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### **FEATURES**



**5**RSNA Visiting Professors Give Back<br/>to Colleagues in Argentina



Use of MR to Identify Brown
Fat Could Fuel Obesity Therapies



9 Novel fMR Imaging Technique May Offer Insight into Spinal Cord Function

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11 Radiologists' Compensation—and Workload—Increasing



13 Inspire-Innovate-Invest: R&E Foundation Fundraising Campaign Invests in Radiology's Future

# 

### **UP FRONT**

- 1 First Impression
- 1 Centennial Snapshots
- **3** Board of Directors Report
- 4 My Turn

### RADIOLOGY'S FUTURE

15 R&E Foundation Donors

### NEWS YOU CAN USE

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

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## CENTENNIAL SNAPSHOTS

During this year as RSNA celebrates its 100th annual meeting and scientific assembly, *RSNA News* takes a look back at milestones in the Society's history.

#### **1942:** Radiology asked to contribute to war effort

The RSNA annual meeting in 1942 was held in Chicago under the gloom of a world at war. The scientific program for that meeting reflected the concerns of the nation. One page in the program exhorted RSNA meeting attendees to salvage scrap metal "for the manufacture of guns, tanks, ships, and other implements."



## **1964:** Two articles from *Radiology* included in time capsule buried at NYC World Fair



In its fifth decade, the journal *Radiology* continued to gain worldwide acclaim as a firstclass publication in the field. Then-editor Howard P. Doub, M.D., published a 25-year review of the journal, showing the progress it had made since the

1940s. As further proof of the importance of *Radiology*, two articles from the journal were included in the contents of a time capsule buried in October at the New York City World's Fair.

#### 2006: First RadLex® Terms Released

#### 2012: International Day of Radiology Debuts

The International Day of Radiology (IDoR)—an effort spearheaded by RSNA, ESR and ACR but involving radiology organizations around the



world—is celebrated in recognition on the day of Roentgen's discovery of X-rays on November 8, 1895. The IDoR goal is to educate the world about the value of medical imaging, the essential role of the radiologist as a part of the healthcare team and the standards required of medical imaging staff.

#### 2014-2015: Centennial Celebration

RSNA 2014 marks the 100th annual meeting with a variety of celebratory activities planned, including a Centennial Showcase



can see, hear, and discover the advancements that shaped radiology. The celebration continues into 2015, when RSNA celebrates

100 years since its founding, with commemorations including a series of classic *Radiology* articles to be highlighted each month.

RSNA has worked with other entities to develop RadLex®, a single source of radiology terms for use by radiologists and in various systems. In 2013 RSNA and the Regenstrief Institute, which maintains the Logical Observation Identifiers Names and Codes, or LOINC®, terminology standard for medical tests and measurements, began harmonizing their work under a cooperative governance process. "This project is a crucial step to bringing the benefits of the RadLex standardized radiology terminology to all hospitals nationally and to enabling national initiatives relying on standardized names for radiology procedures," said **Daniel L. Rubin, M.D.**, chair of the RadLex Steering Committee of the RSNA Radiology Informatics Committee.



MITA PROMOTES PATIENT SAFETY THROUGH STANDARD

In 2013, the Medical Imaging and Technology Alliance (MITA) published a new standard, "XR-29 Standard Attributes on CT Equipment Related to Dose Optimization and Management," to drive adoption of technologies that optimize radiation dose in CT. The standard can be downloaded at no cost, and identifies four features that all CT scanners should have:

- DICOM Dose Structured Reporting, enabling recording of post-exam dose information in a standardized electronic format. This information can be included in the patient record, promoting establishment of diagnostic reference levels, facility dose management and quality assurance.
- Pediatric and adult reference protocols, a pre-loaded set on a CT system serving as a baseline for a variety of clinical tasks.
- CT Dose Check, incorporating notifications and alerts to alert operators and physicians when dose exceeds established thresholds.
- Automatic Exposure Control (AEC), which automatically adjusts the amount of radiation used, based on the size, shape and composition of the patient, in order to achieve a specified level of image quality.

Approximately two-thirds of CT machines are either already compliant or could be made compliant. Older scanners, however, do not have the capacity to receive an upgrade and will not be compliant with the safety standard.

To encourage adoption of the standard, Congress inserted legislation into the March 2014 SGR law that directs the Centers for Medicare and Medicaid Services (CMS) to reduce reimbursements for services that use (CT) equipment not compliant with XR-29. Specifically, CT scans performed on non-compliant CT and hybrid scanners will receive a 5 percent reduction in Medicare reimbursement beginning January 2016. The following January, the reduction will increase to 15 percent. These reductions apply to the hospital outpatient setting as well as services billed under the physician fee schedule. CMS will issue formal regulations to guide implementation of the policy.

MITA is currently encouraging accrediting organizations to reference XR-29 as well. MITA is a division of the National Electrical Manufacturers Association (NEMA). For more information about MITA Smart Dose CT, visit *www.mitasmart.org*.

## NIBIB Funds Fourth Year of RSNA/QIBA Research

Following the 2013 contract for \$1.25 million to support Quantitative Imaging Biomarkers Alliance (QIBA) research, the National Institute of Biomedical Imaging and Bioengineering (NIBIB) recently announced it will provide an additional year of funding to RSNA/QIBA. This marks the fourth consecutive year the NIBIB has funded QIBA research groundwork.

A portion of the new \$1.27 million award has been earmarked to support QIBA projects and activities including development of a Quantitative Imaging Data Warehouse, research to characterize the sources of bias and achievable precision associated with quantitative imaging, and to further develop and test phantoms and digital reference objects. "We are honored and gratified



that NIBIB continues to recognize the importance of objective, quantitative results from imaging studies to patient care, and provides ongoing support for QIBA's foundational work in this effort," said Daniel Sullivan, M.D., QIBA Chair.

To learn more about QIBA, go to RSNA.org/QIBA.

## Levin, Donaldson, Morin Receive RLI Leadership Luminary Award

David C. Levin, M.D., Sarah S. Donaldson, M.D., and Richard L. Morin, Ph.D., are the 2014 recipients of the American College of Radiology's Radiology Leadership Institute (RLI) Leadership Luminary Award.

Dr. Levin is a professor and chairman Emeritus in the Department of Radiology at Jefferson Medical College and Thomas Jefferson University Hospital in Philadelphia. He received the RSNA Gold Medal in 2009. He is a member of RSNA's Public Information Advisors Network.

Dr. Donaldson is the Catharine and Howard Avery Professor at Stanford University School of Medicine and associate residency program director in the Department of Radiation Oncology at Stanford. She is also the chief of radiation oncology service at the Lucile Packard Children's Hospital at Stanford. She served as RSNA president in 2013.



From left: Morin, Donaldson and Levin.

Dr. Morin is the Brooks-Hollern Professor and a consultant in the Department of Radiology at the Mayo Clinic Jacksonville. He is a member of the RSNA's Radiology Informatics Committee and Public Information Advisors Network, as well as the RSNA Research & Education Foundation Board of Trustees.

#### **IN MEMORIAM**

#### Joseph N. Gitlin, D.P.H.

Joseph N. Gitlin, D.P.H., a visionary informatics pioneer and founding member of the Radiology Information System Consortium (RISC)—a group of radiology luminaries who helped launch the revolution in imaging informatics—died Aug. 2, 2014. He was 86.

An early and constant proponent for using computers in radiology management, imaging and healthcare, Dr. Gitlin effectively bridged the worlds of the federal government, military, practicing/academic radiologists and vendors, said informatics expert David Avrin, M.D., Ph.D., past chair of the RSNA Radiology Informatics Committee.

"He saw the future of the public health impact regarding digital imaging and teleradiology," Dr. Avrin said. "He was a forceful advocate within the federal government for the advantages of information technology and the practice of radiology and digital imaging for healthcare."

A graduate of the University of Pennsylvania, Dr. Gitlin spent the majority of his early career with the U.S. Public Health Service, where he directed the National X-ray Exposure Studies in the U.S., evaluated early teleradiology systems and designed the Digital Image Network projects, which preceded the Medical Diagnostic Imaging Support program underway at various military medical facilities.

After earning a Master's of Public Health Degree at Johns Hopkins University in 1966, Dr. Gitlin began studying the benefits of applying computer technology to radiology department operations, which became the basis for his thesis for his Doctor of Public Health Degree awarded in 1970. RISC was formed in 1980 to develop radiology information systems (RIS) with a commercial partner available to member institutions and others. In 1989, the Society for Computer Applications in Radiology (SCAR) was founded under the RISC banner, and in 2006, SCAR was renamed the Society for Imaging Informatics in Medicine (SIIM).

As part of RISC, Dr. Gitlin worked alongside a small group that included 2007 RSNA President R. Gilbert Jost,



Gitlin

M.D., and 2015 RSNA President Ronald R. Arenson, M.D., both co-founders of RISC, to help establish a common radiology information system.

"Joe was always nudging us to move things along, in spite of the fact that he was not a radiologist or an M.D.," Dr. Jost said. "He was instrumental in urging us to work together, forming a 'consortium,' rather than working independently."

In 1986, Dr. Gitlin joined John Hopkins as an associate radiology professor and continued his informatics pursuits. At RSNA 1992, Dr. Gitlin was involved in the first public demonstration of the prototype standard to support communication among disparate modalities and different manufacturers' equipment, DICOM (digital imaging and communication medicine).

Dr. Gitlin's awards include a fellowship from SIIM and an honorary fellowship from the American College of Radiology.

