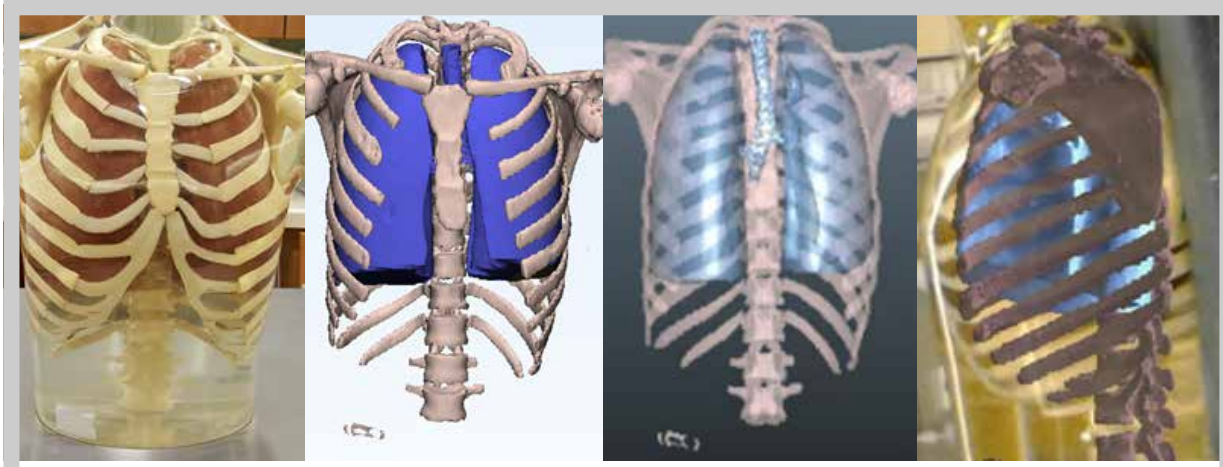
RSNA News™

July 2017 Volume 27, Issue 7



Augmented Reality Technology Poised to be a Game-Changer in Radiology

ALSO INSIDE:

3-D Printed Models Break New Ground in Surgery

Eye-Tracking Technology Targets Wrong-Patient Errors

Device May Detect Esophageal Cancer Earlier

MRI Helps Trace Cause of Vision Problems in Astronauts

Radiology Mentors Leave Lasting Imprint on Students

Register for RSNA 2017 — See Page 24

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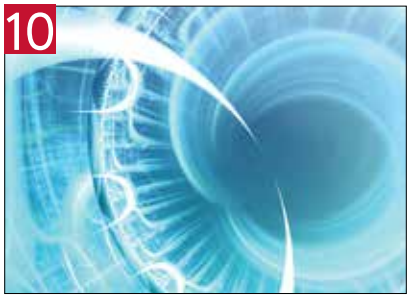
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RSNA Announces 2017 Gold Medalists

The RSNA Board of Directors has announced the Gold Medal recipients who will be honored at the 103rd Scientific Assembly and Annual Meeting. They are:

George S. Bisset III, MD
Houston

J. William Charboneau, MD
Rochester, MN

Roderic I. Pettigrew, MD, PhD
Bethesda, MD

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Join more than 140 radiology-related professional societies from around the globe on Nov. 8 in celebrating the advances that radiologic innovations have brought to patients worldwide.

IDoR 2017 is dedicated to emergency radiology and the essential role that radiologists play in the emergency room, increasing the quality of care and treatment of patients.

IDoR is sponsored by RSNA, the European Society of Radiology and the American College of Radiology, with a dedicated website (*IDoR2017.com*) and social media activities.

Visit *RSNA.org/IDoR* for promotional materials you can customize for your practice or organization.

In Memoriam

Helen M.L. Carty, MBBCh

Renowned pediatric radiologist Helen M.L. Carty, MBBCh, died April 23 in Liverpool, England. She was 72.

A native of Dungarvan, Ireland, Dr. Carty completed her radiology residency at Saint Thomas Hospital in London and remained in England throughout her career. In 1974 she obtained fellowship of the Royal College of Radiologists and soon became consultant radiologist at the Alder Hey Children's Hospital in Liverpool, rising to director of Radiological Service, a post she held for 27 years. In 1996 she became a professor of paediatric radiology at Liverpool University and Alder Hey, a position she held until her retirement from clinical practice in 2004.

Dr. Carty helped to pioneer an interventional technique for children suffering from aneurysmal bone cysts. She published prolifically on pediatric imaging and served as a reviewer for a number of academic journals.

Past president and chair of the European Congress of Radiology (ECR), Dr. Carty received the ECR gold medal in 2009. She received honorary memberships from RSNA, the European Society of Paediatric Radiology, the Radiological Society of Hungary and the Polish Radiological Society. She was a frequent invited lecturer around the world and received the president's award from the Association of American Women Radiologists in 2004.

RSNA Mourns Passing of Immediate Past-President Richard L. Baron, MD

RSNA joins the worldwide radiology community in mourning the loss of RSNA's immediate past-president Richard L. Baron, MD, who passed away suddenly on May 4.

Baron

Widely respected by colleagues across the globe as a diagnostic radiologist, educator, author and researcher, Dr. Baron forged a lasting legacy at RSNA, serving in numerous leadership positions culminating in his RSNA presidency in 2016. The RSNA Board of Directors expressed deep sadness at the loss of their longtime colleague and friend.

"The Board of Directors is extremely sad to lose this important member of our RSNA family. He will be greatly missed," said Valerie P. Jackson, MD, Chair of the RSNA Board of Directors. "Rich Baron was a leader in many areas of his life and radiology. He was an internationally respected abdominal imaging radiologist and an outstanding administrator. He was humble, kind-hearted and always willing to mentor others."

Dr. Baron spent the latter part of his career at the University of Chicago (UC), serving as professor of radiology from 2002 until the time of his passing. He served as UC chair of the Department of Radiology from 2002 to 2011 and as dean for clinical practice from 2011 to 2013. At the University of Pittsburgh, he served as chair of the Department of Radiology from 1992 to 1999, and as founding president and CEO of the University of Pittsburgh Physicians from 1997 to 2002.

Colleagues at UC remember Dr. Baron as a dedicated leader and teacher who was committed to the highest standards in every area of his professional and personal life.

"Dr. Baron possessed an unselfish and lasting commitment to helping young — and sometimes not so young — faculty understand the stresses and rewards of the field," said David M. Paushter, MD, chair of the Department of Radiology at UC. "He continually emphasized the importance of learning new things. Dr. Baron had a reputation for doing the right thing and always taking the high road. He was deeply committed to his patients, colleagues and institutions."

Dr. Baron joined the RSNA Board of Directors in 2008 and served as the Board liaison for education and international affairs. In his RSNA 2016 President's Address, "Beyond Imaging: Ensuring Radiology Impact in Clinical Care and Research," Dr. Baron offered valuable insight on the future of the specialty he devoted his life to building.

Dr. Baron's research focused on diagnostic imaging of liver disease and he served as an international authority on imaging in chronic liver disease and liver tumors. At RSNA 2016, Dr. Baron organized a special Liver Symposium where experts from across the globe met to discuss this critical area of research.

Throughout his career, Dr. Baron was dedicated to building bridges between radiologists across the globe. He worked closely with radiology associations around the world, building a roster of lifelong personal and professional relationships along the way.

Among his many accolades, Dr. Baron received the Medal of Honor and honorary membership in the French Radiological Society in 2015, the Gold Medal of the Asian Oceanian Society of Radiology in 2014, and honorary membership in the European Society of Radiology earlier this year.

Dr. Baron is survived by his wife, Shirley, son Tim and daughter Christine.

The Baron family has designated the RSNA Research & Education (R&E) Foundation for memorial donations. A fund has been established for donations in memory of Dr. Richard Baron which will go to support a young radiology researcher in abdominal imaging.

CAR Gold Medal Awarded to del Carpio-O'Donovan


del Carpio-O'Donovan

The Canadian Association of Radiologists (CAR) awarded its 2017 gold medal to **Raquel Z. del Carpio-O'Donovan, MD,** in recognition of her outstanding contributions to neuroradiology as a researcher, teacher and mentor. Dr. del Carpio-O'Donovan is a professor of radiology at McGill University Health Centre and chief of the Department of Radiology at the Montreal General Hospital, both in Montreal. She is a past member of the RSNA Public Information Committee and traveled to China as part of the RSNA International Visiting Professor Program in 2008.

Fayad Receives $13 Million from NIH


Fayad

Zahi A. Fayad, PhD, who received a 1998 RSNA Research Seed Grant, is principal investigator on a study that has been awarded $13 million from the National Heart, Lung and Blood Institute of the National Institutes of Health (NIH). Dr. Fayad aims to uncover the mechanisms by which stress contributes to cardiovascular risk through a five-year research program.

Dr. Fayad is the Mount Sinai Endowed Chair in Medical Imaging and Bioengineering, professor of radiology and medicine (cardiology), and director of the Translational and Molecular Imaging Institute at the Icahn School of Medicine, New York City.

ISMRM Honors Griswold, Wehrli and Pettigrew


Griswold


Wehrli


Pettigrew

The International Society for Magnetic Resonance in Medicine (ISMRM) presented awards during its annual meeting in April. The society awarded gold medals to **Mark A. Griswold, PhD,** professor of radiology at Case Western Reserve University in Cleveland, and **Felix W. Wehrli, PhD**, professor of radiologic science and director of the Laboratory for Structural NMR Imaging in the Department of Radiology at the University of Pennsylvania Health System, Philadelphia.

