RSNA News™

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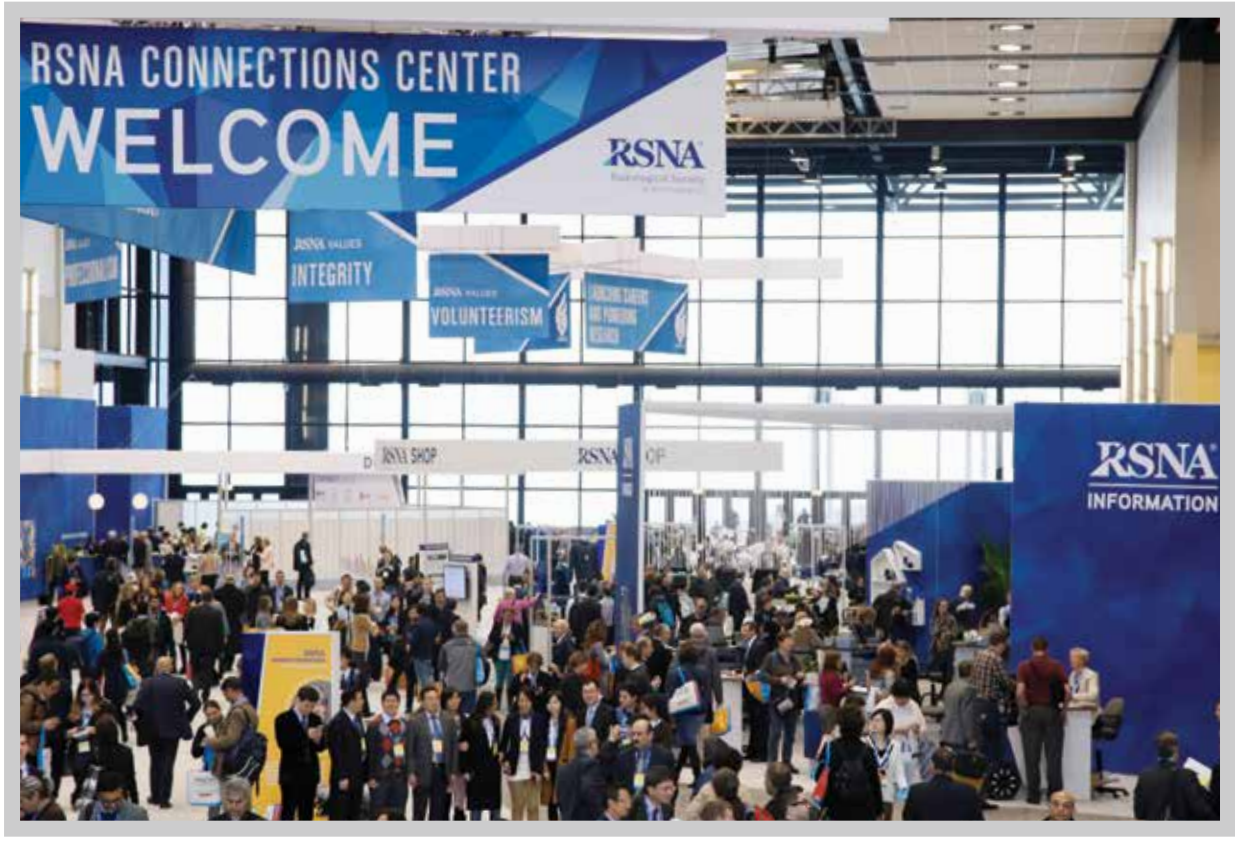

RSNA 2016: Spotlighting a Remarkable Meeting

ALSO INSIDE:

What MACRA Means for Radiology

Radiogenomics Research Earns Margulis Award

The Role of Machine Learning in Radiology

The Evolution of Imaging Perception

RSNA 2017 Abstract Submissions Open Soon — See Page 24

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(From left) **Mauro, Mahoney, Ehman, Rao, Borgstede, Jackson, Haffty, Langlotz**

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Ehman Elected RSNA President

A renowned researcher, inventor and educator, Richard L. Ehman, MD, was elected 2017 RSNA president. Dr. Ehman is professor of radiology and Blanche R. & Richard J. Erlanger Professor of Medical Research at the Mayo Clinic in Rochester, Minn.

Ehman

Dr. Ehman earned his medical degree in 1979 from the University of Saskatchewan in Saskatoon, Canada. His internship at Foothills Hospital in Calgary, Alberta, was followed by a residency in diagnostic radiology at the University of Calgary. In 1984, he completed a year-long research fellowship at the University of California, San Francisco. This was followed by a clinical fellowship and his appointment to the staff of the Mayo Clinic in 1985. In 1989, he received an RSNA Research Scholar Grant.

Dr. Ehman has authored or co-authored more than 300 peer-reviewed scientific articles and has completed many invited lectures and visiting professorships. He has served on the editorial boards for multiple journals, including *Radiology* and *Magnetic Resonance in Medicine*.

Dr. Ehman served on the Mayo Clinic Board of Governors from 2006 to 2014. In 2014, he was elected as an emeritus member of the Mayo Clinic Board of Trustees. He has been an active member of many medical societies and is past-president of several organizations, including the International Society for Magnetic Resonance in Medicine (ISMRM), Academy of Radiology Research, and the Society for Body Computed Tomography and Magnetic Resonance.

Dr. Ehman has served as chair of the Radiology and Nuclear Medicine Study Section of the National Institutes of Health (NIH), where he has also served terms on the Advisory Council of the National Institute of Biomedical Imaging and Bioengineering and on the Council of Councils.

Dr. Ehman is an NIH-funded clinician-scientist and inventor. He holds more than 70 U.S. and foreign patents, and many of these inventions are widely used in medical care. Dr. Ehman was awarded the RSNA Outstanding Researcher Award in 2006, an RSNA Honored Educator Award in 2016, and the gold medal of the Asian Oceanian Society of Radiology in 2016. He was named Mayo Clinic Distinguished Investigator in 2014. In 2010, Dr. Ehman was elected as a member of the Institute of Medicine of the National Academies of Science, which is one of the highest honors in medicine in the U.S.