## **RSNA Board of Directors Report**

At its meeting in September, the RSNA Board of Directors approved plans for collaborations involving a number of entities and objectives and also appointed volunteers for the many committees that drive the Society's progress, including the new Committee on Scientific Affairs and Template Library Advisory Panel.

#### Collaborations Fuel Progress around the Globe

RSNA is pleased to work with other radiologic and medical societies to further excellence in imaging worldwide. RSNA will sponsor a Body CT Symposium at the Interamerican College of Radiology Second Refresher Course in June 2015 in Cancun, Mexico. RSNA will plan the symposium and provide four speakers and include two CIR speakers as well.

Following the first successful joint planning of the Jornada Paulista de Radiologia (JPR) with the Diagnostic Imaging Society of São Paulo (SPR) last May, plans are underway for the 2016 meeting. RSNA has appointed coordinators for subspecialty courses in abdominal, breast, cardiac, chest, gastrointestinal/genitourinary, head and neck, musculoskeletal and pediatric imaging, as well as ultrasound, neuroradiology, image-guided intervention, oncology, PET/CT and nuclear medicine. Coordinators were also appointed for courses on IT in imaging, introduction to research, professionalism, quality and leadership and women's imaging.

RSNA will collaborate with the Society of Nuclear Medicine and Molecular Imaging on an RSNA 2015 session on Targeted Radioisotope Therapy. At the 2015 meeting of the American Physician Scientist Association, RSNA Board Liaison for Science Richard L. Ehman, M.D., will present as an RSNA-sponsored speaker.

#### New Initiatives Address Radiology Research

Significant plans are also underway with regard to RSNA's strategic goal to advance the radiological sciences and foster the development of new technologies. A new Committee on Scientific Affairs will oversee RSNA's strategic science initiatives, monitor emerging trends in imaging research and technology, and design and implement programs to highlight gaps in imaging science and technology development. A Template Library Advisory Panel, which will work under the Structured Reporting Subcommittee of the Radiology Informatics Committee, has been established to promote development and maintain a library of tem-



**Richard L. Baron, M.D.** *Chairman,* 2014 RSNA Board of Directors

plates for structured radiology reports. The European Society of Radiology has been invited to appoint representatives members to the Advisory Panel and collaborate in: providing expertise for the development of radiology reporting templates; soliciting and developing reporting templates for inclusion in the library; reviewing templates submitted to the Open template library; and annotating report templates in the Select library with terms from RadLex<sup>\*</sup> and other ontologies.

#### Volunteers Critical to RSNA Success

The Board also appointed volunteers to numerous RSNA committees involved in publications, the annual meeting, education and other initiatives. RSNA thanks its volunteers for their hours of service, without which the Society could not fulfill its mission. The work of volunteers will be ever more critical as RSNA enters its second century and embraces the opportunities that abound for growth in radiology.

I'm also pleased to announce that the Board of Directors authorized a 50 percent discount on the RSNA dues rate for members who are active armed services in the U.S. military.

#### Richard L. Baron, M.D.

CHAIRMAN, 2014 RSNA BOARD OF DIRECTORS



RSNA continues to collaborate with radiologic societies around the world. Following the first successful joint planning of the Jornada Paulista de Radiologia (JPR) with the Diagnostic Imaging Society of São Paulo (SPR) last May (*left*), plans are underway for the 2016 meeting.

## **My Turn** R&E Foundation Looks Toward the Next 100 Years

As we approach the 100th anniversary of the RSNA, one wonders what the next 100 years of our specialty will look like and whether the central role of radiologists in healthcare will be sustained. Can we possibly meet or exceed the amazing success of these past 100 years? Will the next generation of innovations in imaging be the legacy of our current crop of young investigators, educators, and clinicians?

Radiology's current pre-eminence should never be taken for granted. In fact, in our present society, advances in imaging are not always welcomed. They can be perceived as drivers of cost rather than of quality. Combined with the extraordinarily competitive funding environment at the National Institutes of Health, the young talent we hope to cultivate which is vital to the future of radiology—may become discouraged. If we recede from the forefront of research, whether basic, translational or evidence-based, the respect and caché that radiology now holds comes into certain jeopardy.

It is therefore critical that each of us supports radiology's research and educational mission, whether with our time or material resources. The best way to achieve this goal is to support the RSNA R&E Foundation, whose success is directly correlated with the philanthropy we receive from our members and corporate patrons. The results to date have been amazing. R&E-supported investigators have generated over 1 billion of competitive grant funding over the past two decades. Every dollar awarded by the R&E Foundation returns \$40 of subsequent grant support.



2011 RSNA President Burton P. Drayer, M.D., is the Dr. Charles M. and Marilyn Newman Professor and Chairman of the Department of Radiology, Mount Sinai School of Medicine, and the executive vice-president for risk, Mount Sinai Medical Center. He is chairman of the RSNA Research & Education (R&E) Foundation.

**Read more** about the new R&E Foundation Campaign on Page 13.

In 2014, R&E Foundation grants amounting to over \$3.6 million will launch more academic careers and continue to improve the health and safety of our patients. In addition, the Foundation has formed important partnerships with other radiology society foundations to further expand the quantity and quality of grants awarded to imaging scientists.

Still, the number of qualified researchers and educators applying for support continues to exceed the amount of funding available. I therefore urge each of you to contribute to the recently launched \$17.5 million RSNA R&E Foundation campaign: "Innovate-Inspire-Invest: The Campaign for Funding Radiology's Future"." As members of the radiology community, the future depends on your continued commitment and remarkable generosity.

#### Editor's Note

## Talk To Us!

Did you know that RSNA now invites readers to leave comments at the end of *RSNA News* articles posted online? Our stories tell you what we know and think about the latest in radiology and RSNA programs and services; we want to know what you think, too.

Visit *RSNA News* stories online to make observations, ask questions, answer other readers' questions and/or simply let us know what you think of the topics we're selecting for *RSNA News.* We value your opinion.

#### THIS MONTH IN THE RSNA NEWS ONLINE VERSION

Get more of this month's news online at *RSNA.org/News*. Enjoy interactive features including video, audio, slide presentations and more. Go online to leave us a comment and easily share stories via social

and easily share media as well.

As part of our coverage of RSNA's peer-reviewed journal *Radiology*, we invite

readers to listen to *Radiology* Editor Herbert Y. Kressel, M.D., discuss the journal study, "The Boston Marathon Bombing; After Action Review of the Brigham and Women's Hospital Emergency Radiology Response," with study authors in an October *Radiology* podcast.



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#### FEATURE

## RSNA Visiting Professors Give Back to Colleagues in Argentina

BY EVONNE ACEVEDO JOHNSON

During their recent visit to Argentina, a trio of RSNA International Visiting Professors (IVPs) experienced a warm welcome from a community of highly knowledgeable radiologists eager for advanced training opportunities in an environment with often limited resources.

IN ADDITION TO LECTURING at the Sociedad Argentina de Radiología's (SAR) Annual Congress (CAR 2014) during their September trip, U.S. professors Stephen Zivin, M.D., Suresh K. Mukherji, M.D., and Mahesh Shetty, M.D., interacted with faculty and trainees at three hospitals: Hospital Alemán, Hospital Argerich and Hospital Britanico, in Buenos Aires.

The RSNA IVP program annually sends highly regarded professors to lecture at national radiology society meetings and to visit radiology residency training programs at select host institutions in developing nations.

"Radiologists at both hospitals had a very high level of knowledge," said Dr. Zivin, a radiologist and clinical director of CT at Northwest

Community Hospital in Arlington Heights, Ill. "They read the journals, they attend meetings and are involved in the global community."

The IVP team also touted the warm reception they received from their Argentinian hosts.

"I was impressed with the positive and friendly attitude of both staff and residents," said Dr. Shetty, a clinical professor of radiology at Baylor College of Medicine and chief physician at

### "There is an amicable atmosphere in the departments despite a heavy workload in the face of limited resources."

MAHESH SHETTY, M.D.

the Woman's Center for Breast Care in Houston. "There is an amicable atmosphere in the departments despite a heavy workload in the face of limited resources."

#### Argentinian Radiologists Work to Overcome Challenges

During their visit, the IVP team gained considerable perspective on the challenges facing Argentinian radiologists—and healthcare in the country overall.

For example, Dr. Zivin saw obvious discrepancies between the resources at privately-funded vs. government-funded hospitals.







Shetty

Mukherji

"Many radiologists serve both public and private systems, and during my brief visit, I found that the private system has much better access to resources while the public institution is underfunded," Dr. Zivin explained.

The struggling Argentinian economy creates obstacles on a number of fronts. "There's not enough capital for some of the large-scale equipment purchases that would allow the latest technology to be fully disseminated around Buenos Aires," added Dr. Mukherji, a radiologist at Michigan State University (MSU) HealthTeam in East Lansing and the Walter F. Patenge Endowed Chair and professor at MSU.

The public hospital visited by the IVP team lacks PACS, process images with conventional film and does not possess a reliable filing system for archived images. "When a patient receives a mammogram at the public hospital I visited, each one is essentially a baseline mammogram," Dr. Zivin said.

Nevertheless, radiologists work hard to make the best use of their resources, Dr. Shetty said.

"One of the hospitals where I lectured did not have an image storage capability for general radiology or for breast imaging," he said. "MR imaging was not available. Radiology staff and residents worked long hours, averaging 12 hours or more each day."

Ultrasound was well utilized, Dr. Shetty observed, "and rightly so, considering it is most cost-effective in view of the resource limitations."

