

## Multispecialty Collaboration Advances Precision Medicine

### ALSO INSIDE:

**LOOK AHEAD:** The Future of Ultrasound  
Salaries Increase, but so Do Workload, Burnout  
Gender Identity and Radiology Exams  
R&E Campaign Nears \$17.5 Million Goal  
Education Program Simulates Image Ordering



# EMERGENCY RADIOLOGY

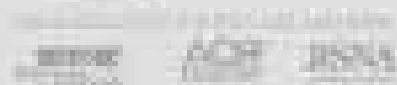
## INTERNATIONAL DAY OF RADIOLOGY

NOVEMBER 8, 2017

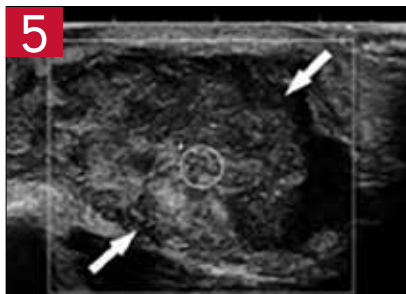
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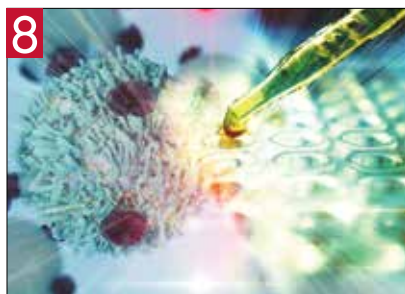
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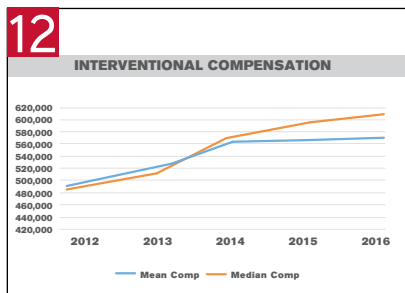
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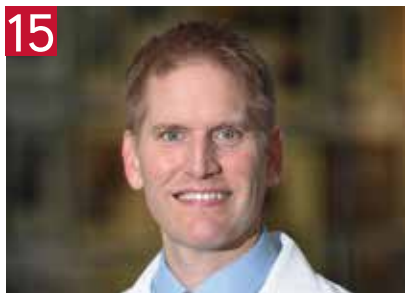
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# IRIYA Participants at 2017 Annual Meeting

The RSNA Introduction to Research for International Young Academics (IRIYA) program encourages young radiology professionals to strengthen and grow their teaching and research careers. The program offers young academics the chance to attend specialized courses, small group discussions and other networking opportunities during the RSNA annual meeting.

The 2017 IRIYA participants and their home countries are:

**Monika Arzanauskaite, MD**

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*India*

**Federica Vernuccio, MD**

*Italy*

## RSNA R&E Foundation Grant Applications Open



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

The online application process will open in October, and deadlines for applications begin in January. Visit [RSNA.org/Foundation](http://RSNA.org/Foundation) to read about current and past funded projects, discover the grants available and learn how to apply.

## ISMRM/RSNA Co-Provided Workshop on High-Value MRI

The economics and value of MRI in healthcare will be the topic of discussion at a workshop co-provided by the International Society for Magnetic Resonance in Medicine (ISMRM) and RSNA to be held Feb. 18-20, 2018, in Washington, D.C. Presentations, posters and panel discussions will include the current and future reimbursement system for MRI, key clinical technologies and procedural innovations being developed to decrease exam time and increase diagnostic impact, how CER can affect imaging research and the potential opportunities of MRI to improve the patient experience. The deadline for abstract submission is Dec. 8.

Attendees will learn to maximize the impact of MRI research and improve the efficiency of MRI operations. For more information, go to [ismrm.org/workshops/18HighValue](http://ismrm.org/workshops/18HighValue).

## New Content on RSNA Education

Since the recent launch of a new online education platform, RSNA continues to update the available resources on the site at [RSNA.org/Education](http://RSNA.org/Education). RSNA Education content is a free resource for members. For more information, contact [customerservice@rsna.org](mailto:customerservice@rsna.org) or 1-630-571-7873.

# RSNA IVP Team Makes First Trip to Indonesia

The RSNA International Visiting Professors (IVP) program kicked off 2017 with a first-time visit to Indonesia.

The team was comprised of Athanasios D. Gouliamos, MD, PhD, professor of radiology at the National and Kapodistrian University of Athens Medical School in Athens, Greece, Maheen Rajput, MD, clinical associate professor of radiology at the University of Iowa Hospitals and Clinics in Iowa City, and Robert M. Steiner, MD, professor of radiology at New York-Presbyterian Hospital/Columbia University Medical Center in New York City.

To support the IVP's goal of teaching around the globe, the professors spoke to faculty, residents and medical students at hospitals in Jakarta, Makassar and Yogyakarta. The IVP team visited radiology departments, saw hands-on teaching and reviewed local radiology cases. The doctors also reviewed each department's protocols and made recommendations for improvements in radiation reduction.

The doctors completed their trip by speaking at the Indonesian Society of Radiology's Annual Meeting in Yogyakarta. The IVP team also listened to presentations and reviewed posters related to the wide variety of pathology-related imaging and other diseases and conditions that are common in Indonesia.

Another RSNA IVP team visited Mexico in 2017. The team, comprised of H. Carisa Le-Petross, MD, a professor of radiology at the University of Texas MD Anderson Cancer Center, Houston, and Frederico F. Souza, MD, a body radiologist at the Baptist Health South Florida, Miami.

After both professors visited the Mexican Federation of Radiology and Imaging meeting in Cancun, Dr. Le-Petross traveled on to León in central Mexico and Dr. Souza went to Monterrey in the northern part of the country.

Dr. Le-Petross visited Unidad Médica de Alta Especialidad IMSS BAJIO Hospital, where she presented formal didactic lectures followed by case presentations and more informal discussions.

Dr. Souza visited Hospital Universitario, Universidad Autónoma de Nuevo León (UANL), where he presented lectures and interpretation sessions to residents and toured the hospital and visited the 3-D Imaging Printing Laboratory.

The Indonesia trip was supported by Agfa HealthCare. Along with Indonesia and Mexico, this year's IVP host nations are Sri Lanka, Malaysia, Latvia and Peru.



**IVP members Maheen Rajput, MD, and Robert M. Steiner, MD, (seated in front of computer) review local radiology cases with faculty and students during their 2017 RSNA IVP trip to Indonesia.**



**Frederico F. Souza, MD, visited Hospital Universitario, Universidad Autónoma de Nuevo León (UANL) where he taught radiology residents.**

## ICRU Issues Report on Stereotactic Treatments with Small Photon Beams

The International Commission on Radiation Units and Measurements (ICRU) has released Report 91, which provides comprehensive recommendations on stereotactic treatments with small photon beams.

The ICRU, which aims to develop internally acceptable recommendations regarding quantities and units of radiation and activities, published, "Prescribing, Recording and Reporting of Stereotactic Treatments with Small Photon Beams,"

which recommends a strict definition of target volumes [gross tumor volume (GTV) clinical target volume (CTV)] by reviewing imaging modalities used in clinical practice.

This report also covers fundamentals of small-field dosimetry, treatment-planning algorithms, commissioning and quality assurance for the existing delivery systems, as well as the role of image guidance during delivery. It also recommends a

framework for prescribing, recording and reporting stereotactic radiotherapy, and covers most of the pathologies eligible for stereotactic delivery (malignant and non-malignant).

The report is consistent with previous ICRU reports: 50 (1993), 62 (1999) and 83 (2010).

For more information, contact David A. Schauer, ScD, CHP, [aticru@icru.org](mailto:aticru@icru.org).

## In Memoriam

### James G. Kereiakes, PhD



A national authority on radiopharmaceutical dosimetry and a preeminent physics educator, James G. Kereiakes, PhD, died on June 26 in Cincinnati. He was 92.

Dr. Kereiakes received his master's and doctoral degrees in physics from the University of Cincinnati. He spent nine years at the U.S. Army Medical Research Lab in Fort Knox, KY, before returning to the University of Cincinnati. He became professor of radiology in 1968, a position he held until he retired in 1991, and became professor emeritus of clinical radiology at the university.

A prolific author of more than 200 peer-reviewed scientific articles, chapters and books, Dr. Kereiakes was an international expert on the biologic effects of radiation. He was asked by the Surgeon General of the U.S. Army to evaluate the impact of radiation released from the Chernobyl reactor meltdown on the health of U.S. military personnel in Europe.

Dr. Kereiakes was a founding member of the RSNA Research & Education (R&E) Fund (now the R&E Foundation), was elected RSNA third vice-president in 1982 and served on numerous committees. He received the RSNA Gold Medal in 1988.

Dr. Kereiakes was a founding member and former president of the American Association of Physicists in Medicine and received its William D. Coolidge Award in 1981. He was recognized with the Daniel Drake Award in 1994 by the University of Cincinnati College of Medicine.

### John "Jack" R. Thornbury, MD



Considered a founder of genitourinary radiology, John "Jack" R. Thornbury, MD, died on July 3 in Longmont, CO. He was 88.

Born in Cleveland, Dr. Thornbury attended The Ohio State University College of Medicine in Columbus. Following two years of active military duty at Malmstrom Air Force Base in Great Falls, MT, he completed his radiology residency at the University of Iowa Carver College of Medicine in Iowa City, in 1961.

He began his radiology career at the University of Colorado (CU) School of Medicine in Denver and continued his academic radiology career at medical schools including the University of Iowa, the University of Washington in Seattle, the University of Michigan in Ann Arbor and the University of Rochester, NY. He served as a radiology professor at the University of Wisconsin School of Medicine and Public Health, in Madison, from 1989 until his retirement in 1994.

In addition to bringing national recognition to the field of genitourinary radiology, Dr. Thornbury is credited with pioneering procedures such as the needle aspiration exploration of renal mass lesions and various percutaneous needle aspiration biopsy methods of the chest.

He served as president of the Society of Abdominal Radiology, where he was inducted into the Hall of Fame in 1974 and received the Howard M. Pollack Gold Medal in 2005. He presented the American Roentgen Ray Society Caldwell Lecture in 1993, received an American Board of Radiology Distinguished Service Award and the Association of University Radiologists Gold Medal.

Dr. Thornbury was a member of the RSNA Scientific Program Committee for breast imaging and was a frequent *Radiology* contributor.

