison) School of Medicine and Public Health. In 1997, he became the clinical director in the MRI division of the Department of Radiology at Johns Hopkins Hospital. In 2008, he became a tenured senior investigator for the NIH and the radiologist-in-chief of Radiology and Imaging Sciences at the NIH Clinical Center. He was also a senior investigator at the National Institute of Biomedical Imaging and Bioengineering (NIBIB) and an adjunct investigator for the National Heart, Lung and Blood Institute (NHLBI). A longtime member of RSNA, Dr. Bluemke served as deputy editor of Radiology from 1993 to 1997.

LOOK AHEAD

Molecular Imaging

BY VIKAS KUNDRA, MD, PhD

Molecular imaging is bringing novel approaches to diagnose and monitor disease. It has already proven successful in clinical practice. New advances will enable molecular characterization and should enable evaluation of therapy not only at the level of detection and response, but also to assess delivery and mechanistically to assess whether a therapy is affecting its intended target. This opens up fresh and exciting avenues for imaging.



VIKAS KUNDRA, MD, PHD, is professor and director of molecular imaging in the Department of Radiology, University of Texas MD Anderson Cancer Center with a joint appointment in the Department of Cancer Systems Imaging. He received his MD and PhD from Harvard University. He trained at Harvard Medical School's Brigham and Women's Hospital. He is a fellow of the Society of Body Computed Tomography-Magnetic Resonance Imaging and Distinguished Investigator of the Academy of Radiology Research.

Dr. Kundra practices as a clinical radiologist focused on body imaging primarily using CT and MRI. He has authored multiple clinical and basic/translational science papers and secured grants from federal sources including the National Institutes for Health, the Department of Defense and the National Science Foundation.

“Molecular imaging requires teams of experts such as those skilled in biology, chemistry, physics and instrumentation.”

VIKAS KUNDRA, MD, PhD

What is Molecular Imaging?

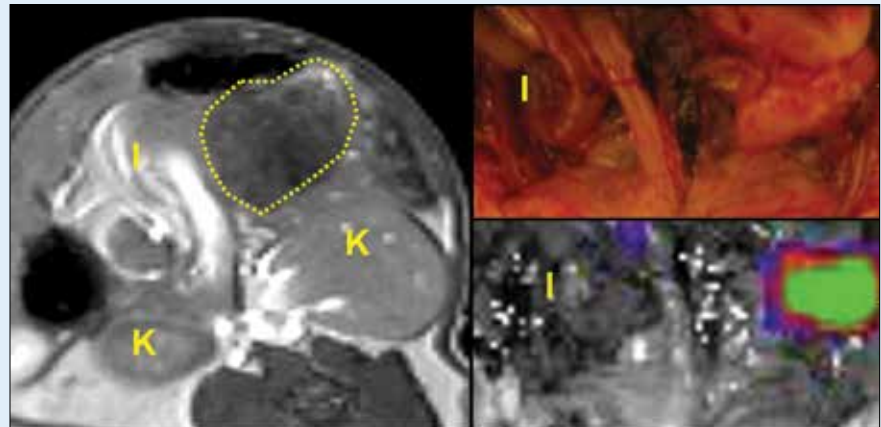
Broadly, molecular imaging may be defined as non- or minimally-invasive assessment of biologic and pathologic processes based on molecular or functional analysis. This may include both molecularly targeted and non-targeted imaging. Although there may be some debate regarding the exact definition, the practical clinical outcome is adding analysis of molecular/functional alteration to anatomic changes in order to improve differential diagnosis and to monitor therapy.

Non-Targeted Imaging

An example of non-targeted molecular imaging performed clinically is diffusion weighted MRI, which is increasingly playing a role in detecting tumors and evaluating response. It is based on assessing molecular motion by MRI. Diffusion weighting depends on the b-value, which reflects the strength and timing of the magnetic gradients. At mid b-values, tissue-level motion can be evaluated and highly cellular structures such as tumors can be detected. Newer techniques include studying faster motion using low b-values, such as afforded by intravoxel incoherent motion (IVIM) for evaluating parameters such as D and f akin to tissue diffusion coefficient and perfusion fraction, as well as studying slower motion using high b-values to limit T2 “shine-through.” These techniques are being evaluated as to whether they enable improved detection and/or response evaluation.

Molecular-targeted Imaging

An example of targeted molecular imaging is ^{18}F -fluorodeoxyglucose (FDG). The beta particle emission by the ^{18}F label enables imaging by positron emission tomography (PET). FDG or fluorodeoxyglucose mimics glucose and enters the cell through glucose (GLUT) transporters and then becomes phosphorylated. The phosphorylated form is not a good substrate for the next enzyme in glycolysis and its neg-



Multimodal imaging of ovarian cancer. DM-dual-Gd-ICG liposomal nanoparticles, which have high MR relaxivity due to gadolinium chelates on their surface and within them, and can be used for near infrared fluorescence (NIR) due to incorporated indocyanine green, were injected intravenously two days earlier. Intraperitoneal human ovarian tumor xenografts (dotted lines or arrows) enhanced by MR (left, axial view) and demonstrated NIR signal (left bottom, coronal view). This should enable presurgical planning by MR and NIR-guided surgical resection. K, kidneys; I intestines.

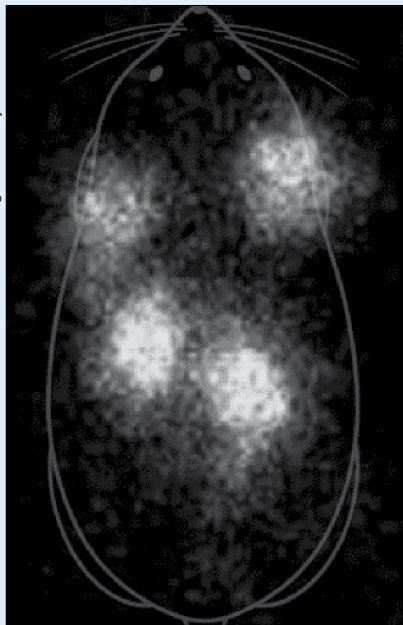
ative charge keeps it from crossing the cell membrane; thus, it becomes entrapped in the cell and accumulates. Inflammatory cells have high metabolic rates and ^{18}F -FDG PET imaging is used for infection/inflammation imaging. As outlined in the Warburg effect, cancer cells tend to utilize the less efficient anaerobic pathway to generate energy more than do normal cells, and thus require more input glucose, the primary fuel source. ^{18}F -FDG PET imaging has been used to image a variety of, but not all, tumors and their response to therapy.