The Distinguished Service Award was presented to **Roderick I. Pettigrew, MD, PhD**, founding director of the National Institute for Biomedical Imaging and Bioengineering. Dr. Pettigrew, a past member of the RSNA Scientific Program and Research Development committees, will present a plenary lecture and receive an RSNA Gold Medal at RSNA 2017.

Numbers in the News

100

Number, in millions of dollars, that the augmented reality market is predicted to capture in three years. Read about radiology's role in this fast-moving technology on Page 8.

Correction

An incorrect image appeared in the article, "Redefining Radiology's Role in the 3-D Printing Revolution," in the May issue of *RSNA News*. The photo at left, featuring Jonathan M. Morris, MD, and Jane Matsumoto, MD, is correct and also appears in the online version of the story at *RSNA.org/News.*

RSNA NEWS
July 2017 • Volume 27, Issue 7
Published monthly by the Radiological Society of North America, Inc.
820 Jorie Blvd., Oak Brook, IL 60523-2251. Printed in the USA.

Postmaster: Send address corrections or changes to: *RSNA News*, 820 Jorie Blvd., Oak Brook, IL 60523-2251

Non-member subscription rate is $20 per year; $10 of active members' dues is allocated to a subscription of *RSNA News.*

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Editor's Note: This is the second in a three-part series on the 3-D printing explosion in radiology. The next article will appear in the September issue.

3-D Printed Models Move Complex Surgery in Exciting New Directions

BY RICHARD DARGAN

In recent years, 3-D printing has expanded into many areas of medicine, but perhaps none more significant than in the modeling of complex pathology for surgical procedures. Surgeons around the world are driving this growth by requesting 3-D models to assist in surgical planning. Radiology plays a critical role in creating the images used to develop the models.

Mitsouras

Prabhu

"I think it speaks volumes as to the utility of the technology for patient care that, even in today's high-tech operating rooms, expert surgeons keep asking for 3-D printed models even though they recognize this is not a routine clinical service," said Dimitris Mitsouras, PhD, an assistant professor of radiology at Brigham and Women's Hospital in Boston (BWH), and a member of the RSNA 3-D Printing Special Interest Group (SIG).

As director of the hospital's Applied Imaging Laboratory, Dr. Mitsouras has assisted vascular, orthopedic and thoracic surgeons in preparing for surgery. On one occasion, he assisted a neuroradiologist who was attempting to perform a second cryoablation of a bone tumor in the spine of a 17-year-old patient.

The first ablation had been incomplete, leaving the patient in pain. But the remaining tumor was close to a nerve root and the neuroradiologist was concerned that the cryoblation process, which involves drilling into the bone and inserting a probe to freeze the tumor tissue, might damage the nerve.

Enter Dr. Mitsouras.

Using a combination of CT and MRI, along with different mixtures of materials and lots of persistence, Dr. Mitsouras was able to craft models that conveyed the patient's tumor, bone, cerebrospinal fluid and the fat encasing the at-risk nerve root.

The simulation of the CT and MR image-guided procedure on the model revealed an atypically-shaped tumor that would have been difficult to access had the initially-planned two-path tract approach been attempted.

The model helped Thomas Lee, MD, assistant section chief of neuroradiology at BWH, to determine that a single approach through the contralateral side of the spinous process would allow the ice ball to cover the entirety of the residual tumor without endangering the nerve.

"This was the first time we had ever used a contralateral approach, and frankly we would not have thought of it had we not had the model," Dr. Mitsouras said. "As a result, today there is a young man out there who can live a full, pain-free life without a neurological deficit."

3-D Printing Charts New Surgical Territory

Pediatric radiologist Sanjay Prabhu, MD, has used 3-D printing to tackle daunting challenges he routinely faces at Boston Children's Hospital (BCH), where he also serves as clinical director of the hospital's SIMPeds 3D Print Service, the in-house rapid 3-D printing and prototyping service for surgical pre-planning (see sidebar).

Surgical teams at BCH often use 3-D models to practice on rarely seen conditions that even experienced surgeons likely have not faced. In one case, Dr. Prabhu and his team printed 10 separate models for a child born with craniosynostosis, a condition in which the bones of the skull fuse in an abnormal fashion. The models allowed John Meara, MD, DMD, plastic surgeon-in-chief at BCH, to perform 10 practice procedures before choosing the best approach.

"Every surgeon knows that there is an element of uncertainty on the operating room table," Dr. Prabhu said. "Anything you can do to reduce that is good for the patient."

In another case, the clinicians sought to develop a surgical plan for a four-month-old boy whose skull had failed to properly close at the top, leaving much of his brain exposed. The fluid-filled cavity that surrounded the boy's brain was growing larger and larger.

"He had been seen elsewhere and they had all said, 'There's nothing we can do

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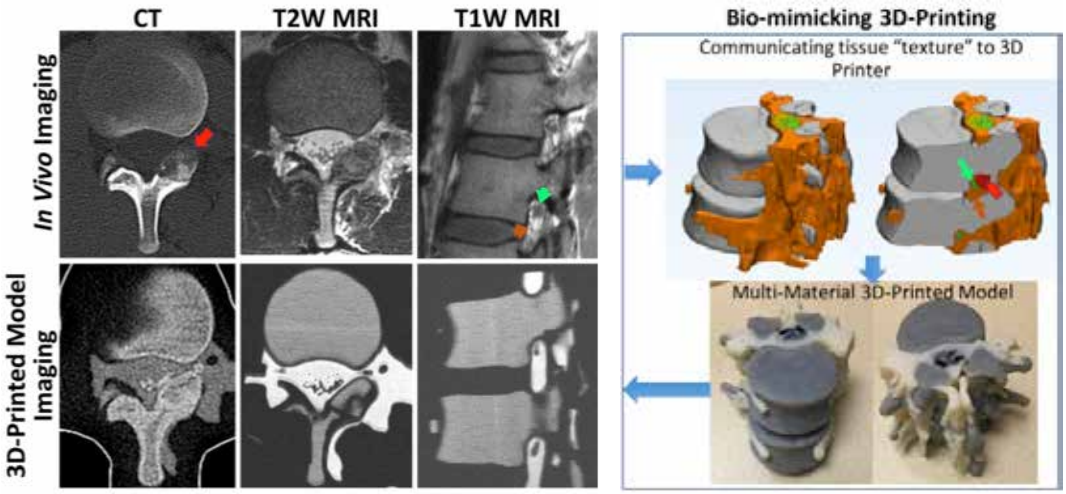


The 3-D printing process at Brigham and Women's Hospital: *Top row, from left*: CT and MRI of a patient with L1 left lamina osteoblastoma (*red arrow*). Segmenting the individual tissues in these images and using 3-D printing to see the images using different radiopaque materials, some MR-visible and some not, produces a printed model (*right*) that replicates the signal densities/intensities of the tissues similar to the in vivo images (*left: bottom row*), including the tumor, adipose tissue including foraminal fat (brown arrows) and spinal nerves (*green arrows*). The model was used to simulate the CT-guided power drilling and subsequent MRI–monitored cryoablation to ensure that the tumor could be ablated without the ice ball impinging on the nerve root (*green arrow*). *Image courtesy of Brigham and Women's Hospital.*

> "*3-D models have made a big difference for patient management.*"
>
> SANJAY PRABHU, MD

Continued from previous page

for this child,'" Dr. Prabhu recalled.

Incisions were needed in the child's skull. Dr. Prabhu used virtual 3-D modeling on the computer to determine the necessary cuts, which he then translated to a physical model for simulation. The model was used as a template to make cuts on the patient for the surgery, which was ultimately successful.

Another common use of 3-D printing at Boston Children's is in patients with scoliosis who need screws put in their backs to fuse the spine. In the past, screws put in place in the operating room were often too large, causing the children to develop post-procedural ulcers. The 3-D models allow surgeons to find the proper size screws before surgery, mitigating the need for additional treatment.

"These 3-D models have made a big difference for patient management," Dr. Prabhu said. "They've helped decrease sedation and blood loss and the time a child spends in surgery."

3-D Printed Models Aid U.S. Service Members and Veterans

The U.S. government has been at the forefront of the 3-D printing revolution, developing a wide range of applications for the technology since the early 2000s.

One of the most advanced printing facilities in the country, the 3-D Medical Applications Center at Walter Reed National Military Medical Center in Bethesda, MD, creates custom pre- and post-surgical models, custom surgical guides and templates, custom cranial implants, prosthetic components and simulation models for training (see sidebar).

"We get more than 300 orders a year, and the number of models we make is at least double that," said Peter Liacouras, PhD, director of services for the center.

Dr. Liacouras and staff use 3-D digital technology and 3-D printers — including a titanium printer — to create prosthetics and rehabilitation attachments, devices and components customized for active duty military and veteran members. CT imaging and reconstructions of the existing geometry aid in the design and construction of new 3-D printed components.

One example of a custom prosthetic and rehabilitation attachment is "shorty feet," which allows bilateral above-the-knee amputees to move without their full prosthetics.