Dr. Mukherji observed another limitation—the lack of subspecialty training.

"Fellowships are limited, as are the opportunities to study abroad," he said. "Advanced imaging techniques are not as prevalent as they are in the U.S., and fellows often don't have access to train in the rest of the world."



Along with visiting three hospitals in Argentina, the RSNA Visiting Professors lectured at the Sociedad Argentina de Radiología's (SAR) Annual Congress (CAR 2014) during their September trip (*left*).

In general, trainees are interested in "what trainees everywhere in the world are focused on, bread and butter radiology. In my subspecialty area—head and neck—I found them extremely receptive," Dr. Mukherji said.

#### Trip Reaffirms Resolve to Give Back

Though it was an honor to be invited to speak at the congress, Dr. Mukherji said that the most rewarding part of the trip was visiting the hospitals to observe different cases and interact with residents.

Dr. Zivin concurred. "That's when you really get to interact with people—it's a great opportunity for a cross-cultural exchange of ideas."

Dr. Shetty added that the experience reinforced his own resolve to mentor trainees throughout his career—a sentiment shared by his teammates. Dr. Mukherji, who early in his career received a seed grant and a scholar grant from the RSNA Research & Education (R&E) Foundation, emphasized the importance of investing in the radiology community.

"As a grantee, I always promised myself that when I had the resources, I would give back, and I have," Dr. Mukherji said. "RSNA does so much for radiology with its myriad of programs, including IVP. I think it's important for all of us to acknowledge that and to make sure we continue to invest.

"Truthfully," he added, "RSNA could ask more of us."

#### Spreading the Wealth of Resources

Dr. Shetty hopes that not only will IVP teams return to Argentina but also that Argentinian trainees will be able to travel to the U.S. for "mini-fellowships."

"We should engage the residents, maybe have a more interactive session, perhaps participate in the daily readouts and schedule formal lectures after hours so as not to interrupt their routine clinical practice and ensure better attendance," Dr. Shetty said.

The international community should always take advantage of the online resources RSNA offers, team members added.

"The international program is impactful," Dr. Shetty continued. "Our lectures build a lot of enthusiasm for RSNA, for the topic we're discussing and for our specialty as a whole."

"Everyone practices radiology differently througout the world," Dr. Zivin said. "Here in the U.S., we're fortunate because of our abundant resources, and this is a way to help educate other parts of the world about the RSNA resources available to everyone."

RSNA thanks Agfa Healthcare and Fuji Medical Systems for their support of the IVP program. For more information on the RSNA IVP program, go to *RSNA.org/International*.

**EVONNE ACEVEDO JOHNSON** is a Goliad, Texas-based freelance writer specializing in healthcare issues.

### *RadioGraphics* Editor Discusses Journal Process at CAR

Along with the IVP team, *RadioGraphics* Editor Jeffrey S. Klein, M.D., traveled to Argentina to educate CAR attendees on the peer-review and publication processes for the RSNA journal and demonstrate the journal's new online capabilities.

Dr. Klein, who lectured at one of the IVP team destination institutions, Hospital Alemán, praised the international impact of RSNA's IVP program.

"The IVP program is an important component of the RSNA effort to better engage the international radiology community," Dr. Klein said. "It provides access to RSNA's educational and technical expertise in a broad spectrum of imaging applications."

Dr. Klein also lectured on evaluation of the solitary pulmonary nodules, including screening demonstrations, at the Neurological Research Foundation.



*RadioGraphics* Editor Jeffrey S. Klein, M.D., (*far right*), engaged with radiology colleagues during his visit to Hospital Alemán in Buenos Aires.

FEATURE

## Use of MR to Identify Brown Fat Could Fuel Obesity Therapies

#### BY MIKE BASSETT

Use of a novel MR imaging technique to detect the presence of brown fat in humans could help researchers develop therapies to battle obesity and related illnesses including diabetes.

"We've DEMONSTRATED FOR the first time that we can use a form of MRI to actually show brown fat (brown adipose tissue, or BAT) and discern it from white fat (white adipose tissue, or WAT)," said Thomas Barber, Ph.D., associate professor of clinical endocrinology and honorary consultant endocrinologist, University of Warwick, University Hospitals Coventry and Warwickshire NHS Trust. "This is the first study that has used MRI to show brown fat in a living human."

The study by Dr. Barber and colleagues was published in the January 2014 issue of the *Journal* of *Clinical Endocrinology and Metabolism*.

White fat has been associated with weight gain, while brown fat helps regulate body weight due to its ability to use energy and burn calories. "If you have a sugar cube size of brown fat, and activate it for a year, you could burn through three or four kilograms of white fat in that time," Dr. Barber said. "You don't need a lot of brown fat to have a very attractive method of producing weight loss."

According to Dr. Barber, the study of brown fat was "revolutionized" five years ago with the publication of a study in the *New England Journal of Medicine* by Wouter D. van Marken Lichtenbelt, Ph.D., and colleagues, who determined that "the amount of brown adipose tissue is inversely correlated with body mass index, especially in older people, suggesting a potential role of brown adipose tissue in adult human metabolism."

Brown fat was previously thought to be relevant only in small mammals and infants. "This, therefore, opened the possibility for further study of brown fat in human adults and potentialtherapeutic avenues," Dr. Barber said.

Until recently, PET/CT had been the standard approach for assessing brown fat tissue in adult humans, but that modality is limited in determining how many adults have brown fat and, if so, how much fat each adult possesses. "PET allows detection of BAT in vivo, but is hampered by various factors including the requirement that the BAT be metabolically active in order for the radiotracer to be taken up," said study author Terrance Jones, Ph.D., a clinical research fellow in radiology at the University of Warwick. Other study authors include Professor Charles Hutchinson, B.Sc., M.B.Ch.B., M.D., Sarah Wayte, Ph.D., and Narendra Reddy, M.D., M.R.C.P.

Dr. Jones added that BAT is also sensitive to external factors, most notably temperature.

For those reasons, PET/CT is not very useful in determining



Barber

the prevalence of BAT in adult humans. For example, Dr. Barber cited some PET/CT studies showing that brown fat is found in just 5 to 10 percent of subjects, and others involving multiple scans that point to a presence brown fat in as many as 50 percent of subjects. "With PET/CT, the question is how many of us have brown fat tissue," Dr. Barber said. "We don't really know the answer. It could be that all of us have some brown fat; it could be that a minority of us do."

Knowing the answers to these questions could be of great value, Dr. Barber said, as they could affect research on brown fat-related therapies used to battle obesity.

#### MR Advantages Could Aid Future Research

Researchers found that MR imaging has imporant advantages over PET/CT. Along with having no ionizing radiation, MR imaging provides superior spatial resolution, which could potentially allow for identification of small brown fat deposits, Dr. Jones said. MR imaging can also differentiate between BAT and WAT based on the difference in water content between the two tissue types, allowing researchers to identify both active and inactive brown fat. PET/CT only identifies brown fat when it is active.

"Identifying BAT using MR has capitalized on the biochemical and morphological differences between BAT and WAT," Dr. Jones said. The application of iterative decomposition of water and fat with echo asymmetry and least-squares

"What we've shown for the first time is that we can use a form of MRI to actually show brown fat and discern it from white fat."

THOMAS BARBER, PH.D.



#### **ON THE COVER**

The first MR imaging study to show "brown fat" in a living adult could be an essential step towards new therapies to aid the fight against obesity. *Left:* a digitally-enhanced axial MR image of the upper chest (as if viewed from the feet). Areas of potential brown fat are shown in green.

estimation (IDEAL) enables MR imaging to distinguish between BAT and WAT, as shown in previous studies.

In the team's proof-of-concept study, they visually identified BAT on anatomical fat-only spin-echo MR images in a single adult with a large volume of BAT. They reported moderate interobserver variability and provided PET/CT, histological and immunohistochemical confirmation.

"When applied to a wider sample, visual identification tended to underestimate BAT on MR compared with PET/CT," Dr. Jones said. "However MRI has the advantage of being able to acquire multiple data points in experiments where precise estimation of BAT volume is required."

It is noteworthy that the proof-of-concept study was performed on a subject who happened to have an abundance of active brown fat that appeared on the original PET/CT, which was performed for clinical reasons, Dr. Barber said. "This needs to be tested on many more subjects so we can examine its reproducibility, its reliability and validate some of the findings we showed in the original study," he said.

The ultimate aim of the research is to identify a way of quantifying BAT so that it can be used to assess the efficacy of future therapies based on brown fat and to shed light on the nature of brown fat itself.

"We are hoping additional research will help us answer questions like how many of us have brown fat," Dr. Barber said. "For those of us who do have brown fat and it's not activated, why isn't it activated? Are we missing something that's not activating our existing brown fat? Hopefully, this MRI technique will help us address these questions."

**MIKE BASSETT** is a writer based in Holliston, Mass., specializing in health and medicine.

#### WEB EXTRAS

Access the study, "Identification of Brown Adipose Tissue Using MR Imaging in a Human Adult with Histological and Immunohistochemical Confirmation," in the Journal of Clinical Endocrinology & Metabolism at press. endocrine.org/journal/ jcem.

## Novel fMR Imaging Technique May Offer Insight into Spinal Cord Function

BY RICHARD S. DARGAN

Researchers using functional MR imaging (fMRI) have detected neural networks in the spinal cord similar to those that exist in the brain, opening the door for improved understanding of spinal cord injuries and neurological diseases such as multiple sclerosis (MS).