As an RSNA member, Dr. Ehman has served on the Refresher Course Committee, Scientific Program Committee, *Radiology* Editorial Board, Research Development Committee, Grant Program Committee and the RSNA Research and Education Foundation (R&E) Board of Trustees. In 2010, he was elected to RSNA's Board of Directors and in 2011 became the Liaison for Science. He served as Board Chair from 2014 to 2015 and President-Elect from 2015 to 2016.

Jackson Named RSNA Board Chair


Jackson

An expert in the field of breast imaging, **Valerie P. Jackson, MD,** was named chair of the RSNA Board of Directors. Dr. Jackson is the executive director of the American Board of Radiology (ABR), a position she has held since 2014. She previously served on ABR's board of trustees from 2001 to 2010.

Dr. Jackson received her medical degree in 1978 from the Indiana University School of Medicine, and completed her residency at the Indiana University Medical Center in 1982. Dr. Jackson is the Eugene C. Klatte Professor Emeritus and has had numerous academic appointments at Indiana University School of Medicine, including lecturer, professor and chairman of the Department of Radiology and Imaging Sciences.

Along with being a sought-after lecturer, Dr. Jackson has published more than 100 peer-reviewed articles and 20 books and book chapters and served as principal investigator on numerous funded grants.

She has served on the editorial boards of multiple journals and as a manuscript reviewer for various journals including *Radiology*, serving as associate editor on the editorial board from 1989 to 1998 and as consultant to the editor in 1999.

An RSNA member since 1982, Dr. Jackson has served as chair of the Refresher Course Committee from 2009 to 2012, chair of the Breast Imaging Subcommittee of the Scientific Program Committee from 2003 to 2006 and as a member of the *RSNA News* Editorial Board from 2005 to 2008. Dr. Jackson is a member of the Public Information Advisors Network — a position she has held since 1997. She has served as a co-presenter of the RSNA Faculty Development Workshop.

She served RSNA as first vice president from 2008 to 2009 and as a member of the RSNA Centennial Committee. She has been active on many RSNA Research & Education (R&E) Foundation committees and served on the R&E Foundation Board of Trustees from 2009 to 2015. Dr. Jackson delivered the Annual Oration in Diagnostic Radiology at RSNA 2002.

Rao Named President-Elect


Rao

Vijay M. Rao, MD, was elected RSNA president-elect. A global authority on head and neck imaging and also recognized for her health services research in radiology, Dr. Rao is The David C. Levin Professor and Chair of Radiology at Jefferson Medical College of Thomas Jefferson University in Philadelphia.

A graduate of the All India Institute of Medical Sciences, Dr. Rao has remained on the faculty at Thomas Jefferson University since completing her residency there in 1978. She was appointed associate chair for education in 1989 and vice chair for education in 2000. In 2002, she became the first woman chair of a clinical department in the university's history. She is a trustee of the Thomas Jefferson University Hospital System.

Dr. Rao has published more than 200 papers, 260 abstracts in medical literature, and a dozen book chapters, and is a highly regarded lecturer and educator.

Dr. Rao has served on the editorial boards of journals including *Academic Radiology* and *Journal of the American College of Radiology* and as a manuscript reviewer for journals including *Radiology*. In 2001, she served as editor of *ASHNR News*, a publication of the American Society of Head & Neck Radiology.

An RSNA member since 1981, Dr. Rao has led numerous courses and sessions at RSNA annual meetings and served on the Health Services Policy & Research Subcommittee of the RSNA Scientific Program Committee. She has served the RSNA Research & Education (R&E) Foundation in a number of roles and was a member of the RSNA Board of Trustees from 2008 to 2011. Dr. Rao served as Board Chair from 2015 to 2016. She was elected to the RSNA Board of Directors in 2011 serving as the Board liaison for information technology and annual meeting from 2011 to 2015.

Langlotz Named to RSNA Board


Langlotz

Curtis P. Langlotz, MD, PhD, a renowned imaging informatics leader and committed advocate for improved radiology reports, joins the RSNA Board of Directors as the liaison for information technology and annual meeting, as Valerie P. Jackson, MD, becomes chairman of the Board of Directors. Matthew A. Mauro, MD, will assume the role of liaison for education.

Dr. Langlotz is professor of radiology and biomedical informatics and associate chair for Information Systems in the Department of Radiology at Stanford University. As medical informatics director for Stanford Health Care, he is responsible for the computer technology that supports the Stanford radiology practice. He accepted his current position at Stanford in 2014.

In addition to over 100 scholarly publications, Dr. Langlotz authored *The Radiology Report: A Guide to Thoughtful Communication for Radiologists and Other Medical Professionals*, and co-edited *Cancer Informatics: Essential Technologies for Clinical Trials*.

Dr. Langlotz founded and is a past president of the Radiology Alliance for Health Services Research, served as chair of the Society for Imaging Informatics in Medicine (SIIM), and as a board member of the Association of University Radiologists. He currently serves as president of the College of SIIM Fellows.

A long-time member of the RSNA Radiology Informatics Committee and an informatics advisor to RSNA, Dr. Langlotz has contributed on a global scale to the growth of informatics in radiology. For more than 15 years, he has led the development of numerous RSNA informatics initiatives, including the RadLex® terminology standard, the LOINC-RadLex Playbook of standard exam codes and the RSNA report template library. He has also served as a member of the RSNA Publications Council, the Research Development Committee and the *Radiology* editor search committee. He is a current member of the steering committee for the RSNA Digital Roadmap.

Next RSNA Spotlight Course Coming to Colombia in May 2017

The second RSNA Spotlight Course, "MSK Interactivo con Casos," (MSK Interactive with Cases) will be held May 18 to 20, 2017, in Bogota, Colombia. The course will be presented in Spanish.