With the advent of hyperpolarization imaging, it has become possible to perform biochemistry in vivo, including assessing late events in glycolysis. Hyperpolarization can increase the signal from atoms in molecules 10,000- to 100,000-fold, but lasts only seconds to minutes for the great majority. Due to the tremendous signal gain, not only can the input molecule be imaged, but also its metabolic products. For example, a key inflection point in glycolysis is pyruvate which sits at the decision point of whether to undergo anaerobic respiration and produce lactate or undergo aerobic respiration. In tumors, the rate of pyruvate to lactate conversion tends to be higher than in normal cells. In animal models there has been a suggestion that the rate of

conversion may be associated with the degree of tumor dedifferentiation or stage and that it may be able to detect early response to therapy even when ^{18}F -FDG PET imaging is not informative. Because multiple metabolites and even molecularly targeted agents may be hyperpolarized, this technology has promise to affect a variety of imaging schema.

Molecularly-targeted imaging has been in place in nuclear medicine departments for some time. One example is peptide-based imaging of somatostatin receptors. ^{111}In -octreotide-based imaging has been a nuclear medicine workhorse. The gamma particle emission by the ^{111}In label enables imaging by single photon emission computed tomography (SPECT). Octreotide mimics somatostatin and binds to somatostatin receptors including types 2 and 5. Newer labels include ^{68}Ga and ^{64}Cu to enable PET for higher resolution imaging. Newer peptides include octreotate for more selectivity for somatostatin receptor type 2. These advances and advances in scanner design and fusion systems such as PET-MR will enable improved detection and localization of molecular signatures. Combining functional and anatomic information can enable quantification of receptors as shown in animal models.

Images courtesy of Dr. Kundra



Imaging of gene expression. Mouse tumors made to express a human somatostatin receptor type 2 (WT)-based reporter or a signaling deficient variant (SD) were imaged after injection of a radiolabeled somatostatin analogue. A reporter that does not perturb the cell such as by initiating signal transduction is desirable. The preferred signaling deficient version was imaged similar to wild type but was muted in initiating cellular signaling. Vec, negative control tumor without reporter expression; expected radiotracer excretion is seen via the kidneys (K).

Promising New Techniques

Oncology is beginning to define tumors beyond just the site of the organ of origin to also include alterations in gene expression for which molecular imaging may make significant contributions. Fusion imaging can help guide biopsy. This is particularly important for obtaining tissue for understanding genomic, metabolomic and proteomic alterations in lesions before and after targeted therapy. This information aids in understanding if the intended target of the therapy was indeed altered and whether this resulted in the expected clinical effect. Biopsy is impractical for whole subject evaluation, whereas, molecularly targeted imaging should enable evaluation of pathologic heterogeneity, such as in a primary tumor and among it and metastases in order to select appropriate targeted therapies. These may include immunotherapies in the future. New tracers are becoming available/approved, such as for prostate cancer imaging and for imaging somatostatin receptors, which should increase reimbursement. Such tracers should benefit from new hybrid technologies such as PET/MR since anatomy and pathology in many important target organs such as in the pelvis, liver, and brain can be better delineated by MR than CT. In addition, improved hardware and software such as time of flight imaging and solid state detectors for PET and faster gradients for MR are resulting in faster scanners with improved image quality resulting in increased subject throughput and improved lesion detection as well as interpretation.


Tau and amyloid beta plaque-imaging agents were recently approved for imaging of neurodegenerative diseases such as Alzheimer's disease. Such techniques have the potential for early detection even before there are overt clinical signs and for monitoring efficacy of preventive and therapeutic strategies, assuming that these or developing imaging agents visualize a relevant surrogate of clinical disease. In this case, the degree of tau or amyloid beta deposition is presumed to reflect the degree of Alzheimers

disease and has been proposed to be used to assess the efficacy of disease interventions.

Gene Therapy Applications

New therapeutic techniques require new imaging approaches. Gene therapy and cellular therapy have found recent success but are limited by an inability to visually localize and quantify gene expression or cellular localization without biopsy. This may be approached using reporter imaging where a gene for imaging is inserted into the gene therapy vector. Commonly, this insert results in the production of a protein that can itself be imaged or can bind to an imaging agent. Most commonly the imaging agent is a radiopharmaceutical since nuclear medicine techniques have the greatest sensitivity, but MRI may follow in the future. It should be possible to insert an appropriately designed gene for imaging into a variety of gene therapy vectors so that several vectors or cell types can be imaged. In addition, it should be possible to link the gene for imaging to a therapeutic gene so that imaging can help measure expression of the therapeutic gene. Ideally, the reporter imaging gene system will enable imaging in patients, is small in order to fit into vectors, is non-immunogenic, and does not depend on its function for imaging so as not to disturb normal cell function. These reporters are becoming available, such as signaling deficient reporters based upon somatostatin receptor type 2. This type of imaging would further enable gene and cellular therapies.

Team Approach

Molecular imaging requires teams of experts such as those skilled in biology, chemistry, physics and instrumentation. It requires development from bench to bedside and expertise in commercialization to bring the innovations to patients. Molecular imaging has already been established in the clinic and new approaches suggest potential for improving current imaging and strong potential to develop new approaches for meeting future needs. 

R&E Raises \$17.5 Million to Fund Radiology's Future

The entire radiology community rose to the challenge and reached the \$17.5 million goal to fund RSNA Research & Education (R&E) Foundation grants for radiology researchers and educators.

The Foundation launched Inspire-Innovate-Invest: The Campaign for Funding Radiology's Future® in 2013 with the ambitious goal of raising \$17.5 million. The effort was led by Campaign co-chairs R. Nick Bryan, MD, PhD, David C. Levin, MD, and the late William G. Bradley, Jr., MD, PhD. The co-chairs worked tirelessly to promote the Campaign and demonstrate the value of giving to the Foundation. In fact, past grant recipients report that for every dollar awarded by the Foundation they have earned an average \$50 more from other sources, including the National Institutes of Health.

Platinum Centennial Pathfinder Phan T. Huynh, MD, was an early and staunch supporter. As chair of the R&E Fund Development Committee, Dr. Huynh proudly champions the Foundation's mission throughout the radiology community. "I feel so much gratitude to be in our amazing profession and I feel I owe it to my mentors who shaped my career to give back," he said.