THE BRAIN'S RESTING STATE NETWORK—which is active when a person is not focused on a specific task—was discovered approximately 20 years ago and has been the frequent focus of research in recent years. Disruptions in this network have been associated with a number of disorders as well as with memory decline related to aging.

Confirmation of a similar network in the spinal cord has been a significant challenge, according to Robert Barry, Ph.D., a postdoctoral research fellow at the Vanderbilt University Institute of Imaging Science in Nashville. "Researchers are trying to image a structure that's 12 to 15 millimeters across and is surrounded by the large bones of the spine," Dr. Barry said. "In addition, the cerebrospinal fluid that surrounds the spinal cord adds noise to the measurement of spinal cord functional connectivity."

After developing new MR imaging protocols to maximinze some of the pragmatic limitations, Dr. Barry and his Vanderbilt colleagues scanned 22 healthy volunteers with a 7-T MR imaging scanner and multichannel spinal cord coils. Activity in neural circuits was measured using blood-oxygen-level-dependent (BOLD) contrast imaging, a noninvasive technique that is sensitive to changes in the oxygen status of hemoglobin. Areas

"The spinal cord regenerates in some injuries, but almost nothing is known about how that happens. With this technique we can look at how the spinal cord tries to reorganize itself in its resting state." ROBERT BARRY, PH.D.

with increased utilization of oxygen are associated with a transient increase in the level of deoxygenated hemoglobin followed by a larger increase in the level of oxygenated blood to meet the increased energy demands.

"We acquired the images very rapidly—one about every three and-a-half seconds," said coauthor Seth Smith, Ph.D., an assistant professor of radiology at Vanderbilt. "If we scan for nine minutes then we will acquire 150 volumes that can be utilized to study fluctuations in the BOLD signal which can be related to functional connectivity."



Vanderbilt researchers (*from left*): Seth Smith, Ph.D., Adrienne Dula, Ph.D., Robert Barry, Ph.D., and John Gore, Ph.D.

Vanderbilt researchers John Gore, Ph.D., and Adrienne Dula, Ph.D., were also authors on the study.

While the subjects were not performing any task, and in the resting state, the fMRI scans showed functional connectivity between areas of gray matter inside the spinal cord that control motor function and sensory perception. "We were excited to use this technology to demonstrate the existence of resting state networks in the spinal cord," Dr. Barry said. "Now that we've established the feasibility of this technique, we can start asking the harder questions."

#### Analyzing Resting State Connectivity

One immediate challenge is to determine if the spinal cord resting state networks are connected to the same networks that exist in the brain. Researchers also hope to find out how these intrinsic resting circuits might be related to neurological disorders affecting spinal cord function. "Our hope is that this work can be translated to address many neurological disorders," Dr. Barry said.

In the case of MS, researchers could use these techniques at the earliest stages of the disease to determine how lesion occurrences affect neural signaling and ultimately day-to-day function. They hope to collaborate with other researchers to study experimental drugs that might help prevent or stop MS progression. "We might be able to use the progression of these networks as a proxy for the patient getting better," Dr. Barry said.



Researchers have noninvasively measured neural signaling in the spinal cords of healthy human volunteers. *Above*: Resting state spinal cord fMRI at 7 Tesla. (*A*) Mid-sagittal slice from a healthy volunteer showing the complete cervical cord and typical axial slice placement for this resting state study. In all subjects the imaging stack was centered on the C3/C4 junction, providing full coverage of C3 and C4 and partial coverage of C2 and C5. (*B*) T2\*-weighted anatomical image at C4 acquired with  $0.6 \times 0.6 \times 4$  mm3 voxels and interpolated to  $0.31 \times 0.31 \times 4$  mm3. Excellent contrast permits visualization of the characteristic butterfly-shaped gray matter column. (*C*) A single T2\*-weighted functional image are high quality with minimal geometric distortions and T2\* blurring and permit adequate spatial delineation between white matter and cerebrospinal fluid.

Resting state studies with BOLD fMRI have a number of advantages. The studies are noninvasive, the sequences are very safe, and the entire exam takes only 55 to 60 minutes. Patients need only to lie still during the exam, which is particularly important for those who can't perform certain motor-function tasks.

The technique might also have a role in determining the impact and therapeutic advantage of surgery. For instance, it

#### WEB EXTRAS

Access the study, "Resting State Functional Connectivity in the Human Spinal Cord" at *elifesciences. org/content/3/e02812.*  would be important to capture spinal cord functional integrity in patients where surgery is often considered. An example is for patients who have slipped disks and conventional imaging shows the disk to be in contact with the spinal cord. Assessing the function of the spinal cord pre- and post-surgery would be invaluable for assess-

ing the associated risk across patients with varying degrees of neurological, radiological and clinical disability.

#### Solving the "Clinico-radiological Paradox"

The pre-surgical eavluation scenario is one example of how refined functional techniques could help solve the "clinicoradiological paradox," a phenomenon in which conventional radiological imaging often proves to be a poor predictor of disease/syndrome activity and in general, the quality of life for patients.

"One person could demonstrate preserved function, yet many spinal lesions are visible on MR imaging; on the other hand, you might have a patient with one lesion who demonstrates significant functional abnormalities," Dr. Smith said. "We need to find out what causes the spinal cord to gain or lose function and how this relates to a patient's day-to-day functioning."

The technique also may have a role in predicting recovery for people with traumatic spinal injuries. Such patients are often fitted with metallic stabilization hardware like rods, pins and staples, rendering them unable to have an MR imaging study for the rest of their lives. These patients conceivably could be scanned with the new methods before surgery. "You could do one scan and determine the prognosis for recovery and potentially design therapies to improve that prognosis," Dr. Smith said.



Examples of within-slice resting state functional connectivity across subjects. These analyses were performed using AFNI's 'InstaCorr' with p < 0.001 and no minimum cluster size. In each panel, a seed voxel is marked with a green crosshair and resultant correlations are overlaid on the anatomical image. (A-F) Connectivity between ventral horns for subjects 1, 3, 8, 10, 11 and 13 respectively. (G-J) Connectivity between dorsal horns for subjects 5, 16, 18 and 22, respectively. (K and L) Less common correlations within gray matter. In (K) (subject 20), focal connectivity between ventral horns and with central gray matter. In (L) (subject 7), connectivity between ventral horns but also with the contralateral dorsal horn. At the single-subject level, there is some evidence for functional connectivity between ventral and dorsal horns, but such correlations are less common across slices and not statistically significant at the group level.

The Vanderbilt team will be studying these functional techniques in patients with spinal cord injury over the next few years thanks to a National Institutes of Health Pathway to Independence Award.

#### Technique Launches "A New Era" in Research

Going forward, researchers hope to adapt the technique for the more commonly available 3-T MR imaging machines. While 3 T has coils that enable head and neck imaging, its signal-tonoise ratio is significantly decreased compared with 7 T. "The clinical impact of this technique becomes exponential if we can transfer it to a lower field," Dr. Smith said.

These findings point the way to an exciting new era in the field. "With recent advances in technology, the spinal cord is getting increased attention and more and more clinicians are now focusing on how to use this information," Dr. Smith said.

**RICHARD S. DARGAN** is writer based in Albuquerque, N.M., specializing in healthcare issues.

#### **FEATURE**

## Radiologists' Compensation-and Workload—Increasing

#### BY MIKE BASSETT

Salaries for both diagnostic and interventional radiologists increased substantially in 2013, reversing a trend in which compensation levels flatlined or even decreased in the past few years.

Yet, according to the 2014 American Medical Group Association (AMGA) 27th Annual Medical Group Compensation and Financial Survey, relative value unit (RVU) rates— the primary measure of a physician's productivity—increased at an even higher rate than compensation, potentially offsetting the gains in yearly salaries.

AMGA mailed the survey questionnaire to groups across the country in January of 2014 and received responses from 289 medical groups, representing approximately 73,700 providers. Survey results showed that the median compensation Vaudrey level in 2013 for non-interventional radiologists increased by 5 percent over the previous year, from \$453,216 to \$476,013. Interventional radiologists received a smaller-yet still healthy-increase of 2.7 percent, from \$504,772 to \$518,164.

"I consider both of these increases to be fairly good considering that one or the other had decreases over the last couple of years," said Brad Vaudrey, M.B.A, C.P.A., principal at Sullivan, Cotter & Associates, Inc., which administered the survey.

In 2012, median compensation for non-interventional radiologists decreased by 1.3 percent compared to 2011, while median compensation increased by 4.2 percent for interventional radiologists. The year before, both specialties experienced declines.

Overall, 68 percent of the 30 physician specialties in the survey saw increases in compensation in 2013. Specialties with bigger increases than radiology (non-interventional) were gastroenterology (9 percent), cardiac/thoracic surgery (8.2 percent), emergency medicine (5.2 percent) and neurology (5.1 percent).

#### Radiology Experiences Rising RVU Rates

Nevertheless, Vaudrey said that any enthusiasm about the compensation increase should be tempered by the increase in work RVUs for non-interventional and interventional radiologists.

RVUs are based on the value assigned to each Current Procedural Terminology (CPT) code through the resource-based relative value scale used partially by Medicare and nearly all health maintenance organizations. Reimbursement by the Centers for Medicare & Medicaid Services (CMS) is based on the RVU system.

Interventional radiologists experienced a 5.8 percent increase in work RVUs, while non-interventional radiologists saw their work RVUs increase by 7.2 percent. These increases represented





Yousem



Fisher

some of the highest in any specialty except for psychiatry, which experienced an 11.6 percent increase.