The course directed by Jorge Soto, MD, and Gabriel E. Dib, MD, w ill include presentations on musculoskeletal iamging and ultrasound. The highly interactive course will be entirely conducted using Diagnosis Live™, RSNA's mobile-based, audience response technology.

The inaugural Spotlight Course, "Radiología de Urgencias: Curso Interactivo con Casos" (Emergency Radiology: Interactive Course with Cases), held in Cancun, Mexico, in June 2016, drew 204 attendees from 17 countries.

For more information about the 2017 RSNA Spotlight Course, go to *RSNA.org/Spotlight.*

Garcia-Monaco Named ISR President

Ricardo D. Garcia-Monaco, MD, PhD, recently became president of the International Society of Radiology (ISR). Dr. Garcia-Monaco, past president of the Interamerican College of Radiology (CIR), is chief of diagnostic imaging at Hospital Italiano in Buenos Aires, Argentina.

Dr. Garcia-Monaco received RSNA Honorary Membership in 2011, becoming the first Argentinian to earn the honor. In 2013 he was appointed as chairman of the RSNA Regional Committee for Latin America.


Garcia-Monaco

IN MEMORIAM

Frank Graham Sommer, MD


Image courtesy of Stanford University School of Medicine

Frank Graham Sommer, MD, professor emeritus of radiology at Stanford's School of Medicine and an expert in diagnostic radiology, died from amyotrophic lateral sclerosis (ALS) on Oct. 2, 2016. He was 70.

Dr. Sommer earned a bachelor's degree in physics from the University of Victoria and a medical degree from McGill University in Montreal. After completing his residency at the University of California, San Francisco Medical Center, he joined the faculty at Stanford in 1979.

Dr. Sommer studied and promoted improved imaging techniques and is best known for his work on ultrasound and imaging blood flow in the kidneys. He received the Academy of Radiology Research's Distinguished Investigator Award in July 2016.

Dr. Sommer served on the *Radiology* Editorial Board as a Consultant to the Editor since 2010 after serving five years as an Associate Editor. He was also a manuscript reviewer for *Radiology*.

Numbers in the News

47

The number of self assessment module (SAMs) courses offered at RSNA 2016. Read RSNA's thank-you to all faculty members who helped make RSNA 2016 educational courses successful on Page 23.

20

Percentage of clinicians in a recent survey who said the language and style in radiology reports was unclear. Read more about the importance of structured reporting on Page 9.

1941

The year the topic of image perception was first introduced at an RSNA annual meeting. At RSNA 2016, presenters discussed how far imaging perception has come and why improvements are still needed. Read more on Page 15.

THIS MONTH IN THE *RSNA NEWS* ONLINE VERSION

This month's story on the MACRA deadline features an RSNA 2016 video interview with healthcare reform expert Ezequiel Silva III, MD, at *RSNA.org/News*.

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My Turn:

Opportunities Ahead in Medical Imaging: the Science of Value

BY RICHARD L. EHMAN, MD

As a global society with more than 54,000 members in 136 countries, the Radiological Society of North America (RSNA) is a powerful force for advancing the science and practice of medical imaging for the benefit of patients worldwide.

As I begin my term as president of RSNA, I am struck by the amazing opportunities that lie ahead in our field. Through its scientific and educational missions, RSNA can have a key role in helping our community realize the promise of those opportunities.

The extraordinary advances in medical imaging technology of the last decades have improved diagnostic medicine so profoundly that most physicians could scarcely imagine taking care of patients without them. In countless ways, these technologies have brought diagnostic clarity to clinical decisions that were previously shrouded in uncertainty. They have provided safe and less expensive alternatives to invasive procedures. Such innovations in medical imaging have often been the product of unique multidisciplinary efforts, combining biomedical science with physical science and engineering.

RSNA is working to accelerate further advances in many ways. The Research & Education Foundation provides highly-competitive research grants to help establish the careers of talented young investigators and innovators who will help chart the future of our field. The Society provides an extensive array of educational programming for aspiring and established investigators. The scientific program of the annual meeting offers an extensive forum to present and see the latest in imaging science. RSNA is the largest supporter of the Academy of Radiology Research, a Washington DC-based organization that advocates for funding research in medical imaging at the NIH and other organizations. Among its many effective strategies, the Academy has provided policy-makers and legislators with compelling evidence that investments in imaging research at the federal level have a high rate of return, including a remarkable rate of new inventions that create substantial downstream economic impact.

Ehman

Many of the medical imaging technologies used in patient care have quantitative capabilities that remain largely untapped. Better use of this information would provide essential tools in precision medicine. Through its major investment in the Quantitative Imaging Biomarker Alliance (QIBA) initiative, RSNA is convening clinicians, scientists and the commercial sector to foster the use of quantitative methods and biomarkers in clinical radiology.

In my view, perhaps the most important opportunity now before us is to reinvent radiology practice to optimize value. In the context of medical imaging, the value of a diagnostic procedure can be considered to be a ratio in which the numerator contains the sum of metrics for diagnostic performance, quality, safety and service, and the denominator represents cost. Extraordinary innovations in medical imaging science and technology over the last decades have steadily advanced the numerator of the value equation. However, as medical delivery systems reorganize to address escalating cost, it seems imperative for the radiology community to show leadership by innovating to maximize the value equation in diagnostic imaging. These efforts will certainly involve the science of medical decision-making and process management. But for me, the exciting aspect is that the radiology community can also invoke the same unique multidisciplinary union of biomedical and physical sciences that created our revolutionary medical imaging capabilities to address the value equation through further innovation.

If we fail to address this opportunity, we risk a future of rationing. In a far better future we will re-invent our practice to optimize value so that we can serve our patients through even better access to our most powerful diagnostic capabilities. RSNA is poised to foster these efforts through its scientific programming, focused presentations and workshops and through the traditional capacity of RSNA to convene diverse stakeholders from across the medical community.