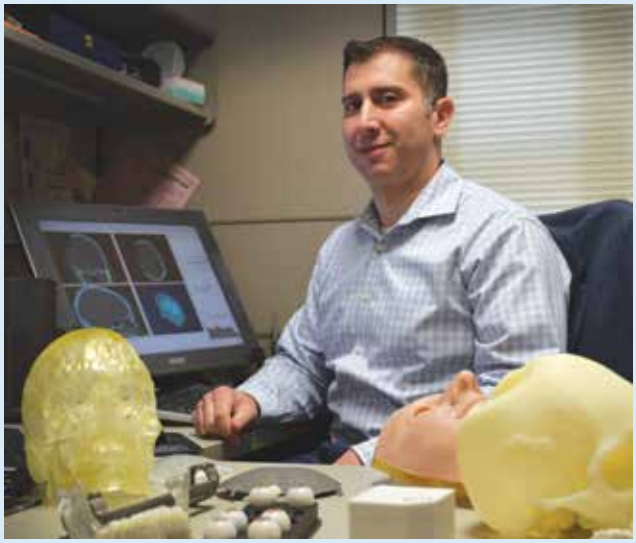
"Other patient-specific prosthetic components have included hockey skate adapters, rock climbing gear, steering wheel adapters and toothbrush holders."

"These are all areas where the normal prosthetic limb and rehabilitation devices available had limitations," Dr. Liacouras said. "This is a great help for patients who want to get back to the quality of life they had before."

CT Still Superior for 3-D Models

CT remains the ideal modality for 3-D models due to its superior resolution

3-D Printing Centers Break New Ground in Patient Care



Peter Liacouras, PhD, is director of the 3-D Medical Applications Center at Walter Reed National Military Medical Center, one of the most advanced printing facilities in the country. ***Image courtesy of Walter Reed Military Medical Center.***

Boston Children's Hospital's SIMPeds 3D Print Service is an in-house rapid 3-D printing and prototyping service for surgical pre-planning, pediatric device discovery, production and research. State of the art printers, machines, radiologic and technical expertise operate under one roof.

Any part of the anatomy that can be visibly distinguished on CT/MR can be printed in 3-D, as well as mechanical devices and products. With the addition of special effects expertise, "feel" and materials can often also be crafted to reflect the real thing.

For more information, go to s*impeds.org/simpeds3d-print.*

The Walter Reed National Military Medical Center's 3D Medical Applications Center (***pictured, left***) provides computer-aided design (CAD) and computer-aided manufacturing (CAM) to create medical models and custom implants, provide technical support for virtual treatment planning, and image capture in support of patient treatment, graduate medical/dental education and research.

For more information, go to *wrnmmc.capmed.mil.*

and consistent image quality, said Dr. Mitsouras. It is more difficult to produce a model from MR images due to the lower resolution, the increased chance for artifacts such as motion, and the limitation of available post-processing software and workflows.

Beyond MRI, nuclear medicine is also being studied as a complement to CT. An application recently developed by Jonathan M. Morris, MD, and Jane Matsumoto, MD, at the Mayo Clinic in Rochester, MN, enables models to convey not only anatomy, but also tumor metabolic activity. Dr. Morris is chair of RSNA's 3-D Printing Special Interest Group.

Regardless of what modality is used, quality images and a firm understanding of anatomy and pathology are critical to getting the best models made — a fact that underscores the importance of radiologists in the growing field.

"If you can't image something, you won't see it, and radiologists understand better than anyone how to image something," Dr. Prabhu said.

The surgical teams at Boston Children's Hospital use 3-D models to practice on rarely seen conditions that even experienced surgeons likely have not faced, including craniosynostosis, a condition in which the bones of the skull fuse in an abnormal fashion. ***Image courtesy of Boston Children's Hospital.***

Augmented Reality Technology Poised to be a Game-Changer in Radiology

BY MICHAEL HART

The global phenomenon Pokemon Go is one example of the fast-growing trend of augmented reality technology, which analysts predict will become a $100 million market within three years.

While the market is primarily driven by the gaming and entertainment industry, healthcare — including radiology — is beginning to piggyback off the trend to develop virtual reality applications that have the potential to dramatically change medicine in a number of ways.

"Our lab at the university has consistently been pulling technologies that have been developed outside of medicine to determine if we can apply them to medical imaging," said Eliot Siegel, MD, a professor at the University of Maryland, College Park, and a member of the RSNA RadLex® Steering Committee.

Unlike virtual reality, which creates a completely immersive environment when someone dons a headset, augmented reality allows users to experience their surroundings at the same time they are viewing computer-generated information.

Back in February 2013, Dr. Siegel and his research team were eager to get their hands on one of the first augmented-reality devices that could be placed on a person's head: Google Glass. More recently, the team has been focusing on Microsoft's HoloLens, introduced in 2016, to gauge the potential for using these devices in radiology.

Although wearable technology is still in its first iteration, Dr. Siegel expects significant changes for radiology in the not-too-distant future.

"I believe wearable technology will be a major game changer in the way we'll be practicing radiology in the future, and in the way health professionals of all kinds will perform their procedures going forward," Dr. Siegel said.

Possible Imaging Applications

Dr. Siegel said there are at least three areas in which the devices could be implemented in radiology: education, diagnostic radiology and imaged-guided intervention.

Education is perhaps easiest to understand. While radiologists are becoming more familiar with 3-D printing, wearable optical devices take that one step further by creating a hologram — a 3-D image that the user can place in one location and move around in real time. By projecting 3-D images, students can "walk" around and view anatomy from different perspectives, aiding the learning process.

Siegel

Gupta

There are numerous potentially promising applications for diagnostic radiology, including using the devices to view as many virtual images as they want in their own field of vision.

"It gives you a tremendous amount of flexibility and the ability to personalize care," Dr. Siegel said.

Augmented-reality devices also allow radiologists to view high-quality images on a screen when they are away from their usual workplace.

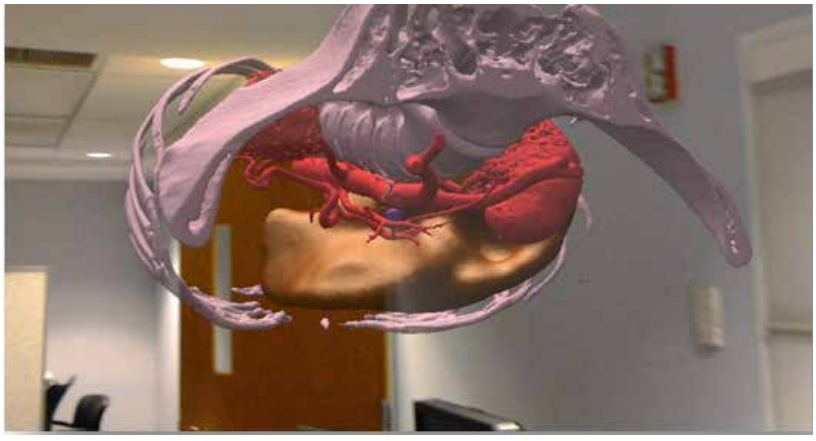
Vikash Gupta, MD, a radiology resident on Dr. Siegel's team, said, "Often you're trying to read something on an iPad or a laptop. With a headset, you can show images across a field where the view is really limitless."

It also opens up the potential to incorporate artificial intelligence and machine learning into treatment planning.

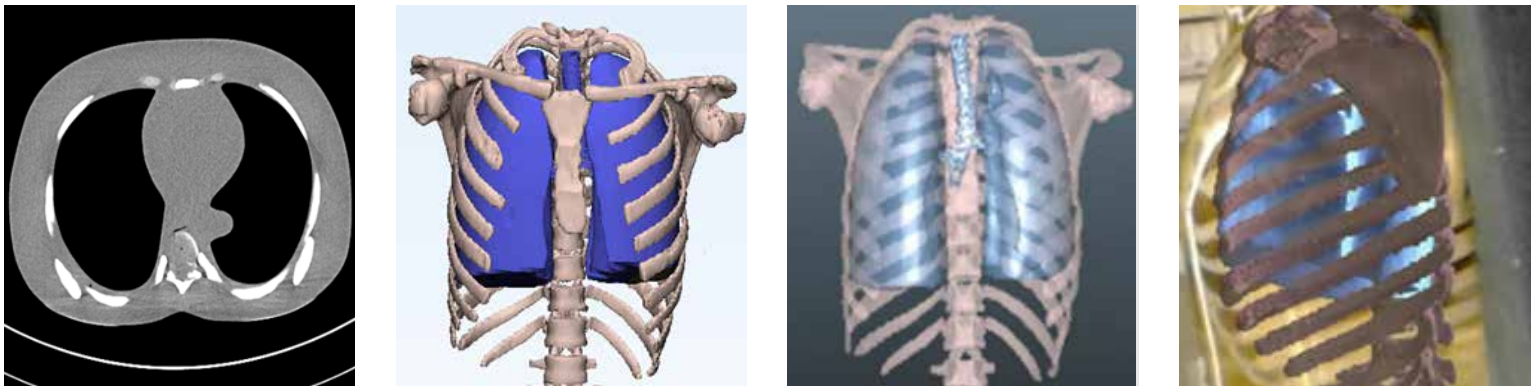
"We can say, 'Headset, please look at another area and tell me if it's the same,'" Dr. Gupta said.

In terms of image-guided intervention, an augmented-reality device allows the radiologist to take all the available data points — from CTs and MRIs, for instance — and create a hologram that can then be placed on the patient's body during a procedure.