Campaign donors who have made multi-year commitments represent every area of radiology, including 65 Centennial Pathfinders who made personal donations, generous private practice groups and corporate supporters. Campaign donors were bound by a common thread — the understanding that radiology research performed by radiologists is the most important way radiologists can support the future of the specialty.

"Our practice, as well as private practice groups across the country, are beneficiaries of research and education in the form of the future development of cutting-edge radiology techniques, interventions and technologies," said Brian D. Petersen, MD, of Inland Imaging, Professional Services. "Our contribution to the Inspire-Innovate-Invest Campaign was the most direct way we could show our support for this process." The practice made a 10-year commitment toward the Campaign.

The Campaign's impact is already evident.



Since the launch, the Foundation has provided \$15 million to 340 innovators in radiology research and education. Moreover, the Foundation's grant program has helped many young radiologists pursue careers in research, helping to maintain the intellectual leadership in imaging and image-guided therapies, earn the respect in the medical community and improve patient care, said N. Reed Dunnick, MD, Board of Trustees chairman.

For example, Robert R. Flavell, MD, PhD, received a 2015 RSNA Research Fellow Grant, and his work has led to the development of multiple new positron emission tomography and hyperpolarized 13C MRI tracers for imaging the tumor

microenvironment. "This initial funding helped propel me into my first academic position and helped greatly in writing several papers, obtaining extramural funding and starting my own laboratory," Dr. Flavell said.

Past R&E grant recipient Colin P. Derdeyn, MD, chair and departmental executive officer of the Department of Radiology at the University of Iowa, committed to the Campaign as a Silver Centennial Pathfinder. "Receiving the Siemens Medical Solutions/RSNA Research Fellow Grant 23 years ago had a profound impact on my career. It opened up a lot of opportunities," Dr. Derdeyn said. "I'm grateful to be in a position to give back."

With the support of these and many more Campaign donors the Foundation will continue to lead in funding radiology research and education well into the future.

"On behalf of the Foundation Board of Trustees, thank you to all of our donors for your investment in advancing the field of radiology through your support of innovative research and education projects," Dr. Dunnick said.

If you are inspired and would like to learn more about Funding Radiology's Future, contact Liten DeNaut, assistant director, fund development, at 630-368-3744 or ldenaute@rsna.org.



Bradley



Bryan



Levin

"On behalf of the Foundation Board of Trustees, thank you to all of our donors for your investment in advancing the field of radiology through your support of innovative research and education projects."

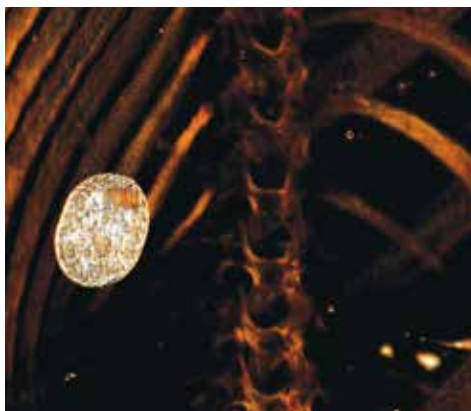
N. REED DUNNICK, MD

Paleoradiologists Unravel the Secrets of Ancient Mummies

BY BETH BURMAHL

When the ancient Egyptians mummified their dead, they did so without recording details about the process, which was intended to preserve the body so the soul could reclaim or “recognize” it after death.

And while the ancients sought to keep the process a secret, radiologists — or more specifically, paleoradiologists — are using imaging to unwrap the mysteries of mummification and reveal astonishing details about the people hidden beneath the linen wrappings.



A CT image of the trunk of the Golden mummy (circa 1000 BC) located at the Egyptian Museum in Cairo shows a rounded amulet of high density inside the mummy's torso.



On the cover: A 3-D CT image of the face of Seti I mummy shows subcutaneous packing material in three regions: around the nose and mouth (naso-labial fold), the cheeks and the temporal regions.

“The Egyptians left no writings about the process for mummies, and yet they wrote about most aspects of their lives,” said Sahar N. Saleem, MBBCH, MSc, MD, a radiologist at Cairo University, Egypt, who spoke about paleoradiology at RSNA 2017. “They wanted to keep it a secret.”

But since the x-ray was discovered in 1895, paleoradiologists have been unlocking those ancient Egyptian secrets, one image at a time.

Captured in 1896, the first radiographs of mummies were helpful, but were often fuzzy and did not reveal the specific details researchers were seeking. When CT was introduced in the 1970s, it provided a level of detail that made CT the method of choice for examining mummies.

“X-rays can only see two planes, but CT scanning can differentiate among the various types of bone and soft tissue,” said Dr. Saleem, who studied scanning mummies in Canada and has been studying royal mummies of the New Kingdom in Egypt since 2005.

Multi-detector CT scanning of ancient human remains has helped researchers understand ancient cultures, revealed the secrets of mummification and provided a deeper level of information on the origin and natural history of diseases. And more recently, 3-D printing technology has allowed radiologists to create 3-D printed models of amulets and jewelry inside the bodies of the mummies.

CT Solves Ancient Murder Mysteries

In recent years, Dr. Saleem and colleagues have used CT to help solve two mysterious deaths that took place in ancient Egypt, including that of the world's most famous pharaoh, King Tutankhamun.

While a bone chip inside his skull had fueled suspicion that Tut had been murdered, the CT scan of the mummy in 2005 determined that the bone was detached from a broken neck vertebra during the autopsy executed by Howard Carter in 1925. Tut, as it turns out, died of malaria and complications from a broken leg (also detected by CT) and likely walked with a cane. More than 160 canes were found in his tomb.

Dr. Saleem also helped solve the murder of Ramesses III, the Egyptian pharaoh who lived from 1190–1070 BC. When Dr. Saleem, with renowned Egyptologist Zahi Hawass, PhD, and other researchers, first scanned the mummy in 2012, they determined that Ramesses III died when someone slit his throat with a sharp knife.

When reassessing the pharaoh's CT scans in 2015, Drs. Saleem and Hawass determined that Ramesses III had sustained injuries from different types of weapons, suggesting that more than one assailant was involved. The researchers detail the story of Ramesses III in their 2016 book, “Scanning the Pharaohs.”

“Imaging also revealed that Ramesses' big toe was chopped off,” Dr. Saleem said. “From what we discovered, it was likely a very bloody scene.”

