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MR Reveals "Swallow Tail" Signs of Parkinson's

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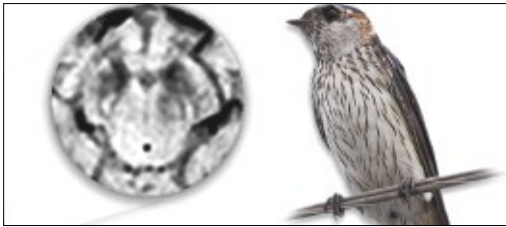
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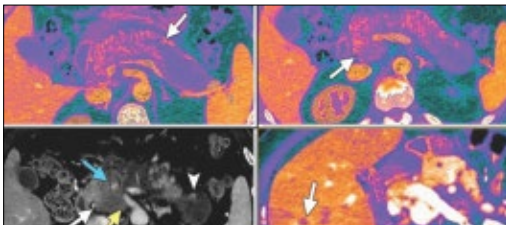
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CENTENNIAL SNAPSHOTS

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.

1923: First issue of *Radiology*



This first, 65-page issue of RSNA's science journal, with **Maximilian J. Hubeny, M.D.**, serving as editor, featured articles including "Treatment of Cancer of the Breast by Deep Radiation and Surgery—A Rational Method According to Present-Day Knowledge" and "Radiation Dosage: Standardization Versus Individual Adaptation." *Radiology* now



publishes approximately 300 pages of peer-reviewed original research, authoritative reviews, well-balanced commentary on significant articles, and expert opinion on new techniques and technologies each month.

1933: Executive Director Hired; Headquarters Established in Syracuse

The work of RSNA had become too involved and complicated to be handled in piecemeal fashion by Society leaders at their respective offices. One of those leaders, Secretary-Treasurer Douglas S. Childs, M.D., of Syracuse, N.Y., hired local Marguerite Hogan Henry as RSNA's first executive director. Henry's office in Syracuse became the Society's first headquarters.

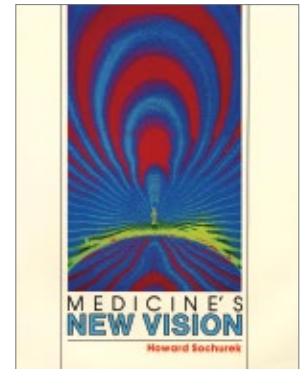


1974: Categorical Course First Offered at Annual Meeting

This new type of Refresher Course offered a series of sessions given throughout the week of the meeting on a single topic. The first Categorical Course covered gastrointestinal radiology and attracted more than 500 attendees to each session, convincing RSNA leaders to offer additional Categorical Courses at future meetings.

1989: "Medicine's New Vision" Published

To commemorate the Society's 75th anniversary, RSNA commissioned National Geographic author Howard Sochurek to expand his article, "Medicine's New Vision," into a book with color illustrations to explain the role of the radiologist to the general public. After spending a year traveling to interview leaders in radiology, Sochurek observed, "I found that—more than any other medical specialist—the radiologist has harnessed the computer and devised technologies to extend his diagnostic abilities in exciting and innovative ways."



2007: Quantitative Imaging Biomarkers Alliance Formed

The Quantitative Imaging Biomarkers Alliance (QIBA) was organized by RSNA in 2007 to unite researchers, healthcare professionals and industry stakeholders in the advancement of quantitative imaging and the use of biomarkers in clinical trials and practice. Today, numerous volunteers serve on modality committees covering CT, MR, nuclear medicine and ultrasound and technical committees covering CT Volumetry, COPD/Asthma, PDF-MRI, fMRI, FDG-PET and ultrasound. Together they're working to achieve the QIBA mission of improving the value and practicality of quantitative imaging biomarkers by reducing variability across devices, patients and time.



ARRS AWARDS GOLD MEDALS

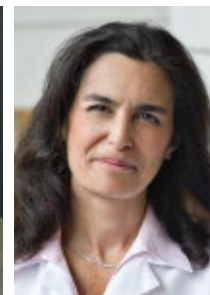
The American Roentgen Ray Society (ARRS) awarded gold medals to **Michael P. Federle, M.D.**, **Ella A. Kazerooni, M.D.**, and **Michael E. Phelps, Ph.D.**

Dr. Federle is a professor of radiology at Stanford University and the associate chair in charge of education for the department. He serves as a reviewer for *RadioGraphics*. Dr. Kazerooni is a professor of radiology, associate chair for clinical affairs, director of cardiothoracic radiology, and chair of the Radiology Service Excellence Program at the University of Michigan. She serves on the RSNA Quality Improvement Committee.

Dr. Phelps is the Norton Simon Professor, chair of the Department of Molecular and Medical Pharmacology, and the director of the Crump Institute for Molecular Imaging at the University of California, Los Angeles.



Federle



Kazerooni



Phelps

ACR Bestows Honors

2014 RSNA President **N. Reed Dunnick, M.D.**, **Carol M. Rumack, M.D.**, and **James H. Thrall, M.D.**, were awarded gold medals at the American College of Radiology's (ACR) recent annual meeting in Washington, D.C. **Michel Claudon, M.D.**, and **Gabriel P. Krestin, M.D., Ph.D.**, were named honorary fellows.

Dr. Dunnick is the Fred Jenner Hodges Professor and chair of the Department of Radiology at the University of Michigan Health System in Ann Arbor. Dr. Rumack, a professor of radiology and pediatrics and associate dean for graduate medical education at the University of Colorado Denver School of Medicine, has served on numerous RSNA committees and is currently a member of the Public Information Advisors Network.

Dr. Thrall is chairman emeritus, Department of Radiology at Massachusetts General Hospital, Boston, and the Juan M. Taveras Distinguished Professor of Radiology at Harvard Medical School. Dr. Thrall was awarded the RSNA Gold Medal in 2007 and served on the Research & Education (R&E) Foundation Board of Trustees from 2002 to 2008.

Dr. Claudon is a pediatric radiologist at Children's Hospital, Centre Hospitalier Universitaire de Nancy Brabois in Vandoeu-

vre, France. Dr. Krestin is a professor of radiology and chair of the Department of Radiology at Erasmus University Medical Centre Rotterdam, the Netherlands. Dr. Krestin was awarded RSNA Honorary Membership in 2013 and is a member of the R&E Foundation Grant Program Committee.

ACR also recently elected new officers:

- **Paul H. Ellenbogen, M.D.**, president
- **Deborah Levine, M.D.**, vice-president
- **Bibb Allen Jr., M.D.**, Board of Chancellors chair
- **James A. Brink, M.D.**, Board of Chancellors vice-chair



**2014 RSNA President
N. Reed Dunnick M.D.**

BRAIN IMAGING FOCUS OF THIRD ANNUAL INTERNATIONAL DAY OF RADIOLOGY

RSNA, the European Society of Radiology (ESR) and the American College of Radiology (ACR), along with other participating societies around the world, will celebrate the third International Day of Radiology (IDoR) on Nov. 8, the anniversary of the discovery of X-rays by Wilhelm Conrad Roentgen, Ph.D.

This year, the main focus will be on the important role brain imaging plays in the diagnosis and treatment of diseases and conditions of the brain.

IDoR is meant to build greater awareness of radiology's value and contributions to patient care and the vital role of the radiologist in the healthcare continuum.

Last year, more than 100 radiology-related professional societies celebrated the day through various activities, including lectures, symposia, social media promotions and press events.

Three booklets, *The Story of Radiology, Vols. I and II*, and *Oncologic Imaging*, will be available along with additional promotional materials, for download on RSNA, ESR, ACR and IDoR websites. For more information on joining the celebration, visit IDoR2014.com or RSNA.org/IDoR2014.



**INTERNATIONAL
DAY OF
RADIOLOGY**
AN INITIATIVE OF THE ESR, ACR AND RSNA

CLARIFICATION

An announcement in the July 2014 issue of *RSNA News*, "AAPM Offers Resources on CT Dose-Check Standard," contained some misleading information. The slide presentation developed by the American Association of Physicists in Medicine (AAPM) explains the National Electrical Manufacturers Association's Medical Imaging & Technology Alliance (MITA) XR 25 standard, also known as Dose Check. All new CT scanners sold in the U.S. are shipped with the MITA Dose Check standard.

To access the free slide presentation, go to www.aapm.org/pubs/CTProtocols/?tab=7#CTPanel. To download a copy of the Dose Check standard, go to www.nema.org/Standards/Pages/Computed-Tomography-Dose-Check.aspx#download.

Access an updated version of this announcement at RSNA.org/newsdetail.aspx?id=12534#aapm

Barentsz Knighted in Native Netherlands

Jelle O. Barentsz, M.D., Ph.D., became a Knight in the Order of the Dutch Lion, one of the highest royal decorations given by The Netherlands. Dr. Barentsz is a professor of radiology at the University Hospital Nijmegen in the Netherlands.

Among Dr. Barentsz's achievements are development of the lymph node specific iron-nano MR contrast agent Combidx, discovery of multi-parametric MR and development of the PI-RADS scoring system for the structured interpretation of prostate MR. Dr. Barentsz serves on the *Radiology* Editorial Board as associate editor in genitourinary imaging.



Barentsz

RSNA Board of Directors Report

At its June meeting, the RSNA Board of Directors approved the Society's 2014-2015 budget, continued planning for the annual meeting and reviewed the work of various RSNA committees.

Committee Volunteers Appointed, New Committee Formed

The Board approved appointments to numerous RSNA committees involved in annual meeting activities, journal publication, collaboration with other societies, the development of radiology informatics and education and the pursuit of other Society goals. In particular, the Board populated the newly created RSNA Regional Committees for Europe and Middle East/Africa with appointments of members from those regions.

In addition, the Board created a new Committee on Scientific Affairs that will be responsible for overseeing RSNA's strategic science initiatives, monitoring emerging trends in imaging research and technology and designing programs to address knowledge gaps in imaging science and technology development.

The Board of Directors also authorized RSNA speakers for the Jornada Paulista de Radiologia (JPR) in São Paulo, Brazil, in May 2015 and the Association of Colombian Radiology in Cartagena in August 2015.

New Position Statement Available on Imaging in the Evaluation of Dementia

The Board has approved a position statement on Imaging in the Evaluation of Dementia. RSNA position statements are designed to aid members when they respond to the media or the public about radiology-related topics that receive prominent coverage in the news. Access the statements on myRSNA® by clicking Member Benefits under myDashboard and scrolling to Position Statements. Also available are position statements on Screening Mammography, Medical Imaging Errors, Radiation Dose, Appropriate Utilization of Medical Imaging, RSNA/ACR Joint Statement on Lung Cancer Screening, Colon Cancer Screening, TSA Airport Scanners, Radiation from a Nuclear Accident and Stroke Imaging.

RSNA 2014 Plans Continue

The Board eagerly anticipates RSNA 2014, where the Society will celebrate its 100th annual meeting and scientific assembly. Commemorative activities at the meeting include a special Centennial Showcase where attendees can see, hear and discover the advancements that shaped radiology and RSNA, and the Sip & Savor Social, a Centennial celebration offering entertainment,

drinks and tastings by some of Chicago's top restaurants. A Technical Exhibits grand opening ceremony will feature RSNA leaders and industry partners in a celebration of a century's worth of technology and innovation that changed the world of radiology.

Also featured at RSNA 2014 will be a mock jury trial involving incidentalomas and failure to diagnose. In addition, more sessions will be enabled with RSNA Diagnosis Live™ technology this year, giving attendees the opportunity to face off against their colleagues in a friendly, competitive environment. The RSNA 2014 Virtual Meeting will offer 50 percent more content than last year and—new this year—provide the opportunity for radiologic technologists to obtain continuing education credit.

The Board approved the dedication of the Annual Oration in Diagnostic Radiology at RSNA 2014 to the memory of Henry N. Wagner Jr., M.D., of Baltimore. Dr. Wagner is considered one of the founders of the specialty of nuclear medicine.

Helping to inform enhancements to this year's annual meeting was the 2013 annual meeting survey. RSNA thanks the more than 1,500 people who participated in the survey and offered feedback about their meeting experiences.

Registration and course enrollment for RSNA 2014 are underway at RSNA.org/Register. I look forward to seeing you in Chicago for the celebration of a century.

RICHARD L. BARON, M.D.

CHAIRMAN, 2014 RSNA BOARD OF DIRECTORS



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



A mock trial at RSNA 2012 focused on a radiologist's duty to inform the referring physician or patient of the possible link between radiation exposure and cancer risk. This year's mock trial involves incidentalomas and failure to diagnose.

My Turn

Radiologists at the Crossroads of Art and Science

Medical imaging remains at the forefront of advanced healthcare. In the personalized medicine era, patient-tailored diagnostic imaging is as important as custom therapeutic options. The role of radiologic science in oncology, stroke and trauma management exemplifies how



Vahid Yaghmai, M.D., M.S., is a professor and medical director of CT imaging and director of the Quantitative Imaging Core Lab (QICL) at Northwestern University-Feinberg School of Medicine in Chicago. Dr. Yaghmai serves on the *RSNA News* Editorial Board.