RSNA Introduces 3-D Printing Special Interest Group

In response to breakthrough 3-D printing technology and its implications for radiology, RSNA is proud to introduce a new 3-D Printing Special Interest Group (SIG) to promote the highest quality 3-D printing for medical applications via education, research and collaboration.

The SIG, chaired by Jonathan Morris, MD, will focus on maintaining a prominent role for radiologists in this diverse and growing specialty. The group will also seek to provide physicians and allied health scientists with optimized education and research programs, said Frank Rybicki, MD, PhD, founding chair of the SIG.

"Among the goals of the SIG are to include and help define leaders in 3-D printing and act as ambassadors of our growing field for RSNA. The SIG is designed to be a valuable resource for medical 3-D printing, connecting our members in education, sharing best practices to formalize guidelines, exchanging cutting edge techniques and technologies in the field, and serving as a forum to share our successes and collaborate on solving our challenges," Dr. Rybicki said.

RSNA members in good standing may simply call the RSNA Membership Department to add 3-D Printing SIG participation to their membership for a fee of $40 per year.

Current RSNA membership is required to join the 3-D Printing SIG. Please call the Membership Department at 1-877-776-2636 to learn more or apply online at *RSNA.org/Apply.*

Learn more about the group at *RSNA.org/3D-Printing-SIG.*

Radiogenomics Research Receives the RSNA Margulis Award

RSNA 2016 President Richard L. Baron, MD, (*left*) presented the fifth annual Alexander R. Margulis Award for Scientific Excellence to Neema Jamshidi, MD, PhD, at RSNA 2016.

BY BETH BURMAHL

The developing field of radiogenomics has made gradual but significant advances in associating molecular profiling measurements with noninvasive imaging in oncology. Nevertheless, more work needs to be done in order to capture the full scope of disease phenotypes.

In recent years, researchers have realized that capturing the complex biology of such tumors and their response to therapy would require deeper classification systems – ones that incorporate information from high-throughput molecular profiling data.

Daily Bulletin* coverage of RSNA 2016 is available at *RSNA.org/Bulletin.

Working with a team of researchers, Neema Jamshidi, MD, PhD, a clinical instructor at the Department of Radiological Sciences, David Geffen School of Medicine at UCLA, has developed just such a classification system: a radiogenomic risk score (RRS) that bridges the gap between quantitative tissue-based molecular data, clinical imaging findings and clinical phenotypes for renal cell carcinoma. The methodology applied to develop the RRS could have useful applications for detecting and tracking other types of cancer and potentially other diseases as well.

"Most radiogenomic studies to date have focused on simultaneously identifying imaging to genomic association maps in an untargeted fashion, but we were curious to do something different," Dr. Jamshidi said. "What if we could systematically construct an imaging surrogate that targeted and tracked a specific molecular (in this case transcriptomic) signature, enabling clinical outcomes to be assessed noninvasively and longitudinally? We were able to do that, and it's kind of exciting."

The resulting study, "The Radiogenomic Risk Score: Construction of a Prognostic Quantitative, Noninvasive Image-based Molecular Assay for Renal Cell Carcinoma," published in the October 2015 issue of *Radiology*, earned Dr. Jamshidi and colleagues the fifth annual RSNA Alexander R. Margulis Award for Scientific Excellence. The award recognizing the best original scientific article published in *Radiology* was presented at RSNA 2016.

Dr. Jamshidi and colleagues designed a noninvasive surrogate of the molecular assay (SOMAs) – the RRS – to serve as a surrogate for the previously developed gene expression based supervised principal component (SPC) risk score, a quantitative multigene expression signature that has been shown to predict disease-specific survival in patients with clear cell renal carcinoma.

To develop the RRS, researchers analyzed gene expression profile data and contrast-enhanced CT images in 70 patients with clear renal cell carcinoma. The RRS imaging predictor was constructed through evaluation of a library of 28 well-measured and variably expressed CT image features and subsequent selection of the top four ranking features associated with the SPC gene expression profile classification using multiple regression-based techniques.

Researchers then independently validated the predictive power of the RRS in an independent cohort of 70 patients with clear renal cell carcinoma and correlated that data with subsequent disease specific survival.

The resulting RRS was shown to correlate with the SPC score in the training group and in the validation group. In addition, the RRS for clear-cell renal cell carcinoma predicted disease-specific survival, independent of disease stage, disease grade and performance status.

Potential for Various Tumor Types

The research breaks new ground in key areas, including its potential applications for other types of cancer, according to *Radiology* Editor Herbert Y. Kressel, MD.

"The methodology can potentially be applied to many other tumor types where the relationship of multi-gene expression data to outcome has been established," Dr. Kressel said. "It is hoped that the use of similar tools may provide an effective means to noninvasively characterize tumors, to better understand the biology of tumor response and to potentially reduce the need for repeated tissue sampling while managing these patients."

And instead of focusing on single measurements of features, the research gathers and integrates multidimensional measures to capture complexities of the biologic process and their response to therapy.

Calling the research a "truly collaborative effort," Dr. Jamshidi credits the success of his research to the teamwork of colleagues from multiple institutions over several years.

"In particular, I want to specifically recognize the senior author, Dr. Mike Kuo, without whom the study would not have been performed, as well as Dr. Dieter Enzmann and his support from UCLA Radiology.

"The Margulis Award was completely unexpected, but it is extremely gratifying," Dr. Jamshidi said. "It's really a great honor and total surprise. I am so thankful that *Radiology* editors recognized our study, as it took many people multiple years to see the results of our research."

WEB EXTRAS

Access the study, "The Radiogenomic Risk Score: Construction of a Prognostic Quantitative, Noninvasive Image-based Molecular Assay for Renal Cell Carcinoma," at *RSNA.org/Radiology*.