'Both of those radiology RVU numbers are notable," Vaudrey said. "You don't typically see numbers like that unless there is some kind of change from CMS, and we really didn't see anything that would cause that kind of increase."

"My perception in talking to radiologists in both academic and private practice is that they are working harder," said David Yousem, M.D., M.B.A., a professor in the Department of

"My perception in talking to radiologists in both academic and private practices is that they are working harder."

DAVID YOUSEM, M.D., M.B.A.

Radiology, vice-chair of program development and director of neuroradiology at Johns Hopkins Hospital in Baltimore, and a nationally recognized expert in radiology economics. "I guess I'm gratified to see they are getting paid slightly higher rates for that extra hard work."

#### MPPR Changes Also Impact Radiology

Another factor impacting radiology is the recent change to Multiple Procedure Payment Reduction (MPPR) as applied to RVUs. When first implemented in 2006, the MPPR applied only to the technical component of contiguous advanced imaging studies performed on the same patient, on the same day. In 2011, CMS changed the MPPR to include non-contiguous body parts, across

#### AMERICAN MEDICAL GROUP ASSOCIATION (AMGA) 2014 MEDICAL GROUP COMPENSATION AND FINANCIAL SURVEY: 2014 REPORT BASED ON 2013 DATA

#### TOP PHYSICIAN COMPENSATION

Specialties	2014	2013	2013-2014 Percentage Change	2012	2011	2012-2014 Percentage Change	2011-2014 Percentage Change	2011-2014 Dollar Change
Cardiac/Thoracic Surgery	\$569,073	\$525,944	8.2%	\$544,087	\$532,567	4.6%	6.9%	\$36,507
Cardiology - Cath Lab	\$544,733	\$547,112	-0.4%	\$524,731	\$504,099	3.8%	8.1%	\$40,634
Orthopedic Surgery	\$538,123	\$525,000	2.5%	\$515,759	\$501,808	4.3%	7.2%	\$36,316
Radiology Interventional	\$518,164	\$504,772	2.7%	\$485,277	\$492,102	6.8%	5.3%	\$26,062
Radiology Non-Interventional	\$476,013	\$453,216	5.0%	\$459,186	\$461,250	3.7%	3.2%	\$14,763

#### TOP PHYSICIAN RVUs

Specialties	2014	2013	2013-2014 Percentage Change	2012	2011	2012-2014 Percentage Change	2011-2014 Percentage Change	2011-2014 RVU Change
Cardiac/Thoracic Surgery	9,700	9,229	5.1%	9,500	9,612	2.1%	0.9%	88
Cardiology - Cath Lab	8,804	8,491	3.7%	8,298	8,629	6.1%	2.0%	175
Radiology Non-Interventional	8,463	7,892	7.2%	7,423	8,296	14.0%	2.0%	167
Ophthalmology	8,460	8,813	-4.0%	8,649	8,821	-2.2%	-4.1%	-361
Radiology Interventional	8,353	7,892	5.8%	7,813	7,597	6.9%	10.0%	756

\*Work relative value units (RVUs) are the primary measure of a physician's productivity for the majority of participating medical groups.

different modalities and in 2012 expanded the MPPR to include a cut to the professional component as well.

Applying the MPPR to the professional component has created a significant reduction in RVUs because radiologists often scan multiple body parts—particularly with MR or CT exams. "Radiologists are still gaining in RVUs despite the fact that CMS implemented this multiple procedure payment reduction, which suggests they are working even harder," Dr. Yousem said.

Along with the increase in work RVUs, a change in the payer mix may also be impacting compensation, Dr. Yousem said. For example, lower unemployment rates could mean that more people are covered by private insurers who pay more than Medicare or Medicaid. Or, he speculated, practice expenses could be falling due to factors such as the implementation of voice recognition software (which can reduce transcription costs), that can help increase compensation. "But I think the major explanation is the increase in RVUs," he said.

Vaudrey noted that the work RVU increases experienced by both diagnostic and interventional radiologists are "very uncommon" and he doesn't expect to see them repeated in 2014. "I

think you can only do so much in terms of increased work effort," he said. "I think we'll see a much flatter work effort level and probably the same for compensation." Added Donald W. Fisher, Ph.D.,

WEB EXTRAS

More information about the American Medical Group Association is available at *www.amga.org.* 

CAE, AMGA's president and chief executive officer, "Although the RVU increase in radiology may be an anomaly, I think we may see other shifts in RVUs—up and down—in many, different specialties in the coming years," Dr. Fisher said. "As more groups move to value-based payment in CMS programs and arrangements with commercial insurers, they will increasingly bear more risk for keeping patients healthy and decreasing ED visits and hospital stays. All specialties, including radiology, will be part of a team-based care approach, which is essential to successfully managing population health, so groups will be figuring out how to more efficiently deliver quality patient care."

**MIKE BASSETT** is a writer based in Holliston, Mass., specializing in health and medicine.

FEATURE

## Inspire-Innovate-Invest: R&E Foundation Fundraising Campaign Invests in Radiology's Future

#### BY PAUL LATOUR

As the RSNA celebrates 100 years as a community of innovators, leaders, researchers, educators, mentors and practitioners, the Research & Education (R&E) Foundation has launched a fundraising campaign to honor that milestone.

"THERE IS NO BETTER WAY TO CELEBRATE RSNA'S 100th birthday than to be part of the effort to ensure that it will continue to be around for at least another 100 years," said Teresita L. Angtuaco, M.D., who along with her husband, Edgardo J. Angtuaco, M.D., are donating \$25,000 to the new campaign as Silver Centennial Pathfinders. "Participating in the Campaign makes us proud to say that we have given back to the organization that has nurtured us through our radiology training and rewarding careers."

The goal of "Inspire-Innovate-Invest: The Campaign for Funding Radiology's Future®" is to raise \$17.5 million to fund grants in radiologic research and education, bridging gaps in funding for promising investigators and educators.

"I feel strongly that investment in this Campaign will help to ensure the future of research and education in all disciplines of radiology," said Valerie P. Jackson, M.D., a Gold Centennial Pathfinder. "Innovation will be necessary to keep our field moving forward in order to optimize patient care in the future.

"Imaging and imaging-guided procedures and therapies are integral to the care of our patients," Dr. Jackson continued. "Radiation oncology is a cornerstone of cancer therapy. Medical physics is the foundation for all that we do. Investment in the RSNA R&E Foundation is a small price to pay for the future progress that will be made to improve health around the world."

#### Investing in the Future of Radiology

The Campaign slogan, "Inspire-Innovate-Invest," captures just how essential donations are to radiologic research. Those who donate \$25,000 or more will be recognized in the Foundation's most prominent giving category, the Centennial Pathfinders, which is broken into three subcategories: Silver, Gold and Platinum.

"I have made a commitment to help support the R&E



Foundation because I can think of no better legacy to leave for radiology than a strong, well-funded research foundation," said Jerry P. Petasnick, M.D., a Gold Centennial Pathfinder.

The R&E Foundation has awarded \$44 million to more than 1,000 educators and investigators since its inception in 1984. The Foundation is proud to say that 90 percent of expenses support grant programs, while 6 percent went to fundraising and 4 percent to administration.

The grant money has enabled more than \$1.5 billion in research funding. A recent study of grant recipients shows that every \$1 awarded by the Foundation generates more than \$40 in subsequent funds received as principal or co-investigator from other sources, such as the National Institutes of Health (NIH).

Due to decreased funding opportunities elsewhere in recent years, the Foundation has seen an unprecedented growth in applicants. In 2014, the Foundation received a record 264 grant applications, a 12 percent increase over 2013. Over the past five years, the number of applications has increased 100 percent.

"Like all of us, I have ample requests for philanthropic donations. I choose the R&E Foundation for my major donations because it has the most impact on our profession," said William G. Bradley Jr., M.D., Ph.D., a Gold Centennial Pathfinder. "Research is what keeps radiology strong, and the R&E Foundation gets research going at the junior level to stimulate future larger grant submissions to the NIH and other funding agencies. It all begins with the R&E."

"Research is what keeps radiology strong, and the R&E Foundation gets research going at the junior level to stimulate future larger grant submissions to the NIH and other funding agencies. It all begins with the R&E."

> WILLIAM G. BRADLEY JR., M.D., PH.D. GOLD CENTENNIAL PATHFINDER

Donations support a number of grants awarded by the Foundation, including the Research Scholar Grant, Research Resident/Fellow Grant, Research Seed Grant, Research Medical Student Grant, Education Scholar Grant and the RSNA/AUR/APDR/SCARD Radiology Education Research Development Grant.

In 2014, money was distributed across these programs to investigators and educators in all career stages representing 46 institutions. "As a medical physicist within radiology, the RSNA has played an integral part in my professional career on both the scientific and educational level,"

#### WEB EXTRAS For more information on the

information on the R&E Foundation and the Campaign, go to *RSNA.org/Foundation*.

said Stephen R. Thomas, Ph.D., a Silver Centennial Pathfinder. "I welcome the opportunity to contribute to the continuing impact that the RSNA has in nurturing young investigators in the radiologic sciences through my direct support of the R&E Foundation during its Inspire-Innovate-Invest Campaign."

**PAUL LATOUR** is a staff writer for RSNA News.

The goal of the R&E Foundation's "Inspire-Innovate-Invest: The Campaign for Funding Radiology's Future®" is to raise \$17.5 million to fund grants in radiologic research and education, bridging gaps in funding for promising investigators and educators.