Read the Story
"Decision Support Software Aids Imaging Utilization Management," Page 7.

utilization will clearly lead to improved patient safety and outcome by providing best decision-support tools and reducing variability. There is no better argument for involving radiologists in medical imaging utilization research.

Whether radiology benefit management companies or radiologists

in clinical practice take the helm in guiding medical imaging utilization remains to be seen. In this issue, we read about an exciting new option: Integration of computerized physician order entry (CPOE) and clinical decision support (CDS). This integration makes the latest scientific evidence in medical imaging available to the clinician—who knows the most about the patient's clinical course—at the point of order entry. This could provide unparalleled benefits to the patient, clinician, radiologist and the healthcare system in general. For example, routine ordering of CT "with and without" contrast material, a well-versed first-line orderable in medical training and practice, has limited use in the clinical imaging realm. The few indications for this commonly ordered exam are well described by the appropriateness guidelines; others are remnants of the "art" of medicine that soon will have no place in the science of radiology as CDS and CPOE are integrated.

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.

advanced imaging guidelines dictate best practices and outcomes. Of course, such reliance on imaging requires appropriate test selection and interpretation. Radiologists are the experts in interpreting medical images. However, many healthcare providers still view appropriate test selection as an art rather than a science.

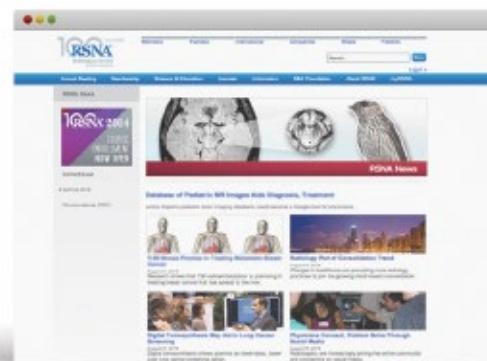
Medical imaging undoubtedly has been pivotal in improving global health. What remains unclear is which imaging test is appropriate for which indication and when. Answering this question is ever more important to the financial state of U.S. healthcare, as costs continue their exponential trajectory and medical imaging remains a constant target of cost control efforts. Making the issue more complex are new imaging technologies introduced at a rapid pace, requiring assessment of their appropriateness.

Evidence-based medical guidelines rely on sound scientific data to guide appropriate decisions and reduce costly aberrations. Appropriate

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 media as well.

Go to RSNA.org/News to view a video interview with Mark Hiatt, M.D., M.B.A., discussing radiology business management companies. And as you gear up for RSNA 2014, be sure to check out the video, "RSNA: A Century of Transforming Medicine," by 2014 RSNA President N. Reed Dunnick, M.D.



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MR Research Could Lead to Earlier Parkinson Diagnosis

BY ELIZABETH GARDNER

Recent advances in MR imaging point the way to a reliable marker for Parkinson disease, which is usually diagnosed almost solely through medical history and clinical findings like muscle stiffness and tremors.

AN IMAGE-BASED diagnostic technique would help clinicians distinguish early Parkinson disease from other conditions that share similar symptoms and could also help track disease progression and measure the effectiveness of drugs and other treatments currently used to manage the symptoms.

Three MR imaging-based studies have discovered distinctive changes in the substantia nigra (SN), a crescent-shaped mass of cells in the midbrain that normally produces the neurotransmitter dopamine. Parkinson disease patients lose dopamine-producing cells in the SN, leading to problems with motor control among other symptoms. All three studies showed consistent differences in the appearance of the SN in normal patients compared with patients diagnosed with Parkinson disease.

Two of the studies used ultra high-field 7-T MR imaging—cutting-edge technology for research institutions—while the other relied on 3-T MR imaging, which is commonly available in clinical settings.

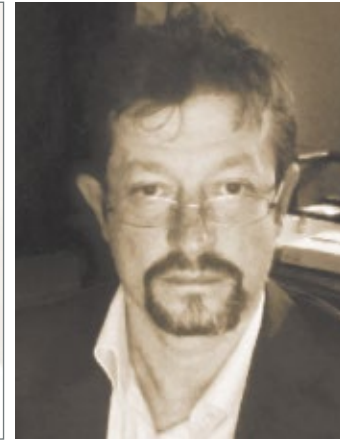
The initial study was conducted by neuroradiologists, neurologists and physicists of the University of Nottingham in the U.K., and published in the July 2013 edition of *Neurology*. Led by researchers Anna Blazejewska, Ph.D., and Stefan Schwarz, M.D., the team investigated 7-T MR imaging changes to nigrosome-1 of the substantia nigra revealing an oval shaped structure found in healthy patients but absent in patients with Parkinson disease. Researchers were able to correlate their imaging findings to histological findings using immunohisto-chemical staining techniques to demonstrate nigrosome-1.

In a follow-up study by the same research team led by Dr. Schwarz, previous findings were translated to a 3-T MR imaging platform revealing a specific “swallow tail” shape indicating the presence of nigrosome-1—part of the SN that has a dense concentration of dopamine-producing cells. Researchers determined that the split-tail shape was clearly visible in normal patients but not present in the patients with Parkinson disease. The study was published in the April 2014 edition of the journal *PLoS ONE*.

In the study, researchers reviewed 114 high-resolution images including a prospective case-control study with 10 patients with Parkinson disease and nine control subjects, and a retrospective study of



Schwarz



Cosottini

95 patients (nine with Parkinson disease and 81 without, five non-diagnostic studies excluded). Two raters independently classified subjects into Parkinson disease and non-Parkinson disease groups, according to the absence or presence of nigrosome-1. Researchers accurately classified eight out of nine control subjects and eight out of 10 patients with Parkinson disease in the prospective

“...we think the ‘swallow tail’ sign has the potential to change how Parkinson disease is diagnosed and confirmed in the future.”

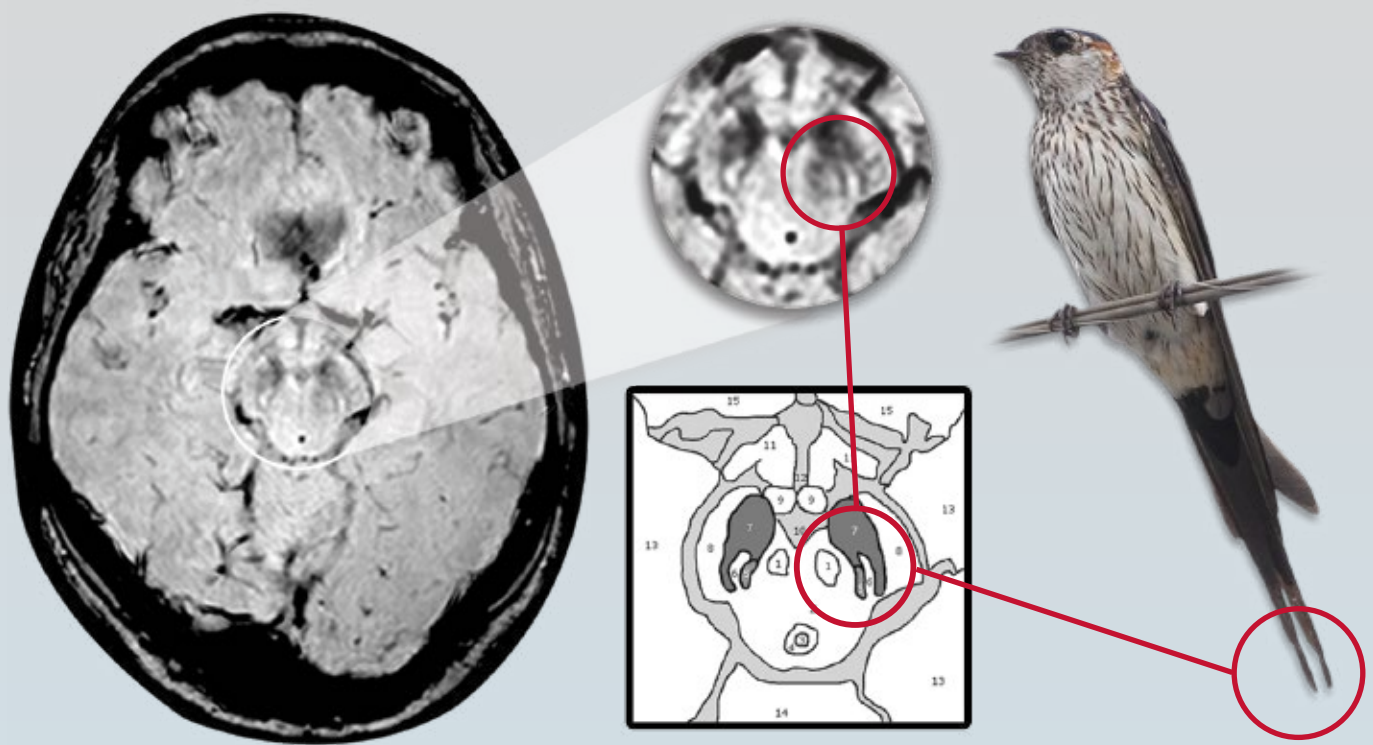
STEFAN SCHWARZ, M.D.

study, and 77 out of 81 healthy patients and nine out of nine patients with Parkinson disease in the retrospective study.

“Visual radiological assessment yielded a high diagnostic accuracy for Parkinson disease versus an unselected clinical control population,” the authors wrote. “Assessing the substantia nigra ... for the typical ‘swallow tail’ appearance has potential to become a new and easy applicable 3-T MRI diagnostic tool for nigral degeneration in Parkinson disease.”

Ultra High-field MR Holds Promise for Parkinson disease

A separate study, published in the June 2014 edition of *Radiology*, used 7-T MR imaging to distinguish a three-layered organization of the SN in patients without Parkinson disease, as well as distinctive structural changes in the SN of patients with the disease. The research was part of a larger experimental protocol funded by the Italian government to study the clinical impact of ultra



New research reveals that the split-tail shape, or “swallow tail,” (above, right) was clearly visible in normal patients but not present in patients with Parkinson disease. Above: A 3T - SWI axial slice just at the level of nigrosome-1 with magnification of the midbrain structures and a sketch outlining relevant anatomical structures: 1 red nucleus, 2 midbrain tegmentum, 3 aqueduct, 4 periaqueductal grey, 5 medial lemniscus, 6 nigrosome-1, 7 substantia nigra, 8 cerebral peduncle, 9 mammillary body, 10 inter-peduncular fossa, 11 optic radiation, 12 3rd ventricle, 13 temporal lobe, 14 cerebellum, 15 frontal lobe.

(PLoS ONE 9(4): e93814. doi:10.1371/journal.pone.0093814) Image credit: Copyright: © 2014 Schwarz et al

high-field MR imaging in diagnosing neurodegenerative diseases.

Researchers at the University of Pisa, led by Mirco Cosottini, M.D., imaged the brains of 38 people, including 17 patients with typical Parkinson disease and 21 healthy people, as well as a brain specimen from a deceased person. (Patients with atypical Parkinson disease or Parkinson disease accompanied by other neurologic or major medical conditions were excluded.) Images revealed a three-layer inner organization of the SN in healthy patients, and loss of that distinctive organization in patients with Parkinson disease.

To determine whether the differences in the 7-T MRI images were a reliable diagnostic marker for Parkinson disease, two neuroradiologists studied images of the healthy SN in eight subjects. Investigators then independently assessed images from the study group, correctly identifying 100 percent of the patients with Parkinson disease and 96 percent of the healthy controls. Each of the raters conducted two blind evaluations one week apart. Results were consistent both with each other and between their own earlier and later assessments.

“We started our work knowing that the inner structure of the SN has never been detected with neuroimaging techniques,” Dr. Cosottini said. “The introduction of the ultra high-field 7-T MR system—the first in our country—gives us a unique opportunity to explore the midbrain in healthy subjects and in patients with Parkinson disease at an extraordinarily high resolution.”

The team is currently studying patients with atypical Parkinson disease symptoms (such as supranuclear palsy, multi-system atrophy and corti-

cobasal degeneration) to evaluate whether the signal changes in the substantia nigra detectable with ultra high-field 7-T MR are unique to Parkinson disease or shared by other conditions, Dr. Cosottini said.

Parkinson Research Continues

Although more research is necessary, the authors believe these findings have the potential to improve early diagnosis of Parkinson disease in the future.

“After confirmation of our findings in further studies, we think the ‘swallow tail’ sign has the potential to change how Parkinson disease is diagnosed and confirmed in the future,” Dr. Schwarz said.

Currently, Dr. Schwarz and colleagues are working on the Parkinson disease Magnetic Imaging Repository (PaMIR) project, a multicenter study combining MR imaging and clinical data of early-stage Parkinson disease and healthy controls.

Researchers hope to further advance 3-T MR imaging markers of Parkinson disease, said Dorothee Auer, M.D., Ph.D., the senior author on the *PLoS ONE* study and head of radiological sciences at the University of Nottingham.

“We will assess the value of MRI-based nigrosome and neuromelanin imaging in tracking Parkinson disease and generate an MR imaging biomarker repository to maximize the clinical benefit of advanced MRI for people with the disease,” Dr. Auer said. □

WEB EXTRAS

Access the study, “The ‘Swallow Tail’ Appearance of the Healthy Nigrosome—A New Accurate Test of Parkinson Disease,” at Plosone.org.