"You can actually put a needle or a catheter into a patient and perform a procedure by using image guidance from a



Augmented technology is poised to benefit radiology education. By projecting 3-D images, students can "walk" around and view anatomy from different perspectives.
Image courtesy of the University of Maryland.



On the cover: The step-by-step process for 3-D hologram projection with Microsoft HoloLens. *From left*: CT scan acquired with fiducial marker in place; de-identified DICOM stent converted to STL file; STL files converted to FBX rendering; FBX projected on patient and co-registered to fiducial marker. *Images courtesy of the University of Maryland.*

> "We in radiology have the potential to be leaders in augmented-reality applications."
>
> ELIOT SIEGEL, MD

previous scan in a holographic projection," Dr. Siegel said.

Because access to information is often limited during a procedure, a surgeon might have to walk away from the patient to view an image. But by wearing a headset, the surgeon could have all the information necessary in his field of vision.

"You can reference prior anatomy, prior scans, prior labs, prior medical notes," Dr. Gupta said. "All the information is at your fingertips, without ever having to leave the patient's side."

Technology Faces Limitations

There are limitations, but many of them are related to the development of the augmented-reality technology itself, not necessarily its application in radiology.

Marrying the devices' optical display features to software that will segment, register and stream data in real time will be vital. Also, the image resolution is still in its early stages and most would say it is not yet on par with high-definition television.

"The images are not quite as sharp as we're used to with the current generation of monitors," Dr. Siegel said.

Refresh rates are still slow and the devices weigh about a pound, which can lead to fatigue for longer procedures. And it will take time for radiologists to adjust to the changes to their current workflows.

"There is a learning curve," Dr. Gupta said. "Our hope is that once radiologists see the benefit, it will outweigh the learning curve."

Dr. Siegel predicted that over the next three to five years other academic institutions will begin experimenting with the technology. And as younger radiologists who have grown up with this type of technology enter the specialty, that will enhance the odds of its mainstream acceptance.

"It's been wonderful to work with really savvy residents like Dr. Gupta and others who already have programming, game design and development in their backgrounds," Dr. Siegel said. "We in radiology have the potential to be leaders in augmented-reality applications."

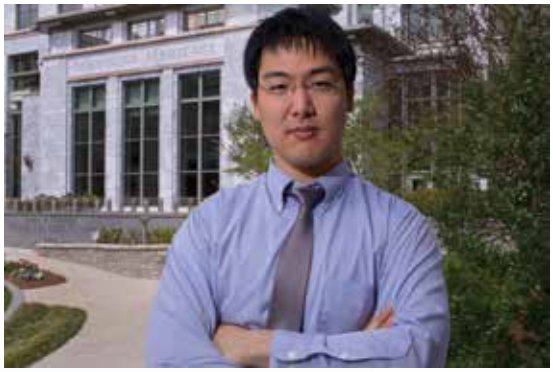
Augmented-reality devices allow radiologists to view high-quality images on a screen when they are away from their usual workplace. *Image courtesy of the University of Maryland.*

WEB EXTRAS

Dr. Siegel plans to present a session on wearable technology at RSNA 2017. Register for the meeting at *RSNA.org/Register*.

Researchers Use Eye-Tracking Technology to Assess Wrong-Patient Errors

BY LYNN ANTONOPOULOS



Alex Chung, MD

> *"This research shows that having photographs may help communicative and empathic dimensions of the interpretation process as well."*
>
> ALEX CHUNG, MD

New RSNA-funded research shows that patient photographs paired with radiographs may reduce wrong-patient errors and improve image assessment without increasing interpretation time.

With a 2015 Canon U.S.A./RSNA Research Medical Student Grant, Alex Chung, MD, and colleagues used eye-tracking technology to assess the visual attention of radiologists examining radiographs with and without paired photographs.

Despite protocols that require ensuring patient identity by checking two unique identifiers whenever a procedure is done, radiographs taken in emergency departments (EDs) or intensive care unit settings are at a higher risk of wrong-patient identification errors because patients often cannot provide the unique identifier information.

While previous research has demonstrated that a paired photograph of the patient taken simultaneously at the time of the radiograph increases the detection rate of wrong-patient errors, there is some concern that the photos are a distraction or may increase interpretation time.

"Our specific aim was to incorporate eye-tracking technology and objectively quantify the degree of distraction posed by photographs," said Dr. Chung, a transitional year resident at Emory University School of Medicine, Atlanta.

Eye-Tracking Technology Yields Results

The study comprised 10 radiologists (six male, four female) from the University of Arizona specializing in a variety of areas including general, abdominal, cardiothoracic and pediatric radiology. Dr. Chung and colleagues obtained patient data (radiographs and photographs) at Emory University and conducted the eye tracking observer study at the University of Arizona.

The subjects reviewed 21 portable chest radiographs in two phases. First, the images were provided without patient photographs and the radiologists were asked to note the placement of various tubes and lines. To prevent recall bias, Dr. Chung and his team allowed at least three weeks to pass before performing the next review. In the second phase, the images were paired with photographs and subjects were asked to perform the same task noting placement of lines and tubes.

Eye-tracking technology measured how long the subjects focused on various areas of the image and the total time spent looking at each case. The technology also noted the distraction rate, or number of times the subjects' eyes scanned off the radiograph either to view image labels, or in the second phase, to view the photograph.

INNOVATE

GRANTS IN ACTION

NAME:
Alex Chung, MD

GRANT RECEIVED:
Canon U.S.A./RSNA Research Medical Student Grant (2015)

STUDY:
"An Analysis of Wrong-patient Errors in Radiology and Distraction Effects of Adding Photographs to Radiographs."

CAREER IMPACT:
"This grant was immensely helpful in many aspects of my career," Dr. Chung said. "Not only did it help me secure protected time at my institution, I was able to learn the process of generating a grant proposal. This type of experience does not traditionally happen in a medical school classroom setting but is very important for a medical student like myself, who is interested in pursuing a future career in academics."

CLINICAL IMPLICATION:
"Clinically, the conclusions from this study will add to the literature about the value of adding paired photographs to radiographs for detecting wrong-patient errors, advancing the current image acquisition systems, and ultimately improving patient care and safety," Dr. Chung said.

In both phases, the images were presented on an LCD display, ambient room lighting levels were controlled, the average distance between the observer and the screen was 35 cm, and the eye-tracking equipment sampled eye positions every one-sixtieth of a second with an accuracy of 0.4 degrees and a precision of 0.34 degrees.

The findings from both studies showed that overall time spent viewing the cases did not increase with the addition of the photograph.

"Radiologists compensated by integrating the examination of the photo into their search by decreasing, somewhat, their time on the x-ray image," said Elizabeth Anne Krupinski, PhD, professor and vice chair for research in the Department of Radiology and Imaging Science at Emory University, who supervised Dr. Chung's research.

After each phase, the subjects completed a survey collecting demographic information and answering questions about how they acquire patient information, their opinions about the photographs and which body areas they would like included in patient photographs.

Following the first study, all subjects indicated that they would be significantly likely to contact the referring provider if they detected a critical result. After the second study, the subjects were asked to indicate how much more likely they were to call the referring provider if an important finding was detected with the photographs present than without. Seven providers reported no difference, two reported slightly more, and one reported significantly more when photographs were present.

"This research shows that having photographs may help communicative and empathic dimensions of the interpretation process as well," Dr. Chung said.

"This study was important, because it was the first of its kind to assess the impact of providing patient photographs during image interpretation on the way radiologists search images for findings," Dr. Krupinski said.

Results May Personalize the Reading Experience

The research findings also show promise for the patient-radiologist relationship, said Srini Tridandapandi, PhD, MD, MBA, a radiologist at Emory University who helped develop the technology to add photographs to radiographs.

"With widespread adoption of PACS over the last couple of decades, we have 'lost the patient' and such photographs may help bring the patient back to the radiologist," said Dr. Tridandapandi, who also served as Dr. Chung's mentor.

Dr. Chung agreed, noting that this preliminary study provides a firm rationale for conducting a clinical study. "In the future, a study that explores whether the diagnostic accuracy of the reports is affected by the presence of photographs is warranted," he said.

Dr. Chung credits the RSNA Research Medical Student Grant program with helping him develop grant writing skills and providing support for securing protected time at his institution. He plans to conduct additional research as he pursues a career in academics.

Novel Device May Aid Earlier Detection of Esophageal Cancer

BY MIKE BASSETT

Because most patients with suspected esophageal cancer are not diagnosed until the disease has reached an advanced stage, early detection has become a critical goal among researchers.

To that end, a device that may facilitate early diagnosis and staging of esophageal cancer — hybrid optical and optoacoustic endoscope for esophageal tracking (ESOTRAC) — is being developed by researchers at the Institute of Biological and Medical Imaging (IBMI) at Helmholtz Zentrum München and Technical University of Munich in Germany.

ESOTRAC has been awarded €4 million from Horizon 2020, the European Union framework program for research and innovation.

The current gold standard for diagnosing esophageal cancer is high-definition white-light endoscopy (HD-WLE) with biopsy, while endoscopic ultrasound, as well as CT and MRI, is used for staging. PET has also become a mainstay in the staging of esophageal cancer, particularly in terms of metastatic disease.

But HD-WLE, which employs a videoscopic approach based on human vision, is significantly limited in terms of sensitivity and specificity, said Vasilis Ntziachristos, MSc, PhD, ESOTRAC coordinator, director of the IBMI at Helmholtz Zentrum München and professor and chair of biological imaging at the Technical University of Munich.