Expanding on his *Radiology* research, Dr. Jamshidi and colleagues used the RRS biomarker to stratify outcomes in patients with metastatic renal cell cancer in a Phase 2 clinical trial in a study published in the August 2016 issue of *European Radiology*.

Looking forward, Dr. Jamshidi says further studies are needed to evaluate imaging capabilities in detecting causal links between intratumoral heterogeneity and tumor phenotype. He is also interested in understanding the radiogenomic associations on a more mechanistic level.

"One of our main goals is to achieve robust automated segmentation," he said. "This would improve consistency, reproducibility and throughput in developing and using radiogenomic-based SOMAs." R

Margulis a Leader in Innovation, Research

One of radiology's preeminent leaders, Alexander R. Margulis, MD, is a distinguished investigator and inspiring visionary whose pioneering work in gastrointestinal radiology is felt throughout the specialty today.

During his more than two decades as chair of radiology at the University of California, San Francisco (UCFS), he built the department into a preeminent global leader in research and education. Under his leadership, the department pioneered the development of CT and MRI as clinical tools.

Moreover, he built the radiology department into an internationally renowned center for education, training important radiology leaders in the U.S., France, Germany, Sweden, Japan and China.

Dr. Margulis was a founding member of the Society of GI Radiology (now the Society of Abdominal Radiology), the Society of Magnetic Resonance in Medicine (now the International Society of Magnetic Resonance in Medicine), and the International Society for Strategic Studies in Radiology. The Margulis Society at UCSF was founded in his honor.

Dr. Margulis is an emeritus clinical professor of radiology at the Weill Cornell Medical College in New York City.

Dr. Margulis was appointed to the rank of Chevalier of the French Legion of Honor for his contribution to radiology innovation and research. He received the RSNA Gold Medal in 1983.

Dorsal Anterior Insula Connectivity — A Potential Target for Cognitive Improvement in MS Patients

A new study suggests that the dorsal anterior insula may be an attractive target for non-invasive strategies to modulate connectivity in order to improve cognitive function related to multiple sclerosis (MS).

BY LYNN ANTONOPOULOS

Bizzo

"The role of the anterior insula as a critical region regulating switching between cognition and behavior is only just beginning to be investigated and understood," said presenter Bernardo Canedo Bizzo, MD, research fellow in radiology, Harvard Medical School/Massachusetts General Hospital (MGH), at RSNA 2016.

He added, "The ability to predict possible cognitive deficits based on our functional neuroanatomic findings has the potential to help guide patient management and patient counseling in the future."

Cognitive impairment is estimated to occur in 40 to 60 percent of MS sufferers. Dr. Bizzo and his team assessed whole-brain, dorsal anterior insula intrinsic functional connectivity using resting state functional MRI (fMRI) in 28 MS patients. In addition, each patient was assessed for cognitive status, degree of disability and cognitive reserve.

They sought to relate dorsal anterior insula instrinsic functional connectivity with measures of cognitive status and reserve. The study provided support for recent findings that relate the insula to a tripartite framework of cognition, emotion and interoception — the sensory system responsible for detecting the body's internal regulation responses.

The researchers performed 3T MRI using the Connectome scanner at MGH Martinos Center for Biomedical Imaging. The scanner maps white matter connections in the brain by tracking the movement of water and produces higher quality images than conventional MRI in a fraction of the time.

The team used the data they collected to look at the relationship of the dorsal anterior insula and its functional connectivity to the cognitive deficit presented by the patient. They found a significant correlation between cognitive reserve and left dorsal anterior insula instrinsic functional connectivity to an occipital cluster in the left hemisphere of the brain which included the cuneus and superior occipital gyrus.

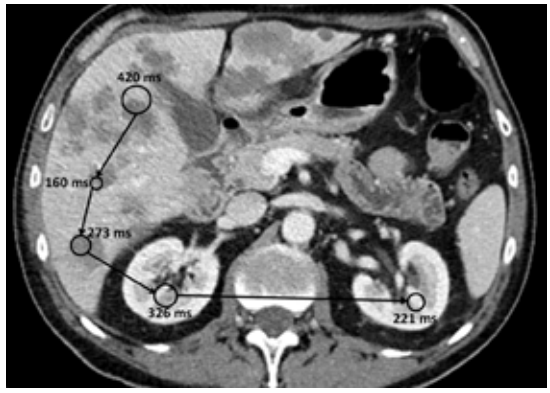
"This combination of advanced hardware with cutting edge computational tools is especially timely and important given the NIH's blueprint for 'The Human Connectome Project: Mapping Structural and Functional Connections in the Brain', as well as the White House Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative," Dr. Bizzo said.

According to Dr. Bizzo, he and his fellow researchers sought to ensure that their methods of analysis did not result in an increased number of false positives associated with some commonly used fMRI methods. After their initial review, they reanalyzed the complete dataset using a more conservative approach. Doing so, they confirmed their initial findings and were able to more precisely define the anatomical regions independently related to cognitive reserve in patients with MS. He said, "On our re-analysis it became clear that the occipital region was, without doubt, a strong predictor of cognitive reserve."

The team plans additional exploration of this topic and will write a review paper on anterior insula function in the hope of raising awareness and generating further research. In addition, they plan to perform a more detailed structural connectivity mapping of the anterior insula specifically in MS using their diffusion spectral imaging dataset. R

Image Perception: Eye Movement Behavior Measures Visual Expertise in Radiologists

BY EVONNE ACEVEDO JOHNSON



Fixations and saccades projected on a CT image of a patient with liver metastases. Each circle represents a fixation and the size of a circle reflects fixation duration, which appears next to each circle. Around fixations, fine image details can be perceived. Saccades are represented by arrows between fixations; the amplitude of saccades varies both within and across radiologists. ms = milliseconds.
(*Radiology* 2016;281:3;805-815) ©RSNA 2016. All Rights Reserved

Bertram

When interpreting abdominal CT studies, radiologists with more experience are more flexible in their eye movement behavior and are more likely to maintain better performance during long work hours than residents in training, according to researchers in Finland.