## Numbers in the News

# 34

Percentage increase in relative value units (RVUs) for radiologists in 2016, new survey shows. Read how workload is connected to increasing burnout on [Page 12](#).

# 90

Percentage of the \$17.5 million goal raised for the R&E Inspire-Innovate-Invest Campaign. Read more on [Page 14](#).

# 133

Number of live-streamed and on-demand courses available through the RSNA 2017 Virtual Meeting. Read more on [Page 24](#).

#### RSNA NEWS

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#### LETTERS TO THE EDITOR

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1-630-571-7837 fax

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# LOOK AHEAD

## *The Future of Ultrasound in Radiology*

BY DEBORAH LEVINE, MD

As I am sure the radiology community is aware, the use of ultrasound (US) has exploded around the world and across medical subspecialties. Changes in hardware and software have allowed for smaller, less expensive machines, and thus many healthcare providers now utilize US in their daily practice. Despite concerns that this will lead to the demise of US as practiced by radiologists, my anecdotal experience, *i.e.*, talking to radiologists around the United States and Canada, has shown me that US volumes are still robust. However, there is growing concern in the ultrasound community that if our expertise in the subspecialty dwindles, other subspecialists will fill the void.

### **Image Optimization and Ultrasound Education**

Over the past two decades, US machines have decreased in size and increased in performance, so much so that it has become easier to obtain diagnostic-quality images. Many machines have image optimization buttons that allow for a variety of machine-controlled variables that automatically adjust to improve image quality. While I lament the fact that many imagers do not understand the physics behind the varied US parameters that can be manipulated on a US machine, how can I complain when the vast majority of the images I see are of good-to-excellent quality? Nonetheless, it behooves the imaging community to ensure that our trainees understand US physics, and have the opportunity to develop skills in real-time scanning so that we can maintain our role as US experts. Hands-on training of US is variable across radiology residency programs. While many of our residency and fellowship programs continue to have strong scanning requirements in our US rotations, there is increased demand for trainee time in other imaging subspecialty areas, especially considering that the U.S. radiology residency curricula are condensed into the first three years of residency. Training in US will allow radiologists to continue to offer this safe and inexpensive modality for the benefit of our patients.

### **Keeping the Focus on Patient Care**

It was 30 years ago that Roy Filly lamented in a *Radiology* editorial (*Radiology* 1988;167:400) that US would be the stethoscope of the future. Today we continue to see the proliferation of US in many medical subspecialties given the advances in technology that allow for smaller, less expensive machines and imaging at the bedside. While small laptop and handheld US machines can be disruptive and pervasive technologies and can be a threat to the practice of US by radiologists, they can also benefit patient care if appropriate diagnoses can be obtained in a more timely fashion. We need to work with our referring clinicians to ensure that appropriate training and standards for quality exist in their US practices; that quality metrics are met; and that images are available outside of their departments for review and/or re-interpretation when needed. This is our opportunity to continue to contribute as imaging experts.

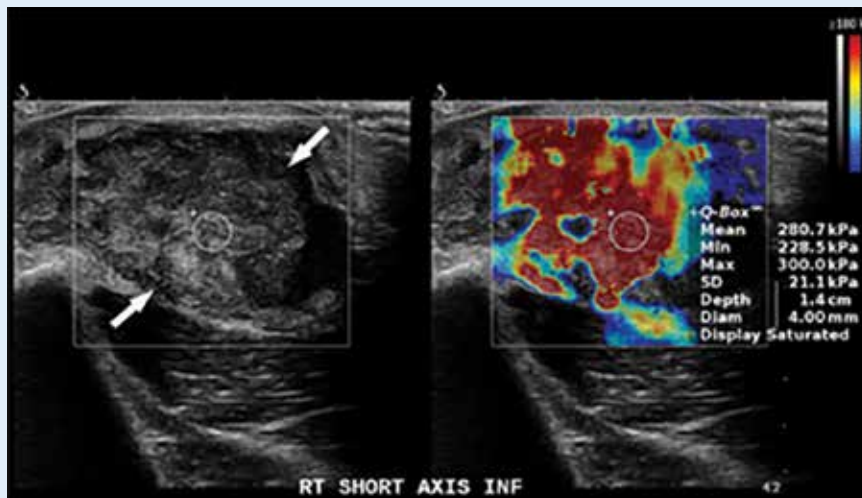


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### **DEBORAH LEVINE, MD**

Dr. Levine is director of Obstetric & Gynecologic Ultrasound (US) at Beth Israel Deaconess Medical Center, Boston, and a professor of radiology at Harvard Medical School. Dr. Levine focuses her clinical work in US and her research on obstetric and gynecologic US. For the past decade, Dr. Levine has devoted much of her academic time to working as senior deputy editor of *Radiology*. Dr. Levine is president of the Society of Radiologists in Ultrasound. She is a member of the RSNA Public Information Advisors Network.

A 66-year-old man with an elbow mass. Gray-scale image shows a solid heterogeneous mass (arrows) in the lateral elbow soft tissues. A two-dimensional tissue stiffness color map obtained using shear wave elastography (right) demonstrates high intra-lesional stiffness and permits quantitative measurement of tissue stiffness, expressed in kilopascals. Biopsy confirmed pleomorphic leiomyosarcoma. Case courtesy of Colm McMahon, MD



Beside US examinations are often targeted exams to answer a specific clinical question. These differ from the complete diagnostic US examinations performed in radiology departments.

As in any imaging examination, we need to ensure that our image quality is excellent, that images are available for review outside of our imaging departments, that reports are available in the information system in a timely fashion, that our conclusions address the clinical indication for the examination, and that we have excellent communication of critical results with our referring providers. We should feel comfortable making sonographic diagnoses and not always rely on referral to CT or MR for additional information when that information can be provided by US. We should feel comfortable talking face-to-face with our patients about their sonographic diagnoses.

#### Volumes and Cine Clips — More Than Pretty Pictures

There is no doubt that parents love the 3-D images of the fetus that are obtained during obstetric imaging. However, I find 3-D imaging most useful for intrauterine device (IUD) position, where the coronal view is most important and can be easily reconstructed. With the rapidly decreasing cost of storage of medical images and with faster internet connections, we can review, reconstruct and store 3-D volumes outside of the examination room, potentially allowing for more rapid examinations.

We can also review cine clips that allow for interpretation by specialists at remote locations and for reassessment of images after the patient has left the US suite. While I much prefer onsite US scanning and talking to the patient personally, I realize that practice patterns vary according to regional and

local needs. Having the ability to obtain large quantities of US data and optimize display for later interpretation are advances in US and information technology that should allow us to improve our US practices.

#### Elastography — Taking US Beyond Anatomy

Elastography allows for non-invasive assessment of tissue mechanical properties. Much has been written about liver elastography for assessment of liver fibrosis (and monitoring of treatment of viral hepatitis), but there are many other uses of elastography, including assessment of tumors in a variety of organs and assessment of muscular diseases. The wide availability of US-based elastography, including its use at the bedside and relatively low cost, ensures that this technique will have increasing use in the future.

#### Contrast — Beyond Screening and Lesion Characterization

Ultrasound contrast allows for improved screening for metastatic disease and improved characterization of lesions (for example in the liver and kidney), compared to non-contrast imaging, providing tumor imaging at a lower cost (compared to MRI) and with no radiation exposure (compared to CT). These issues of cost, lack of radiation exposure, and also paucity of contra-indications are particularly important in patients who need multiple examinations or at-risk populations, such as children. Ultrasound contrast can also be used for studies such as voiding cystourethrogram, allowing for a non-radiation, non-iodine contrast method for examining the urinary tract. Looking to the future, US contrast will enjoy increased use for the above-mentioned vascular and other intra-cavitary indications.

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*“It is up to us whether or not we will continue to be the physician experts in the field of ultrasound.”*

DEBORAH LEVINE, MD



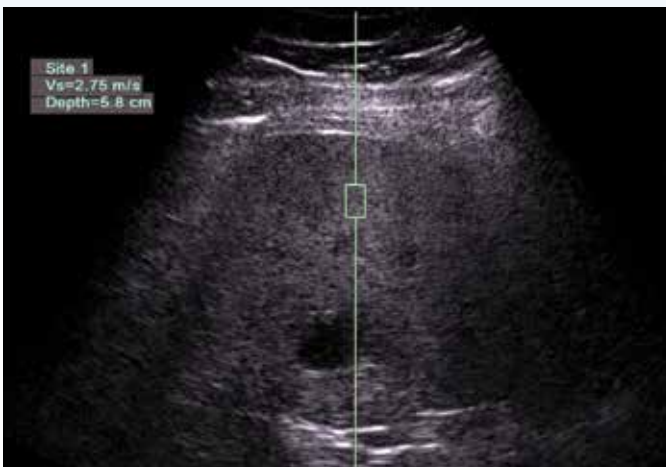
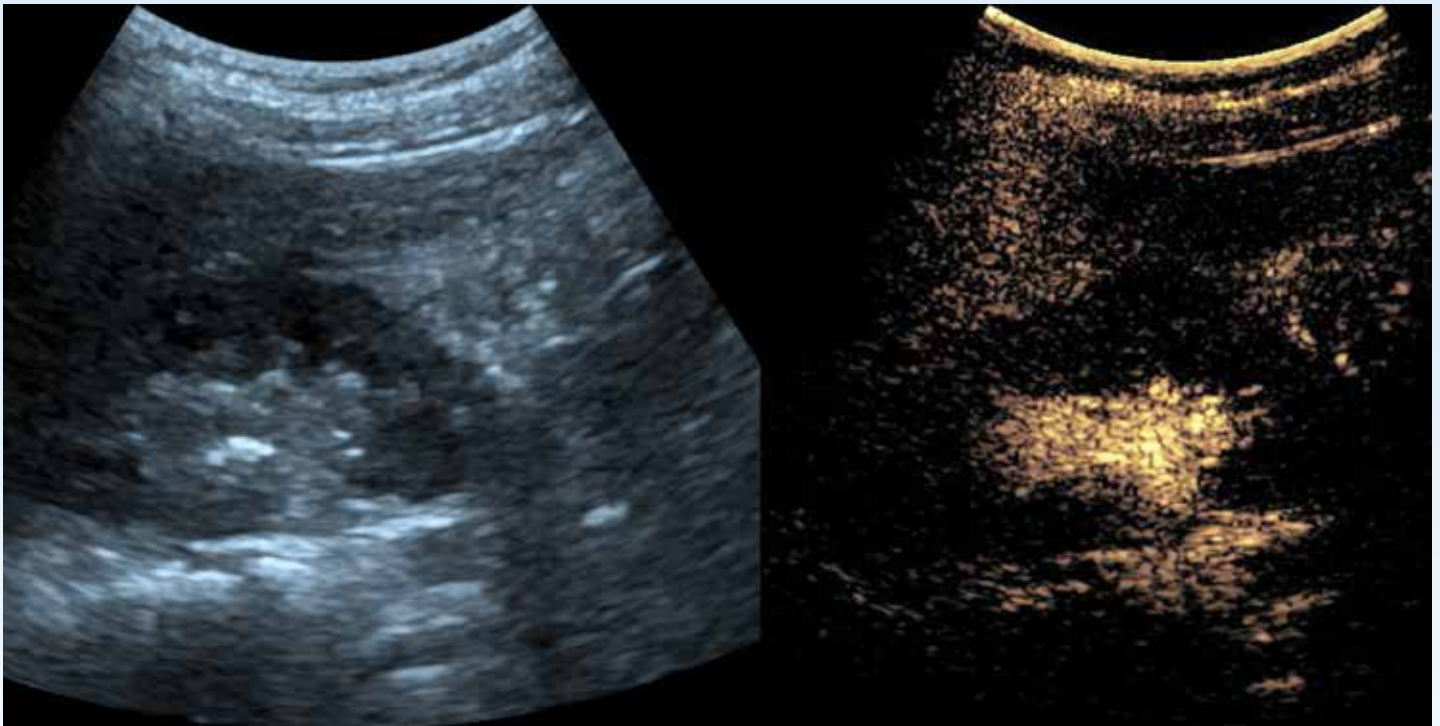
### Ultrasound Therapeutics and Procedures