Access an abstract of the study, “Visualization of nigrosome 1 and its loss in PD: pathoanatomical correlation and in vivo 7 T MRI,” at Neurology.org.

Access the study, “MR Imaging of the Substantia Nigra at 7 T Enables Diagnosis of Parkinson Disease,” in the June 2014 issue of *Radiology*, at RSNA.org/Radiology.

ELIZABETH GARDNER is a Chicago-based freelance writer specializing in medical technology and health IT.

Decision Support Software Aids Imaging Utilization Management

BY RICHARD S. DARGAN

While radiology benefit management (RBM) companies continue to play a major role in managing the utilization of advanced diagnostic imaging, computerized physician order entry (CPOE) software, enhanced by real-time clinical decision support (CDS) is quickly gaining ground as an effective imaging utilization management tool.

RBM COMPANIES emerged in the 1990s and quickly became the dominant player in the radiology utilization management market. Today, approximately 90 million Americans are covered by RBMs and payers have credited these companies with reducing costs associated with imaging. But as healthcare continues to move toward the widespread adoption of electronic healthcare records (EHRs), the industry is increasingly turning to evidence-based CDS tools, which can be easily integrated with computerized ordering and EHRs.

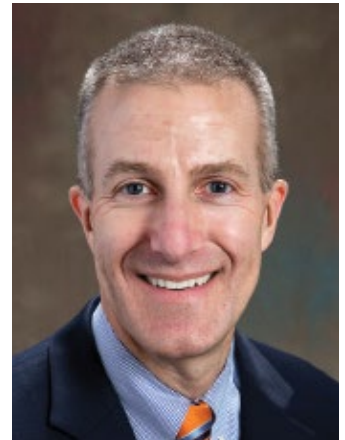
“Traditionally, insurance companies have outsourced imaging utilization management to RBM companies,” said Richard Duszak Jr., M.D., chief medical officer of the Harvey L. Neiman Health Policy Institute and vice-chair for health policy and practice at the Emory University School of Medicine in Atlanta. “But the technology for CPOE with decision support has improved and the software has become more easily embedded into EHRs, which is spurring a shift away from using RBMs.”

The balance is shifting fairly quickly. When Dr. Duszak co-authored a two-part article about utilization management in the October 2012 issue of the *Journal of the American College of Radiology (JACR)*, market penetration of CPOE with CDS was limited due to costs and software issues.

“At the time of the article, technological enablers weren’t there, and they weren’t embedded enough,” he recalled. “All of those pieces have improved, while challenges of RBMs have remained largely the same.”

Federal laws now back the use of CDS tools. Beginning January 2017, ordering physicians will be required to consult appropriateness criteria when ordering advanced imaging procedures for Medicare patients and the secretary of the U.S. Department

of Health and Human Services must identify CDS tools to help physicians navigate appropriateness criteria. The American College of Radiology has long advocated for the use of CDS systems. There is already mounting evidence suggesting that CPOE with CDS can decrease the frequency of inappropriate imaging at a rate similar to that of RBM companies, Dr. Duszak said. A January 2011 *JACR* study concluded that targeted use of imaging CDS is associated with large decreases in the inappropriate utilization of lumbar MR imaging for back pain, head MR imaging for headache and sinus CT for sinusitis. A study published in April 2009 in *Radiology* found substantial decreases in the growth of outpatient CT and ultrasound procedure volume coincident with CPOE implementation.



Duszak

Radiologist Consultation Reduces Radiation Exposure

Nevertheless, RBMs will continue to play a significant role in imaging utilization management for millions of consumers for the foreseeable future. Radiologists who consult for RBMs can make a big difference in reducing unnecessary radiation exposure by providing guidance to other physicians, experts say.

In a study presented at RSNA 2013, Mark D. Hiatt, M.D., M.B.A., executive medical director for Regence BlueCross BlueShield of Utah in Salt Lake City, examined the impact radiologists had when consulting for RBMs. Dr. Hiatt examined records of 5 million subscribers to a national health plan from 2009 to 2010. In that time, radiologist consultations led to the cancellation of more than 19,000 CTs and the changing of more than 5,000 CT exams to other modalities including MR and ultrasound, sparing patients the radiation equivalent to more than 7 million postero-anterior chest X-ray equivalents.

Dr. Hiatt, who is also presenting an RSNA 2014 session on RBMs (See sidebar), named three key reasons for inappropriate imaging: wrong choice of modality; incorrect timing; and incorrect protocol, such as when contrast media is used when a non-contrast approach may be more appropriate.

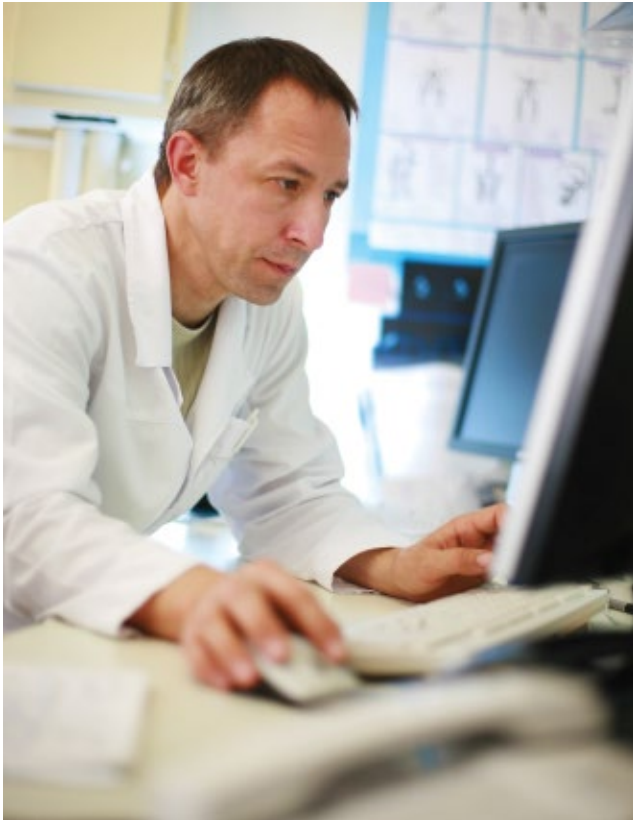
The results of Dr. Hiatt’s research show the impact radiologists may have in reducing unnecessary imaging by providing expert guidance to other physicians. “It’s always better to get the right test the first time rather than the second or third time,” Dr.

“Radiologists shouldn’t stay shut away in the dark room. They need to take ownership of their studies and be a part of the shared decision-making process.”

RICHARD DUSZAK JR., M.D.

of Health and Human Services must identify CDS tools to help physicians navigate appropriateness criteria. The American College of Radiology has long advocated for the use of CDS systems.

There is already mounting evidence suggesting that CPOE with CDS can decrease the frequency of inappropriate imaging at a rate similar to that of RBM companies, Dr. Duszak said. A



Left: Mounting evidence shows that computerized physician order entry software enhanced by real-time clinical decision support can decrease the frequency of inappropriate imaging at a rate similar to that of radiology benefit management companies.

Right: Radiologists may have a considerable impact in reducing unnecessary imaging by providing expert guidance to other physicians, research shows. In a study of the records of 5 million subscribers to a national health plan from 2009-2010, Mark Hiatt, M.D., M.B.A. (*above at RSNA 2013*), radiologist consultations led to the cancellation of more than 19,000 CTs and the changing of more than 5,000 CT exams to other modalities.

Hiatt said. "Encouraging adherence to guidelines saves millions of dollars while avoiding unneeded procedures and the negative consequences of false positives from those unnecessary tests."

Imaging Volume Shows Decrease

Overall, one recent study points to a reduction in imaging volume. A study in the July 2013 issue of *JACR* conducted by the Neiman Institute and co-authored by Dr. Duszak found that physicians are ordering diagnostic imaging exams as an increasingly lower percentage of their interactions with Medicare patients. The number of physician visits by patients 65 years of age or older resulting in an imaging exam dropped from 12.8 percent in 2003 to 10.6 percent in 2011, and Medicare spending per enrollee for imaging declined from \$418 in 2006 to \$390 in 2011.

While the numbers suggest that initiatives to reduce unnecessary imaging are paying off, there

is concern within the specialty about the effects these efforts will have on access to necessary examinations. "There have been so many efforts in recent years to decrease the cost of imaging and raise the bar to receive imaging, but at what point do we curtail imaging so much that we decrease access?" Dr. Duszak asked. "The answer to this will take years to play out."

In the meantime, radiologists will play an important role in ensuring that appropriate imaging remains accessible to patients, particularly through their interactions with referring physicians.

"Radiologists shouldn't stay shut away in the dark room," Dr. Duszak said. "They need to take ownership of their studies and be a part of the shared decision-making process." □

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

WEB EXTRAS

☑ Access the articles, "Utilization Management in Radiology, Part 1: Rationale, History, and Current Status," "Utilization Management in Radiology, Part 2: Perspectives and Future Directions," and "Effectiveness of Clinical Decision Support in Controlling Inappropriate Imaging," in the *Journal of the American College of Radiology*, at JACR.org.

☑ Access the study, "Effect of Computerized Order Entry with Integrated Decision Support on the Growth of Outpatient Procedure Volumes: Seven-year Time Series Analysis," in the April 2009 issue of *Radiology*, at RSNA.org/Radiology.

RBM's Focus of RSNA 2014 Session

Mark Hiatt, M.D., M.B.A., executive medical director for Regence BlueCross BlueShield of Utah in Salt Lake City, will present the lecture, "Radiologists Are from Mars, Radiology Benefit Managers Are from Venus: Secrets of Dealing with Radiology Benefit Management Companies," as part of the Hospital Administrator Symposium on December 3 at RSNA 2014.

Registration for this and all RSNA 2014 sessions is underway at RSNA.org/Register.



Patient-specific Dose System Moves Closer to Reality

BY BETH BURMAHL

While CT dose index (CTDI) and size-specific dose estimates (SSDE) for estimating and reporting patient radiation dose from CT are useful constructs, they share a common limitation that one researcher is working to overcome: lack of specificity.



“CURRENT METHODS for estimating and reporting radiation dose from CT examinations are largely patient-generic; knowledge of organ dose, the best indicator of cancer risk, is not available for individual patients,” said Xiang Li, Ph.D., an assistant physics professor at Cleveland State University. “Furthermore, current protocol designs rely on dose as a surrogate for the risk of cancer incidence, neglecting the strong dependence of risk on age and gender.”

In keeping with the growing effort to manage and track CT radiation, Dr. Li set out to create a dose-reporting system that provides estimates of radiation dose and potential cancer risk index specific to each patient and each CT exam. With the aid of a 2011 RSNA Presidents Circle Research Resident Grant, Dr. Li, then an imaging physics resident at Duke University Medical Center, launched the pilot phase of a research project that laid the foundation for her long-term goal of enabling patient-specific organ dosimetry (radiation dose and cancer risk index) for the entire spectrum of pediatric and adult CT exams.

“Such a system could guide individualized protocol optimization,” Dr. Li said. “For patients who undergo sequential exams, knowledge of dose and risk may also aid in deciding exam frequency.”

Under the supervision of two scientific advisors at Duke University Medical Center, Donald P. Frush, M.D., a professor of radiology and pediatrics, and Ehsan Samei, Ph.D., a professor of radiology, biomedical engineering, and physics, Dr. Li assessed organ dose and dose conversion coefficients for a wide range of clinical CT protocols. The research employed a database of digital human models created from clinical CT images. Monte Carlo programs were developed to accurately model CT systems and simulate organ dose for each human model and clinical protocol.

“For each protocol, we sought to determine the conversion coefficients from reference dose quantities (for example, CT dose index and dose-length product) to patient dose quantities (organ dose, effective dose and risk index). We further sought to correlate conversion coefficients with patient size, age and gender,” Dr. Li said.

Dr. Li’s research yielded a number of important findings, including the discovery that organ dose and effective dose conversion factors are exponential functions of patient diameter. Additionally, for a given gender, the risk index conversion factor is an exponential function of both diameter and age. Obesity also has a significant effect on dose and risk conversion coefficients that cannot be predicted using body diameter alone, research showed.

Among the most important outcomes, Dr. Li said, is the finding that SSDE is not an effective surrogate for organ dose and

that it generally overestimates organ dose for obese patients.

“This finding is important because it highlights the need for more accurate and rigorous methods for assessing organ dose from CT scans,” Dr. Li said. “Organ dose is the best indicator for the cancer risk of CT radiation.”

“Through Dr. Li’s systematic integration of patient specific-factors of age, gender and morphology, with detailed application of patient-based modeling of organ size and distribution and radiation exposure and dosimetry, we are gaining a much more detailed and relevant understanding of the limitations of some current dose and risk estimations, and tools that afford a more personalized approach to CT performance,” Dr. Frush said.