"Human vision cannot identify early signs of disease, small foci or sub-surface tissue alterations, which means that patients who undergo surveillance endoscopies must be further treated with random four-quadrant biopsies," Dr. Ntziachristos said.

"The current random biopsy approach has an inherently high chance of sampling error, resulting in a remaining detection miss rate of up to 57 percent for the combined HD-WLE/random biopsy approach," Dr. Ntziachristos said. "These limitations have led to a search for alternative endoscopic techniques."

Device May Surpass Gold Standard

The objective of the ESOTRAC research project is to develop an optical endoscope based on optoacoustic technology that will non-invasively provide 3-D visualization of the morphological and pathophysiological features of the wall of the esophagus.

"Using multi-spectral optoacoustic tomography technology, the new scope will be able to quantitatively resolve inflammation, tissue blood oxygen saturation and vascularization without using contrast agents and in high-resolution," Dr. Ntziachristos said. "Furthermore, the ESOTRAC scope will be engineered for fast 3-D imaging of the entire esophageal tract."

Therefore, he says, it offers a more accurate visualization for surveillance applications compared to the current gold standard.

Researchers plan to integrate the ESOTRAC scope's multi-spectral optoacoustic tomography with optical coherence tomography (OCT), combining two promising optical imaging methods in one modality, operating on complementary optical contrast.

The ESOTRAC scope is able to sense esophageal tissue alterations occurring earlier in esophageal cancer progression, at a microscopic scale, before the development of large protruding lesions from the vessel wall that are typically captured by HD-WLE, Dr. Ntziachristos said.

Ntziachristos

Guimaraes

Promise in Depth Penetration

Regarding tumor staging, esophageal cancer and colon cancer are very similar in terms of the relationship of the tumor to the muscular layers of the organ of interest, said Alexander Guimaraes, MD, PhD, co-chair of the RSNA Oncologic Imaging and Therapies Task Force and the recipient of two RSNA research grants.

But the challenges involved with esophageal cancer are different than those associated with colon cancer, said Dr. Guimaraes, associate professor in the Diagnostic Radiology Department at the Oregon Health and Science University.

"The organ is smaller and is also surrounded by the lung," he said. "And while we can image the esophagus well, we don't seem to be able to do as good of a job determining the small size of tumors and their relationship to these muscle layers with MRI."

"Optical coherence tomography and ultrasound have done adequately — both in rectal and esophageal cancer," he continued. "But this device shows promise in seeing the relationship of the tumor well with regard to the muscular layers. And because of its depth penetration, it may be able to answer questions of nodal involvement better than existing endoscopic ultrasound techniques."

The device will have direct implications for imaging the entire gastrointestinal tract, Dr. Ntziachristos said. The researchers also envision applications for gastric and colon cancer.

ESOTRAC comprises top physicians and engineers from nine different European institutions in five countries.

"There is a rigorous timeline to develop, test and compile a set of imaging features leading to improved endoscope practices by 2021," he said.

> "... the ESOTRAC scope will be engineered for fast 3-D imaging of the entire esophageal tract."
>
> VASILIS NTZIACHRISTOS, MSC, PHD

MRI Helps Radiology Researchers Trace Cause of Vision Problems in Astronauts

BY NICK KLENSKE

In 2010, when NASA noticed that several U.S. crew members flying primarily on the International Space Station (ISS) exhibited spaceflight-induced vision impairment, the agency contacted noted researcher Noam Alperin, PhD.

Dr. Alperin, well-known for researching ocular and vision issues related to cerebrospinal fluid biomechanics in the brain, sought to determine the cause of what is now termed visual impairment and intracranial pressure (VIIP) syndrome.

Understanding VIIP, characterized by visual performance decrements accompanied by ocular structural changes in the posterior pole of the eye globes, is critical to future space exploration. But while prior efforts to explain VIIP focused on cephalad vascular fluid shift, Dr. Alperin, professor of radiology and biomedical engineering at the University of Miami Miller School of Medicine, has focused his research on another possible source for the problem: cerebrospinal fluid (CSF).

In a new *Radiology* study, Dr. Alperin and colleagues show that VIIP-associated ocular changes occur only during long-duration spaceflight and that the magnitude of these changes correlates significantly with increases in orbital CSF volume, which compresses the posterior wall of the eye globe. Dr. Alperin's *Radiology* study expands on the research he presented at RSNA 2016.

The researchers took high-resolution orbit and brain MRI scans before and after spaceflights of seven long-duration mission ISS astronauts and nine short-duration mission space shuttle astronauts. Using advanced quantitative imaging algorithms, the researchers looked for correlations between changes in the ocular deformations and in CSF and cerebral vascular fluid volumes.

"This computerized quantitation of the globe deformations yielded continuous and reproducible measures of globe flattening and nerve protrusion that have stronger statistical power than the ordinal measures available from prior subjective assessments using visual inspection," Dr. Alperin said. "Even with a relatively small number of astronauts, this automated quantitation allowed us to discover the correlations between the ocular changes and increased orbital CSF volume and establish the role CSF plays in causing VIIP."

The study also demonstrated a link between increased orbital CSF volume and an increase in intracranial CSF volume, which is likely related to the lack of gravity in space, Dr. Alperin said.

"On earth, the CSF system is designed to accommodate significant changes in hydrostatic pressures, such as when a person stands up from lying down," he said. "In space, however, there is no force that intermittently reduces the cranial CSF volume, thereby allowing reversed movement of CSF from the orbit back into the cranium."

The research also noted the existence of more flattened globes at preflight in short-duration astronauts compared to long-duration astronauts, which Dr. Alperin attributes to the fact that four of the nine short-duration astronauts had previously been on a long-duration ISS mission.

Comparing these four short-duration astronauts to the others revealed that both globe flattening and nerve protrusion were significantly increased in the astronauts with previous long-duration missions.

"This finding implies that space-induced globe deformations do not fully reverse once back on earth, at least not for several years," Dr. Alperin said.

This could explain why, according to a NASA-proposed VIIP clinical practice guideline, short-duration astronauts were found to have VIIP — contributing to the generally-held misconception that VIIP also occurs during short-duration spaceflight.

Using continuous quantitative measures of VIIP-related ophthalmic deformations, Dr. Alperin and colleagues provide evidence for the primary role of CSF in the formation of VIIP. The ocular changes occurring during long-duration exposure to microgravity are significantly associated with a large increase in orbital and ventricular CSF volumes.

These findings will play a significant role in the development of countermeasures to protect crew members from the negative effects of long-duration exposures to microgravity. NASA is currently studying a number of possible measures to simulate the conditions that lead to VIIP, along with testing various countermeasures.

Alperin

WEB EXTRAS

Access the research, "Role of Cerebrospinal Fluid in Spaceflight-induced Ocular Changes and Visual Impairment in Astronauts," *RSNA.org/Radiology*.

Radiology Mentors Leave a Lasting Imprint on Students

BY MARY HENDERSON

As veteran physicians can attest, radiologists do not make it soley on their own. "We are a product of the teachers we've had, the patients we've cared for and the colleagues we've interacted with," said James V. Rawson, MD, chair of radiology and imaging, Medical College of Georgia (MCG), at Augusta University. "We are the accumulated experiences we've had, many of which are not random, but guided by a mentor."

> *"We are the accumulated experiences we've had, many of which are not random, but guided by a mentor."*
>
> JAMES V. RAWSON, MD

Dr. Rawson, a member of the RSNA Quality Improvement Committee who has lectured on mentoring, is a strong believer in the value of experienced physicians helping to develop future generations. "Part of our job is to help develop the individuals who will ultimately replace us," he said.

In addition to the formal mentoring program within MCG's residency training, residents are encouraged to find additional like-minded mentors who can supervise a research project or shepherd them through the process of applying for fellowships or attending a national meeting.

"We have a culture of many mentors," Dr. Rawson said. "I'm a fan of formal mentoring relationships supplemented by multiple informal mentors."

After mentoring graduate students, post-doctorates, clinical radiologists and junior faculty, Jody L. Tanabe, MD, professor of radiology at the University of Colorado School of Medicine, Denver, agrees that it is critical to have multiple mentors — especially in academic radiology.

"We face challenges in terms of research mentoring in radiology," Dr. Tanabe said. "The majority of radiologists are not trained to conduct hypothesis-driven research, and as a result, we are often at a disadvantage compared to other specialties competing for grants funded by the NIH."

Dr. Tanabe, who earned an RSNA research scholar grant in 1998, currently serves as an advisor/mentor to University of Colorado radiology resident Michael F. Regner, MD, who was awarded a 2016 Hitachi Medical Systems/RSNA Research Resident Grant from the Research & Education (R&E) Foundation for his project, "Insular Inhibitory Neuromodulation to Reduce Cigarette Craving and Alter Brain fMRI Connectivity and Activity Patterns in Smokers."

"Dr. Tanabe has taught me what it means to be an academic researcher," Dr. Regner said. "She's not only experienced at conducting and guiding the process of medical research, but also applying for grants, developing an experimental design and managing complex collaborations as well. Having a strong mentor is a life-changing experience that opens doors and allows you to be successful at navigating complex systems in general."

Finding the Right Mentors

National industry meetings, including RSNA annual meetings, often offer mentor workshops, but finding a mentor can also be as simple as asking. Dr. Regner knocked on Dr. Tanabe's door because he was interested in her field of neuroradiology.