Imagine combining a therapeutic agent into US contrast microbubbles. We could inject the contrast and burst the bubbles right when they arrive at the tissue of interest to provide targeted therapy. Other methods of drug delivery with US include binding ligands that are over-expressed in tumors to microbubbles to enhance local delivery or using US to disrupt the blood brain barrier to allow medications into the brain. These therapies are already in select use for enhancing the delivery of chemotherapy and genetic material, but are not yet mainstream. Additionally, high-intensity

focused ultrasound (HIFU) can be used to treat fibroids and even prostate cancer. Many other uses for HIFU are on the horizon. Finally, fusion imaging is a welcome technology that allows for US-guided biopsies of lesions initially visualized on other modalities such as CT and MRI.

### Expanding Opportunities

I see the future of US as one of expanding opportunities for improvements in patient care. However, it is up to radiologists whether or not we will continue to be the physician experts who are the leaders in the field. ❌



**Above:** A two-year-old girl with a history of UTI. Sagittal images of the right kidney during ultrasound contrast enhanced voiding cystourethrogram (VCUG) shows reflux into the collecting system, which had not been noted on prior x-ray VCUG. *Images courtesy of Harriet Paltiel, MD*

**Left:** Ultrasound in a patient with elevated liver function tests. Liver stiffness mean from 10 measurements (one shown here) was 2.98m/s, which is in the range of cirrhosis. *Image courtesy of Richard Barr, MD*

# Radiology, Oncology, Quantitative Imaging Converge to Advance Precision Medicine

BY MIKE BASSETT

As precision medicine moves patients toward targeted therapies and treatment, cross-disciplinary collaboration is becoming more vital than ever. But that raises the question: who are radiology's natural partners in this process?



**Choyke**



**Sullivan**



**Flanders**

According to Peter L. Choyke, MD, director of the Molecular Imaging Program at the National Cancer Institute's (NCI) Center for Cancer Research, the most obvious partnership is with oncology.

"For example the new targeted immunotherapy drugs only work about 20 percent of the time, and it is very unclear which patients will respond," said Dr. Choyke, a member of RSNA's Molecular Imaging Committee.

For that reason, methods are needed to best select patients who will respond to a particular therapies. And for patients who do respond, decisions need to be made about the duration or the aggressiveness of the response to a therapy.

"Imaging could play a big role in selecting patients who would be good candidates for specific cancer therapy, and in monitoring the intensity of the response after those therapies," he said.

He pointed to the development of PD-L1 pathway inhibitors, which are changing the landscape of cancer. By binding to its receptors, antiPDantiPD-L1 antibodies reduce induce cytotoxic T-cell activity, proliferation and cytokine production which kill cancer cells.

"One of the goals of these therapies is to activate T cells against a tumor, yet there is no really good way to measure T-cell activation," he said. "So researchers are developing imaging agents that can show activated T-cell populations after checkpoint inhibitor therapy."

The convergence of radiology, pathology and genomics will also play a key role in the future of precision medicine — particularly that of precision cancer care. Dr. Choyke pointed out that pathologists — like radiologists — must deal with issues related to "information density" and the need to compress a good deal of infor-

mation into a few words.

"You can have a two-centimeter prostate cancer and the entire description will be a Gleason score and nothing else," he said. "So you can see how much information is left on the slide.

"But if you take an MRI and the pathology and then determine specific areas in the pathology that are correlated with bad outcomes and then determine the genomic mutations within those regions, you can predict through imaging which patients are likely to have worse outcomes," Dr. Choyke said.

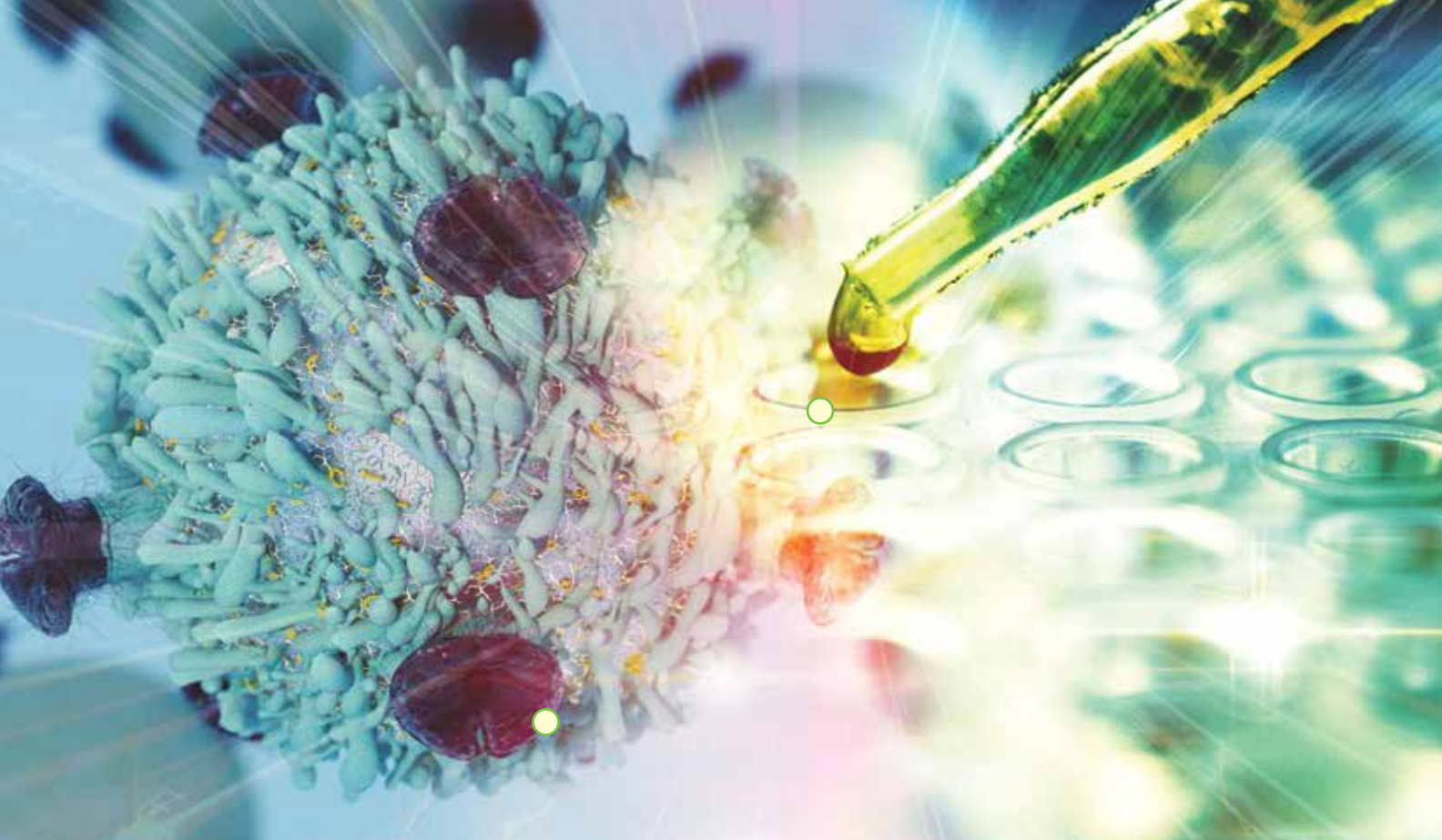
In prostate cancer, for example, researchers are working to correlate imaging with digital pathology; not just Gleason grading, but feature analysis of digital pathology that can be correlated with specific areas that have been selected for genomic testing.

This database can then be used to develop deep learning methods that extract features not visible to radiologists, but that are nonetheless associated with higher risk cancers.

"That is important because a physician will then know at a glance if a patient is at high risk for an aggressive tumor," he added. "But it's also important because a physician can direct a needle biopsy into that area and target the tissue more accurately and do genomics on the most aggressive part of the tumor."

## Standardization Critical to Precision Medicine

Another discipline poised to play a key role in personalized or precision medicine is quantitative imaging, which is critical to cancer care. There is a need for rapid development of quantitative imaging biomarkers for tumor diagnosis and prognosis to create better risk stratification and aid physicians in making personalized



treatment decisions.

But quantitative imaging faces a key challenge — the lack of standardization of imaging.

To that end, RSNA's Quantitative Imaging Biomarkers Alliance (QIBA) and the NCI's Quantitative Imaging Network (QIN) are working to accelerate that progress by developing a standard of care for imaging practices that would also contribute to clinical trials.

According to Daniel Sullivan, MD, a founding member of QIBA, clinical image acquisition must be standardized in order to reduce variability in clinical practice and clinical trials. Such quantification is important in reducing variability and increasing precision, particularly when compared to interpreting results qualitatively.