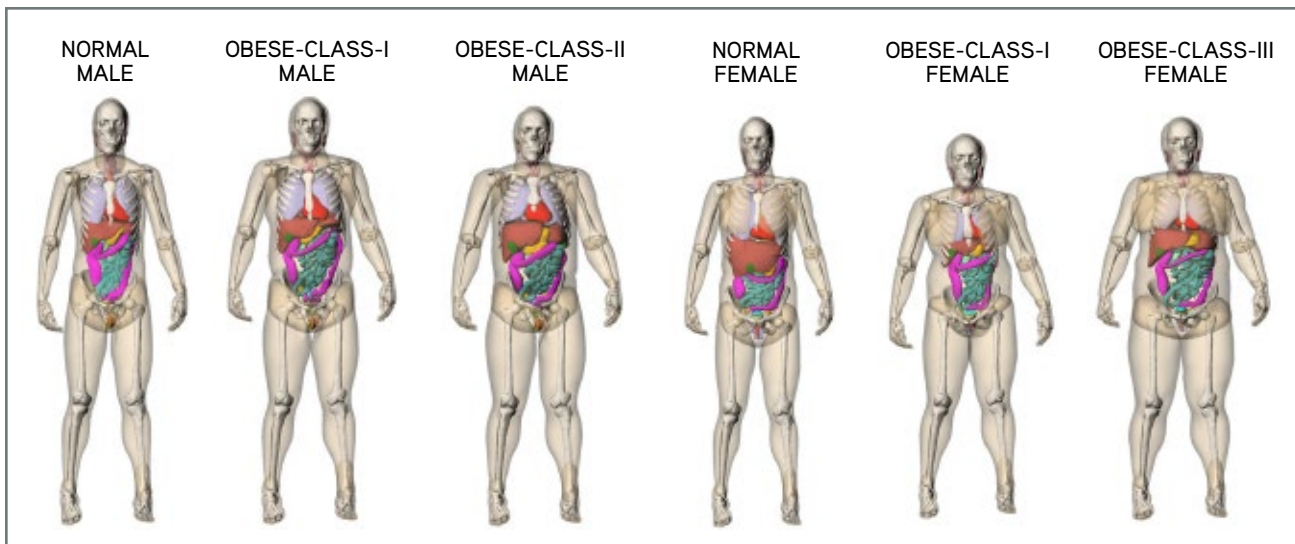
Li

RSNA Grant Spurs Further Research

Dr. Li’s preliminary results suggested the feasibility of estimating patient-specific dose and risk index in both pediatric and adult patients for various clinical CT protocols. The findings were the basis for larger studies with the goal of enabling a system of patient-specific dose estimation and reporting in CT. Her research, “The Effects of Protocol and Obesity on Dose Conversion Factors in Adult Body CT,” was published in the November 2012 issue of *Medical Physics* and was awarded the Farrington Daniels Award for Best Article on Radiation Dosimetry in 2012. Another study that grew from this RSNA grant, “The Impact on CT Dose of the Variability in Tube Current Modulation Technology: a Theoretical Investigation,” has been accepted for publication by *Physics in Medicine and Biology*.

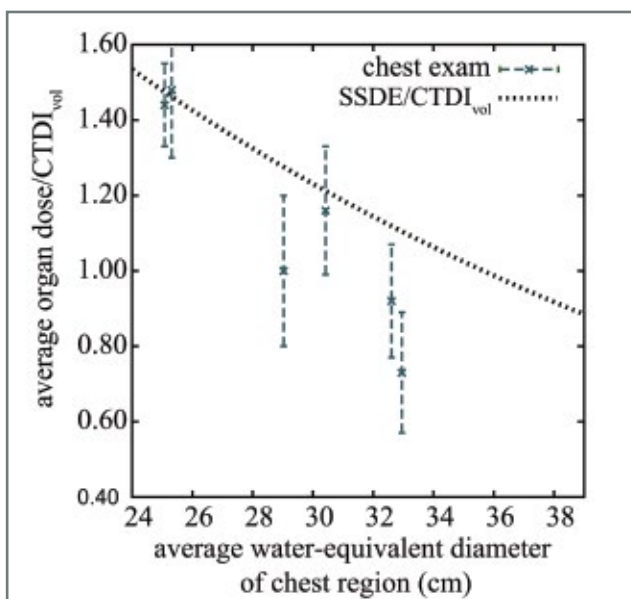
A third study co-authored by Dr. Li, “Dose Coefficients in Pediatric and Adult Abdominopelvic CT Based on 100 Patient Models,” was published in the December 2013 edition of *Physics in Medicine and Biology*.

Dr. Li said her RSNA grant has been invaluable to jumpstarting additional research that could eventually aid patients in a number of critical ways. Tracked over time, patient-specific dose estimates would allow the establishment of cumulative dose profiles for individual patients, while individual dose profiles could facilitate clinical decision making—especially in patients who require repeated imaging and who are genetically more radiosensitive.



With the aid of an RSNA Presidents Circle Research Resident Grant, Xiang Li, Ph.D., set out to create a dose-reporting system that provides estimates of radiation dose and potential cancer risk index specific to each patient and each CT exam. Above: An image from Dr. Li's research included six computational phantoms representing patients of different body mass index categories.

Li X, et. al., Effects of Protocol and Obesity on Dose Conversion Factors in Adult Body CT. *Med Phys*. 39(11):6550-71 (2012)



Dr. Li's research showed that size-specific dose estimates generally overestimate organ dose for obese patients.

sitive. The research could also improve the accuracy of software applications for mobile devices developed for estimating and tracking patient dose, Dr. Li said.

In addition, "patient-specific organ dose can be combined with patient-specific image quality to establish the tradeoff between the two for patients of various body sizes," Dr. Li said. "Such a quantitative tradeoff of 'benefit' versus 'risk' provides the most solid basis for designing size-based CT imaging protocols."

When realized, Dr. Li said, the research aims achieved through her RSNA grant "will not only contribute to the scientific knowledge of radiation in medical imaging, but also directly to the care, safety and management of patients." □

GRANTS IN ACTION:

NAME:

Xiang Li, Ph.D.

GRANT RECEIVED:

RSNA Presidents Circle Research Resident Grant

STUDY:

"Patient-specific Dosimetry in Pediatric and Adult Computed Tomography"

CAREER IMPACT:

"The RSNA grant has a significant influence on my career development," Dr. Li said. "Applying for the grant familiarized me with the grant application process including preparing the written materials, developing a budget and interacting with grant administrators. Further, the grant provided me with the opportunity to continue my line of research and gave me the confidence to seek funding from other sources. Most importantly, it boosted my research aspirations and my desire to pursue an academic career."

CLINICAL IMPLICATION:

"The work supported by the RSNA grant is an essential step towards achieving patient-specific organ dosimetry in routine clinical practice of medical imaging," Dr. Li said. "Patient-specific dose estimation and reporting are the most effective means to promote responsible use of ionizing radiation and increase accountability. They further allow cumulative dose recording for individual patients to facilitate clinical decision making, especially in patients who require repeated imaging."

BETH BURMAHL is the Managing Editor of *RSNA News*.

Image Viewer Tool Aids Online Radiology, RadioGraphics Experience

BY PAUL LATOUR

For the first time, online readers of *Radiology* and *RadioGraphics* have access to a unique, multifaceted image viewing tool to aid in their learning and understanding of the medical studies appearing in both journals.

THE RSNA IMAGE VIEWER, which debuted in June, gives users a rich new interface for viewing and comparing images. New capabilities include: comparing up to four images from the same article (two when using a tablet); zooming in and out of images or focusing on specific areas with the magnifier; and downloading images and captions to a PowerPoint deck to use for teaching or self-study. RSNA members can also save images as bookmarks in myRSNA® to access anytime. The tool is available for all articles in both journals.

“It is of the utmost importance for us to facilitate readers’ ability to look at, organize and manipulate images,” said *RadioGraphics* Editor Jeffrey S. Klein, M.D. “The new RSNA Image Viewer actually allows users to see and compare images in the same article. It provides functionality in new ways that parallel a diagnostic setting.”

The zoom function allows images to maintain their resolution upon magnification, so users can examine the type of subtle finding that might illustrate a mammographic study, for example.

Imaging Tool Built to Expand

A partnership with Atypon, a leading provider of specialty software to deliver online content, allowed RSNA to create the tool, which is available for all articles in both journals. It also allows for future expansion of the tool to continue efforts to recreate a diagnostic setting for radiologists.

One such tool could offer a way to mimic how radiologists examine stacks of images for a particular cross-sectional study. Eventually the Image Viewer will let users display an entire stack

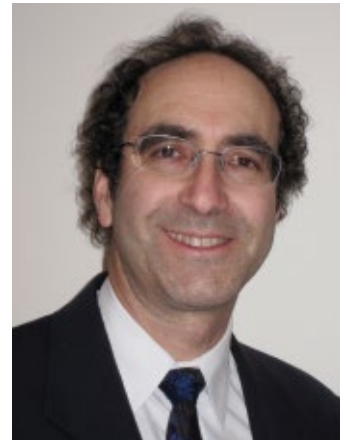
of images in a cine fashion, which is a motion-picture record of successive images.

The ability to compare images from previous published papers or from studies in the same issue of the journals is also being developed. Another upcoming feature includes the ability to use the gray-tone window/level settings, which cannot be done with a static image.

“Other features we are going to build into this will have significant educational possibilities in assessing whether our readers, when reviewing our papers, are actually learning where to find the abnormalities or how to describe them, Dr. Klein said.

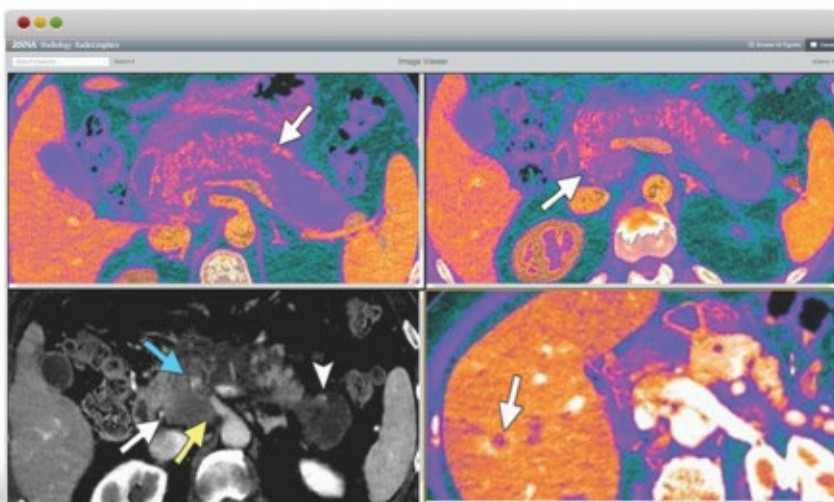
“This is RSNA’s tool, so we really have a lot of control over how it evolves and what features we want it to have. Whatever functionality is built into it is going to be geared toward those people who read our journal,” he added.

A tutorial of the Image Viewer can be found at RSNA.org/ImageViewer. □



Klein

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



“The new Image Viewer actually allows users to see and compare images in the same article.”

JEFFREY S. KLEIN, M.D.

SPECIAL CENTENNIAL SUPPLEMENT OF *RADIOLOGY* EXPLORES THE EVOLUTION OF IMAGING



Kressel

As RSNA prepares to celebrate its first 100 years, *Radiology* editors are offering an RSNA Centennial supplement to the journal, "*Radiology: Exploring the Evolution of Imaging*," featuring 10 review articles that highlight the evolution of imaging during RSNA's history. "*Radiology: Exploring the Evolution of Imaging*," will appear as a complimentary supplement to the November issue online and in print.

In an introduction to the supplement, *Radiology* Editor Herbert Y. Kressel, M.D., and Senior Deputy Editor Deborah L. Levine, M.D., stress the importance of using the journal to reflect on radiology's past and the dramatic changes in imaging and its role in medicine.

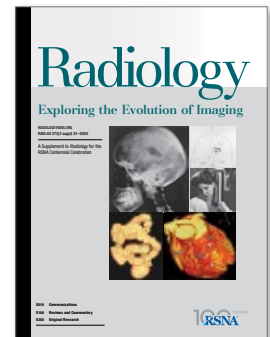
"For this centennial celebratory edition, we asked authors to provide a scientific narrative of the development of imaging approaches to diagnosis and management, highlighting key inflection points in the history of imaging, and using original images published in our journal to highlight their important points," Drs. Kressel and Levine write. "The selection of topics for articles was in many ways subjective, since every area of our field has shown remarkable change in the past nine decades that span our journal's history."

The articles are tied together by the themes of initial observations leading to more scientific discovery, technical development and growth of clinical applications. They are:

- "The Role of Radiology in the Evolution of the Understanding of Articular Disease," Mark Schweitzer, M.D., and Mingquan Huang M.D.
- "The Evolution of Breast Imaging: Past to Present," Bonnie Joe, M.D., Ph.D., and Edward Sickles, M.D.
- "CT: Revolutionizing the Practice of Medicine for 40 Years," Geoffrey Rubin, M.D.
- "Interventional Radiology: A Half Century of Innovation," Stanley Baum, M.D., and Richard Baum, M.D.
- "The History of Imaging Obstetrics," Carol Benson, M.D., and Peter Doubilet, M.D., Ph.D.
- "The History and Evolution of Brain Tumor Imaging: Insights through Radiology," Mauricio Castillo, M.D.
- "The Imaging of Renal Masses," Bruce McClennan, M.D.
- "The History of Cardiac Imaging," Albert de Roos, M.D., and Charles Higgins, M.D.
- "History, Evolution, and Current Status of Radiologic Imaging Tests for Colorectal Cancer Screening," Marc Levine, M.D., and Judy Yee, M.D.
- "The History of MR Imaging as Seen Through the Pages of *Radiology*," Robert Edelman, M.D.