In researching the mummification process, Dr. Saleem determined that subcutaneous packing was used in mummies including those of Tutankhamun and Ramesses III. In the process, the ancients inserted resins and other fillers under the



Saleem



A 3-D CT image of the trunk of the mummy of pharaoh Ramesses III (1190-1070 BC) shows four statues made of faience representing the four sons of Horus, an ancient Egyptian deity. CT identified the statues as the body of man with different heads: human, jackal, falcon and baboon.



A 3-D CT image of a pot (circa 500 BC) from the basement of the Egyptian Museum in Cairo. The wall of the pot is virtually cut open to show that it contains a full mummy of a neonate. Pot burial of young children was common in ancient Egypt, especially for middle and lower social classes.

skin to preserve the looks of the dead — essentially an early form of cosmetic surgery. Egyptians believed preserving the looks of a dead person would help the soul more easily find its body.

“We discovered that the ancient Egyptians must have had substantial knowledge of anatomy as well as considerable surgical skills,” Dr. Saleem said.

Ensuring the Legacy of Egyptian Mummies


Along with the royals, ancient Egyptians also mummified millions of bodies, including those of common people, Dr. Saleem said. After a massive excavation in the 19th Century, mummies were so plentiful in Europe and America that they were often unwrapped publicly and at private parties held by the elite. Dr. Saleem called the events “freak shows.”

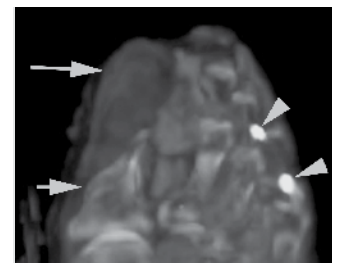
“Thousands of mummies were ground up and used as powder and

even for fertilizer,” Dr. Saleem said.

The discovery of the x-ray a short time later gave researchers the ability to see beneath the cloth wrappings and piece together the individual stories — adding value and dignity to each person’s life.

Dr. Saleem, who does much of her research at the Museum of Cairo, spends her time in the museum’s basement, which is filled with sealed artifacts that have never been studied. The museum, the only one in the world with a CT scanner, has some 160,000 pieces on display and regularly exhibits those identified by CT. The museum also has a database of information related to imaging the artifacts, she said.

During the RSNA 2017 session, Gerald J. Conlogue, MHS, RT, presented on his experience in field imaging of mummies in their tombs, while Andrew J. Nelson, PhD, discussed his work on micro CT in archaeology. 



A CT image of the left foot of Ramesses III shows a partially amputated left big toe. The bony edges are sharp without signs of attempted healing (*short arrow*). The ancient embalmers replaced the missing toe with a linen-made prosthesis (*long arrow*) and placed several metallic amulets (Eye of Horus) at the foot region to promote magical healing for the after life (*arrowheads*).

“We discovered that the ancient Egyptians must have had substantial knowledge of anatomy as well as considerable surgical skills.”

SAHAR N. SALEEM, MBBCH, MSc, MD

The Winding Road to Diversity and Inclusion in Radiology

BY JENNIFER ALLYN

While the number of women and minorities graduating from medical school has risen in recent years, the number of these students who choose radiology as a specialty has remained static.



24 to 26% of practicing radiologists and radiation oncologists are women.

— Association of American Medical Colleges



Women now comprise up to **50%** of both medical school graduates and graduate medical education trainees.



Female representation has only risen **0.3%** per year in radiation oncology over the past 20 years.



Minorities comprise **15%** of both medical school graduates and graduate medical education trainees.



8% of radiology trainees and **9%** of radiation oncology trainees are minorities.

Diagnostic radiology ranks **17th** for representation of women among the 20 largest medical training programs.

Diagnostic radiology ranks **18th** in total minority resident enrollment among the 20 largest medical training programs.

**Statistics provided by Johnson B. Lightfoote, MD*

In this first of a series of articles about diversity and inclusion in radiology, *RSNA News* talked with experts who offer their perspectives about when and how the call for diversity and inclusion in the field originated and discuss the challenges and obstacles to bringing more diverse viewpoints into radiology.

Discussions about diversity and inclusion go all the way back to 1955 when medical colleges acknowledged the lack of African-Americans in medicine. By the late 1960s and early 1970s, the number of African-American students in medical schools had risen from 2.4 percent to 6.3 percent. In 1974, the number of women in medical school was 22.4 percent.

By the late 1990s and early 2000s, there were calls for diversity across the board at medical schools and not just in terms of race and gender.

Today, diversity and inclusion are top-of-mind imperatives for leaders of medical schools where students are treating an increasingly diverse American population, according to Johnson B. Lightfoote, MD, a diagnostic radiologist and medical director for the Pomona Valley Hospital Medical Center, Pomona, CA.

“As medicine moves toward more patient-centered care, not just in radiology, but in all specialties, the workforce needs to reflect the patients we serve — not only in clinical care, but in all aspects of medicine, including research and healthcare access discussions,” Dr. Lightfoote said.

Women now comprise up to 50 percent of both medical school graduates and graduate medical education trainees, while minorities comprise just 15 percent, according to a 2015 study in *JAMA Internal Medicine*.

For these groups, radiology and radiation oncology rank near the bottom of the largest residency specialties. While women make up approximately 24 to 26 percent

of practicing radiologists and radiation oncologists, according to the Association of American Medical Colleges, the number of female radiology trainees has remained stagnant over the past eight years and shows only a subtle 0.3 percent increase per year in radiation oncology over the past 20 years.

Since 1995, there has been minimal improvement in minority trainee representation in radiology, with 8 percent of students in general radiology training and 9 percent in radiation oncology, according to 2016 statistics cited by Dr. Lightfoote.

These slowly rising numbers are a source of concern for Curtiland Deville, MD, associate professor of radiation oncology and molecular radiation sciences, Johns Hopkins Medicine, Baltimore, MD, and clinical director, radiation oncology, Johns Hopkins Kimmel Cancer Center at Sibley Memorial Hospital, Washington, D.C.

“The number of diverse individuals is increasing in medical schools but for reasons that are becoming increasingly clearer, radiology is not a specialty of interest for many of them or is not seen as offering benefits as unique as other specialties,” Dr. Deville said.

Overcoming Misconceptions

While many of the barriers to increasing the number of medical students in radiology are the same for all students — such as lack of early exposure to the specialty — there are common misconceptions that specifically affect women and minority medical students.

Two common misconceptions about the specialty are that radiologists rarely interact with patients and have limited opportunities to provide direct service to the community. According to Dr. Deville, a driving factor for many African-American and Latino students who are considering medical school is whether or not they will be able to give back to their community.