## R&E GRANT RECIPIENT PAYS IT FORWARD WITH RESEARCH ENDOWMENT

#### BY PAUL LATOUR

Martin R. Prince, M.D., Ph.D., a Platinum Centennial Pathfinder, knows better than most the power of an RSNA Research & Education (R&E) Foundation grant. That is why he recently made a gift to endow the new Prince Research Resident Grant.

When he was a first-year resident, Dr. Prince was inspired by a fellow resident who secured an NIH grant. A relatively new member of RSNA, Dr. Prince looked to the R&E Foundation and was awarded one of the Foundation's first Research Resident Grants in 1991.

"The incredible thing about the Research Resident Grant is not only do you receive funding, but your department commits the time to allow you to do the study," Dr. Prince said. "Even without any money, dedicated research time is a great thing."

His early success as a researcher helped Dr. Prince secure an assistant professorship and position as co-director of MR Imaging just one year out of radiology residency at Massachusetts General Hospital. Currently Dr. Prince is a professsor of Radiology at Weill Medical College of Cornell University and adjunct Professor of Radiology at Columbia College of Physicians and Surgeons. He also serves as chief of MRI at New York Hospital and runs an active program of MR angiography research.

This success inspired Dr. Prince to turn his ambitions outward. Now he is shifting his focus to maximizing the positive impact he can have on the practice, society and his family.

Dr. Prince has enjoyed remarkable success with the patents that have resulted from his research. He decided to use a portion of those royalty earnings to establish the Martin R. Prince Foundation. It is through that Foundation that he created the endowment for the Prince Research Resident Grant.

"I've realized I can have an impact that goes beyond my local institution," he said. "I thought, what better cause could I support than the R&E Foundation, which has a great track record and with which I have personal experience."

The first Prince Research Resident Grant was awarded this year to Christopher Maroules, M.D., a resident in diagnostic radiology at the University of Texas Southwestern Medical Center.

"I'm honored to be the first recipient of the Prince Resident Research Grant through the R&E Foundation," said Dr. Maroules, whose grant is titled, "Quantification of Volumetric Pulmonary Arterial Hypertension Using 3D Arterial Spin Labeled Perfusion MRI: Feasibility and Evaluation in Pulmonary Arterial Hypertension."

"This grant will be instrumental in developing a strong foundation for my research career in cardiothoracic imaging," he added.







Maroules

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#### YOUR DONATIONS IN ACTION

INSPIRE Increasing Efficacy of Hepatic Arterial Embolization for Hepatocellular Carcinoma

Transcatheter arterial embolization (TAE) is the standard of care for patients with intermediate stage hepatocellular carcinoma (HCC). HCC

tumor cells are thought to respond to TAE by activating signaling pathways to promote angiogenesis; however, of the numerous molecular factors involved in angiogenesis, relatively few have been studied in this setting.



James Spencer Clayton Ronald, M.D., Ph.D., (left) with scientific advisor Charles Kim, M.D.

With a Cook Medical Cesare Gianturco/RSNA Research Resident Grant, James Spencer Clayton Ronald, M.D., Ph.D., of Duke University Medical Center, plans to make measurements of a large panel of key angiogenesis signaling molecules in serum samples from HCC patients prior to and serially following TAE. He aims to identify the specific angiogenesis signaling factors that show sustained upregulation following TAE, and will determine whether levels of these specific molecules predict early progression of disease. By better understanding the changes in tumor biology that occur after TAE. more efficacious treatment regimens that combine systemic antiangiogenesis chemotherapy with TAE can be developed.

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## 2015 R&E Grant Application Deadlines Approach

Applications for RSNA Research & Education (R&E) Foundation grants for 2015 are being accepted (*see deadlines below*). For more information, go to *RSNA.org/Foundation* or contact Scott A. Walter, M.S., Assistant Director, Grant Administration at 1-630-571-7816 or *swalter@rsna.org*.

#### EDUCATION GRANTS

#### DEADLINE-JAN. 12

- Education Scholar Grant
- RSNA/AUR/APDR/ SCARD Radiology Education Research Development Grant

#### RESEARCH GRANTS

#### **DEADLINE–JAN. 15** • Research Scholar Grant

- Research Seed Grant
- Research Resident/ Fellow Grant

#### RESEARCH MEDICAL STUDENT GRANT

- DEADLINE-FEB. 2
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### Education and Funding Opportunities

## Attendees Went 'Beyond the Podium' in RSNA's Faculty Skills Update

More than 100 people attended the RSNA session, Faculty Skills Update: Beyond the Podium—Tips for Teaching and Testing (formerly the Faculty Development Workshop), held in September in Chicago.

During the one-day session, presenters provided instructions on lecture and presentation skills, as well as strategies for best-practice question writing from recognized experts, and emphasized inclusion of Audience Response Systems (ARS) during formal lectures.

Presentations were made by physician faculty 2012 RSNA President George S. Bisset III, M.D., chief of pediatric radiology at Texas Children's Hospital and a professor of radiology and Edward B. Singleton Chair of Pediatric Radiology at Baylor College of Medicine in Houston, David J. DiSantis, M.D., associate residency program director, professor and quality, safety and compliance medical director in the Department of Radiology at the University of Kentucky, Lexington, and Harprit S. Bedi, M.D., director, radiology residency program, radiologist and assistant professor at Tufts University School of Medicine, Boston.

Presenters outlined the secrets of good question writing, holding attendees' attention during a lecture and best-practice techniques for giving PowerPoint presentations. Experienced faculty guided attendees through pitfalls and pearls, sharing their own successes (and misses) with the audience.

Attendees learned to identify and apply question-writing techniques by submitting their own test questions for faculty analysis during the live workshop. Presenters reviewed and revised each question in real time while applying best practice methods illustrating how to turn a bad test question into a good one. Attendees were able to see techniques in action and begin to think critically about applying them to their own question-writing methodology.

Presenters also demonstrated RSNA's Diagnosis Live<sup>™</sup> ARS, providing insight into engaging the audience with thought-provoking self-assessment questions. Tips and tricks for course presentation materials—including information on how best to attract and retain audience attention during an ARS presentation—were presented.

For more information, go to RSNA.org/Faculty-Skills-Update.

#### Medical Meetings

### January-March 2015

#### JANUARY 15-17

American Gastroenterological Association (AGA) Institute, the American Society of Clinical Oncology (ASCO), the American Society for Radiation Oncology (ASTRO) and the Society of Surgical Oncology (SSO), Co-sponsored Gastrointestinal Cancers Symposium, Moscone West Building, San Francisco • www.gicasym.org

#### JANUARY 22-25

Society of Nuclear Medicine and Molecular Imaging (SNMMI), 2015 Mid-winter Meeting, Grand Hyatt San Antonio, San Antonio, Texas • www.snmmi.org

#### JANUARY 26-30

Integrating the Healthcare Enterprise (IHE®) North American Connectathon, Cleveland Convention Center and HIMSS Innovation Center, Cleveland, Ohio • www.ihe.net/Connectathon

#### JANUARY 29 - FEBRUARY 1

Indian Radiological & Imaging Association (IRIA), 68th Annual Congress, Hotel Le Meridien, Kochi, Kerala •www.iria.in/68th\_annual\_conference.php

#### **FEBRUARY 5-8**

American Society of Spine Radiology (ASSR), Annual Symposium, Caesar's Palace, Las Vegas, Nevada •www.theassr.org

#### FEBRUARY 18-21

Sociedad Mexicana de Radiologia e Imagen / Mexican Society of Radiology and Imaging, XXVII Encuentro Nacional de Residentes y Radiólogos / XXVII National Meeting of Residents and Radiologists, Mexico City • www.smri.org.mx

\* Visit the RSNA Booth

#### FEBRUARY 21-26

International Society for Optics and Photonics (SPIE), Medical Imaging 2015, Renaissance Orlando at SeaWorld, Orlando, Florida • www.spie.org

#### FEBRUARY 28-MARCH 5

Society of Interventional Radiology (SIR), 40th Annual Scientific Meeting, Georgia World Congress Center, Atlanta, Georgia

www.sirweb.org

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

## Writing a Competitive Grant Proposal Program

March 6-7, 2015 RSNA Headquarters Oak Brook, Ill. 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. Faculty includes Udo Hoffmann, M.D., M.P.H., and G. Scott Gazelle, M.D., M.P.H., Ph.D., of Massachusetts General Hospital in Boston; Ruth Carlos, M.D., of the University of Michigan Health System in Ann Arbor; and Martin Pomper, M.D., Ph.D., of Johns Hopkins School of Medicine in Baltimore.

The course fee is \$175. Register online at RSNA.org/CGP. Contact Rachel Nelson at 1-630-368-3742 or rnelson@rsna.org for additional information.

### **Journal Highlights**

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

#### Dual-Energy CT for Imaging of Pulmonary Hypertension: Challenges and Opportunities

Increasing evidence supports the use of dual-energy CT (DECT) for imaging of pulmonary hypertension (PH) and highlights its potential to evaluate pulmonary vascular resistance noninvasively. DECT may even-

tually replace scintigraphy and evolve into a superior anatomic and functional comprehensive "one-stop"

test for PH diagnosis and severity assessment for surgical or drug therapy planning.

In an article in the November-December issue of *RadioGraphics (RSNA. org/RadioGraphics)*, Seyed Ameli-Renani, M.B.B.S., of St. George's Hospital in London, and colleagues reviewed the current use of DECT in patients with suspected or established PH, evaluated established DECT applications and evolv-ing functions, and discussed current limitations and future potential.