"It takes luck to come together with the right mentor," Dr. Tanabe said. "The more the mentor is aligned with your career, the more likely the relationship will succeed. If you're young and you know what you're interested in, persist and find that mentor who you click with."

Edward W. Lee, MD, PhD, assistant professor and director of research, interventional radiology, David Geffen School of Medicine, University of California, Los Angeles (UCLA), has become deeply involved in helping young radiologists since relying on a mentor to help guide him through the early part of his career.

"It's not always easy finding a mentor," Dr. Lee said. "I think it's easier for established radiologists to look out for those who need our help, to show our interest and push them to grow as an academic radiologist."

"Dr. Tanabe has taught me what it means to be an academic researcher," said University of Colorado radiology resident Michael F. Regner, MD, pictured at left with scientific advisor Jody L. Tanabe, MD. Dr. Regner received an R&E funded grant for his research project.

Rawson

When Dr. Lee learned that UCLA resident Sarah N. Khan, MD, was interested in a fellowship in interventional radiology, he encouraged her to apply for an R&E grant.

Dr. Khan was awarded the 2016-2017 Philips Healthcare/RSNA Research Resident Grant to fund her project, "Tumor MicroRNA Expression Profiles as Biomarkers for Predicting Hepatocellular Carcinoma Tumor Response to Y90 Radioembolization."

"Dr. Lee is very knowledgeable and had also received an R&E grant himself, so he knew the process," Dr. Kahn said. "It's great to have someone show you the way instead of having to fend for yourself."

The Rewards of Mentoring

One of the keys to successful mentor/mentee relationships is good communication. "It's important to be honest and maintain consistent regular communication so your mentor knows where you're at in your project and how they can be of help to you," Dr. Regner said.

Dr. Tanabe said mentor/mentee relationships often fail because the mentee expects the mentor to drive it — which was not the case with Dr. Regner.

"I could not keep up with Mike," she said. "He worked incredibly hard."

Dr. Rawson advises prospective mentors and mentees to agree on areas of focus and set up boundaries for the relationship.

"Successful mentorship requires a mutual understanding of expectations," he said. "Not establishing such stipulations early in the relationship increases the possibility that someone will be disappointed."

Dr. Rawson said mentoring is very rewarding, especially when he sees former mentees succeeding and doing well.

"When you mentor someone, you leave an imprint on them that doesn't go away," he said. "It's a long-lasting impact on someone's career and trajectory."

Studies have shown that mentoring pays dividends at an institutional level. According to a recent study in the *Journal of the American Medical Association*, (*JAMA*), faculty with mentors reported improved teaching and clinical care as well as increased career satisfaction. Another study published in Academic Medicine demonstrated increased faculty retention as a result of mentoring.

"Personally, I think being a mentor makes work more fun and infuses the day with enthusiasm," Dr. Tanabe said.

Once established, a strong mentoring relationship is self-perpetuating.

"Finding a good mentor and being mentored is a gift," Dr. Regner said. "The only way to pay it back is to pay it forward. I'm very likely to be a mentor in the future."

Edward W. Lee, MD, PhD, *left*, guided Sarah N. Khan, MD, *right*, through her R&E-funded research project at UCLA. "Dr. Lee is very knowledgeable and had also received an R&E grant himself, so he knew the process," she said.

The Campaign for Funding Radiology's Future®

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RSNA Research Medical Student Grant Recipient Goes Full Circle, Serves as Scientific Advisor to a New Generation

2017 RSNA Research Medical Student Grant recipient **Travis Robert Hallett, BA** (left), is a first-year medical student at Boston University. Travis will spend his summer conducting a research project "Epicardial Adipose Tissue and High-Risk Plaque Features in HIV-Accelerated Coronary Artery Disease" at Massachusetts General Hospital, Boston, under the scientific guidance of **Michael T. Lu, MD**, director of research, Cardiovascular Imaging Division and assistant professor of radiology at Harvard Medical School.

"I am interested in studying the long term effects of HIV on the heart using imaging biomarkers that may have a future diagnostic role," Travis said. "The ultimate goals of the research will be to identify and track these biomarkers, and help identify potential interventions."

An RSNA grant recipient himself, Dr. Lu is proud to serve as the scientific advisor and mentor for this project. "As a 2005 recipient of the RSNA Medical Student Research Grant, I have a very good understanding of how important this award will be for Travis," Dr. Lu said. "Like Travis, I was a medical student with a budding interest in academic radiology. This award solidified my commitment and was critical for launching my career."

Make an inspired investment in innovation. Support the Campaign for Funding Radiology's Future® today.

5k Fun Run to Support the RSNA R&E Foundation

Nov. 28 at 6:30 a.m.

Run, jog or walk in the 2017 Fun Run to support education and radiology research. All proceeds benefit the RSNA R&E Foundation, so enjoy an outing for a good cause and join your colleagues along Chicago's beautiful Lake Michigan shoreline. Add the Fun Run to your RSNA 2017 registration. Participants receive a commemorative T-shirt, while supplies last, and the fully tax-deductible donation benefits the RSNA R&E Foundation. In case of inclement weather, the Fun Run may be canceled. All Fun Run fees are non-refundable and non-transferable.

Education and Funding Opportunities

Final Call:
Advanced Course in Grant Writing

Applications are still being accepted for this course designed to assist 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: October 6 -7, 2017
- Session II: November 10-11, 2017
- **NEW DATE: Session III: February 23-24, 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.*

Final Call:
Introduction to Academic Radiology for Scientists (ITARSc)

Application Deadline
July 1

Postdoctoral fellows and early-stage researchers in the imaging sciences and biomedical engineering 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.*

Apply Now:
RSNA/AUR/ARRS Introduction to Academic Radiology (ITAR)

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.*

For Your Calendar

JULY 9–12
The Association for Medical Imaging Management (AHRA) 2017
Anaheim, CA
Visit the RSNA booth
• *AHRA.org*

OCTOBER 13-16
Journées Françaises de Radiologie (JFR)
Paris, France
Visit the RSNA booth
• *JFR.radiologie.fr*

NOV. 26 -DEC. 1
RSNA 103rd Scientific Assembly & Annual Meeting
Chicago
• *RSNA.org*

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

Register Now:

Creating and Optimizing the Research Enterprise (CORE) Workshop

Registration Deadline
August 15

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.*

New RSNA Online Education Platform Coming Soon

RSNA is upgrading its online education platform in early August. Based on member feedback, the new platform will incorporate an enhanced, mobile-friendly user interface offering more than 600 online activities eligible for SA-CME credit.

It is not too late to complete courses started in the current platform before the transition. Current users of the RSNA eLearn library are encouraged to complete all online activities no later than July 10 to ensure a smooth transition of completions and earned SA-CME credits to the new platform. For questions and more information, contact the Education Center at *ed-ctr@rsna.org* or 630-571-2199.

In preparation for the new site launch, the current eLearn library will be unavailable from July 31 to Aug. 1. Users can visit the new platform at *RSNA.org/Education* beginning on Aug. 2.

Patient Focus

RSNA's Newest Vignette Instructs on "Communicating Bad News"

RSNA's most recent Professionalism Vignette, "Communicating Bad News," is now available at *RSNA.org/Professionalism*.

Developed by the RSNA Professionalism Committee, the series of free educational vignettes on ethics and professionalism cover a wide range of topics that radiologists may encounter in their practice.

"Communicating Bad News" offers radiologists practical tips on how to more effectively communicate with patients — particularly helpful for those who need to deliver results that may be difficult to hear.

Each vignette includes several scenarios with embedded questions and potential responses. Explanations comprising the relevant principles of professionalism help users to assess the appropriateness of their choices. References are provided for further study.

The vignettes are intended to raise awareness about the need for radiologists to incorporate professionalism into routine practice and to facilitate discussion of this core competency.

The website also features RSNA's Professionalism Education Toolkit, providing various journal publications, an online education course and additional professionalism and ethical behavior resources designed for radiologists.

Journal Highlights

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

Stratification, Imaging, and Management of Acute Massive and Submassive Pulmonary Embolism

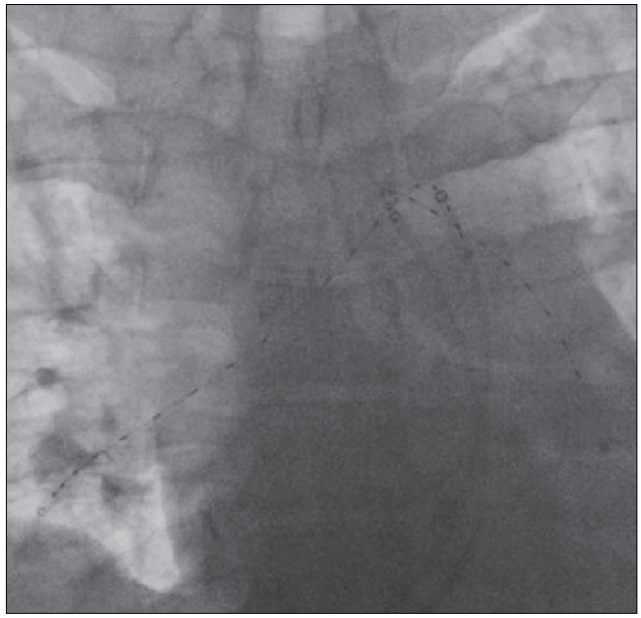
Although the true incidence of pulmonary embolism (PE) remains unclear, it is recognized as a substantial cause of morbidity and mortality among hospitalized patients. While PE causes approximately 100,000-180,000 deaths per year in the U.S., mortality is restricted to patients who suffer massive or submassive pulmonary emboli.