Editor's Note: This is the first in a series of *RSNA News* articles on diversity and inclusion in radiology. The second article will address how radiology leaders can promote diversity in the field.

“We acknowledge that the numbers of women and minorities in radiology won't change overnight and that these issues will require sustained attention for years to see meaningful change.”

MATTHEW BUCKNOR, MD



Lightfoote



Deville



Kulkarni



Lu



Bucknor

“Community and family play strong roles in these students' lives,” Dr. Deville said. “Radiology is not seen as having enough community interaction that would benefit the lives of their families and neighbors.”

A lack of female role models and a perception that radiology is a male-dominated profession, have also been noted, especially hindering the ability of female medical students to envision a radiology career path.

Finally, bias, often unconscious or implicit, has been documented in several studies as occurring in radiology, especially when considering promotions, whereby an equally qualified candidate is ranked lower for a position because of gender, race or ethnicity.

While these misconceptions and barriers may seem overwhelming, both Drs. Deville and Lightfoote said that if the need for improved diversity resonates within every practice, training hospital and university, there can be a culture shift that can positively affect both the clinical and business sides of radiology.

“Developing goals and strategies to improve workforce diversity will require an investment by our profession, our academic leaders and our practices,” Dr. Deville said. “It is time to expose women and underrepresented minorities to radiology earlier in their schooling and then engage and support their career growth once they enter the specialty.”

Radiology Initiatives Promote Diversity

While larger, U.S. efforts are moving forward slowly, universities across the country have adopted initiatives to help radiology departments integrate strategies to facilitate a more diverse and inclusive staff.

At the University of Chicago, the Radiology Committee on Diversity was formed to support a university priority to increase diversity in every department.

The committee did ad hoc work in 2012 that revealed a huge gender gap in radiology trainees. Female resident representation was less than 20 percent and, in one year, zero out of eight residents were women.

To help drive more interest, the committee hosts the Radiology Expo, a large-scale lecture and hands-on annual event that exposes all medical students to radiology, hopefully early enough in their education so that they can make an informed decision about the specialty.

“We decided to be more proactive to introduce medical students to radiology, instead of waiting for them to find us during their rotations,” said Radiology Committee on Diversity member Kirti Kulkarni, MD, associate professor of radiology at the University of Chicago.

The Radiology Expo has drawn a diverse roster of attendees. Over the past year, more than 70 students from nine different universities across the midwest have attended with more than 33 percent being women and 22 percent being minorities.

“Mentoring programs and outreach events, like the Radiology Expo, will continue to help equal out diversity across the board, along with support from leadership,” said Zheng Feng Lu, PhD, co-chair of the Radiology Committee on Diversity and a professor of radiology, clinical diagnostic physicist at the University of Chicago. “I hope that those who benefit from these activities will find the energy and desire to pay it forward to the generation after them.”

Continued on next page



From left to right: Kirti Kulkarni, MD, Maryellen Giger, MD, PhD, Carina Yang, MD, Etta Pisano, MD, and Zheng Feng Lu, PhD. Drs. Kulkarni, Giger, Yang, and Lu are key members of the University of Chicago Committee on Diversity, pictured here at the Radiology Expo. Dr. Pisano was the keynote speaker at the inaugural Radiology Expo in 2016.

Continued from previous page

In 2015, the University of California, San Francisco, (UCSF) formed their Radiology and Biomedical Imaging Diversity Committee that builds upon the university's system-wide commitment to promoting diversity and inclusion.

UCSF offers the Research Initiative to promote Diversity in Radiology (RIDR), a summer program that provides high school, college and medical students from diverse and underrepresented backgrounds with a paid internship to work with a faculty researcher. Its Radiology Elective to promote Diversity in Radiology (REDR) program offers a travel stipend for medical students outside of UCSF to visit the four major hospitals that make up its system and explore the opportunities available.

"We acknowledge that the numbers of women and minorities in radiology won't change overnight and that these issues will require sustained attention for years to see meaningful change," said Matthew Bucknor, MD, chair of the committee and assistant professor in residence in musculoskeletal radiology at UCSF.

Change Will be Gradual

With increased awareness and several creative and effective programs driving interest in radiology training, what are the next steps to further ensuring diversity and representation in radiology?

"Next steps should include meeting potential students where they are, which is online," Dr. Bucknor said. "Utilizing webinars to address misconceptions that stymie these students and creating online mentorships that showcase a radiology career path could make a huge difference in raising interest and securing recruitment."

Reaching students early in their careers will be increasingly pivotal, Dr. Lightfoote said.

"Change does not come easy in medicine, but early success inspires continued innovation," Dr. Lightfoote said. "Placing diversity, representation and inclusion into the core policies and missions of medical organizations and universities will allow us to achieve workforce diversity that meets the needs of our patients and ourselves." ❏

Technology Can Aid Healthcare Team Communication

BY LYNN ANTONOPOULOS

With continuous advancements in technology, radiologists have access to more tools than ever to combat breakdowns in communication with referring physicians and to ultimately play a greater role in improved patient care.



Annette J. Johnson, MD; Andrew B. Rosenkrantz, MD; Tarik K. Alkasab, MD, PhD; and Max Wintermark, MD, participated in a panel to explore communication strategies between radiologists and referring physicians.

During RSNA 2017, Max Wintermark, MD, professor of radiology and chief of neuroradiology at Stanford University, moderated a panel of presenters focused on identifying costly communication gaps between radiologists and referring physicians while broadening awareness of some creative and strategic ways radiologists are leveraging technology to be more active in patient care after imaging.

Often overwhelmed with heavy workloads, radiologists may be hesitant to assume additional responsibilities related to conveying test results and ensuring proper follow-up with patients. Yet those activities can play an important role in not only carefully interpreting images and making recommendations but also acting as a safe, patient-centered back-up system and ensuring that actionable results are not overlooked.

Virtual Connections

Among the creative methods highlighted were a virtual consult application and virtual rounds. Each follow the traditional model of a group of specialists meeting to review patient films and discuss the course of care. However, through these virtual meetings, the teams can use available technologies to overcome the challenge of gathering specialists in one place. Instead, they may teleconference from separate locations and accomplish the same care goals.

The virtual consult application is particularly important in the emergency department because it cuts through the problem of accessing help and can deliver an immediate benefit to the patient. “This is also especially useful where experts may not be in the area where patients live. Their access to care is not limited by geographic boundaries,” Dr. Wintermark said.