Members and subscribers who receive print copies of *Radiology* will automatically receive a printed copy of the supplement with their November issue. Members who have opted out of receiving print issues can request a free copy of the supplement online at RSNA.org/centennial-supplement/ until September 30. After that, there will be a \$25 fee (U.S., Canada, Mexico); \$37 international. Non-member subscribers who do not receive the print issue can purchase a copy via the website for \$40 (U.S., Canada, Mexico); \$52 international.

The supplement will also be available for purchase at the RSNA Store during the Annual Meeting. Podcasts with the authors will be available at pubs.rsna.org/page/radiology/podcasts.



COMING NEXT MONTH The legacy of imaging research in *Radiology* will be the focus of an October-November My Turn column by *Radiology* Senior Deputy Editor Deborah Levine, M.D.

RSNA 2014 Sessions Focus on Peer Review Process

The peer review process is included in RSNA 2014 sessions including:

- **"Reviewing Manuscripts for the RSNA Journals" (Sponsored by the RSNA Publications Council), Thursday, Dec. 2.** *Radiology* Editor Herbert Y. Kressel, M.D., and *RadioGraphics* Editor Jeffrey S. Klein, M.D., will discuss similarities and differences in the peer review process for RSNA journals. Topics include the functions of the reviewer in the peer process, desired elements for peer review of a manuscript and how a reviewer can receive *AMA PRA Category 1 CME* credit for manuscript review.
- **"RadioGraphics' Publication Information for Potential Authors," Thursday, Dec. 2** *RadioGraphics* Editor Jeffrey S. Klein, M.D., will discuss the publication process including content elements, figure preparation and format compliance. The session includes a live demonstration of the steps involved in submitting a manuscript through the *RadioGraphics* site in ScholarOne Manuscripts.

More information on *Radiology* and *RadioGraphics* will be available at the Journals Booth in RSNA Services at RSNA 2014. Registration for all RSNA 2014 sessions is underway at RSNA.org/Register.



Explore Chicago During RSNA 2014

Don't let the chance to explore Chicago pass you by at RSNA 2014. Peruse our annual roster of Chicago events for everything from world-class museums to dazzling architecture to artwork and much more. We also include Our Insider's Guide to Chicago's Best Deals, featuring the many free activities available in the Windy City.

MUSEUMS

Chicago History Museum

This collection dates from 1856, approximately 25 years after the founding of Chicago, and was started with the intent to help research and interpret the city's history. The museum brings to life many aspects of Chicago's past, including the Great Chicago Fire of 1871, the rise of Chicago's Chinatown and the life and times of Abraham Lincoln. Details on neighborhood tours, lectures, performances and events are available on the website.

- 1601 N. Clark St.
1-312-642-4600
www.chicagohs.org

Museum of Contemporary Art

The largest museum of contemporary art in the world, the MCA displays a variety of Post-World War II art including paintings, sculptures, photographs and video installations. MCA will feature the special exhibit "David Bowie Is," with more than 300 objects brought together from the David Bowie Archive for the first time. Other exhibits include "BMO Harris Bank Chicago Works: Sarah and Joseph Belknap," and "Anne Collier."

- 220 E. Chicago Ave.
1-312-280-2660
www.mcachicago.org

DuSable Museum of African American History

A special museum dedicated to collecting and preserving the history of African Americans, this nearly 50-year-old institution is the first of its kind in the U.S. It features exhibits on salient historical topics such as civil rights as well as work by African-American artists.

- 740 E. 56th Pl.
1-773-947-0600
www.dusablemuseum.org

Garfield Park Conservatory

Enjoy the holiday flower show in one of the world's largest gardens under glass, built at the turn of the last century. The conservatory is famous for its prairie waterfall set among stone and water landscapes.

- 300 N. Central Park Ave.
1-312-746-5100
www.garfield-conservatory.org

Shedd Aquarium

As the world's largest indoor marine animal facility and home to 32,000 animals, the Shedd Aquarium offers an array of exhibits from adorable sea otters to vicious piranhas and allows visitors the chance to pet a sea star. The popular dolphin and Beluga whale show takes place in the Oceanarium amphitheater and sharks can be found in the Wild Reef. Enjoy the high-tech 4D Experience in the Phelps Auditorium while Jellies demonstrates how sea jellies hunt and grow exponentially.

- 1200 S. Lake Shore Dr.
1-312-939-2438
www.sheddaquarium.org

Art Institute of Chicago

Renowned for its Impressionist and Post-Impressionist collection as well as its Depression-era American paintings, the Art Institute boasts a 260,000 piece-collection representing 5,000 years of art from around the globe. Don't miss the Modern Wing, which exhibits early 20th Century European Art.

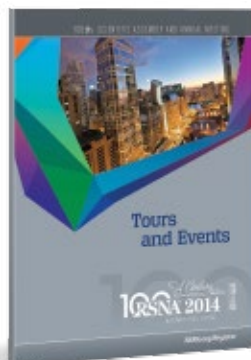
Special exhibitions include: "Chicagoisms," key historical principles that have powered the city's distinctive evolution; "Heaven and Earth: Art of Byzantium from Greek Collections," "Ghosts And Demons in Japanese Prints," an exhibition of Japanese prints including Hokusai's series, "One Hundred Stories (Hyaku monogatari)" and depictions of Shoki the Demon Queller. Another exhibition, "Temptation: The Demons of James Ensor," includes Ensor's "The Temptation of Saint Anthony"—meticulously restored and on view for the first time outside Belgium.

- 111 S. Michigan Ave.
1-877-307-4242
www.artic.edu
www.ticketmaster.com

Peggy Notebaert Nature Museum

The Notebaert welcomes children of all ages to explore nature in unusual and innovative ways. Permanent exhibits include The Birds of Chicago, the Birth of Chocolate, Extreme Green House, Istock Family Look-in Animal Lab, Judy Istock Butterfly Haven, Mysteries of the Marsh, Nature's LunchBox, River-Works and the Wilderness Walk. Visitors seven years of age and younger are invited to enjoy the Hands-on Habitat.

- 2430 N. Cannon Dr.
1-773-755-5100
www.naturemuseum.org



RSNA Tours and Events

RSNA is sponsoring a series of tours and events during RSNA 2014. The RSNA Tours & Events brochure is available at RSNA.org/Register.

Look for the RSNA Tour icon next to event listings in this article, signifying that a pre-arranged RSNA package is available. Enroll for tours and events online when registering for the annual meeting or while adding courses.

Museum of Science and Industry

The only remaining building from the 1893 World's Columbian Exposition, the museum is packed with one-of-a-kind exhibits: one of two U-505 German submarines captured during World War II; a realistic coal mine; the multilevel Science Storms exhibit, complete with a vapor tornado and tsunami tank; and the Henry Crown Space Center featuring Apollo 8. Also not to be missed is the Colleen Moore Fairy Castle. Annual seasonal exhibits include the Christmas Around the World and Holidays of Light.

- 57th St. and Lake Shore Dr.
1-773-684-1414
www.msichicago.org

Field Museum of Natural History

Upon entering, visitors will encounter Sue, the world's largest and most complete Tyrannosaurus Rex fossil. The natural history museum has something for everyone, from taxidermal animals and dioramas to Egyptian mummies and a memorable dinosaur exhibit. Stop by this year's special exhibits, "Bunky Echo-Hawk: Modern Warrior," "Vodou: Sacred Powers of Haiti," "The Machine Inside: Biomechanics," "Tiny Giants 3D," and "Titans of the Ice Age 3D."

- 1400 S. Lake Shore Dr.
1-312-922-9410
www.fieldmuseum.org

Lincoln Park Conservatory

Built in the late 1800s, the conservatory originally provided visitors a chance to view exotic plants and grew most of the specialized horticulture for Chicago's parks. Today, visitors can stroll among the four display houses: Fern Room, Orchid House, Palm House and Show House, where the Christmas show is hosted.

- 2391 N. Stockton Dr.
1-312-742-7736
www.chicagoparkdistrict.com

Millennium Park Ice Rink

The McCormick Tribune Plaza & Ice Rink is located just off Michigan Avenue in the shadow of the Cloud Gate sculpture, affectionately called "The Bean." The Park Grill's windows look out on the rink. Skating is free and skate rental is available.

- East side of Michigan Avenue between Washington and Madison streets
1-312-742-1168
www.millenniumpark.org

Daley Bicentennial Plaza Ice Rink

Located across Millennium Park's snake-like BP Pedestrian Bridge is a secluded ice rink with far fewer skaters than the well-known Millennium Park rink. The facility offers free skating, skate rental and a warming building.

- South side of East Randolph Street between Columbus Drive and Lake Shore Drive
1-312-742-7650
www.chicagoparkdistrict.com



"David Bowie Is"

THEATER

"The Testament of Mary"

The 2013 Tony Award nominee for Best Play recounts Mary's narrative of the last days in the life of her son, Jesus.

- Victory Gardens Theater
2433 N. Lincoln Ave.
1-773-871-3000
www.victorygardens.org

"Iphigenia in Aulis"

As the Greek army restlessly paces the silent shores of Aulis, King Agamemnon is faced with a harrowing decision. In return for the winds that would carry his army to victory over Troy, the goddess Artemis has demanded the impossible: the sacrifice of the King's own daughter, Iphigenia.

- Court Theatre
5535 S. Ellis Ave.
1-773-753-4472
www.courttheatre.org

Late Nite Catechism

This witty performance examining the Baby Boomer parochial school experience is a longtime favorite among those taught by nuns and also serves as a wry introduction to Catholicism.

- Royal George Theatre
1641 N. Halsted St.
1-312-988-9000
www.ticketmaster.com

Shedd Aquarium



Continued on Next Page



"A Christmas Carol"

"Pericles"

Pericles embarks on a tempest-tossed quest in search of adventure, wealth and family. As he travels to parts unknown, our hero is confronted by villains, pirates, goddesses and kings. In the end, he discovers an essential truth—the renewal of love and life itself.

- Chicago Shakespeare Theater
800 E Grand Ave.
1-312-595-5600
www.chicagoshakes.com

The Second City

Second City is the comedic training ground for many of today's favorite comedians. Shows are scheduled on both the Main Stage and the smaller ETC stage, combining short comedy sketches and improvisation. Cocktails and food are served during performances.

- Main Stage and ETC stage
1616 N. Wells St.
1-312-337-3992
www.secondcity.com

Tommy Gun's Garage

This interactive dinner theatre set in the Roaring Twenties features Prohibition-era gangsters and flappers in a musical comedy show.

- Tommy Gun's Garage
2114 S. Wabash St.
1-312-225-0273
www.tommygunsgarage.com

Up Comedy Club

Catch the best of stand-up comedy or see an improv show created by Second City producers at the new Up Comedy Club. Cocktails and food are served during the performance.

- Piper's Alley
230 W. North Ave., Third Floor
1-312-662-4562
www.upcomedyclub.com

"Danny Casolaro Died For You"

The true story of Danny Casolaro, a freelance reporter investigating high-level corruption in the Reagan/Bush Justice Department. A year into uncovering information, Casolaro was found dead in a Virginia motel room.

- TimeLine Theatre
615 W. Wellington Ave.
1-773-281-8463
www.timelinetheatre.com

"Ghost Brothers of Darkland County"

Nov. 28

A haunting tale of fraternal love, lust, jealousy and revenge, performed by an ensemble cast of 15 actors and a four-piece live band comprising members of rocker John Mellencamp's band.

- Ford Oriental Theatre
24 W. Randolph St.
312-977-1700
www.ticketmaster.com

Zanies Comedy Night Club

Chicago's favorite for stand-up comedy. Enjoy comedians from Comedy Central, HBO and the Tonight Show in Zanies' intimate atmosphere.

- Zanies
1548 N. Wells St.
1-312-337-4027
www.chicago.zanies.com

FAMILY PERFORMANCES

A Christmas Carol

For more than 35 years, the Goodman Theatre has presented this timeless Dickens classic during the holiday season.

- Goodman Theatre
170 N. Dearborn St.
1-312-443-3800
www.goodmantheatre.org

RSNA
TOURS

The Blue Man Group

A vibrant event blending flashing lights, comedy, loud music—and yes, blue men—for one unique experience. Shows are unique to each city. Children under five not admitted.

- Briar Street Theatre
3133 N. Halsted St.
1-773-348-4000
www.blue.com
www.ticketmaster.com

RSNA
TOURS

Dee Snider's Rock & Roll Christmas Tale

The story of Däisy Cütter, a heavy metal bar band looking to make it big even though the '80s are long over.