In a review article published in *Radiology* (*RSNA.org/Radiology*), Akhilesh K. Sista, MD, of Weill Cornell Medical College in New York, and colleagues describe the pathophysiology, clinical presentation, stratification and imaging assessment of acute PE and the medical, surgical and endovascular management of massive and submassive PE. The authors summarize the most up-to-date literature on imaging, systemic thrombolysis, surgical embolectomy and catheter-directed therapy for submassive and massive PE and give representative examples that reflect modern practice.

Due to the high mortality associated with acute massive PE, effective treatment requires prompt risk stratification and early intervention in the form of systemic thrombolysis, surgical embolectomy and/or catheter-directed therapy (CTD).

The authors conclude that future research on acute PE treatment should focus on the standardization of thrombolytic doses to maximize benefit while minimizing bleeding risk and the ideal method of thrombolytic administration (peripheral IV vs. CDT).

"Although trial data for systemic thrombolysis support the notion that thrombolytic therapy may reduce long-term sequelae from PE, further studies examining the impact of low-dose CDT on long-term quality of life are needed. In addition, randomized trials should also be supported by large-scale observational data," the authors write.



Depiction of catheter-directed therapy with ultrasound assistance. The dashed appearance within the infusion catheters is the radiopaque markers of the inner ultrasound filament that is thought to disperse fibrinolytic drug farther into the thrombus and disrupt fibrin strands to allow more drug-substrate binding. (*Radiology* 2017;284;1:5-24)

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

Prepare for the ABR Diagnostic Radiology Core Exam with *RadioGraphics* Articles

Residents and fellows planning to take the American Board of Radiology (ABR) Diagnostic Radiology Core Exam can use *RadioGraphics* articles to help prepare.

Go to *RSNA.org/RadioGraphics* and click on the headings to open the outline and find RSNA journal articles chosen by experts in the field as covering material particularly relevant to each section of the exam. Bookmark an article to read later using the "Add to Favorites" link on the article page.

Residents and fellows can also access the ABR Diagnostic Radiology Core Exam Study Guide on the website.

Beyond the Bowel: Extraintestinal Manifestations of Inflammatory Bowel Disease

Inflammatory bowel disease (IBD) is a chronic, relapsing immune-mediated inflammation of the gastrointestinal tract. The two major subtypes of IBD are Crohn disease and ulcerative colitis. Imaging plays an important role in the detection, characterization, and surveillance of IBD.

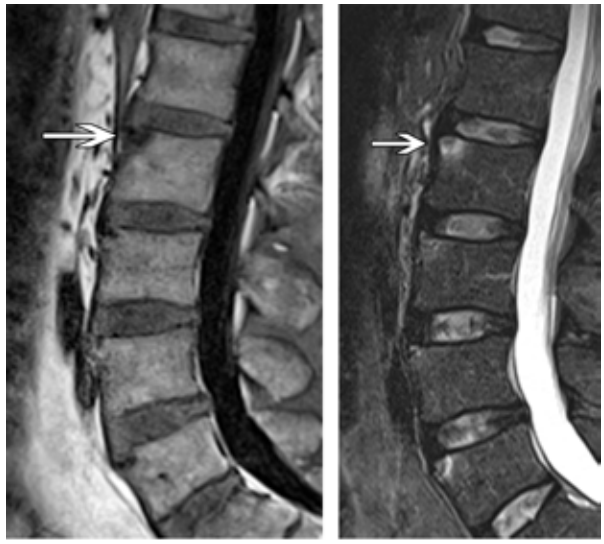
In the July-August issue of *RadioGraphics* (*RSNA.org/RadioGraphics*), Jeffrey D. Olpin, MD, of the University of Utah in Salt Lake City, and colleagues describe how CT enterography and MR enterography have emerged in recent years as invaluable tools in the assessment of IBD.

The authors discuss the various extraintestinal organ systems that can be affected in the setting of Crohn disease and ulcerative colitis, describe specific extraintestinal disorders that are associated with IBD, and discuss the roles of CT and MRI in the evaluation of patients suspected of having extraintestinal manifestations of IBD.

"IBD and associated disorders are complex disease entities that demand an interdisciplinary approach among various subspecialties, including gastroenterology and various surgical services. Radiologists involved in the interpretation of these imaging examinations must be aware of the extraintestinal manifestations of IBD to optimize clinical management of these complex patients," the authors write.

RadioGraphics

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



a. b.

Axial spondyloarthropathy: spine findings in a 45-year-old man with ulcerative colitis and chronic back pain. Sagittal T1-weighted (a) and STIR (b) MR images show Romanus lesions at the anterior annular ligament attachment sites; the lesions are depicted as areas of hypointensity on the T1-weighted MR image (*arrow on a*) and areas of hyperintensity on the STIR MR image (*arrow on b*).

(*RadioGraphics* 2017;37;4:1135-1160)

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

Radiology PODCASTS

- "Supplemental Breast MR Imaging Screening of Women with Average Risk of Breast Cancer," Christiane K. Kuhl, MD, and colleagues.
- "Machine Learning of Three-dimensional Right Ventricular Motion Enables Outcome Prediction in Pulmonary Hypertension: A Cardiac MR Imaging Study," Timothy J. W. Dawes, PhD, and colleagues.
- "Transient Bone Marrow Edema Syndrome versus Osteonecrosis: Perfusion Patterns at Dynamic Contrast-enhanced MR Imaging with High Temporal Resolution Can Allow Differentiation," Tobias Geith, MD, and colleagues.

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

RadioGraphics PODCASTS

- "Demystifying Orbital Emergencies: A Pictorial Review," by Viet D. Nguyen, MD, and colleagues.

Radiology in Public Focus

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

Artificial Intelligence May Help Diagnose Tuberculosis in Remote Areas

Researchers are training artificial intelligence (AI) models to identify tuberculosis (TB) on chest x-rays, which may help screening and evaluation efforts in TB-prevalent areas with limited access to radiologists, according to a new study in *Radiology*.

"An AI solution that could interpret radiographs for presence of TB in a cost-effective way could expand the reach of early identification and treatment in developing nations," said study co-author Paras Lakhani, MD, from Thomas Jefferson University Hospital (TJUH) in Philadelphia.

According to the World Health Organization, TB is one of the top 10 causes of death worldwide. In 2016, approximately 10.4 million people fell ill from TB, resulting in 1.8 million deaths. TB can be identified on chest imaging, however TB-prevalent areas typically lack the radiology interpretation expertise needed to screen and diagnose the disease.

For the study, Dr. Lakhani and his colleague, Baskaran Sundaram, MD, obtained 1,007 x-rays of patients with and without active TB. The cases consisted of multiple chest x-ray datasets from the National Institutes of Health, the Belarus Tuberculosis Portal, and TJUH. The datasets were split into training (68.0 percent), validation (17.1 percent), and test (14.9 percent).

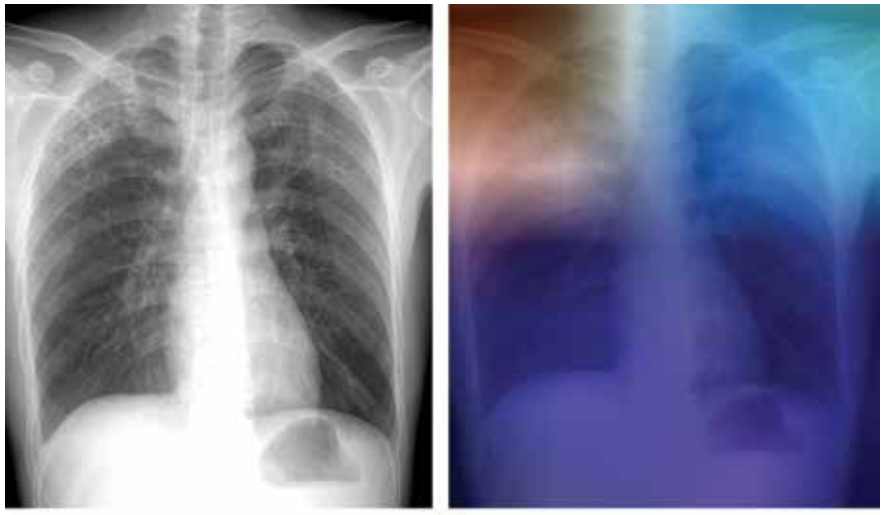
The cases were used to train two different deep convolutional neural network (DCNN) models – AlexNet and GoogLeNet – which learned from TB-positive and TB-negative x-rays. The models' accuracy was tested on 150 cases that were excluded from the training and validation datasets.

The best performing AI model was a combination of the AlexNet and GoogLeNet, with a net accuracy of 96 percent.

The two DCNN models had disagreement in 13 of the 150 test cases. For these cases, a cardiothoracic radiologist blindly interpreted the images, accurately diagnosing all 13 cases. This workflow had a greater net accuracy of close to 99 percent.

Dr. Lakhani said that the team plans to further improve the models with more training cases and other deep learning methods.