Bridging the Data Divide

As a result of advancements in artificial intelligence, future radiologists will move toward a more data-driven environment with more clinically useful work and less mechanical work related to interpreting and reporting. Data-driven image acquisition, data extraction, data-assisted interpretation and data-oriented reporting are all part of the future of radiology.

Using a wealth of data from a wide variety of sources, radiologists can turn reporting into the optimal tool for advancing patient care. The challenge is to bridge the divide between imaging data and clinical data, presenters said. The answer may be to employ technology to gather rich data from all sources and provide layered reporting that includes details more useful to referring physicians and more understandable to patients, they said.

Maintaining a Personal Connection

Although technology can increase communication, it can also be a barrier between radiologists and their clinical colleagues. It has the potential to lead to de-personalization during care. Dr. Wintermark said the key to incorporating technology effectively is striking the right balance, providing the patient access to expertise while retaining a familiar connection with a trusted provider.

“Though the patients do not generally see radiologists, radiologists see the patients, and the patients are the center of our concerns — prioritized above all else,” Dr. Wintermark said. “IT tools are used to better serve the patient behind the film.” ❏

WEB EXTRAS

View a video of Dr. Wintermark discussing interacting effectively with referring physicians in the digital age at [RSNA.org/News](https://www.rsna.org/News).

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Towards an Early Detection of Coronary Artery Bypass Graft Failure: A Computational Fluid Dynamics Approach Based on CT and 4-D flow MRI

Thanks to a 2017 Agfa HealthCare/RSNA Research Scholar Grant, **Laura Jimenez-Juan, MD**, will investigate the use of a computational fluid dynamics method based on CT angiography and 4-D flow MRI data for the early detection of coronary artery bypass graft (CABG) failure.

“If our method is successful, it will allow early non-invasive assessment of coronary graft performance and could change the postoperative management of CABG patients,” Dr. Jimenez-Juan said.



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

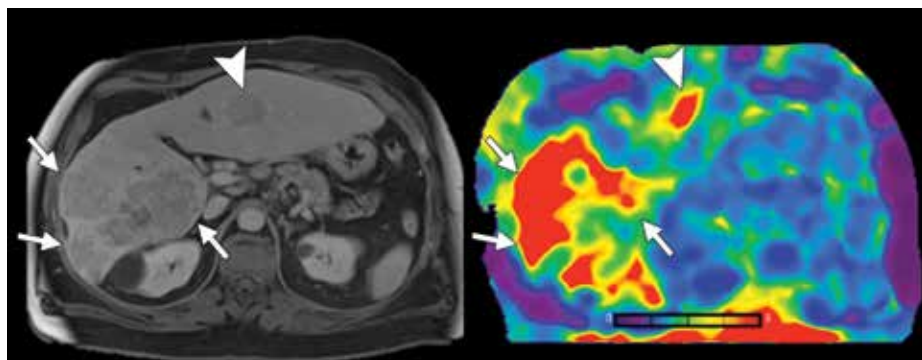
Quantitative Elastography Methods in Liver Disease: Current Evidence and Future Directions

Because treatment strategies and prognosis differ greatly depending on the severity of liver fibrosis, determining fibrosis staging is important. Liver biopsy is the method of choice for fibrosis evaluation, but alternative, noninvasive methods of evaluating liver health are being developed, such as ultrasonographically (US) and MR-based elastography.

In an article published online in *Radiology* (RSNA.org/Radiology), Paul Kennedy, PhD, Icahn School of Medicine at Mount Sinai, New York City, and colleagues review the techniques, results and limitations of US- and MRI-based elastography techniques.

Quantitative US elastography methods include transient elastography (TE) – the most validated elastographic technique – and acoustic radiation force impulse (ARFI) techniques. MR elastography offers equivalent to slightly better diagnostic accuracy than TE and ARFI, although it is less well validated and less available than US elastography methods.

Increasing fibrosis stage is associated with increased liver stiffness, providing a discriminatory feature that can be exploited by elastographic methods. However, for all elastographic methods, liver



Images in a 59-year-old man with chronic hepatitis C virus infection and infiltrative HCC in right hepatic lobe (arrows). MR elastography demonstrates increased stiffness (7.7 kPa) compared with background liver parenchyma (3.2 kPa). Another HCC nodule is present in left lateral hepatic lobe (arrowheads), also demonstrating increased stiffness. HCC = hepatocellular carcinoma.
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stiffness measurement can be affected by a variety of factors such as hepatic inflammation, congestion and cholestasis while TE can be affected by steatosis.

Ultrasound and MR elastography techniques have developed into accurate methods for quantitative, noninvasive diagnosis of liver fibrosis in a wide range of etiologies, the authors concluded.

"Interpretation of results should take

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into account potential confounding factors of liver stiffness measurements, pitfalls and technical limitations.

"The emergence of advanced techniques such as three-dimensional MR elastography and US-based controlled attenuation parameter measurement may increase the accuracy of fibrosis and steatosis staging in liver disease, although more data are needed," the authors write.

High-Intensity Focused Ultrasound for Pain Management in Patients with Cancer

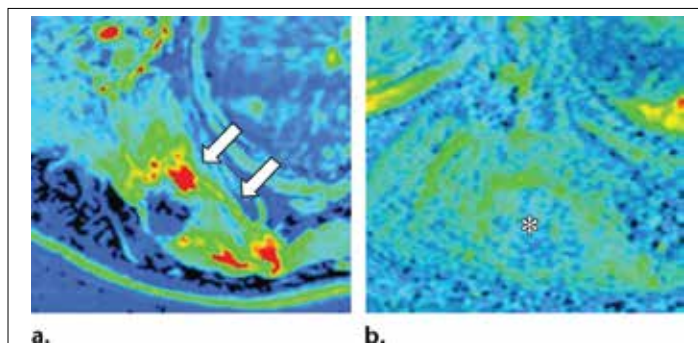
Cancer-related pain affects up to 80 percent of patients with malignancies. High-intensity focused ultrasound (HIFU) is a noninvasive technique that can be used to achieve pain palliation by producing several effects, including tissue denervation, tumor mass reduction and neuromodulation, each of which can influence different pathways at the origin of the pain.

In the March-April issue of *RadioGraphics* (RSNA.org/RadioGraphics), Susan Dababou, MD, Sapienza University of Rome, Italy, and colleagues discuss the emerging technique involving the use of high-energy ultrasound waves to precisely ablate a well-circumscribed target volume with MRI or ultrasonographic (US) guidance, without damaging the surrounding healthy structures.