"In order for standardized, objective, quantitative results to become accepted and expected in clinical practice, data from clinical trials needs to show that such objective results lead to better clinical decision-making and outcomes," said Dr. Sullivan, professor emeritus in the Department of Radiology at Duke University Medical Center, Durham, NC, who now serves as QIBA's external relations liaison.

Therefore, clinical trials are important

for implementing quantitative image acquisition parameters and demonstrating their value, he said.

As both QIBA and QIN develop and collate data to validate the precision and utility of quantitative imaging biomarkers, radiologists, clinical trialists and ordering physicians will have more confidence in using them in clinical research and practice, Dr. Sullivan said.

"Change always occurs slowly in medicine, so widespread implementation of quantitative imaging biomarkers for clinical decision-making will evolve gradually," Dr. Sullivan said.

The issue of standardization also extends to standardizing the names and features of data elements in order to support comparative effectiveness research, precision medicine, radiomics, registry participation, machine learning, communication and public health.

RSNA is working with the American College of Radiology (ACR) to define a set of common data elements (CDEs) for radiology reporting and decision support, according to Adam Flanders, MD, professor and co-director of the Department of Radiology, Division of Neuroradiology/ENT at Thomas Jefferson University Hospital in Philadelphia.

*Continued on next page*

### **Precision Medicine Focus of RSNA 2017 Sessions**

Numerous precision medicine courses at RSNA 2017 focus on oncology and quantitative imaging, including:

- "Research Opportunities Using the NIH: The Cancer Imaging Archive (TCIA) That Links Cancer Imaging to Clinical Data, Genomics, Proteomics, Quantitative Imaging and Deep Learning"
- "Interrogating Tumor Heterogeneity Using Imaging"
- "Multidisciplinary Communication in Cancer Care: Talking the Same Language"
- "Special Interest Session: Translation of Quantitative Imaging from Clinical Research to Clinical Practice: Why and How?"

### **RSNA 2017 Annual Oration in Radiation Oncology**

Daphne A. Haas-Kogan, MD, will speak on "Personalized Medicine and Radiation Oncology," in this year's Annual Oration in Radiation Oncology," at 1:30 p.m., Wednesday, Nov. 29 in the Arie Crown Theater.

Add these and all RSNA 2017 courses to My Agenda at [Meeting.RSNA.org](http://Meeting.RSNA.org).

While RSNA's Reporting Initiative is designed to develop best reporting practices for radiology, the RSNA/ACR Joint Effort for Common Data Elements takes it one step further, said Dr. Flanders, who serves as chair of the RSNA Radiology Informatics Committee and is on the RSNA Steering Committee on Content for the Digital Roadmap.

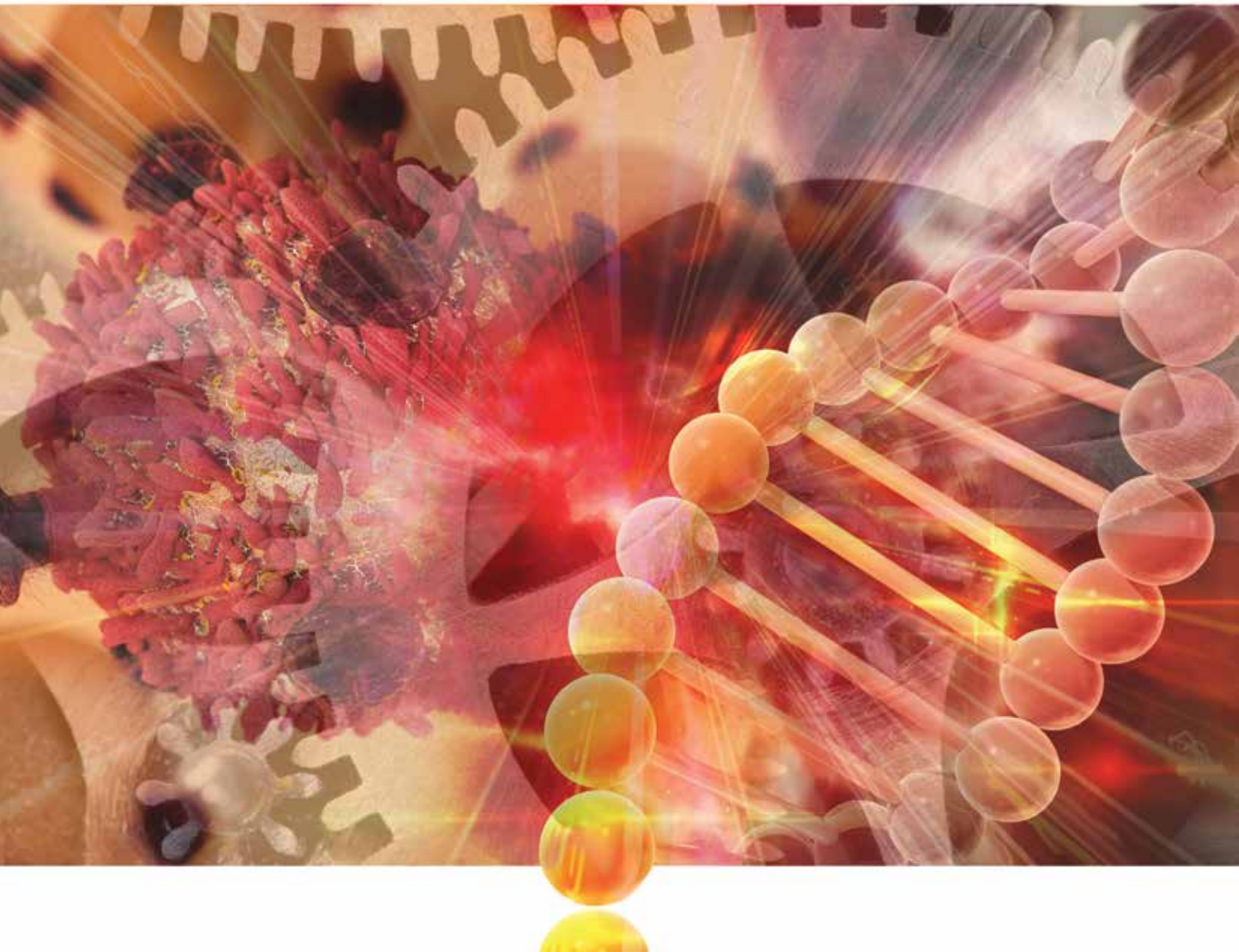
Each CDE represents a concept or feature with a controlled set of potential values. In neuroradiology, for example, if you are talking about a patient with a stroke, the question becomes, "What are the features that need to be described — whether quantitative or qualitative — and that should appear in a report so they can be understood by a human or mined very easily by a computer, and used to either drive therapeutic pathways or collect data on large-scale patient outcomes?" For this purpose, Dr. Flanders and colleagues are currently collaborating with the American Society of Neuroradiology to focus on reporting concepts specific to neuroradiology.

"The whole idea is to collect the best practice features that exist for each disease entity and codify what those features are," Dr. Flanders said. "That supplements activities of both QIBA and QIN." ❏

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*"Imaging could play a big role in selecting patients who would be good candidates for specific cancer therapies, and also in monitoring the intensity of the response after those therapies."*

PETER L. CHOYKE, MD



# Gender Identity Requires Re-thinking Routine Radiology Procedures

BY NICK KLENSKE

Performing what she assumed to be a routine x-ray on Henry, an eight-year-old boy, Sidsel Pedersen, a medical radiologic technologist (MRT) and instructor at the Southern Alberta Institute of Technology, was given some surprising news. After calling Henry away from the changing room, the child's mother pulled Pedersen aside and informed her that Henry in fact, identifies as a girl and prefers to go by Harriet.

Although the x-ray was only of Harriet's wrist, Pedersen began thinking about how transgender patients could affect traditional radiology practices. For instance, because MRTs use different techniques to shield male and female reproductive organs from radiation, in the case of a transgender patient, the radiographer will first have to confirm where the patient's reproductive organs are located.

When discussing this situation with her colleague Virginia Sanders, MRT, the two had an in-depth conversation about the changing gender landscape and how routine x-ray exams may differ when the patient is transgender. "How can MRTs treat transgender patients both professionally and respectfully?" they asked.

It became evident that more and more MRTs are facing similar questions.

To help MRTs better understand the topic and their responsibility to their transgender patients, Sanders and Pedersen will present the session "Gender Diversity — It's the Parts that Matter" during RSNA 2017. The session is one of the American Society of Radiologic Technologists (ASRT)/RSNA sessions planned for RSNA 2017. (See sidebar.)

## The Changing Gender Landscape

In investigating the issue, the two MRTs found that, although various studies examined healthcare for transgender patients, none of the research addressed the specific issue of communicating with patients about reproductive organs. These studies did reveal the marginalization of this community, and more specifically, highlighted the disparity in healthcare services for transgender patients vs. cisgender patients (people whose gender identity matches the sex that they were assigned at birth).

"Traditionally, the model of gender has been binary — male and female — but that landscape is completely different now," Sanders said. "Awareness of this shifting landscape is important for those of us in healthcare, particularly with transgender patients, as they

may not identify and present the same as their biological sex."

As an example of the impact on standard practice, MRTs can now utilize a gender continuum that contains many different categories of gender variance, such as sex-to-gender congruency and sex-to-gender non-congruencies. "It is imperative for MRTs to be aware of the diversity within the gender continuum as we are the ones delivering ionizing radiation to the public," Pedersen said.

"For those of us in diagnostic imaging, the incongruence between a patient's gender expression, gender identity and biological sex means we could potentially shield the wrong reproductive organs from ionizing radiation during certain x-ray exams," Sanders said. "We could then be negligent in protecting the public from potentially harmful radiation."

## Best Practices for Transgender Patients

The ASRT/RSNA 2017 presentation will open with a general overview of the issue and discuss how gender variance affects shielding reproductive organs from ionizing radiation. Presenters will also offer an in-depth look at the new gender continuum and best practices for ensuring that all patients feel respected and heard while receiving a high level of care.

Attendees will gain practical tips, such as adapting questionnaires and communications so that the MRT can determine the location of the patient's reproductive organs in a respectful and dignified way.