- Broadway in Chicago's Broadway Playhouse at Water Tower Place
175 E. Chestnut St.
Chicago, IL 60611
1-773-935-7100
www.broadwayinchicago.com



"Porgy and Bess"

SYMPHONY AND OPERA

LYRIC OPERA OF CHICAGO

The historic and renovated art-deco Civic Opera House is the perfect setting to see the renowned Lyric Opera of Chicago. Free lectures are offered one hour before every performance.

"Porgy and Bess"

Nov. 26 & 28 and Dec. 2, 5, 8, 11 & 13

The great American opera, bursting with iconic songs that have moved easily into the worlds of jazz and pop, becoming hits generation after generation.



"Anna Bolena"

Dec. 6, 9, & 12

Anne Boleyn may be Queen of England, but she doesn't stand a chance. Henry VIII wants her gone, with Jane Seymour taking her place on the throne and in his bed. And Henry's minions do the dirty work, finding "proof" of Anne's infidelities.

- 20 N. Wacker Dr.
1-312-332-2244 x5600
www.lyricopera.org

CHICAGO SYMPHONY ORCHESTRA

CSO at the Movies: Pixar in Concert

Nov. 28, 29 & 30

Memorable scores from Pixar's 14 films including "Up," the "Toy Story" trilogy and their latest release, "Monsters University," played live with visually stunning clips of some of the most beloved characters in cinematic history.

Special Event: Vienna Boys Choir

Nov. 29

The Vienna Boys Choir returns for its annual Thanksgiving performance, filled with holiday favorites, secular music and popular folk songs.



A Chanticleer Christmas

Dec. 2 & 3

Grammy Award winning a cappella group. Note: This performance will be at Fourth Presbyterian Church.

- 126 E. Chesnut St.

"The Nutcracker" and "Petrushka"

Dec. 4, 5, 6, 9

Hear excerpts from this beloved ballet alongside Stravinsky's "Petrushka," which depicts the misadventures of a hapless puppet in pursuit of a beautiful ballerina.

Jazz Series

Dec. 5

SCP Jazz Series: Kenny Barron and Dave Holland/Julian Lage and Chris Eldridge. Some of the hottest and most versatile players in jazz perform.

- 220 S. Michigan Ave.
1-312-294-3000
www.cso.org

FAMILY ACTIVITIES

American Girl Place

Beyond the shopping frenzy the American Girl experience can include dining, book signings, cooking classes and the popular doll hair salon.

- Water Tower Place
835 N. Michigan Ave
1-877-247-5223
www.americangirl.com

Chicago Children's Museum

Children of every age experience interactive learning through 15 permanent hands-on exhibits that range from dinosaurs to art, water play to fire safety, climbing to commerce. Daily activities offer even more focused learning opportunities.

- 700 E. Grand Ave. (Navy Pier)
1-312-464-7732
www.chicildrensmuseum.org

John Hancock Observatory

This observatory experience on the 94th floor begins with a ride on the fastest elevator in North America and includes an open-air skywalk, free multimedia sky tour and the first interactive telescopes in the U.S.

- 875 N. Michigan Ave.
1-888-875-VIEW

Navy Pier IMAX Theatre

The Navy Pier IMAX theatre will announce its complete holiday film schedule in late autumn.

- 700 E. Grand Ave.
1-312-595-5MAX
www.imax.com/chicago

Lincoln Park Zoo

One of the nation's last free zoos, and one of its oldest, the Lincoln Park Zoo is conveniently located in nearby Lincoln Park. Walk through the zoo at night with the holiday-themed ZooLights festival on Friday through Sunday evenings.

- 2200 N. Cannon Dr.
1-312-742-2000
www.lpzoo.com

Skydeck Chicago at Willis Tower

At 1,353 feet above the ground, Skydeck Chicago in Willis Tower, the tallest building in the Western Hemisphere, offers views up to 60 miles. If you dare, venture out onto The Ledge, four glass-enclosed—and glass-bottomed—boxes outside the building.

- 233 S. Wacker Dr.
Enter Skydeck on Jackson Boulevard
1-312-875-9447



Lincoln Park Zoo



The Insider's Guide to Chicago's Best Deals

Many Chicago museums offer free admission on select days. With some smart scheduling, you can visit many of the city's top attractions for little to no money. Here is a rundown of some of the best deals in town:

Free as indicated:

- **Museum of Contemporary Art**
220 E. Chicago Ave.
(Tuesday for Illinois residents)
- **Clarke House Museum**
1827 S. Indiana Ave.
(Free tours on Wednesday)
- **DuSable Museum of African American History**
740 E. 57th Pl. (Sunday)
- **Glessner House Museum**
1800 S. Prairie Ave.
(Free tours on Wednesday)
- **Art Institute of Chicago**
11 S. Michigan Ave.
(Thursday, 5–8 p.m. for Illinois residents)
- **Charnley-Persky House Museum**
1365 N. Astor St. (Wednesday)
- **Chicago Children's Museum at Navy Pier**
700 E. Grand Ave. (Thursday, 5–8 p.m. for all and first Sunday of each month for ages 15 and younger)
- **Notebaert Nature Museum**
2430 N. Cannon Dr.
(Thursday are suggested donation days for Illinois residents)
- **Shedd Aquarium**
1200 S. Lake Shore Dr., (December 6-7, one free mini-pass admission to those who present a valid Bank of America/Merrill Lynch ATM, credit or debit card, along with photo ID.)

Always free:

- **Chicago ArchiCenter**
224 S. Michigan Ave.
- **Chicago Cultural Center**
78 E. Washington St.
- **City Gallery at the Historic Water Tower**
806 N. Michigan Ave.
- **Lincoln Park Conservatory**
2391 N. Stockton Dr.
- **Lincoln Park Zoo**
2200 N. Cannon Dr.
- **Millennium Park Welcome Center**
201 E. Randolph St.
- **Museum of Contemporary Photography**
600 S. Michigan Ave.
- **National Museum of Mexican Art**
1852 W. 19th St.
- **Navy Pier**
600 E. Grand Ave.
- **Smart Museum of Art**
5550 S. Greenwood Ave.

Macy's Holiday Windows

Walk outside alongside the Macy's store at 111 N. State St. to view animated holiday scenes. Afterward, stop in for lunch at the Walnut Room and view the store's spectacular Christmas tree.

McDonald's Thanksgiving Parade

Spend Thanksgiving morning with marching bands, enormous inflatables, floats, and Santa Claus and Ronald McDonald. This annual parade travels down State Street from 8 to 11 a.m.

Christkindlmarket Chicago and the Santa House

One of Chicago's most popular holiday events is Christkindlmarket Chicago, a traditional German open air market offering authentic German food, drink and wares. Christkindlmarket is free and is located on Daley Plaza between Washington and Dearborn Streets.

Caroling at Cloud Gate

Nov. 28 & Dec. 5

'Tis the season for caroling! Exercise your pipes with some fun holiday singing on Friday nights at Millennium Park, 201 E. Randolph St., on Michigan Avenue between Randolph and Monroe.

Maxwell Street Market

Nov 30 & Dec. 7

Visit this historic outdoor market at 800 S. Desplaines St., to explore an eclectic mix of food and merchandise. The market is a Chicago tradition of bargains and bargaining.

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Journal Highlights

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

CT and MR Imaging Diagnosis and Staging of Hepatocellular Carcinoma

The ability of CT and MR imaging with extracellular agents to identify and differentiate cirrhotic nodules, low-grade dysplastic nodules, high-grade dysplastic nodules and early hepatocellular carcinoma (HCC) is limited. However, hepato-

biliary phase MR imaging shows promise for characterizing precursor lesions and for identifying high-grade dysplastic nodules and early HCCs prior to neo-arterialization and progression to overt HCC. In the first of a two-part review in the September issue of *Radiology* (RSNA.org/Radiology), Jin-Young Choi, M.D., of the Research Institute of Radiological Science in Seoul, South Korea, and colleagues discuss key concepts of HCC development, growth and spread, emphasizing those features with imaging correlates and hence most relevant to radiologists. Also discussed are state-of-the-art CT and MR imaging techniques with extracellular and hepatobiliary contrast agents and the imaging appearance of precursor nodules that eventually may transform into overt HCC.

Multiphase CT and MR imaging with extracellular agents permit diagnosis of HCC based mainly on assessment of vascularity, the authors write. Critical contrast-enhanced phases include the late arterial, portal venous and delayed phases. MR

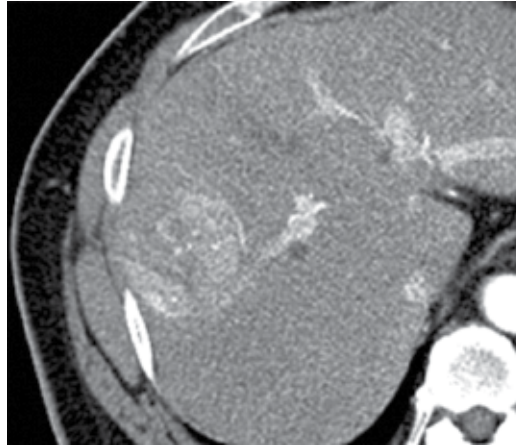


Image of a 51-year-old man with HCC and hepatitis B-related cirrhosis: multiphase CT technique. Late hepatic arterial phase image shows heterogeneously hyperenhancing mass with mosaic architecture in segment 8. Notice enhancement of hepatic artery and portal vein branches in late hepatic arterial phase. Hepatic veins are not enhanced.

(*Radiology* 2014;272;3:InPress) ©RSNA 2014 All rights reserved. Printed with permission.

imaging with the hepatobiliary agents gadobenate dimeglumine and gadoxetate disodium, they note, provides information on hepatocellular function in addition to vascularity. The delay required for the hepatobiliary phase depends on the agent.

"Due to its rapid uptake by hepatocytes, gadoxetate disodium does not provide a conventional delayed phase but instead provides a transitional phase in which the intracellular and extracellular pools both contribute to parenchymal enhancement," the authors write.

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

US for Diagnosis of Musculoskeletal Conditions in the Young Athlete: Emphasis on Dynamic Assessment

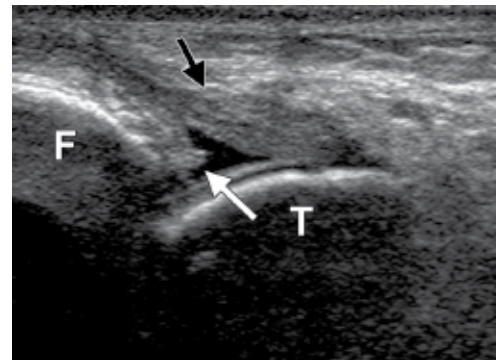
The dynamic capability of ultrasonography (US) is ideal for diagnosing many conditions that affect the musculoskeletal system of the young athlete, many of which would be difficult or impossible to identify using other imaging modalities.

In an article in the September-October issue of *RadioGraphics* (RSNA.org/RadioGraphics), Andrew M. Zbojniec, M.D., of Cincinnati Children's Hospital Medical Center, reviews the utilization of US in the diagnosis of musculoskeletal conditions that affect young athletes, with emphasis on the role of dynamic US assessment. Specifically, Dr. Zbojniec discusses the types of pathologic musculoskeletal conditions encountered in young athletes, case examples of specific conditions and suggested techniques for US assessment to identify these conditions.

Many congenital variations occur throughout the body that can result in an awkward sensation of snapping, popping or clunking. Although these conditions frequently are asymptomatic in the general population, they may become painful and result in activity limitations, particularly in athletes.

"Ultrasonography can be used for diagnosis of musculoskeletal conditions in the young athlete and includes static assessment—which is used to characterize conditions such as tendinosis—and dynamic assessment, which is useful for diagnosing conditions such as joint instability, snapping hip syndrome, snapping triceps syndrome and snapping knee syndrome," Dr. Zbojniec writes.

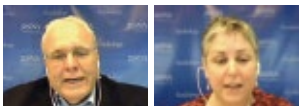
RadioGraphics



ATFL tear and instability in a 16-year-old female soccer player who presented with right ankle laxity five months after injury. Longitudinal US image shows discontinuity of the ATFL, with a small stub of ligamentous tissue still attached to the fibular footprint (white arrow). The ligament also shows loss of the normal fibrillar pattern, decreased echogenicity, and abnormal tapering near the fibula (F) (black arrow), findings consistent with prior tearing and subsequent degeneration. T = tibia.

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Listen to *Radiology* Editor Herbert Y. Kressel, M.D., deputy editors and authors discuss the following articles in the July issue of *Radiology* at pubs.rsna.org/page/radiology/podcasts:

- “Cell Therapy in Reperfused Acute Myocardial Infarction Does Not Improve the Recovery of Perfusion in the Infarcted Myocardium: A Cardiac MR Imaging Study,” Lourens F.H.J. Robbers, M.D., and colleagues.
- “Repeatability of Diagnostic Features and Scoring Systems for Hepatocellular Carcinoma by Using MR Imaging,” Matthew S. Davenport, M.D., and colleagues.
- “Effect of Diabetes on Brain Structure: The Action to Control Cardiovascular Risk in Diabetes MR Imaging Baseline Data,” R. Nick Bryan, M.D., Ph.D., and colleagues.