In recent years, the introduction of multidetector CT systems capable of DECT has led to a practical implementation of the imaging potential first proposed and investigated at the inception of CT more than 30 years ago. The use of dual-source systems or highly responsive detector materials that permit rapid kilovoltage switching has permitted near-simultaneous acquisitions of volumetric isotropic datasets at varying kilovoltages. In turn, these acquisitions permit material differentiation according to three-material decomposition mathematic algorithms.

"As with every novel technology, enthusiasm for applying DECT to the variety of indications and techniques for PH imaging must be tempered with awareness of its limitations and further investigations of how to surmount such limitations," the authors write.



Differentiation of embolic physiologic characteristics in a 49-year-old woman who presented with acute pulmonary embolism. Coronal color-coded PBV image shows an occlusive right lower lobe lateral pulmonary artery embolism (*arrow*) and corresponding perfusion defect (*arrowhead*). (*RadioGraphics* 2014;34;1769-1792) ©RSNA 2014 All rights reserved. Printed with permission.

This study features an Invited Commentary by Myna Cobos Barco Godoy, M.D., Ph.D., Department of Diagnostic Radiology, University of Texas MD Anderson Cancer Center, Houston.

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

#### **IN MEMORIAM**

#### Dr. William J. Tuddenham, Founding Editor, *RadioGraphics*

In the late 1970s, William J. Tuddenham, M.D., felt that scientific exhibits presented at RSNA annual meetings should not be limited to attendees only.

Dr. Tuddenham dreamed of creating a journal with pictorial appeal that focused on the teaching value of selected scientific exhibits. In 1981 that dream became reality when Dr. Tuddenham became the founding editor of *RadioGraphics*, now one of the premier education journals in diagnostic radiology.

Dr. Tuddenham died Oct. 8, 2014. He was 91.

"Bill Tuddenham was an accomplished diagnostic radiologist, superb teacher and an innovator," said 1989 RSNA president Robert E. Campbell, M.D. "His idea to create *RadioGraphics* by converting scientific exhibits from RSNA annual meetings into manuscripts for a journal was brilliant. He had the uncanny capability to make difficult situations seem simple."

Dr. Tuddenham was born in Salt Lake City, Utah, in 1922. He earned his bachelor's degree from the University of Utah, and after serving in the U.S. Navy, he attended the University of Pennsylvania School of Medicine and graduated in 1950. Following his internship and radiology residency at the Hospital of the University of Pennsylvania (HUP), he joined the staff, ultimately rising to the position of radiology professor. He served as director of the HUP Department of Radiology from 1962-1986. *RadioGraphics* was his crowning achievement. His labor of love was shared by his wife, Phyllis, who designed the journal's pages. Dr. Tuddenham served as editor until 1989 and was named editor emeritus when William W. Olmsted, M.D., assumed the editor position.

"I was honored to be the selected as the second editor of *RadioGraphics*, following in Dr. Tuddenham's shoes," Dr. Olmsted said. "Bill and Phyllis Tuddenham made



Tuddenham

me. He was a great radiologist and will always be recognized and remembered as the founder of *RadioGraphics*." Even after retiring, Dr. Tuddenham kept *RadioGraphics* close to his heart. When Jeffrey S. Klein, M.D., was named as Dr.

the transition easy and I always appreciated the guidance he gave

Olmsted's successor in 2011, Dr. Tuddenham sent a congratulatory letter to the new editor. "It was a very gracious note, and I was very touched by it,"

Dr. Klein said. "I've kept it because it showed a lot of character and also that he remained interested in the journal into retirement."

Dr. Tuddenham received the RSNA Gold Medal in 1991 and presented the RSNA Annual Oration in 1978. Other honors included the Memorial Fund Lecture and the Christian R. and Mary F. Lindback Foundation Award for distinguished teaching at the University of Pennsylvania.

#### How I Do It: Managing Radiation Dose in CT

While radiologists, medical physicists and manufacturers have implemented many examination protocols and software and

Radiology hardware modifications to reduce CT radiation dose, CT scanners are complicated devices and the terminology of CT

exposure outputs, radiation units and risk remain confusing to many radiologists.

Radiologists should be familiar with CT parameters, optimize CT protocols and ensure the appropriate use of the modality to tailor examinations and minimize radiation for their patients. Educating referring physicians regarding proper indications for the examination, working as a team with physicists and technologists and partnering with manufacturers can result in an overall decrease in radiation, according to a "How I Do It" paper in the December issue of *Radiology (RSNA.org/Radiol-ogy)* by William W. Mayo-Smith, M.D., of Brigham and Women's Hospital, and colleagues.

The dramatic increase in CT utilization since its introduction is testimony to the clinical value of CT in practice. While radiation exposure from CT is a potential concern, it is also important to recognize the added benefits of CT, current efforts to reduce radiation exposure, and controversies concerning medical radiation risk estimates, according to the authors. "By employing some of the strategies described in this manuscript, we hope you can achieve your CT dose reduction goals while maintaining diagnostic examination quality," the authors write.





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

- "The Boston Marathon Bombing: After-Action Review of the Brigham and Women's Hospital Emergency Radiology Response," John Brunner, M.D., and colleagues.
- Detection of Extracolonic Pathologic Findings with CT Colonography: A Discrete ChoiceExperiment of Perceived Benefits versus Harms," Andrew A. Plumb, M.R.C.P., F.R.C.R., and colleagues.

## Value of Membership

### SAM Credit Deadline Approaches for Radiology Select Volume 1

Those who have purchased *Radiology* Select Volume 1: Pulmonary Nodules should be aware of two important deadlines. On January 30, 2015, the opportunity to earn self assessment module (SAM) credits associated with *Radiology* Select Volume 1 will expire. Those who have previously purchased access to the Volume 1 online tests will need to complete the tests by January 30, 2015, to earn credit. After this date, access to the online tests will be removed.



The online educational edition of Volume 1 will be available at a 50 percent discount off the standard price until January 30, 2015. This offer applies to the online educational edition only and does not apply to print or tablet editions.

Radiology Select is a continuing series of selected Radiology articles that highlight developments in imaging science, techniques and clinical practice. For more information, go to RSNA.org/RadiologySelect.

### **Radiology in Public Focus**

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

#### Multiple Sclerosis: Changes in Microarchitecture of White Matter Tracts after Training with a Video Game Balance Board

Training with the Nintendo Wii balance board system modified the microstructure of superior cerebellar peduncles after a 12-week intervention aimed at improving balance in patients with multiple sclerosis (MS) by using visual feedback training, according to a recent study.

In a 24-week, randomized, two-period crossover pilot study, Luca Prosperini, M.D., Ph.D., of the S. Andrea Hospital, Sapienza University in Rome, Italy, and colleagues studied 27 patients who underwent static posturography and brain MR imaging at study entry, after the first 12-week period and at study termination. Thirteen patients started a 12-week training program followed by a 12-week period without any

intervention, while 14 patients received the reverse order. Virtual dissection of white matter tracts was performed with streamline tractography; values of diffusion tensor imaging (DTI) parameters were then obtained for each dissected tract. Repeated measures of analyses of variance were performed to evaluate whether DTI parameters significantly changed after intervention, with false discovery rate correction for multiple hypothesis testing.

Results showed that a medium effect size (Cohen f2 = 0.161–0.273) of high-intensity, task-oriented visual feedback exercises on DTI parameters can be expected; training-induced behavioral changes in standing balance may be accompanied by transient structural white matter plasticity (correlation coefficient, 20.381 to 0.401), specifically involving the superior cerebellar peduncles; and the observed improvement in fractional anisotropy observed after balance training was mainly due to a reduction in radial diffusivity, suggesting the occurrence of activity-dependent modulation of myelin in partially damaged pathways.

"These changes in DTI could be considered clinically relevant because they were correlated with improved standing balance detected at static posturography," the authors write.



#### Improved Prognosis of Women Aged 75 and Older with Mammography-detected Breast Cancer

Mammography-detected breast cancer in women 75 years and older was diagnosed at an earlier stage, required less treatment, and had better disease-specific survival than patient- or physician-detected breast cancer, new research shows. Findings indicate that the same benefits of mammography detection observed in younger women extend to older women.

Judith A. Malmgren, Ph.D., of HealthStat Consulting in Seattle, and colleagues conducted a prospective cohort study with waiver of informed consent in patients with primary breast cancer, aged 75 years and older, with stage O-IV disease from 1990 to 2011, identified and tracked with a registry database (n = 1162). Details including stage, treatment, outcomes and method of detection (by patient, physician, or mammography) were noted from the chart at the time of diagnosis. Kaplan-Meier estimation was used to compare invasive disease-specific survival rates.

Among patients with breast cancer aged 75 years and older, mammography detection of cancers increased over time, from 49 percent to 70 percent (P < .001). Mammography-detected cases were more often stage I (62 percent), whereas patient- and physician-detected cases were more likely stage II and III (59 percent). Over time, from 1990 to 2011, the incidence of stage II cancers decreased by 8 percent, the incidence



Bar graph shows the change in detection method over time (1990-2011) for breast cancer cases in patients aged 75 years and older (n = 1162). Pt/ PhysD = detection by patient or physician. (Radiology 2014;273;3:686-694) ©RSNA 2014 All rights reserved. Printed with permission.

of stage III cancers decreased by 8 percent and the incidence of stage 0 cancers increased by 15 percent (P < .001). Patients with mammographydetected invasive breast cancer were more often treated with lumpectomy and radiation and underwent fewer mastectomies and less chemotherapy than patients with cancer detected by patients and physicians (P < .001). Mammography detection was associated with significantly better 5-year disease-specific survival for invasive breast cancer (97 percent versus 87 percent for patient- and physician-detected cancer [P < .001], respectively).