The session will close with a look at what clinics and hospitals can do to create a gender-friendly environment. ❏

## ASRT@RSNA 2017 Sessions

"Gender Diversity — It's the Parts that Matter," is one of the ASRT@RSNA 2017 sessions to be held on Wednesday and Thursday, Nov. 29 and 30. Other sessions include:

- "Where Does the Radiation Hurt in Low Dose, High Dose and Multiple Dose Radiology?"
- "Male Breast Cancer: What Lies Beneath"
- "Understanding Practice and Ethics Standards in a Changing Healthcare Environment"
- "Cybersecurity for Medical Imaging"

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Pedersen



Sanders

*"It is imperative for MRTs to be aware of the diversity within the gender continuum as we are the ones delivering ionizing radiation to the public."*

SIDSEL PEDERSEN, MRT

# Radiology Salaries Increase, but so Do Workload and Burnout

BY RICHARD DARGAN

Radiology remains one of the highest-paid specialties in healthcare, according to a recent 2016 survey by the American Medical Group Association (AMGA). But the survey also showed that radiology continues to experience a substantial growth in productivity.

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*“Rather than constantly pushing for more productivity, radiologists should take the time to be human beings.”*

MYRIAM HUNINK, MD, PHD

## Burnout Focus of RSNA 2017 Sessions

Richard B. Gunderman, MD, will moderate the session, “Why Do Radiologists Burn Out, and What Can We Do About it?” and present the course, “Causes of Burnout.” Other courses are “Strategies for Avoiding Burnout,” and “Resiliency and Thriving.”

Add these and all RSNA 2017 courses to My Agenda at [Meeting.RSNA.org](http://Meeting.RSNA.org).

And with that increasing workload comes a harmful side effect: a high level of burnout. For that reason, recognizing burnout and addressing it as quickly as possible at the individual and institutional level is more critical than ever, experts say.

AMGA’s 2016 annual survey found that productivity in radiology, represented by relative value units (RVUs), increased 3.4 percent in 2016, following a 3.5 percent increase the year before. Productivity grew faster than compensation for the fifth consecutive year. (See sidebar)

“Statistics show that, 10 years ago, we interpreted one image every 20 seconds; now we do one every three seconds,” said Myriam Hunink, MD, PhD, professor of radiology, Erasmus University Medical Center, Rotterdam, the Netherlands, and an adjunct professor of health policy at Harvard University’s T.H. Chan School of Public Health in Boston. “With the aging population, the increasing number of procedures and the documentation required, our workload is greater than it’s ever been.”

As productivity continues to outpace salary, signs of burnout — defined as physical and emotional exhaustion, a detached, cynical attitude and diminished feelings of personal accomplishment — have become more evident in radiology.

A 2015 survey of 504 residents at the University of North Carolina in Chapel Hill, found that 85 percent of radiology residents met the criteria for burnout — second only to surgery residents. In a 2017 Medscape survey of more than 14,000 physicians from more than 30 specialties, about half of radiologists reported feeling burned out, and only 33 percent indicated that they were very or extremely happy at work.

“Radiologists are increasingly being treated as a means of production and often end up feeling like cogs in a

machine,” said Richard B. Gunderman, MD, PhD, a professor and vice chairman of the Department of Radiology at Indiana University. “That commodification of radiology takes a toll and is especially troublesome for some of the best people in the profession.”

Along with feelings of de-personalization, other reasons for burnout in radiology include too many hours, liability pressures and feelings of isolation. Burnout could also be a sign that a person is a poor fit for radiology, or that the group or practice is a poor fit for the individual, said Dr. Gunderman, a member of RSNA’s Public Information Advisors Network.

## U.S. Culture Plays a Role in Burnout

Physician burnout is particularly epidemic in the U.S., affecting more than half of all physicians, according to a 2015 Mayo Clinic study. The phenomenon reflects differences in culture and expectations, said Dr. Hunink, who works in both the U.S. and the Netherlands, a nation where physician burnout rates are only 20 percent.

“The United States is more of an individualistic culture,” she said. “In the U.S., doctors are told to stay and work long hours, to not get sick, to always put the patient first. If you keep doing these things, the candle will not burn anymore.”

Nevertheless, burnout is a growing concern outside of the U.S. as well. But no matter where they live, radiologists generally work in isolation, which can create stressors not experienced by other specialties.

“Radiologists at outpatient facilities often work in a sequestered environment,” Dr. Gunderman said. “Hours and even days can go by without any contact with patients, technologists or other radiologists. That can take a toll on people.”

“We used to have more conversations with referring physicians,” Dr. Hunink added. “Now, most of our interactions are with computers.”

### Taking a Mindful Approach


There are no quick fixes for burnout, but the best approach is to avoid it in the first place by recognizing signs of mental and physical exhaustion like headaches, stiff neck, lower back pain, and gastrointestinal problems, along with insomnia and anxiety, and to take action before things get worse.

Exercise, meditation and taking time off all are effective techniques to alleviate stress. Dr. Hunink also suggests learning the practice of mindfulness — a Buddhist concept that has been adapted for secular use. Dr. Hunink, who practices yoga, meditation and the non-violent martial art of aikido, describes mindfulness

as “focusing on the here and now in a non-judgmental way.”

“As radiologists, we’re always judging,” she said. “Mindfulness takes us to a totally different way of looking at life — living in the moment and trusting that things will go the way they should.”

For radiologists suffering a particularly bad case of burnout, Dr. Gunderman recommends seeking professional help. Many state medical associations and hospitals offer such resources, according to Dr. Gunderman.

Dr. Gunderman will moderate a session on burnout and speak on the topic at RSNA 2017. (See sidebar) 

*Editor’s Note:* This is the second in a series of articles on work/life balance in radiology. The next article will focus on strategies for preventing burnout.



Hunink



Gunderman

## Radiology Salaries Showed Impressive Gains in 2016

A recent survey showing radiologists experienced a healthy salary increase in 2016 demonstrates the specialty’s ability to thrive even in an era of reimbursement cuts.

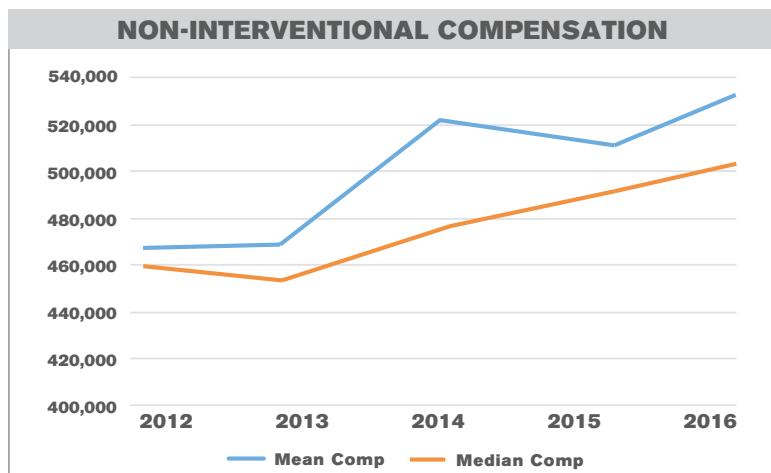
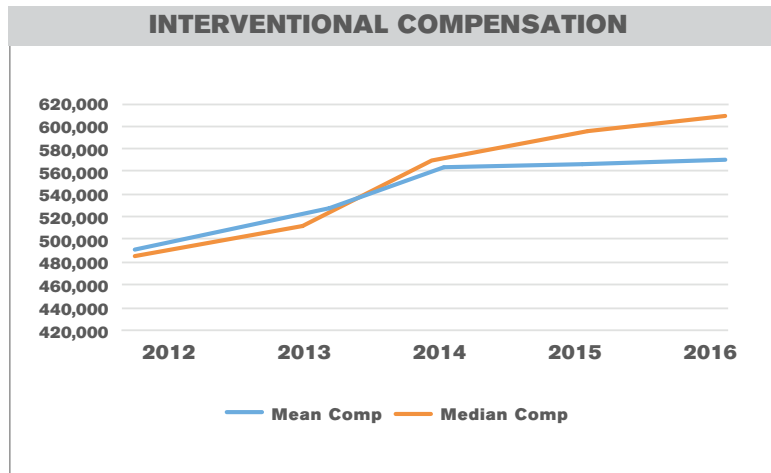
According to the American Medical Group Association (AMGA) survey, Median compensation for non-interventional diagnostic radiologists rose from \$490,399 in 2015 to \$503,225 in 2016 — a 2.6 percent increase. Radiology salaries increased just 1.5 percent in 2015 in the AMGA survey.

Interventional radiology salaries increased from \$592,750 in 2015 to \$610,500 in 2016, for a 3 percent increase in median compensation. That uptick continues a trend evident between 2014 and 2015, when salaries for interventional radiologists rose 2.7 percent.

The rising salaries in diagnostic and interventional radiology were consistent with the overall weighted average increase in 2016 compensation across all specialties of 2.9 percent. The report, based on responses from 269 medical groups representing more than 102,000 providers, found that 77 percent of physician specialties experienced increases in compensation.

Radiologists came in fifth on the salary list, behind cardiac/thoracic surgery, gastroenterology, orthopedic surgery and cardiology (cath lab). Cardiac/thoracic surgery was the top paid specialty with a median compensation of \$690,000 a year, according to the survey.

Read the full report on 2016 radiology compensation at [RSNA.org/News](http://RSNA.org/News).



Radiology salary increases were consistent with the overall weighted average increase in 2016 compensation across all specialties of 2.9 percent. *Charts courtesy of AMGA*

# R&E Inspire-Innovate-Invest Campaign Nears its \$17.5 Million Goal

BY MARY HENDERSON

As the Research & Education (R&E) Foundation's Inspire-Innovate-Invest Campaign draws to a close at the end of the year, the Foundation has raised more than 90 percent of its \$17.5 million goal. Launched in 2014, the Campaign will help the Foundation continue funding critically needed grants in radiologic research and education. By donating to the Campaign this fall, supporters have an opportunity to affect the way the specialty is practiced in the not-too-distant future, from the development of new disease-related biomarkers to novel therapeutic interventions.



Ehman

"Typically when you become a benefactor of medical research, you can expect it to take 10 years or more for that research to reach clinical practice," said Richard L. Ehman, MD, RSNA president and former R&E Foundation grant recipient. "But in imaging and radiology, the research translates much sooner."

Case in point: 2016 Cook Medical Cesare Gianturco/RSNA Research Seed Grant recipient Mubin I. Syed, MD, recently published results of a pilot study that may help pave the way for a new minimally invasive treatment for morbid obesity. His GET LEAN (Gastric Artery Embolization Trial for the Lessening of Appetite Non-surgically) study collected safety and efficacy on the new procedure, which targets a condition that has become a worldwide epidemic.