The main benefit of HIFU for cancer patients is the capability to address different features of a malignancy by decreasing painful stimuli, locally controlling the tumor, potentially enhancing local drug delivery and stimulating the host antineoplastic immune response.

Currently, MRI-guided HIFU is recommended as a second-line treatment after unsuccessful radiation therapy for palliation of pain related to nonspinal and non skull bone metastases. Current evidence suggests that the use of HIFU can facilitate reduced pain in patients with pancreatic adenocarcinoma, with up to 81 percent of affected patients reportedly experiencing pain relief.

“The improvement in pain control can be immediate, and the procedure can be safely combined with chemotherapy and radiation therapy to synergistically enhance their effects. Moreover, this procedure is noninvasive, and the absence of ionizing radiation ensures that there is no radiation-related risk if retreatment is deemed



Treatment of bone metastasis in the right scapula, secondary to melanoma, in a 74-year-old man. (a, b) Axial dynamic contrast-enhanced color-coded T1-weighted MR images acquired before (a) and after (b) HIFU treatment show intense vascularization of the malignant area (arrows in a) before treatment and markedly decreased vascularization (* in b) after the procedure. Color gradients indicate blood perfusion, from less perfused (blue) to highly perfused (red).

(*RadioGraphics* 2018;38;2:InPress) © RSNA 2018. All rights reserved. Printed with permission.

necessary after the recurrence of symptoms or worsening of the primary condition,” the authors write.

RadioGraphics

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



Listen to *Radiology* Editor David A. Bluemke, MD, PhD, discuss this month’s research you need to know about. Podcasts summarize the importance and context of selected recent articles. Subscribe today at RSNA.org/Radiology-Podcasts and never miss a single episode.

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- 📻 “Evaluation of Kidney Stones with Reduced–Radiation Dose CT: Progress from 2011–2012 to 2015–2016—Not There Yet” Karrin Weisenthal, BA, and colleagues.
- 📻 “Temporary Hearing Threshold Shift in Healthy Volunteers with Hearing Protection Caused by Acoustic Noise Exposure during 3-T Multisequence MR Neuroimaging” Chao Jin, PhD, and colleagues.



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RadioGraphics
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- 📺 “Acute Radiologic Manifestations of America’s Opioid Epidemic,” David D.B. Bates, MD, and colleagues.

Radiology in Public Focus

Radiology in Public Focus

RSNA Updates Gadolinium Position Statement

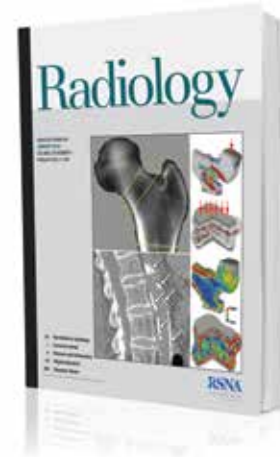
The FDA recently issued a safety announcement requiring a new class warning and other safety measures for all gadolinium-based contrast agents (GBCAs) used for MRI. These include requiring a new patient Medication Guide and a requirement for manufacturers of GBCAs to conduct human and animal studies to further assess the safety of these contrast agents. RSNA updated its position statement on gadolinium-based MR contrast agents to reflect this news. No other changes were made to the position statement.

Access the updated RSNA position statement at RSNA.org/Position-Statements and the updated FDA statement at fda.gov.

Media Coverage of RSNA

In November 2017, more than 20,500 RSNA-related news stories were tracked in the media. These stories reached an estimated audience reach of 10.6 billion people.

Coverage included *U.S. News & World Report*, *Newsweek*, *The Boston Globe*, *Daily Mail*, *San Francisco Chronicle*, *Houston Chronicle*, *BBC.com*, *Forbes.com*, *Reuters.com*, *WebMD*, *Drugs.com*, *HealthDay*, *Philly.com*, *The Arizona Republic*, *Yahoo! Finance*, *Pittsburgh Post-Gazette*, *Milwaukee Journal Sentinel*, *CBSNews.com*, *Health.com*, *Diagnostic Imaging* and *Auntminnie.com*.



March Public Information Outreach Focused on Colorectal Cancer

In recognition of National Colorectal Cancer Awareness Month in March, RSNA is distributing radio public service announcements (PSAs) encouraging listeners to get screened for colorectal cancer.

New on *RadiologyInfo.org*

March is Colorectal Cancer Awareness Month. Do your patients know they should begin screening for colorectal cancer at age 50? Encourage them to visit *RadiologyInfo.org*'s Colorectal Cancer Screening page to learn more about this disease, its risks, symptoms and available screening methods such as CT colonography.

RadiologyInfo.org Wants to Share Your Patients' Stories

RadiologyInfo.org – the RSNA-ACR patient information website – helps patients better understand radiology and the role radiologists play in their healthcare. Now, *RadiologyInfo.org* is exploring a new way to spotlight radiology with the public by sharing patient stories — *your* patients' stories.

Do you have patients who would be willing to share their radiologic care experience with others? Email RadiologyInfo@RSNA.org with the subject line "Patient Stories" to connect us with your patients. Visit the *RadiologyInfo.org* Patient Stories section to learn more about this opportunity.

RadiologyInfo.org
For patients

Value of Membership

RSNA Offers Affordable Membership as Residents Transition into Practice

There are numerous things that can be challenging about transitioning to full-time practice. Maintaining your RSNA membership should not be one of them.

Residents and fellows transitioning from training receive reduced RSNA membership rates during their first and second years of practice – just \$100 in year one and \$200 in year two.

This RSNA benefit gives transitioning members time to settle into the profession before paying the full membership fee in year three. Under the program, transitioning members receive all the benefits of full membership, including subscriptions to *Radiology*, *RadioGraphics* and *RSNA News*, free standard admission (with advance registration) to the RSNA annual meeting and free access to hundreds of online CME opportunities.

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.



Education and Funding Opportunities

RSNA/ASNR Comparative Effectiveness Research Training (CERT) Program

**Application Deadline
April 30**

Apply now for the RSNA/American Society of Neuroradiology (ASNR) Comparative Effectiveness Research Training (CERT) Program. There is no fee for this course. Apply at RSNA.org/CERT or contact RSNA staff at dor@rsna.org with questions.

RSNA 2018 International Travel Stipend Program

**Application Deadline
April 30**

The RSNA International Travel Stipend Program aids eligible members from developing or low-resource nations by partially defraying travel expenses related to attending the RSNA annual meeting. For more information and to apply, visit RSNA.org/Annual-Meeting-International-Travel-Stipend.