"Expert behavior is manifested in distinct eye-movement patterns of proactivity, reactivity and suppression, depending on the nature of the task and the presence and type of abnormalities," said Raymond Bertram, MS, PhD, a senior lecturer in the Psychology Department at the Turku Institute of Advanced Studies, the University of Turku, Finland. The research was published in the December issue of *Radiology*.

Working with the university's Department of Psychology, Dr. Bertram and colleagues determined that analyzing residents' eye movement behaviors as they gain experience "could be useful to monitor individual residents' learning curves, and contribute to a further shift toward competency-based resident training."

As radiologists interpret studies, their eye movements are composed of fixations — maintaining the gaze on a single location — and saccades, the rapid movements of eyes as they shift between fixation points. "Saccade length and fixation duration are parameters that reflect the moment-to-moment cognitive processing of visual information," the researchers noted.

In the study, 29 residents classified as having either early (less than two years of specialist education) or advanced experience (more than two years of specialist education) participated along with 12 specialists with a minimum of two years' experience in abdominal radiology. To record the volunteers' eye movements, the researchers used a desktop-model eye tracker with a forehead and chin rest, collecting eye movement data at a sampling rate of 1000 Hz.

Volunteers were shown CT studies as a continuous presentation at a fixed frame rate, one set at three frames per second and another at five frames per second. These speeds were chosen based on earlier data indicating that a frame rate of about four per second was satisfactory for comprehensive CT reading, the researchers explained.

The team determined that experienced radiologists showed more flexibility in their eye movement behavior than the residents.

"Specialists reacted to the presence of lesions in CT images by longer fixation durations and shorter saccades, and adapted to faster presentation speeds by longer fixation durations and longer saccades," the researchers reported.

The researchers determined that the decrease in saccade length likely reflects a switch from searching to closer inspection and characterization of a lesion. "The smaller decrease in saccade length for the resident groups indicates that residents are still learning to use this strategy," the authors said.

Resident Eye Movement Behavior

The findings revealed that less experienced residents detected fewer low-visual-contrast lesions than advanced residents and specialists: 45 percent vs. 56 percent and 62 percent, respectively.

Specialists and advanced residents exhibited longer fixation durations at five frames per second than at three. In the presence of lesions, saccade lengths of the experienced radiologists were shorter than those of the residents. Notably, the early residents' detection rate decreased as they worked longer hours.

"One peculiar finding was that early residents participating in the morning performed better than those who came to participate in the afternoon," Dr. Bertram said. "This was not the case for advanced residents and expert specialists. This finding suggests that early residents are more likely to be affected by exhaustion than advanced residents and specialists, something that may be taken into consideration when assigning their daily schedule.

"However, in order to make a good assessment of this potentially important phenomenon, in the future, participants should be tested in the beginning and end of the working day."

Dr. Bertram emphasized that the study was conducted under difficult visual circumstances in order to push the visual limits of radiologists and residents in training.

"It is remarkable that under these circumstances so many of the abnormalities were detected and that eye movement behavior is as efficient as it is, also signifying that adaptivity can be observed already for early residents," Dr. Bertram said.

One observation that surprised Dr. Bertram's team was how closely eye movement behavior of advanced residents resembled that of expert radiologists.

"Also surprising was that even some early residents were quite similar to experts in both eye movement behavior and diagnostic accuracy, even after one year of training," he said. "We should investigate them more thoroughly in the future, because they probably will make 'star radiologists'."

Research in imaging perception is inspiring projects like the Image Perception Lab held at RSNA 2016. Sponsored by the U.S. National Cancer Institute (NCI), the lab invited RSNA attendees to volunteer their own time reading data in an interactive setting. R

WEB EXTRAS

Access the *Radiology* study, "Eye Movements of Radiologists Reflect Expertise in CT Study Interpretation: A Potential Tool to Measure Resident Development," at *RSNA.org/Radiology*.

Image Perception in Radiology Remains an Important Topic

BY FELICIA DECHTER AND PAUL LaTOUR

Image perception in radiology is not a new topic to the RSNA annual meeting. In fact, W. Edward Chamberlain, MD, broached the topic in his Annual Oration in Diagnostic Radiology at RSNA 1941.

Krupinski

Jacobson

Since then, a wide variety of tools and techniques have been developed to improve the understanding of how images are perceived, abnormalities detected and diagnostic decisions made.

There is room for improvement considering radiologists still make mistakes even using advanced image processing and analysis tools, said Elizabeth A. Krupinski, PhD, during her RSNA 2016 presentation, "A Short History of Image Perception in Radiology."

Improved understanding of how these image manipulations and decision support systems impact radiologists' decision-making processes is critical to further improving their effectiveness, said Dr. Krupinski, professor and vice chairman for Research Department of Radiology and Imaging Sciences at Emory University in Atlanta.

"Determining the best ways to integrate these tools into everyday clinical workflow is critical as well, since poorly integrated systems, no matter how good they are in a stand-alone setting, will not impact performance positively," Dr. Krupinski said.

It's important to consider the radiologist's perceptual and cognitive capabilities when developing new imaging technologies and tools, she said. Better training and education methods and better integration of technology into clinical workflow can impact patient care and outcomes without placing undue burdens on the radiologist.

"If we understand why errors are made we can develop tools or processes to reduce them or we can develop better training methods," Dr. Krupinski said.

Image analysis tools, eye-tracking, better software and hardware — there are a multitude of ways technology can be used to understand and then aid or complement the human visual system and decision making processes, she said.

The role of fatigue also needs to be understood, Dr. Krupinski said.

"Studies have demonstrated that after only eight hours of clinical work radiologists are fatigued and their diagnostic accuracy drops significantly," Dr. Krupinski said. "We need to improve our understanding of the role of fatigue and how to ameliorate its impact."