"Our results are exciting," said Dr. Syed, lead investigator of the study conducted at Dayton Interventional Radiology. "I really think this procedure will change the world."

In the study, four patients underwent a catheter-based procedure in which the left gastric artery is embolized with particles to block blood flow to the area of the stomach where the appetite-stimulating hormone ghrelin is produced. No serious adverse events occurred and the four treated patients experienced an average weight loss at six months of 20.3 pounds and an average excess body weight loss of 17.2 percent.

Dr. Syed's study was one of the first of its kind to be conducted in humans and authored an FDA supervised Investigational Device Exemption study on his experience with the procedure. Earlier animal studies showed significant ghrelin suppression and weight loss following the procedure and a retrospective study conducted at Harvard

University demonstrated that patients undergoing the procedure to combat hemorrhaging experienced significant ghrelin suppression and weight loss.

"Radiologists are the vanguard for this procedure, which I believe will be proven effective and become the standard of care for obesity," said Dr. Syed, who will soon embark on Phase II of the GET LEAN study. "R&E Foundation funding is critically important because it allows us to begin research and win additional funding to finish our work."

As research funding becomes increasingly difficult to secure from national sources, the R&E Foundation is able to grant awards to approximately 30 percent of proposals, giving early career researchers a solid start. In 2017, the R&E Foundation awarded \$4 million to grant recipients for the second year in a row, including Eduardo M. Barbosa Jr, MD, assistant professor of radiology, University of Pennsylvania Medical Center.

Dr. Barbosa, who received the 2017 Fujifilm Medical Systems/RSNA Research Seed Grant, will conduct a pilot study using high-resolution CT to develop and validate biomarkers for fibrotic interstitial lung diseases.

"The biology of chronic fibrotic lung disease is not completely understood and diagnosis is challenging," he said. "Using quantitative CT imaging data correlated with relevant clinical information and patient outcomes, we hope to better understand the course of the disease and recommend interventions that are more effective for individual patients."

The two-stage retrospective study will enroll approximately 300 patients and use both commercial software and advanced



Syed



Barbosa




## Inspire-Innovate-Invest Campaign Co-Chairs



Campaign co-chairs pictured left to right: William G. Bradley, Jr, MD, PhD, R. Nick Bryan, MD, PhD, and David C. Levin, MD.

custom-made texture recognition and quantification algorithms to correlate CT data with subjective imaging assessments, multidisciplinary diagnosis and clinical/functional parameters.

“R&E grants allow researchers to do work that has more risk but that offers potentially high rewards,” Dr. Barbosa said. “An R&E grant is a crucial step in creating and validating methods to support new techniques and interventions.”

Help the Campaign finish strong by making a donation at [RSNA.org/Donate](https://www.rsna.org/Donate). For more information, contact Ashley Koman, Manager, Fund Development, at [akoman@rsna.org](mailto:akoman@rsna.org). 

# Radiology-TEACHES Project Simulates Image Ordering Process

BY JENNIFER ALLYN

An innovative education program funded with a two-year GE Healthcare/RSNA Education Scholar Grant simulates the decision-making process for medical students learning how to select the appropriate medical imaging for patients.

Founded at Baylor College of Medicine in Houston, by grant recipient Marc H. Willis, DO, MMM, the web-based program Radiology-TEACHES (Technology Enhanced Appropriateness Criteria Home for Education Simulation), uses case vignettes to simulate the image ordering process and educate students about appropriate imaging. The program is integrated with the clinical decision support tool (ACR Select) to aid medical providers learning to follow the American College of Radiology’s (ACR) Appropriateness Criteria™.

Once students review a case, they must decide which test is best, most cost-effective and will expose the patient to the least radiation. Their decisions receive immediate feedback.

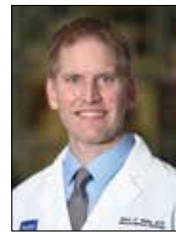
“Students working in a busy hospital or clinic usually don’t have adequate time to review the ACR’s Appropriateness Criteria,” said Dr. Willis, associate professor of radiology, associate program director of the diagnostic radiology residency program and associate chair for quality improvement at Baylor. “While the criteria are available online, it is in PDF format, which might not be ideal for today’s tech-savvy students. I wanted to develop something that would simulate the clinical

decisions that are made at the time of radiology examination order entry.”

The 2016 RSNA Education Scholar Grant is funding the expansion of the program, integrating the modules into the curriculum for Baylor’s seven required medical student core clerkships. This expansion will provide comprehensive instruction about ordering appropriate imaging to students who might not otherwise receive this information during medical school.

“At Baylor, like many medical schools, students are not required to take a radiology clerkship,” Dr. Willis said. “Our team believed that integrating the simulation modules into clerkships where imaging studies were being requested would be a better approach.”

The grant also supported the creation of a communication tool within the modules that connects medical students with radiologists. Students can send their imaging related questions directly to a radiologist. Dr. Willis and his research team hope to increase interest in radiology as a career choice by exposing medical students to the specialty, as well as strengthen the



Willis

perception of radiologists’ value as members of the healthcare team.

“During their clerkships, most patients the students care for will undergo some type of radiology examination during their cycle of care,” Dr. Willis said. “This grant will help to prepare more current and future medical students to select the most appropriate, most cost-effective and safest examinations for patients.”

An additional benefit is the improved efficiency of teaching medical students how to appropriately order intravenous contrast, Dr. Willis added.

Radiology-TEACHES can be utilized across the continuum of medical education, Dr. Willis explains. “This one-of-a-kind program is also being piloted with Baylor’s physician assistant students, utilized with our diagnostic radiology residents as a resource to help them become better consultants, and used as CME modules for practicing physicians.”

Eventually, Dr. Willis would like to make Radiology-TEACHES available as an education resource to academic institutions, hospitals and healthcare systems across the country.

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### Artificial Intelligence Aids the Accuracy and Efficiency of the Interpreting Radiologist

Bridging the disciplines of neuroscience, computer science, medical imaging and informatics, 2017 RSNA Research Resident Grant recipient **Andreas Rauschecker, MD, PhD**, is pursuing an approach that combines advances in the fields of image processing and artificial intelligence (AI) to perform automated neuroradiologic diagnosis.

“Proof-of-concept development will focus on image-based feature quantification algorithms for lesion detection and characterization in two traditionally difficult sets of neuroimaging disease types: those involving the basal ganglia and those involving the white matter,” said Dr. Rauschecker, a resident at the University of Pennsylvania, Philadelphia.

“These general methods, when established, may apply to other pathologies and to other organ systems in the future, providing a framework for AI algorithms that can transform images to differential diagnosis for both common and rare diseases. Our hope is that these types of algorithms can greatly aid both the accuracy and efficiency of the interpreting radiologist.”



Andreas Rauschecker, MD, PhD

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## Journal Highlights

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

### Coronary CT Angiography–Derived Fractional Flow Reserve

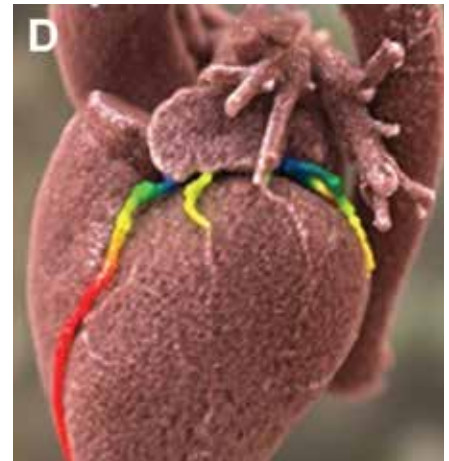
Invasive coronary angiography (ICA) with measurement of fractional flow reserve (FFR) by pressure wire technique is the established reference standard for the functional assessment of coronary artery disease (CAD). Coronary CT angiography (cCTA) has emerged as a noninvasive method for direct assessment of CAD and plaque characterization with high diagnostic accuracy compared with ICA. FFR derived from standard cCTA data sets (CT-FFR) using any of several advanced computational analytic approaches enables combined anatomic and hemodynamic assessment of a coronary lesion by a single noninvasive test.

In an article published in *Radiology* ([RSNA.org/Radiology](http://RSNA.org/Radiology)), Christian Tesche, MD, of the Heart Center Munich-Bogenhausen, Germany, and colleagues review the growing body of evidence that has validated the diagnostic accuracy of

CT-FFR techniques compared with invasive FFR.

Present CT-FFR algorithms focus solely on the noninvasive derivation of flow conditions through a diseased coronary artery. While FFR quantitation is a key determinant in clinical decision making, conceptually this narrow focus makes insufficient use of the richness of cCTA data in terms of plaque characteristics and vessel remodeling. These features in themselves are predictors of flow obstruction and, more importantly, portend strong predictive value for patient outcome.

“Current evidence shows that FFRCT may be an important adjunct to coronary CT angiography for clinical decision making and appropriate, guideline driven patient management while reducing the rate of unnecessary invasive testing,” the authors write.



**Three-dimensional color-coded cinematic rendering (not yet available for clinical use) of cardiac anatomy with FFRCT map superimposed on the coronary artery course illustrates functional data in the context of the heart's morphology. Stent placement was subsequently performed.**

(*Radiology* 2017;285:1:17–33) © RSNA 2017. All rights reserved. Printed with permission.

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



Listen to *Radiology* Editor Herbert Y. Kressel, MD, deputy editors and authors discuss the following articles in the August issue of *Radiology* at [RSNA.org/Radiology-Podcasts](http://RSNA.org/Radiology-Podcasts).

**Radiology**  
PODCASTS

- “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,” Alexandra S. Gersing, MD, and colleagues.
- “Deep Learning at Chest Radiography: Automated Classification of Pulmonary Tuberculosis by Using Convolutional Neural Networks,” Paras Lakhani, MD, and Baskaran Sundaram, MD.



Listen to *RadioGraphics* Editor Jeffrey S. Klein, MD, and authors discuss the following articles in recent issues of *RadioGraphics* at [RSNA.org/RG-Podcasts](http://RSNA.org/RG-Podcasts).

**RadioGraphics**  
PODCASTS

- “Decreasing Stroke Code to CT Time in Patients Presenting with Stroke Symptoms,” Aleksandrs Kalnins, MD, MBA, and colleagues.
- “Beyond the Bowel: Extraintestinal Manifestations of Inflammatory Bowel Disease,” Jeffrey D. Olpin, MD, and colleagues.
- “Imaging of Pregnancy-related Vascular Complications,” R. Scooter Plowman, MD, MBA, MHSA, and colleagues.