"We hope to prospectively apply this in a real world environment," Dr. Lakhani said. "An AI solution using chest imaging can play a big role in tackling TB."



a. b.

a: Posteroanterior chest radiograph shows upper lobe opacities with pathologic analysis–proven active TB. b: Same posteroanterior chest radiograph with a heat map overlay of one of the strongest activations obtained from the fifth convolutional layer after it was passed through the GoogLeNet-TA classifier. The red and light blue regions in the upper lobes represent areas activated by the deep neural network. The dark purple background represents areas that are not activated. This shows that the network is focusing on parts of the image where the disease is present (both upper lobes).

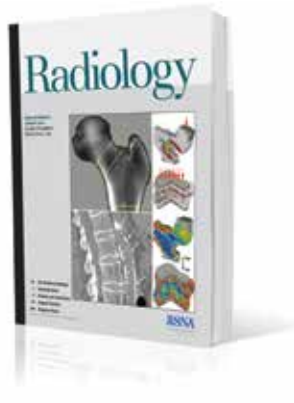
WEB EXTRAS

Access the *Radiology* study "Deep Learning at Chest Radiography: Automated Classification of Pulmonary Tuberculosis by Using Convolutional Neural Networks" at *RSNA.org/Radiology*.

Media Coverage of RSNA

In March, 370 RSNA-related news stories were tracked in the media. These stories had an estimated audience reach of 329 million.

Coverage included Yahoo! News, WGN-AM (Chicago), *CNBC.com*, Reuters Health, *CBSNews.com, The Arizona Republic*, ScienceDaily, MedPage Today, *Auntminnie.com*, *DOTmed Business News* and *Diagnostic Imaging*.



Weight Loss Can Slow Down Knee Joint Degeneration

Overweight and obese patients who lost a substantial amount of weight over a 48-month period showed significantly lower degeneration of their knee cartilage, according to new *Radiology* research.

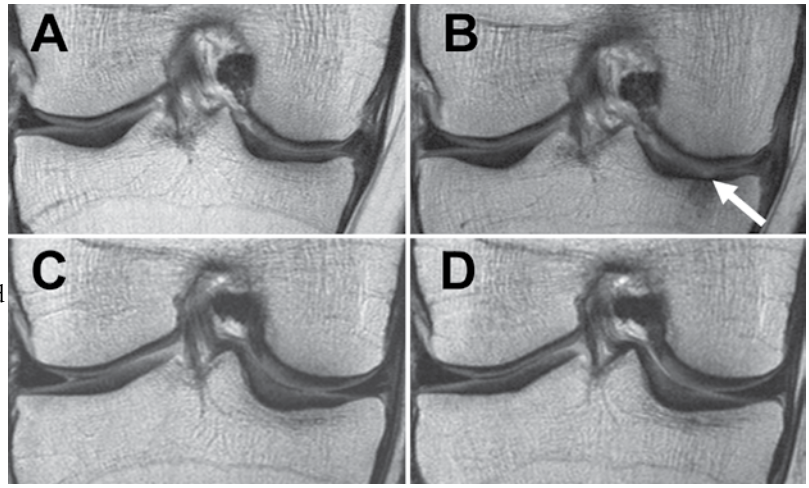
Researchers at the University of California, San Francisco, looked at the degeneration of menisci, articular cartilage and bone marrow in the knee joint, according to the study's lead author, Alexandra Gersing, MD, Department of Radiology and Biomedical Imaging.

Dr. Gersing and colleagues investigated the association between weight loss and the progression of cartilage changes on MRI over a 48-month period in 640 overweight and obese patients (minimum body mass index [BMI] 25 kg/m2) who had risk factors for osteoarthritis or MRI evidence of mild to moderate osteoarthritis using data that was collected from the Osteoarthritis Initiative. Patients were categorized into three groups: those who lost more than 10 percent of their body weight, those who lost five to 10 percent of their body weight and a control group whose weight remained stable.

The results showed that patients with five percent weight loss had lower rates of cartilage degeneration when compared with stable weight participants. In those with 10 percent weight loss, cartilage degeneration slowed even more.

In addition to slowed articular cartilage degeneration, researchers also saw changes in the menisci after weight loss.

"The most exciting finding of our research was that not only did we see slower degeneration in the articular cartilage, we saw that the menisci degenerated a lot slower in overweight and obese individuals who lost more than five percent of their body weight, and that the effects were strongest in overweight individuals and in individuals with substantial weight loss," Dr. Gersing said.



MR images of the right knee obtained with the coronal proton density–weighted fast spin-echo fat-suppression sequence at, A, C, baseline and, B, D, after 48 months. Patients were an obese 65-year-old woman with stable weight and mild knee pain (WOMAC pain subscale score of 3 at baseline; baseline BMI, 33.1 kg/m2) (A and B) and an obese 64-year-old woman with weight loss over 48 months and mild knee pain (approximately 10.9% decrease in BMI; WOMAC pain subscale score of 5 at baseline; baseline BMI, 33.7 kg/m2) (C and D). The woman with stable weight developed a full-thickness focal cartilage defect at the medial tibia (*arrow*) (baseline cartilage WORMS grade 0 in A and 2.5 in B). In contrast, no cartilage defects were detected at baseline or 48-month follow-up in the woman with weight loss (cartilage WORMS grade 0 in C and D).

WEB EXTRAS

Access the *Radiology* study "Is Weight Loss Associated with Less Progression of Changes in Knee Articular Cartilage among Obese and Overweight Patients as Assessed with MR Imaging over 48 Months? Data from the Osteoarthritis Initiative" *at RSNA.org/Radiology.*

New Videos on *RadiologyInfo.org*

RadiologyInfo.org
For patients

RadiologyInfo.org, produced by RSNA and ACR, continues to develop and post patient-focused videos that describe imaging procedures. Visit the website to watch the latest videos, including:

- CT of the Heart
- Radioiodine I-131 Therapy
- CT of the Sinuses
- Colorectal Cancer Screening

The Value of Membership

RSNA Weekly Keeps Members Informed

RSNA Weekly, a news brief delivered to members by email, includes headlines affecting the radiology profession.

Each Tuesday, RSNA Weekly compiles a selection of current news related to radiology and clinical practice from a wide variety of news sources. RSNA works with a news service to identify articles that may be of interest to radiologists, allied professionals and their patients. This free service is an RSNA member benefit. If you are not receiving the email, go to *RSNA.org/Membership*, click My Account, log in, scroll to E-News Subscriptions and select RSNA Weekly.

Annual Meeting Watch

RSNA 2017 Registration Packages

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

RSNA 2017
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November 26 to December 1

Important Dates

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 the first night's room and tax.
November 26 -December 1	103rd Scientific Assembly & Annual Meeting

Reserve Your Room Now Through RSNA

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

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RSNA's official hotel partners:

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

Annual Meeting Watch

Submit Abstracts for High-Impact Clinical Trial at RSNA 2017

The process for submitting abstracts for the High-Impact Clinical Trial (HICT) session at RSNA 2017 is now open. Submission deadline is Aug. 1 at noon Central Time.

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

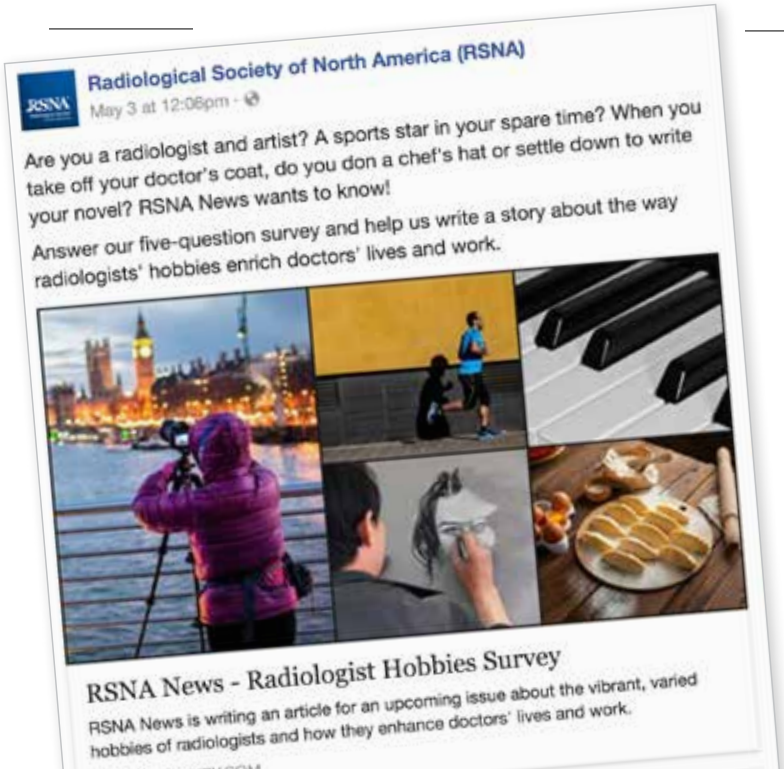
Authors of accepted submissions will be notified Aug. 15. For more information, go to *RSNA.org/AnnualMeeting*.

International Visitors

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

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

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



COMING NEXT MONTH

What do radiologists do in their downtime? We wanted to know, so we asked you on Facebook (*left*). Next month, *RSNA News* will spotlight some of the interesting and varied hobbies radiologists are passionate about.

103rd Scientific Assembly and Annual Meeting

November 26 to December 1
McCormick Place, Chicago

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