"When discussing mammography screening options after the age of 75, our results indicate that women should be informed of the possible benefit of a decreased need for aggressive treatment and better disease-specific survival associated with early detection with mammography," the authors write.

#### Fast Whole-Brain Threedimensional Macromolecular Proton Fraction Mapping in Multiple Sclerosis

Macromolecular proton fraction (MPF) mapping enables quantitative assessment of demyelination in normal-appearing brain tissues and shows primary clinical relevance of gray matter (GM) damage in multiple sclerosis (MS), according to new research. MPF outperforms magnetization transfer (MT) ratio and relaxation rate (R1) in detection of MS-related tissue changes.

Vasily L. Yarnykh, Ph.D., of the University of Washington in Seattle, and colleagues studied 14 healthy control participants, 18 relapsing-remitting MS (RRMS)

patients and 12 secondary progressive MS (SPMS) patients who underwent 3-T MR imaging. Three-dimensional MPF maps were reconstructed from MT-weighted images and R1 maps by the single-point method. Mean MPF, R1 and MT ratio in normal-appearing white matter (WM), GM and lesions were compared between subject groups by using analysis of variance. Correlations (Pearson r) between imaging data and clinical scores (Expanded Disability Status Scale [EDSS] and MS Functional Composite [MSFC]) were compared by using the Hotelling-Williams test.

RRMS patients had lower WM and GM MPF than controls, with percentage decreases of 6.5 percent (P  $\leq$  .005) and 5.4 percent (P  $\leq$  .05). MPF in SPMS was

reduced relative to RRMS in WM, GM and lesions by 6.4 percent (P < .005), 13.4 percent (P < .005), and 11.7 percent (P < .05), respectively. EDSS and MSFC demonstrated strongest correlations with MPF in GM (r = 20.74 and 0.81; P < .001) followed by WM (r = 20.57 and 0.72; P < .01) and lesions (r = 20.42 and 0.50; P < .05). R1 and MT ratio in all tissues were significantly less correlated with clinical scores than GM MPF (P < .05).

"Our results demonstrate utility of MPF as a myelin biomarker in MS, reveal primary clinical relevance of GM demyelination and provide methodologic background for future applications of fast MPF mapping as a clinically targeted tool for quantitative monitoring of myelin damage and repair," the authors write.

#### Carotid Artery Stenosis: Cost-effectiveness of Assessment of Cerebrovascular Reserve to Guide Treatment of Asymptomatic Patients

Cerebrovascular reserve (CVR) testing can be a cost-effective tool to identify asymptomatic patients with carotid stenosis who are most likely to benefit from revascularization, according to new research.

Ankar Pandya, Ph.D., of Weill Cornell Medical College in New York, and colleagues compared three strategies, including immediate revascularization (carotid endarterectomy) and ongoing medical therapy (with antiplatelet, statin and antihypertensive agents plus lifestyle modification), medical therapy-based treatment with revascularization only for patients who progressed and use of

a CVR-based decision rule for treatment in which patients with CVR impairment undergo immediate revascularization and all others receive medical therapy.

Total costs per person and lifetime quality- adjusted life years (QALYs) were lowest for the medical therapy-based strategy (\$14,597, 9.848 QALYs), followed by CVR testing (\$16,583, 9.934 QALYs) and immediate revascularization (\$20 950, 9.940 QALYs). The incremental costeffectiveness ratio for the CVR-based strategy compared with the medical therapy-based strategy was \$23,000 per QALY and for the immediate revascularization versus the CVR-based strategy was \$760,000 per QALY.

"CVR assessment can help identify patients with carotid artery stenosis who are at higher baseline risk for stroke, and thus, are better candidates for revascularization procedures," the authors write.



Graph of two-way sensitivity analysis shows optimal strategy for different combinations of baseline stroke risk and probability of complications during revascularization. CVR strategy is optimal in the blue region, which includes base-case result (marked by an x); other strategies could be optimal given other combinations of stroke risk and revascularization complication risks. (Radiology 2014;273;3:853-858) ©RSNA 2014 All rights reserved. Printed with permission.

#### Intravenous Contrast Material Exposure Is Not an Independent Risk Factor for Dialysis or Mortality

Intravenous contrast material administration was not associated with excess risk of acute kidney injury (AKI), dialysis or death, even among patients with comorbidities reported to predispose them to nephrotoxicity, according to new research.

Between 2000 and 2010, Robert J. McDonald, M.D., Ph.D., of the Mayo Clinic in Rochester, Minnesota, and colleagues examined a study group of 10,673 patients who underwent a contrast-enhanced CT exam and 10,673 patients who underwent a similar CT without intravenous contrast. Researchers found that the risks of AKI (odds ratios [OR], 0.94; 95 percent confidence interval [CI]: 0.83, 1.07; P = .38), emergent dialysis (OR, 0.96; 95 percent CI: 0.54, 1.60; P = .89), and 30-day mortality (hazard ratio [HR], 0.97; 95 percent CI: 0.87, 1.06; P = .45) were not significantly different between the contrast and the noncontrast groups.

The study also showed that patients with an increased baseline serum creatinine level, diabetes mellitus, congestive heart failure, preexisting renal dysfunction or a history of acute renal failure had higher rates of AKI, dialysis and short-term mortality compared with patients without these comorbidities independent of contrast material administration.



## Media Coverage of RSNA

In August, 602 RSNA-related news stories were tracked in the media. These stories reached an estimated 336 million people. Coverage included U.S. News & World Report, The Seattle Times, WABC (New York), WCBS-TV (New York), WBBM-TV (Chicago), WBBM-AM (Chicago), KCBS-AM (San Francisco), WKRC-TV (Cincinnati), WISH-TV (Indianapolis), Yahoo! News, Forbes, WebMD, MSN. com, Philly.com, HealthDay, FOXNews.com and CBSNews.com.

### DECEMBER PUBLIC INFORMATION ACTIVITIES FOCUS ON MR IMAGING

In December, RSNA's "60-Second Checkup" radio program will focus on the use of MR imaging to investigate the association between diabetes duration and severity associated with brain degeneration.

## Become a RadiologyInfo.org Content Reviewer

*RadiologyInfo.org*, the public information website produced by RSNA and the American College of Radiology, is dedicated to being the trusted source of information for the public about radiology and the unique and vital role of radiologists in their healthcare.

Over the past15 years since *RadiologyInfo.org* was launched, more than 330 radiology professionals have volunteered their time and expertise to contribute to the success of the site. Now, you too can help shape, review and publish useful patient information by volunteering as a *RadiologyInfo.org* Medical Advisor.



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If you are interested, send your curriculum vitae to Joshauna Strong at *jstrong@rsna.org*, noting your area of expertise and interest. RSNA Medical Advisors are recognized online at *Radiologyinfo.org/reviewers*.

## **Annual Meeting Watch**

## RSNA 2015 Online Abstract Submission Opens mid-January

The online system to submit abstracts for RSNA 2015 will be activated in mid-January. The submission deadline is noon Central Time (CT) on Wednesday, April 8, 2015. Abstracts are required for scientific presentations, education exhibits,

applied science, quality storyboards and quantitative imaging reading room showcase.

To submit an abstract online, go to RSNA.org/abstracts.

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

#### Important Dates for RSNA 2015

Wednesday, April 29	Member registration and housing open at 9 a.m. CT
Wednesday, June 3:	Non-member registration and housing open at 9 a.m. CT
Wednesday, July 8:	Course enrollment open at 9 a.m. CT
Friday, October 16:	Deadline for international badge mailing
Friday, November 6:	Final housing and discounted registration deadline at 5 p.m. CT
Wednesday, November 25	Deadline to guarantee a seat for all ticketed courses at 5 p.m. CT
ovember 29 – December 4	101st Scientific Assembly & Annual Meeting



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## **RSNA.org**

# Explore the Many Benefits of RSNA Membership

Along with renewing your membership online on *RSNA.org*, you can explore the many exclusive benefits including the new automatic enrollment option for paying annual dues.

Members can also access their accounts and the membership directory, apply for retired status membership, review the list of membership applicants from the U.S. and abroad, and more.

Need to notify RSNA of an address change? Looking for information about volunteering to serve on an RSNA committee? Want to learn how free registration for the annual meeting works? You'll find answers to these questions and more in the FAQs section.

Access benefits of RSNA membership at RSNA.org/benefits\_overview.aspx:

- Free advance registration to the world's premier medical meeting
- Subscriptions to the top peer-reviewed journals, *Radiology* and *RadioGraphics*, and the *RSNA News* monthly magazine
- Free online education resources to maintain your certification and enhance your career
- Apply for funding for your research or education project from the RSNA Research & Education (R&E) Foundation
- Network with colleagues, serve on committees and build your curriculum vitae

Members are reminded to renew their membership at *RSNA.org/renew* by December 31, 2014, to avoid interruption of access to RSNA's online journals, *Radiology* and *RadioGraphics*.

## COMING NEXT MONTH

Along with featuring highlights of some of the most captivating images of the Centennial celebration at RSNA 2014, we report on new research showing MR imaging may be a better assessor of stroke and the appropriateness of clot-busting drugs in its treatment.



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