## Molecular and Clinical Approach to Intra-abdominal Adverse Effects of Targeted Cancer Therapies

Targeted cancer therapies encompass an exponentially growing number of agents that involve myriad molecular pathways. To excel within this rapidly changing field of clinical oncology, radiologists must eschew traditional organ system-based approaches of cataloging adverse effects

### RadioGraphics

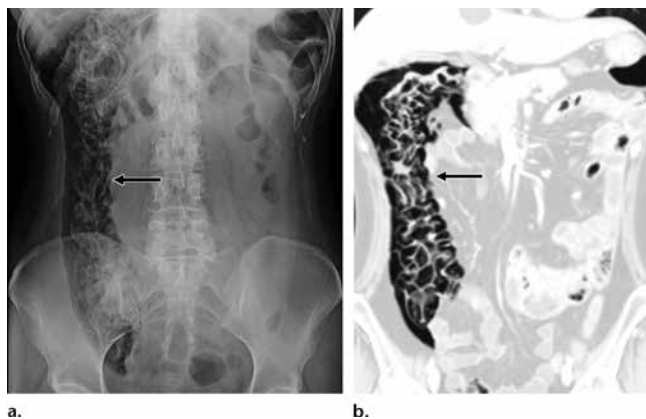
in favor of a conceptual framework that incorporates molecular mechanisms and associated clinical outcomes.

In the September-October issue of *RadioGraphics* ([RSNA.org/RadioGraphics](http://RSNA.org/RadioGraphics)), Stephanie T. Chang, MD, of Stanford University, CA, and colleagues review the adverse effects primarily within the abdomen and pelvis. The authors advocate that adverse effects from targeted therapies are approached most effectively when they are grouped into four categories based on the molecular mechanism and association with treatment response: Category 1, on-target adverse effects associated with treatment response; Category 2, on-target adverse effects without associated treatment response; Category 3, off-target adverse effects; and Category 4, tumor necrosis-related adverse effects.

Understanding molecular mechanisms

that underlie imaging manifestations of adverse effects and known associations with treatment response allows radiologists to more effectively recognize adverse effects and differentiate them from tumor progression. Radiologists can therefore more effectively guide oncologists in the management of adverse effects and treatment decisions regarding continuation or cessation of drug therapy.

“Radiologists must adopt a conceptual framework that incorporates molecular mechanisms and clinical prognosis to accurately recognize and interpret drug toxic effects, differentiate adverse effects from disease progression, and predict emerging drug toxic effects,” the authors write. “As clinical oncology enters a golden age of targeted therapies, radiologists must also move toward a molecular-based perspective of drug-related adverse effects to offer optimal patient care.”



**Metastatic ovarian cystadenocarcinoma in a 44-year-old woman who had undergone debulking surgery, intraperitoneal chemotherapy, and adjuvant chemotherapy with bevacizumab and who presented with abdominal distention. Frontal abdominal radiograph (a) and follow-up coronal CT image of the abdomen (b) show diffuse pneumatosis of the ascending colon (arrow).**

(*RadioGraphics* 2017; 37;5:1461-1482) © RSNA 2017. All rights reserved. Printed with permission.

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

## Radiology in Public Focus

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

### Insurance Coverage for CT Colonography Increases Likelihood of Screening

People with insurance that covers CT colonography for colorectal cancer screening are almost 50 percent more likely to get screened than those whose policies don't cover the procedure, according to a new *Radiology* study published ahead of print.

The American Cancer Society recommends CT colonography as one of the screening tests that can find both pre-cancerous polyps and cancer in people age 50 or older, but insurers have been slow to cover the technology.

Meanwhile, screening adherence rates have stalled at about two-thirds of the people who need to be screened, according to lead author Maureen A. Smith, MD, PhD, MPH, from the University of

Wisconsin-Madison School of Medicine and Public Health.

“CT colonography is a newer technology that can detect both pre-cancer and cancer, but because it's relatively new it isn't widely covered by insurance and isn't covered by Medicare,” Dr. Smith said.

Dr. Smith and colleagues recently examined whether changing insurance benefits to cover CT colonography for screening might help improve screening rates.

The researchers looked at overall colorectal cancer screening rates for 33,177 patients under age 65 who were eligible and due for colorectal cancer screening. About half of the people in the group were ultimately screened during the study

period, and researchers compared screening rates between those with and without insurance coverage for CT colonography.

Data analysis showed that the people in the study who had insurance coverage for CT colonography had a 48 percent greater likelihood of being screened by any method compared with those without coverage who were due for screening.

Dr. Smith said the study findings represent another piece of the puzzle in getting people to follow screening recommendations — a particularly important challenge in groups that traditionally have lower screening rates, such as people in rural areas, racial/ethnic minorities and people with lower incomes.

*Continued on next page*

## Radiology in Public Focus

Continued from previous page

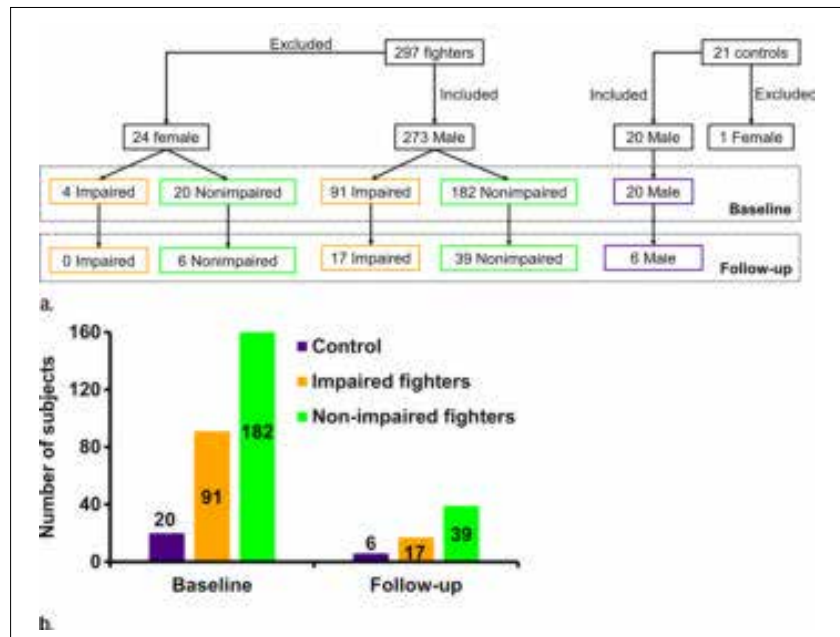
### MRI May Help Predict Cognitive Impairment in Professional Fighters

Images of the brain's gray and white matter obtained with multiple MRI techniques can help identify and track cognitive impairment in active professional fighters, according to a new study in *Radiology*.

Fighters are exposed to repeated mild traumatic brain injury (mTBI), which has been associated with neurodegenerative disorders, as well as mood and movement dysfunction, according to lead author Virendra Mishra, PhD, from the Cleveland Clinic Lou Ruvo Center for Brain Health in Las Vegas. A tool that could find biomarkers of mTBI-related brain damage would be invaluable in helping fighters and their physicians understand their risk of cognitive impairment while potentially speeding interventions and contributing to the study and development of drugs designed to slow or reverse cognitive decline.

The researchers used data from the Professional Fighters Brain Health Study, one of the largest longitudinal studies of brain health in contact sports. Data included 273 male fighters who had baseline imaging exams and 56 who returned for a follow-up scan. Using neuropsychological testing, measures from processing speed and psychomotor speed were used to differentiate fighters into cognitively impaired and non-impaired groups. All fighters underwent T1-weighted MRI and DTI.

The study revealed seven imaging predictors, including regions of gray matter and white matter, which were associated with cognitive function in fighters. For instance, T1-weighted volumetric measurements of the left thalamus helped distinguish cognitively impaired and non-impaired fighters. Fractional anisot-



**a)** The flowchart shows the total number of subjects who participated in the study and gives a breakdown of these subjects into impaired fighters, nonimpaired fighters and control subject groups. Breakdown of the subjects according to sex at baseline and follow-up for each group is also shown. Of note, only male fighters were included to design the classifier for separation of impaired and nonimpaired fighters. **(b)** The bar graph shows distribution of the male cohort at baseline and follow-up and classification into impaired and nonimpaired fighter groups based on standardized clinical scores is shown. Numbers in bar graph represent total number of subjects in each group at baseline and follow-up.

ropy values along two different white matter tracts were also identified as possible predictors of cognitive impairment. The researchers concluded that this set of seven brain regions comprising of both gray and white matter may become imaging biomarkers of cognitive impairment in fighters.

“We found lower gray matter volume and thickness measures along with lower white matter tract integrity at baseline measurements that declined over time in those with ongoing trauma, and only

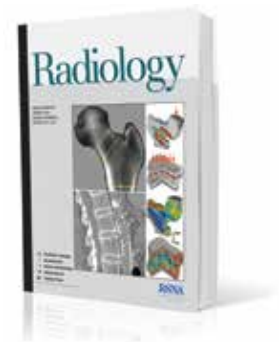
by looking at both were we able to predict which fighters would be cognitively impaired,” Dr. Mishra said. “One of the key questions we’re trying to answer is, what’s affected first, the neurons in the gray matter or the fiber tracts in the white matter?”

Dr. Mishra noted that these findings may also have applications in studying the impact of other contact sports where head injuries often occur, such as football and hockey.

## Media Coverage of RSNA

In June, 1,032 RSNA-related news stories were tracked in the media. These stories reached an estimated 360 million people.

Coverage included *Today.com*, *Philly.com*, WGN-AM (Chicago), HealthDay, *The Arizona Republic*, *Drugs.com*, *Health.com*, ScienceDaily, MedPage Today, *Auntminnie.com*, *Diagnostic Imaging*, *DOTmed Business News* and *Medical Imaging*.