Daily Bulletin* coverage of RSNA 2016 is available at *RSNA.org/Bulletin.

Does Lighting Impact Performance?

In another session, Francine Jacobson, MD, MPH, said that in the early days of the specialty, radiologists used red goggles for dark adaptation to better see fluoroscopic images. Red light remained in dark rooms for film development until digital conversion was completed in the early 2000s.

Yet in 2006, after an RSNA lecture, a radiologist approached her to suggest that reading should be done in neutral gray lighting rather than the long-standing dictum to recruit darkness. Ambient lighting is also needed for non-image computer work, said Dr. Jacobson, director of lung cancer screening at Brigham and Women's Health Care, staff radiologist at Brigham and Women's Hospital, Division of Thoracic Imaging, and assistant professor of radiology, Harvard Medical School in Boston.

Dr. Jacobson pointed toward aviation and other industries that use blue light to improve performance as a guide for radiology. She said blue light improves alertness, attentiveness and mood. And as the use of color in imaging increases, basic color effects and color interactions also become more important.

"The most basic perceptual task is detection," Dr. Jacobson said, adding the attribution of the finding and the company it keeps can be most important.

"Radiologists are increasingly the integrators of visual and non-visual data," Dr. Jacobson said. "CT scans now often replace physical examination, requiring more consideration of the history that is not given to the radiologist as part of the order." R

What Does MACRA Final Rule Mean for Radiology?

BY PAUL LaTOUR

Radiologists are facing some urgent questions about where they fit under the new radiology payment policy paradigm, said Ezequiel Silva III, MD, vice chairman of the American College of Radiology (ACR) Commission on Economics, during an RSNA 2016 session.

In the session titled, "Prospering in the Era of Payment Reform," healthcare experts discussed issues including the Medicare Access and CHIP Re-Authorization Act (MACRA) final rule, which was scheduled to take effect Jan. 1, 2017. Dr. Silva said the main consideration for radiologists is that the patient experience will be an integral component of future payment structures.

"We have to embrace patient experience. It's not just terminology to throw around lightly," said Dr. Silva, a diagnostic and interventional radiologist at the South Texas Radiology Group in San Antonio.

Classification Will Determine Reimbursement Schemes

The first step in radiologists' process is deciding whether or not to be classified as patient facing or non-patient facing within the final rule categorization. The rule was released Oct. 14, but won't begin affecting payments until 2019. However the performance period under which all physicians will be judged was scheduled to begin Jan. 1.

"By mere coincidence, we find ourselves in this room talking about something this complex and yet with that degree of urgency," Dr. Silva said, referring to the 2,400-page regulatory document defining the final rule.

According to the new regulations, individual radiologists qualify as patient facing if they bill more than 100 patient-facing encounters per year. In the group practice reporting option, at least 75 percent of the collective radiologists must reach the threshold for individual radiologists to qualify the group as patient facing.

WEB EXTRAS

View an RSNA 2016 video interview with presenter Ezequiel Silva III, MD, at *RSNA.org/News*.

McGinty

Brink

Silva

While the services to be considered patient facing are still in question, Dr. Silva said it is known that evaluation and management (E/M) coding will qualify. However, it's still not known if procedure codes will be considered patient facing because those codes have yet to be released.

"The implications are not small — this is not a small differentiation for us to make," Dr. Silva said.

***Daily Bulletin* coverage of RSNA 2016 is available at *RSNA.org/Bulletin*.**

Changes Present Opportunity to Improve Quality of Care

Geraldine B. McGinty, MD, the former vice chairman of the ACR Commission on Economics, spoke about the need to create a culture of high-value, patient-centered care in radiology during her presentation.

"We have an opportunity to improve our patients' outcomes by making sure they get the imaging that they need, and making sure they get the right imaging," said Dr. McGinty, assistant chief contracting officer and assistant professor of radiology at Weill Cornell Medicine, and assistant attending radiologist at New York-Presbyterian Hospital, both in New York.

The session was capped by James A. Brink, MD, chief of radiology at Massachusetts General Hospital in Boston, discussing radiology's role in population health management and the triple aim for health reform — better health for the population, better care for individuals and lower cost through improvement.

"The goal is to keep a patient population as healthy as possible, minimizing the need for expensive interventions such as emergency department visits, hospitalization, imaging tests and procedures," Dr. Brink said.

Read more about the implications of payment reform for patient-centered care and radiology's role in population health managment in the February issue. R

> "We have an opportunity to improve our patients' outcomes by making sure they get the imaging that they need, and making sure they get the right imaging."
>
> GERALDINE B. MCGINTY, MD

Structured Radiology Reporting Improves Communication

BY FELICIA DECHTER

When communicating information in radiology reports to other physicians, radiologists should use language that is direct, clear and concise, according to an RSNA 2016 presenter.

But that isn't always happening. Recent surveys gauging the value of radiology reports found that 20 percent of responding clinicians said the language and style used in radiology reports was unclear, said presenter Herbert Alberto Vargas, MD, director of genitourinary radiology at the Memorial Sloan Kettering Cancer Center in New York. Another study determined that referring clinicians may reach different conclusions when reading the same reports, he said.

To that end, structured reporting, which allows for effective communication of imaging findings by standardizing format, terminology and content, is an effective solution, Dr. Vargas said.

"We need uniform ways to communicate radiologic findings, clinical impressions and management recommendations," he said.

Another important issue relevant to standardized reporting is the expression of diagnostic certainty, Dr. Vargas said.

"Radiologists are often tasked with summarizing multiple findings and rendering an opinion with regard to potential explanations for the radiographic findings," Dr. Vargas said. "There are scenarios in which no differential diagnoses are warranted and the findings are reported in terms of the absolute presence or absence of a pathologic process, for example, 'no fracture.'"