Updated Ethics and Professionalism Courses Now Available

The RSNA Professionalism Committee recently reviewed and updated the Ethics and Professionalism courses on the RSNA Online Learning Center. This 11-course series is essential to the practice of diagnostic radiology, radiation oncology and medical physics.

Developed in 2011, updated in 2014 and again in 2017, the online courses educate radiologists on how to navigate tricky ethical situations that can arise in the workplace or during academic research.

The series includes such topics as “Physician-Physician and Physician-Patient Interactions,” “Personal Behavior, Peer Review and Contract Negotiations with Employers” and “Conflicts of Interest.”

Each self-guided course includes a CME test to help learners assess their comprehension and application of the principles and practices described in the course.

RSNA members can earn SA-CME credits for the successful completion (80 percent or better score) of the tests. Course

credits for the Ethics and Professionalism Online Courses range from 1.50 to 3.0 *AMA PRA Category 1 Credits*™ per course. These credits and can be applied toward the American Board of Radiology (ABR) MOC self-assessment requirement.

RSNA members can access these courses for free in the Online Learning Center at Education.RSNA.org. Enter “Ethics and Professionalism” in the Search field.

Annual Meeting Watch

RSNA 2018 Online Abstract Submission Now Open

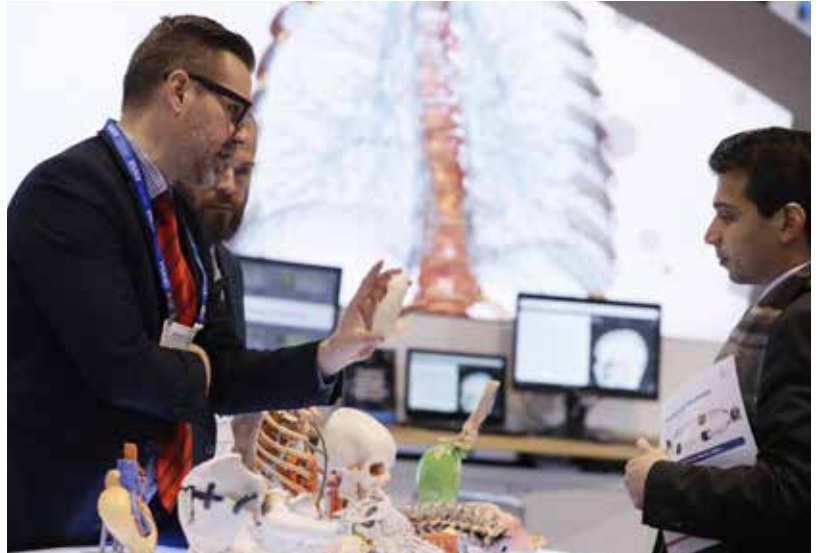
The online system to submit abstracts for RSNA 2018 is open. The submission deadline is noon Central Time (CT) on Wednesday, April 11, 2018. Abstracts are required for scientific presentations, education exhibits, applied science, quality improvement reports and quantitative imaging reading room showcases.

To submit an abstract online, go to RSNA.org/Abstracts. The easy-to-use online system helps the Scientific Program Committee and Education Exhibits Committee evaluate submissions efficiently. For more information about abstract submissions, contact the RSNA Program Services Department at 1-877-776-2227 within the U.S., or 1-630-590-7774 outside the U.S.

The top neuroradiology scientific paper as selected by the Scientific Program Committee will receive a \$3,000 award at RSNA 2018.

Students, clinical trainees and post-doctoral trainees are eligible to receive \$500 travel awards for top-rated abstracts accepted for presentation at RSNA 2018. Trainees are also eligible to receive a \$1,000 research prize.

Full eligibility requirements for all awards are available with the 2018 Call for Abstracts.



Present at RSNA 2018:

- ▶ Scientific Presentations
- ▶ Applied Science
- ▶ Education Exhibits
- ▶ Quality Improvement Reports
- ▶ Quantitative Imaging Reading Room

RSNA 2018
TOMORROW'S
RADIOLOGY TODAY

November 25-30
 104th Scientific Assembly & Annual Meeting

Reserve your RSNA 2018 Hotel Now!
 Hotel reservations with discounted rates for all RSNA 2018 attendees are available at RSNA.org/Annual-Meeting.

Technology Forum

2018 IHE® Connectathon Draws Leading HIT Vendors



Top health information technology (HIT) vendors gathered in Cleveland in January for the 20th annual Integrating the Healthcare Enterprise (IHE®) North American Connectathon.

More than 63 organizations and nearly 500 individuals participated in the live, cross-vendor, supervised and structured event where industry leaders tested the implementations of IHE profiles to advance health IT interoperability. More than 100 IHE Profiles were tested this year.

An event within the Connectathon is the Plug-a-thon, which offered four tracks to help participants explore and create new capabilities for products that interoperate with each other, especially older, legacy systems used in hospitals. These included sessions on FHIR®, Blockchain and its uses in healthcare, mHealth and the growing number of medical equipment, facility and resource management solutions promoting sensory information.

RSNA and the Health Information and Management System Society (HIMSS®) have sponsored the Connectathon since its inception in 1999. For more information, visit RSNA.org/IHE.aspx or IHEUSA.org/what-is-ihe-connectathon.



Industry leaders gathered recently for the IHE® Connectathon to test IHE profiles and advance IT interoperability.

COMING
NEXT
MONTH

Next month, *RSNA News* will report on the challenges radiology faces in serving rural areas of the U.S.



GET NOTICED

Present at RSNA 2018:

- ▶ Scientific Presentations
- ▶ Applied Science
- ▶ Education Exhibits
- ▶ Quality Storyboards
- ▶ Quantitative Imaging Reading Room

EARN RECOGNITION!

The RSNA Travel Award Program for Students

Up to 430 top-rated abstracts from current RSNA members will earn a \$500 travel stipend.

Kuo York Chynn Neuroradiology Research Award

The top scientific paper as selected by the Scientific Program Committee will earn a \$3,000 award recognition.



Visit RSNA.org/Abstracts for complete guidelines.

Submit online

beginning January 2018 at RSNA.org/Abstracts
through Wednesday, April 11, 2018, 12 NOON Chicago Time.

Questions?

Call 1-877-776-2227 (*within U.S.*)
or 1-630-590-7774 (*outside U.S.*)

Includes courses in joint sponsorship with the
American Association of Physicists in Medicine