## Researchers Identify Visual System Changes that May Signal Parkinson's Disease

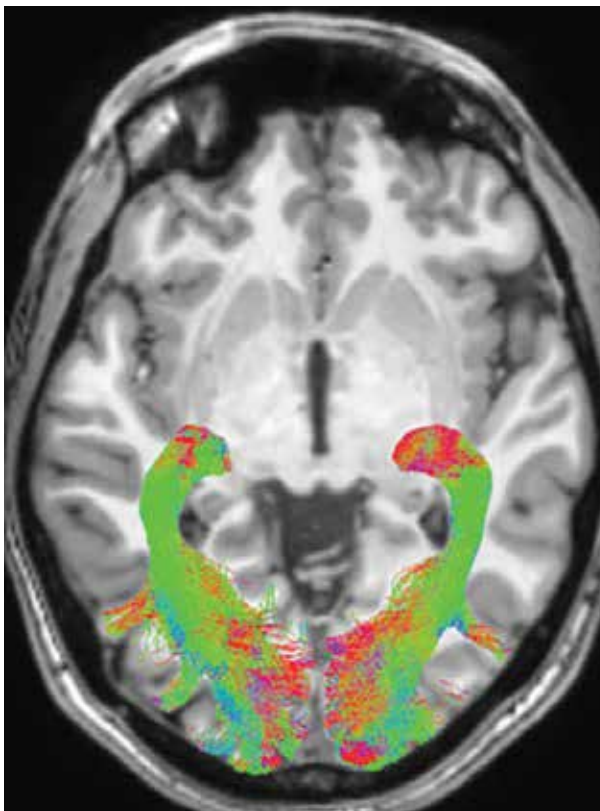
Changes in the visual systems of newly diagnosed Parkinson's disease patients may provide important biomarkers for the early detection and monitoring of the disease, according to a new study in *Radiology*.

Non-motor symptoms, such as the inability to perceive colors, a change in visual acuity and a decrease in blinking, are common in Parkinson's disease, according to lead author Alessandro Arrigo, MD, ophthalmology resident at the University Vita-Salute San Raffaele in Milan. However, these symptoms can precede the appearance of the more commonly recognized motor symptoms by more than a decade. If patients are unaware of the link between these non-motor symptoms and Parkinson's disease, their disease may go undiagnosed and under-treated.

The multi-disciplinary team of ophthalmology, neurology and neuroradiology researchers at the University of Messina, Italy, looked at 20 newly diagnosed Parkinson's patients and 20 age- and gender-matched controls. Researchers used MRI to assess the white matter changes and voxel-based morphometry to investigate concentration changes in the brain. Study participants also received an ophthalmologic exam.

The researchers found significant abnormalities within the visual system brain structures of the Parkinson's patients, including alterations of optic radiations, a reduction of white matter concentration and a reduction of optic chiasm volume. Further studies are needed to better understand the timing of the degeneration along visual pathways, as well as the specific changes.

"The in-depth study of visual symptoms may provide sensitive markers of Parkinson's disease," Dr. Arrigo said. "Visual processing metrics may also prove helpful in differentiating other Parkinsonism disorders, following disease progression and monitoring patient response to drug treatment."



Left and right optic radiation (OR) image in a representative subject overlaid onto a T1-weighted axial volume image of the same subject. OR images were obtained on the basis of diffusion-weighted volume images by means of constrained spherical deconvolution fitting and related tractography. Each bundle was automatically colored according to tract main directionality: red for left to right, green for anterior to posterior, and blue for inferior to superior.

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## October Public Information Activities Focus on Breast Cancer Awareness

In recognition of Breast Cancer Awareness Month in October, RSNA is distributing public service announcements (PSAs) that focus on the importance of screening and the symptoms, risk factors and possible treatment options related to breast cancer.

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## Breast Cancer Screening Content on *RadiologyInfo.org*

October is Breast Cancer Awareness Month. It's the time of year when pink awareness ribbons become more visible, charity walk/run events take place and public service announcements about breast cancer awareness are aired. Join the fight against breast cancer by directing your patients to *RadiologyInfo.org* to learn about the different types of breast cancer screening such as mammography, breast ultrasound and breast MRI.

***RadiologyInfo.org***  
For patients

## Patient Focus

### New Image Wisely® Safety Case Focuses on Child-Sizing CT Dose

The tenth special edition Image Wisely® Radiation Safety Case — Child-Sizing CT Dose: Optimizing Patient Care Through Quality Improvement – Pediatric and Adult Imaging — is now available to help radiologists, imaging technologists and medical physicists assess their understanding of important radiation safety concepts — including dose monitoring and management.



This special edition of the Image Wisely series of free, online and mobile-compatible educational offerings was developed by Image Gently® with the assistance of the American College of Radiology (ACR).

This case offers information on how to manage the radiation dose for CT examinations to provide physicians with diagnostic quality images while exposing patients to a well-controlled amount of radiation in order to obtain the images, with special emphasis on pediatric imaging.

“This is an excellent addition to the Image Wisely collection of educational material,” said Eric Gingold, PhD, director of the Image Wisely Radiation Safety Case series and member of the Image Wisely Executive Committee. “CT imaging is invaluable to medicine; however, it does expose patients to ionizing radiation. Practitioners should be cognizant of the potential risks involved and informed about the appropriate use of the technology.”

Child-Sizing CT Dose: Optimizing Patient Care Through Quality Improvement — Pediatric and Adult Imaging offers a total of 1.0 AMA PRA Category 1 Credits™, 1.0 MPCEC credits by the Commission on Accreditation of Medical Physics Education Programs Inc. and 1.0 Category A Credits of the American Registry of Radiologic Technologists.

Image Wisely is a joint partnership of RSNA, the ACR, the American Society of Radiologic Technologists and the American Association of Physicists in Medicine with the objective of lowering the amount of radiation used in medically necessary imaging studies and eliminating unnecessary procedures.

For more information on Image Wisely cases, go to [ImageWisely.org](http://ImageWisely.org).

## Education and Funding Opportunities

*Last call to register to ensure your seat*

### Creating and Optimizing the Research Enterprise (CORE) Workshop

**October 20 – 21, 2017**  
**RSNA Headquarters**  
**Oak Brook, IL**

The 2017 Creating and Optimizing the Research Enterprise (CORE) workshop will be held in October. 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 workshop features a combination of presentations, case studies and group discussions. For more information and to register, go to [RSNA.org/CORE](http://RSNA.org/CORE).

### Writing a Competitive Grant Proposal Workshop

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

Registration is open for the Writing a Competitive Grant Proposal Workshop designed for researchers in radiology, radiation oncology, nuclear medicine and related sciences who are interested in actively pursuing federal funding.

Guided by a faculty of leading researchers with extensive experience in all aspects of grant applications and funding, the program will focus on developing specific aims to be included in a grant application.

Participants will be provided tools for getting started in the grant writing process and developing realistic expectations.

The course fee is \$225. Register online at [RSNA.org/CGP](http://RSNA.org/CGP).

Please contact the Department of Research with questions at [DOR@rsna.org](mailto:DOR@rsna.org) or 1-630-368-3742



## Annual Meeting Watch

# RSNA 2017 Registration Packages

RSNA offers several new registration options to best meet your needs. Visit [RSNA.org/Registration-Packages](http://RSNA.org/Registration-Packages) for a personalized registration recommendation.



### Important Dates

- Oct. 27** Last day for RSNA members to register for free. 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** 103<sup>rd</sup> Scientific Assembly & Annual Meeting

## Reserve Your RSNA Hotel Room Today

RSNA has secured the best rates at over 85 Chicago hotels. Book through RSNA and you will receive discounted rates, free shuttle service to and from McCormick Place, including complimentary Metra Electric train tickets.

Hotel reservations booked through RSNA's official hotel partners are the only approved method to guarantee RSNA's discounted rates. Do not risk your credit card or hotel reservation – using unauthorized hotel solicitors can have unfortunate and expensive consequences.

Plus, reserve a room with the RSNA hotel reservation system and you'll receive an exclusive link for a 25 percent discount on your fare when travelling from either Chicago O'Hare or Midway International Airport through GO Airport Express. As an added bonus, Go Airport Express will donate a portion of all proceeds raised during the RSNA Annual Meeting to the RSNA Research & Education (R&E) Foundation.

Register at [RSNA.org/Register](http://RSNA.org/Register) to view hotel rates and availability.



### RSNA's official hotel partners:

- Experient is the official hotel partner for the RSNA annual meeting. For more information, visit [RSNA.org/Register](http://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](mailto: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](mailto:stephaniezhu@acemarketing.com.cn).



**e.s.a. voyages**

**ACE**

## Annual Meeting Watch

Continued from previous page

# Plan your RSNA 2017 Experience

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



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



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



**5K Fun Run** — Run, jog or walk in the 2017 Fun Run to support education and radiology research. Your tax-deductible donation benefits the RSNA Research & Education (R&E) Foundation and participants receive a commemorative T-shirt. Register online at [RSNA.org/Fun\\_Run](http://RSNA.org/Fun_Run). The 5K Fun Run is sponsored by Konica Minolta Healthcare.

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

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

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

## Transform Your Learning: Go Virtual for RSNA 2017

Experience RSNA 2017 where and when you want — register for the Virtual Meeting to take advantage of the exceptional educational programming, scientific presentations and education exhibits. With over 100 live-streamed and on-demand courses — some with live chat capabilities allowing you to discuss course content with colleagues from across the globe — the Virtual Meeting gives you the power to maximize your meeting experience.

CME credit is available for all live-viewed sessions upon completion of a course evaluation. Select on-demand courses, including Cases of the Day, qualify for CME credit upon submission of a course evaluation and either a correct diagnosis or completion of a test.

Visit [RSNA.org/Virtual](http://RSNA.org/Virtual) to learn more.



# Badges and Ribbons: Onsite Pick Up Only

**NEW THIS YEAR:** Registration badges and meeting materials will not be mailed. You can visit one of several onsite designated registration areas throughout McCormick Place to pick up your badge. A valid photo ID is required to receive your badge.

Your badge is now equipped with beacon technology that eliminates the need to verify your attendance, simplifies the CME process and links you to Meeting Central for an enhanced meeting experience.

While RSNA will never share, rent or sell the information collected on your badge, you can opt out of this technology by visiting any registration location.

In addition, all badge ribbons for committee, council or group work will be distributed onsite. Ribbons will be available at a self-serve ribbon wall housed in the Connections Center. If you are eligible for a ribbon, you will receive a personalized email from the RSNA Board of Directors detailing which ribbons you are entitled to and pick-up information. RSNA staff will be available onsite to assist you.



## Save Up to 10 Percent with Exclusive Airline Discounts

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

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

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

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

## International Visitors

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

our goal to improve patient care.

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

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

COMING  
NEXT  
MONTH

Next month, watch for the annual *RSNA News* Meeting Preview double issue filled with everything attendees need to know about RSNA 2017.

# 103<sup>rd</sup> Scientific Assembly and Annual Meeting

November 26 to December 1  
McCormick Place, Chicago



Explore



Invent



Transform



# Explore. Invent. Transform.

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