Study Guides Available for *Radiology* and *RadioGraphics* SA-CME Tests

Readers of *Radiology* and *RadioGraphics* are invited to access study guides for journal articles that have accompanying SA-CME tests. The printable guides highlight pertinent information, helping test-takers prepare as they read the articles.

To access a study guide for an article offering SA-CME, find the article online at RSNA.org/Radiology or RSNA.org/RadioGraphics. Click the SA-CME Test button to be redirected to the *RSNA.org* website, log in and open the test. Click Study Guide at the top of the screen to access the printable guide



Research & Education Foundation Donors

Continued From Page 18

YOUR DONATIONS IN ACTION

Grant Recipient Will Develop Problem-based Educational Material for Medical Physics Residency Training

The 2014 American Board of Radiology (ABR) requirement for medical physicists to complete an accredited two-year residency program has resulted in a 30 percent increase in medical physics residency programs over the past two years. Compared to their physician colleagues, there is a lack of publically available problem-based learning (PBL) resources for medical physics education.

With an RSNA Education Scholar Grant, **Jonathon A. Nye, Ph.D.**, assistant professor and program director for Medical Physics Imaging Residency at Emory University, will develop PBL teaching material based on clinical cues appropriate for medical physicists.

“We plan to accomplish this effort by developing 20 problem-based learning modules that will reinforce the underlying didactic knowledge of the American Association of Physicists in Medicine report on residency curriculum,” Dr. Nye said. “These materials will serve as tools for program directors and residents who wish to enhance their medical physics education.”



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Radiology in Public Focus

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

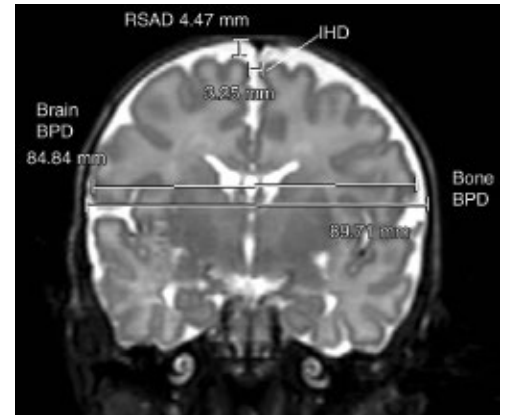
Moderate and Late Preterm Birth: Effect on Brain Size and Maturation at Term-Equivalent Age

Moderate and late preterm (MLPT) birth is associated with smaller brain size, less developed myelination of the posterior limb of the internal capsule and more immature gyral folding than those associated with full-term birth, new research shows.

Jennifer M. Walsh, M.B.B.Ch., of Royal Women's Hospital in Melbourne, Australia, and colleagues performed MR imaging exams on 199 MLPT and 50 term-born infants at 38 to 44 weeks of corrected gestational age. Researchers looked for signs of brain injury and compared the size and maturation of multiple brain structures in the two groups. Group differences were compared by using linear regression for continuous variables and logistic regression for categorical variables, and interrater and intrarater reliability were assessed by using intraclass correlation coefficients.

Compared with the term-born control group, measurements of brain biparietal diameter, corpus callosum, basal ganglia and thalami and cerebellum were smaller in infants in the MLPT group (all $P \leq .01$), while extracerebral space was larger ($P < .0001$). Myelination of the posterior limb of the internal capsule was less developed and gyral maturation was delayed in the MLPT group (both $P < .001$). Signal intensity abnormalities and cysts were uncommon in both groups, with 13 (6.5 percent) MLPT infants and one (2 percent) term infant demonstrating abnormalities. Inter- and intrarater reliability were good for most measures, with intraclass correlation coefficients generally greater than 0.68.

"These findings suggest that the expected trajectory of brain growth that would normally occur in the last approximately two months in utero may be disrupted by MLPT birth, and this disruption may help to explain the basis of the poorer long-term neurodevelopmental outcomes of MLPT infants," the authors write.



Coronal T2-weighted image shows brain and bone biparietal diameter (BPD), interhemispheric distance (IHD), right superior extra-axial distance (RSAD).

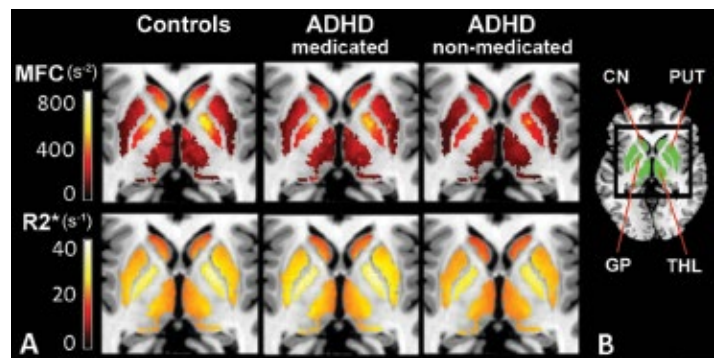
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Multimodal MR Imaging of Brain Iron in Attention Deficit Hyperactivity Disorder: A Noninvasive Biomarker That Responds to Psychostimulant Treatment?

Lower magnetic field correlation (MFC) indexes of striatal and thalamic brain iron in medication-naïve attention deficit hyperactivity disorder (ADHD) patients and lack of differences in psychostimulant-medicated patients suggest that MFC indexes of brain iron may represent a noninvasive diagnostic biomarker that responds to psychostimulant treatment, new research shows.

Vitria Adisetiyo, Ph.D., of the Medical University of South Carolina, Charleston, and colleagues prospectively examined 22 patients with ADHD (12 medication-naïve patients and 10 with a history of psychostimulant treatment) and 27 control subjects (age range, 8 to 18 years). Brain iron was indexed noninvasively using MR imaging relaxation rates (R_2 , R_2^* , R_2') and MFC in the globus pallidus, putamen, caudate nucleus and thalamus. Serum iron measures were also collected. Subgroup differences were analyzed with data-appropriate omnibus tests followed by post-hoc pairwise comparisons; false discovery rate correction was conducted to control for multiple comparisons.

Medication-naïve ADHD patients had significantly lower striatal and thalamic MFC indexes of brain iron than control subjects (putamen, $P = .012$; caudate nucleus, $P = .008$; thalamus, $P = .012$) and psychostimulant-medicated ADHD patients (putamen, $P = .006$; caudate nucleus, $P = .010$; thalamus, $P = .021$). Conversely, the MFC indexes in medicated patients were comparable to those in control subjects. No sig-



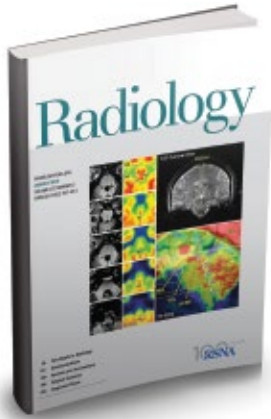
Subgroup averages of MFC and R_2^* . A: MFC and R_2^* parametric maps for 27 control subjects, 10 ADHD patients with a history of psychostimulant treatment (ADHD-medicated subgroup) and 12 medication-naïve ADHD patients (ADHD-nonmedicated subgroup). Qualitative differences between control subjects and ADHD subgroups are visible only on MFC maps. B: ROIs (green) used to mask parametric maps. CN = caudate nucleus, GP = globus pallidus, PUT = putamen, THL = thalamus.

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nificant differences were detected with R_2 , R_2^* , R_2' or serum measures.

"Our results implicate reduced striatal and thalamic brain iron levels in ADHD pathophysiology before medication and suggest that reduced brain iron levels may normalize with psychostimulant treatment," the authors write.

Media Coverage of RSNA



In June, 548 RSNA-related news stories were tracked in the media. These stories reached an estimated 298 million people.

Coverage included *The New York Times*, *U.S. News & World Report*, *Newsweek*, *WGN-TV (Chicago)*, *Examiner.com*, *The Washington Post*, *MSN.com*, *FOXNews.com*, *Yahoo! Health* and *Health.com*.

SEPTEMBER PUBLIC INFORMATION OUTREACH ACTIVITIES FOCUS ON OVARIAN, PROSTATE CANCERS

In recognition of Ovarian Cancer and Prostate Cancer Awareness Month in September, RSNA is distributing public service announcements (PSAs) focusing on risk factors, screening methods and possible treatment options for ovarian and prostate cancers.

The RSNA “60-Second Checkup” audio program, distributed to nearly 100 radio stations across the U. S., will focus on ovarian cancer awareness.

New on *RadiologyInfo.org*

Visit *RadiologyInfo.org*, the public information website produced by RSNA and the ACR, to read the latest content posted to the site on Skeletal Scintigraphy (Bone Scan). Access it at: Radiologyinfo.org/en/info.cfm?pg=bone-scan

RadiologyInfo.org

The radiology information resource for patients

Technology Forum

IHE Connectathon Moves to Cleveland for 2015

The IHE North American Connectathon is leaving its long-time Chicago home and moving to Cleveland for its 17th annual event to be held January 26-30, 2015, at the Healthcare Information and Management Systems Society (HIMSS) Innovation Center.

Sponsored by IHE USA in association with IHE Canada, the event allows vendors from across healthcare to test implementations of IHE Profiles and their ability to connect effectively with industry peers. Connectathon testing helps the health information technology (HIT) industry achieve the level of interoperability needed to meet the demands of healthcare providers and patients for convenient, secure access to electronic health records (EHRs).

The move to Cleveland will coincide with a continuing expansion of Connectathon testing offerings. This year's event will include the New



Directions testing track, designed for testing of innovative HIT applications still in development. Testing services offered in the New Directions track will be sponsored by IHE USA's partnering organizations in the healthcare IT industry. IHE USA is also currently offering a program of certification testing, now in its second year. The program is based on selected mature IHE profiles and provides increased testing rigor and product-level certification.

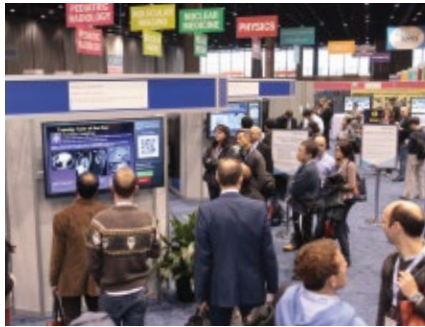
The event will continue to offer the conformance and interoperability testing of a broad array of HIT systems and IHE profiles.

For more information, go to ihe.net.



Annual Meeting Watch

A Century
of Transforming Medicine
100 RSNA® 2014



RSNA 2014 Registration

Internet

(fastest way)

Go to RSNA.org/Register

Telephone

(Mon.-Fri. 8 a.m. – 5 p.m. CT)

1-800-650-7018 • 1-847-996-5862

Registration Fees

BY NOV. 7	VIRTUAL	COMBO	
\$0	\$100	\$100	RSNA/AAPM Member
0	100	100	RSNA/AAPM Member Presenter
0	0	0	RSNA Member-in-Training, RSNA Student Member and Non-Member Student
0	300	300	Non-Member Presenter
180	300	480	Non-Member Resident/Trainee
180	300	480	Radiology Support Personnel
825	300	1,125	Non-Member Radiologist, Physicist or Physician
825	300	1,125	Hospital or Facility Executive, Commercial Research and Development Personnel, Healthcare Consultant and Industry Personnel
325	300	625	One-day registration to view only the Technical Exhibits

Important Dates for RSNA 2014

October 24	International deadline to have full conference badge mailed
November 7	Final housing and discounted registration deadline
November 26	Deadline to guarantee a seat for all ticketed courses
Nov 30 - Dec 5	100th Scientific Assembly & Annual Meeting

Enhance Your Experience with the Virtual Meeting

With the vast offerings RSNA 2014 provides, it's impossible to see it all at McCormick Place. Add the Virtual Meeting to your registration to access selected offerings, both live and on-demand. The Virtual Meeting is available during the meeting and on-demand until December 19 at 4 p.m. CST. Earn CME for select live sessions only; no CME credits are awarded for viewing on-demand sessions. Live sessions offer *AMA PRA Category 1 Credit™* and, new this year, Category A and A+ credit for technologists.

Virtual
100 RSNA® 2014



Guarantee Your Seat!

Tickets are required for various meeting components, including refresher and multisession courses, informatics workshops and RSNA tours and events. All ticketed courses must be confirmed prior to November 26 to guarantee a seat. There is no onsite course ticketing. Registrants without tickets will be allowed entrance into a course after all ticketed registrants have been seated. Enroll today at RSNA.org/Register.

Receive Registration Materials Prior to the Meeting

Register by November 7 to receive the discounted registration fee and full conference materials mailed to you in advance. (International visitors must register by October 24 to receive these materials in advance.) Registrations received after November 7 will be processed at the increased fee and conference materials must be obtained at the McCormick Place Convention Center.

Name Badge

Included in the conference materials is a name badge, required to attend RSNA courses or events or to enter the exhibit halls. RSNA will use radiofrequency identification (RFID) badge scanning technology within the Technical Exhibit Halls. No personal information is stored in the RFID badge, only an ID number. Those wishing to “opt out” of the program can visit one of the Help Centers located onsite in the Grand Concourse and Lakeside Center Ballroom on Level 3.



Spouse/Family Member Badge

Full conference professional registrants are entitled to one complimentary spouse/family member badge; each additional badge is \$50. This badge is intended for use by a spouse or family member (16 and over) accompanying a full conference professional registrant to the meeting. It allows access to technical exhibit halls, Learning Center, and classrooms, space permitting, after all professional registrants have been seated. CME credit is not tracked or awarded. A co-worker or industry associate is not eligible for this badge and must register as a professional and pay the applicable registration fee.

Arrange Childcare

To uphold the professional and educational standards of the RSNA annual meeting, children under 16 years of age are not permitted in the exhibit halls or sessions or issued a badge. Onsite childcare will be available for children six months to 12 years through ACCENT on Children's Arrangements, Inc.

Online registration and application forms are available at RSNA.org/ServicesAndFAQs (click childcare).

Reserve Your Room Now

RSNA contracts with 84 hotels offering the lowest room rates and flexible change and cancellation terms as well as an easy booking process. Booking through the RSNA supports the Society and creates cost benefits that are passed on to the attendee. Reserve your room now for the best selection; see the hotel list and room rates at RSNA.org/Register.



International Visitors

If you require a temporary non-immigrant visa to attend the RSNA Scientific Assembly and Annual Meeting, you are advised to apply as soon as U.S. travel is decided and no later than three to four months in advance of the travel date. RSNA offers an official, personalized letter of invitation for RSNA 2014 attendees. Information is available at RSNA.org/Visas.



Take Advantage of Exclusive Airline Discounts



No Blackout Dates; No Online Airline Service Fees

Save on airfare using the exclusive discounts offered by American Airlines, United Airlines and Delta Air Lines. To view the terms and conditions go to RSNA.org/PlanYourTrip.

5k Fun Run

**Tuesday, December 2, 6:30 a.m. Arvey Field,
South Grant Park, Chicago**

Enjoy a 5k event with your colleagues along Chicago's beautiful Lake Michigan shore and help fuel critical research.



During online registration or onsite at McCormick Place, you can sign up as a runner or walker for the 5k Fun Run. The signup donation of \$40 will benefit the RSNA R&E Foundation and is fully tax deductible. Participants receive a commemorative T-shirt.



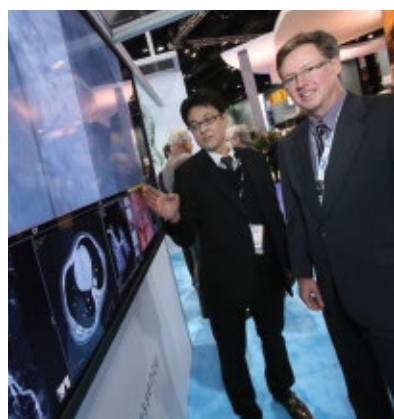
Enjoy the Sip & Savor Social

When registering for RSNA 2014, purchase tickets to the Sip & Savor Social celebrating RSNA's centennial on Wednesday, Dec. 3, 5 to 7 p.m., in the Skyline Ballroom at McCormick Place. Enjoy drinks, entertainment and tastings by some of Chicago's top restaurants. Tickets are \$40 (children under age 16 will not be admitted).

Sip & Savor
SOCIAL

RSNA Gears up for 2014 Technical Exhibits

The world's largest exhibition of radiology-related products, the 2014 RSNA Technical Exhibits will feature nearly 700 exhibitors from across the globe showcasing products of all kinds in every specialty. Shop and compare equipment supplies, devices and software exhibited by leading manufacturers, suppliers and developers of medical information technology—all under one roof.



Experience a special Technical Exhibits Grand Opening Ceremony on Sunday, November 30 at 11 a.m. in the Grand Concourse of McCormick Place.

Highlights of the 2014 Technical Exhibits:



- **Exhibitor Product Theater:** Discover new products, services and software systems from exhibitors.
- **Vendor Workshops:** Get hands-on tutorials of vendor software systems.
- **Publishers Row:** Shop for educational publications covering all areas of medical imaging.
- **IHE Image Sharing Demonstration:** See how software systems can communicate seamlessly across locations.

Go to RSNA.org/ExhibitingCompanies and search the interactive list of exhibitors and floor plan to find the companies you want to visit.

Value of Membership

Featured Benefit: *RSNA News*

Whether you prefer the print or online edition, free access to *RSNA News* is a premier benefit of RSNA membership.

For almost a quarter century, *RSNA News* has provided high-quality, timely coverage of radiology research and education and critical issues facing the specialty, along with comprehensive information about RSNA programs, products and other member benefits.

RSNA News online is now interactive with a section for comments following each article. Users are welcome to respond with questions or comments, to offer feedback about information presented or to stimulate respectful debate on an issue in the news. To leave a comment, users must sign in with their Facebook, Twitter or Google Plus accounts, or register with Disqus.

Look for the RSNA 2014 meeting preview issue of *RSNA News* next month. In it you will find everything you need to prepare for the world's premier medical meeting—previews of presentations in every subspecialty and a guide to the technology that will help you navigate the meeting, as well as a roundup of dining options for McCormick Place and in the city.

For more information on these and other *RSNA News* features, go to RSNA.org/News.



Online Refresher Course Offerings Continue to Grow

RSNA's collection of online SA-CME resources continues to grow, with more than 85 tablet-ready refresher courses now available at RSNA.org/library. Courses span 15 subspecialties and are free for RSNA members.

Among the newest additions are "Clinical Breast MR Imaging," "Advances in Cardiac Nuclear Imaging" and "Abdominal Incidentalomas." Courses are also available for those interested in earning an RSNA Quality Essentials Certificate, including "Quality Improvement: Radiologist Performance Improvement" and "Quality Improvement: Keeping our Customers Satisfied."

In addition, RSNA also offers several clinical-based courses focusing on specific conditions including, "Sports Injuries in the Chest and Abdominal Wall," "Brain Aneurysms" and "Pulmonary Thromboembolism."

Each online refresher course includes a visual presentation side-by-side with speaker commentary. Progress is dynamically tracked throughout the courses, which also feature an automatic bookmark function that saves your place so you can complete the course later.

An interactive CME test at the conclusion of the course allows users to enter their answers on-screen and receive immediate feedback. CME credits for RSNA members will automatically be entered into the user's personalized CME Repository on RSNA's website.

Access all of the course offerings at RSNA.org/library. Filter by "Refresher Courses." Newest courses appear with a blue "New" tag. Access for non-members can be purchased for \$50 per course.



RSNA Around the World

As part of RSNA's international outreach, the RSNA booth travels to international radiology conferences throughout the year. Later this year, the RSNA booth will travel to:

- Kobe, Japan—Asian Oceanian Congress of Radiology (AOCR)
September 24-28
- Seoul, Korea—Korean Congress of Radiology (KCR)
October 8-11
- Paris, France—Journées Françaises de Radiologie (JFR)
October 17-20

Education and Funding Opportunities

Grantsmanship Workshops

November 29, 2014
McCormick Place
Registration **Now Open**

Registration for the NIH Grantsmanship Workshop and RSNA/ARR Study Section Reviewers Workshop is now open.

The NIH Grantsmanship Workshop introduces participants to the process of preparing a competitive research or training grant application. Designed for junior faculty in academic centers who wish to pursue a career in radiologic research, this didactic workshop is led by a faculty of leading researchers with extensive experience in the grant application process.

The RSNA/ARR Study Section Reviewers Workshop, "What It Takes to Be an Expert Reviewer for the NIH: The Peer Review Process Demystified," prepares potential reviewers and grant authors with an overview of grant mechanisms, evaluation criteria and the skills needed to become a study section reviewer. The workshop provides insight into the reviewers' perspective, which may be helpful when responding to grant reviews. Each workshop features a mock study section.

The workshops will be held before the start of RSNA 2014 on Saturday, November 29, 2014, 1-5 p.m., at McCormick Place, Chicago. Registration is available via the RSNA annual meeting site at RSNA.org/Register. There is \$35 registration fee for each workshop.



Medical Meetings September - October 2014

SEPTEMBER 24-28

Asian Oceanian Society of Radiology (AOSR) & Japan Radiological Society (JRS), 15th Asian Oceanian Congress of Radiology (AOCR) and 50th Autumn Assembly of JRS, Kobe Convention Center, Japan
• www2.convention.co.jp/aocr2014
* Visit RSNA Booth

SEPTEMBER 25-27

European Society of Head and Neck Radiology (ESHNR), 27th Congress and Refresher Course, Palais du Pharo, Marseille, France
• www.eshnr.eu

SEPTEMBER 25-28

Society of Diagnostic Medical Sonographers (SDMS), 2014 SDMS Annual Conference, Louisville International Convention Center, Louisville, KY
• www.sdms.org

SEPTEMBER 26-27

European Society of Breast Imaging (EUSOBI), Annual Scientific Meeting, Amsterdam, Netherlands
• www.eusobi.org

OCTOBER 2-4

European Society of Cardiac Radiology (ESCR), Annual Scientific Meeting, Cité Universite, La Maison Internationale, Paris
• www.escr.org

OCTOBER 8-11

Korean Society of Radiology (KSR), 70th Korean Congress of Radiology, Seoul
• www.kcr4u.org
* Visit RSNA Booth

OCTOBER 15-18

International Skeletal Society (ISS), 41st Annual Meeting and Musculoskeletal Imaging Course, Edinburgh International Conference Centre, Edinburgh, Scotland
• www.internationalskeletalsociety.com

OCTOBER 15-18

The Society of Chairs of Academic Radiology Departments (SCARD), 2014 Fall Meeting, JW Marriott Tucson Starr Pass Resort & Spa, Tucson, AZ
• www.scardweb.org

OCTOBER 16-20

La Société Française de Radiologie (SFR)/ French Society of Radiology, Journées Françaises de Radiologie (JFR) 2014/French Days of Radiology 2014, Palais des Congrès, Porte Maillot, Paris
• www.jfrexpo.com
* Visit RSNA Booth

OCTOBER 17-19

Australasian Society of Ultrasound in Medicine (ASUM), 44th Annual Scientific Meeting, Crown Promenade, Melbourne
• www.asum.com.au

OCTOBER 19-21

Radiology Business Management Association (RBMA), Fall Educational Conference, The Westin Seattle, WA
• www.rbma.org

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

Residents & Fellows Corner

Medical Students Learn About Radiology Careers

RSNA once again participated in the annual American Medical Association (AMA) Medical Student Showcase, with RSNA representatives joining Brijal Desai, M.D. (left), a radiation oncology resident at Northwestern University in Chicago, to promote radiology and radiation oncology to medicine's future practitioners.

The AMA showcase gives medical students a chance to survey many specialties and opportunities. While Dr. Desai answered students' questions about radiology, RSNA representatives welcomed them to learn more about the specialty through RSNA membership, which is free to medical students, residents and fellows.



Add the Virtual Meeting to Experience RSNA 2014 on Your Own Time

With the vast offerings RSNA 2014 provides, it's impossible to see it all at McCormick Place. Adding the Virtual Meeting to your registration package provides access to select live-streamed and on-demand sessions, scientific presentations and education exhibits and Cases of the Day. You can also see the latest products and services from the technical exhibit halls from any computer or mobile device.

Visit RSNA.org/Virtual to add the Virtual Meeting to your registration and tune into live sessions during RSNA 2014 and on-demand through December 19. The fee is \$100 for RSNA/AAPM members and \$300 for non-members. RSNA members-in-training, medical student members and retired members can access the RSNA 2014 Virtual Meeting for free.



Visitors to the Virtual Meeting page can view video highlights of the RSNA 2013 Virtual Meeting and explore the RSNA 2014 schedule. Starting November 29, registered Virtual Meeting attendees can:

- Watch more than 40 live streaming courses, including most plenary sessions, the Image Interpretation Session, refresher courses, multisession courses, series courses and scientific sessions.
- Participate live in RSNA's exciting interactive game sessions, powered by RSNA Diagnosis Live™.
- Submit diagnoses for Cases of the Day consisting of five cases per subspecialty area throughout the week. Answers will be revealed the following morning.
- View education exhibits and digital scientific presentations.
- Earn continuing education credits for live-streamed events.
- Watch live exhibitor product theater demonstrations.

100 Virtual
RSNA® 2014



COMING NEXT MONTH

Our Special Meeting Preview issue will get you ready for RSNA 2014. We preview annual meeting offerings including the RSNA 2014 Presents Sessions spotlighting Canada and Korea.



CELEBRATE INTERNATIONAL DAY OF RADIOLOGY

A recognition of Radiology's Impact on Medicine

▶ **NOVEMBER 8, 2014** The 119th Anniversary of the X-ray!

You, your local radiology association, and your institution can build greater awareness of radiology and its contribution to patient care.

IDoR 2014 focuses on the role imaging plays in diagnosing and treating diseases of the brain.

Help spread the word in your community with ready-to-use promotional materials available at RSNA.org/IDoR.



INTERNATIONAL
DAY OF
RADIOLOGY

AN INITIATIVE OF THE RSNA, ESR AND ACR

100 YEARS
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Radiological Society
of North America