In other cases, findings are not definitive, and radiologists need to indicate their level of certainty for their interpretation of the imaging findings, Dr. Vargas said. In a study of patients with prostate cancer, 38 different terms were used in MRI reports to express the levels of certainty for the presence of extracapsular extension (ECE), prior to the introduction of a five-point "certainty lexicon," he said.

"The lexicon not only simplified the communication of the radiologists' level of suspicion but also allowed more objective quantification of the diagnostic performance of MRI for diagnosing ECE," Dr. Vargas said.

There are many key elements necessary to maximize the clinical utility of diagnostic imaging exams, including a pertinent clinical indication, adequate technical acquisition, accurate interpretation and effective communication of the imaging findings, Dr. Vargas said.

"The literature suggests that structured reporting in radiology leads to clearer and more thorough communication of relevant diagnostic findings than does conventional, free-form reporting," he said.

In a study of body oncologic CT examinations, structured reports were given significantly higher satisfaction ratings by both radiologists and referring physicians compared to free-form reports, Dr. Vargas said.

Structured reporting software offers such features as drop-down menus which facilitate data entry and minimize the amount of free-text entries.

"However, the benefits of structured reporting cannot be accepted dogmatically," Dr. Vargas said. "An accurate interpretation reported in free-form style is more clinically useful than a structured report containing erroneous information." R

Vargas

Access RSNA's Reporting Template Library

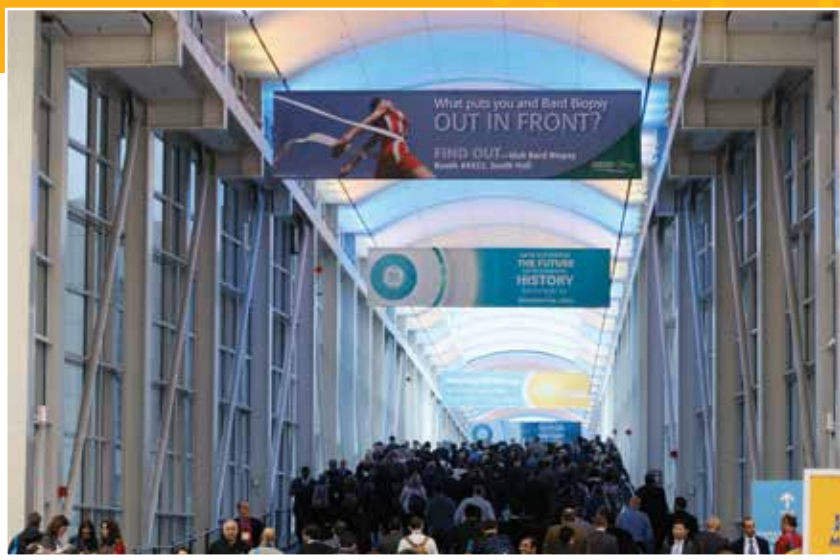
RSNA's reporting initiative has created a library of clear and consistent report templates. The report template library (*www.radreport.org*) serves as a starting point for radiology practices seeking to improve the quality of their reports by standardizing format, content and structure. These report templates represent best practices that can be adapted based on local practice patterns. The templates are published in a form that is accessible to the user — whether you use automated speech recognition or other reporting tools. For more information, go to *RSNA.org/Informatics.*

> *"The literature suggests that structured reporting in radiology leads to clearer and more thorough communication of relevant diagnostic findings than does conventional, free-form reporting."*
>
> HERBERT ALBERTO VARGAS, MD

RSNA 2016: SPOTLIGHTING A REMARKABLE MEETING

BEYOND IMAGING
RSNA 2016
NOVEMBER 27 – DECEMBER 2

RSNA 2016 President Richard L. Baron, MD, *(left)* opened RSNA 2016 with his President's Address, "Beyond Imaging: Ensuring Radiology Impact in Clinical Care and Research," to a capacity crowd at the Arie Crown Theater. That theme was reflected throughout the meeting, from the vast array of sessions designed to move the specialty forward to an array of new innovations such as the Machine Learning Demonstration and 3-D Printing in Medicine Exhibit, *see next page)* that represent the future of radiology.



One highlight from the new Discovery Theater: the Nancy Pochis Bank Art Studio created a live painted mural on site *(left);* throngs of attendees filled the Skybridge at McCormick Place.

The all-new Discovery Theater, *(above)* featuring music, performance acts and RSNA programs, kept attendees buzzing all week; early morning joggers showed up en masse at Chicago's Grant Park for the annual 5K Fun Run that raised over $30,000 to benefit the RSNA Reseach & Education (R&E) Foundation *(right).*

Machine Learning was the focus of sessions and events throughout RSNA 2016, including the "Eyes of Watson" demonstration of machine learning technology platform *(above)* in the Learning Center.

3-D Printing was a hot topic throughout the week, with attendees flocking to see the new 3-D Printing Demonstration and Showcase (*left*) spotlighting the increasing clinical significance of 3-D printing and its connection to imaging.

Not So Elementary: Experts Debate the Takeover of Radiology by Machines

BY RICHARD DARGAN

Radiologists could be replaced by computers in 20 years — **or not,** depending on who you were listening to during the RSNA 2016 Controversy Session, "Elementary My Dear Watson: Will Machines Replace Radiologists?"

Erickson

Siegel

Panelists Bradley J. Erickson, MD, PhD, and Eliot Siegel, MD, participated in the spirited debate. Dr. Erickson, of the Mayo Clinic in Rochester, Minn., said that improvements in graphic processing units (GPUs) and developments like deep learning (DL) have enabled computers to surpass humans in some cases of image recognition. He cited the potential of DL to improve radiology by identifying normal screening exams and delivering high quality preliminary reports. In five years, DL will likely be able to create reports for mammography and chest x-rays, he said, and in 15 to 20 years for most of diagnostic imaging.

But Dr. Siegel, of the University of Maryland Medical Center in Baltimore, argued that these image recognition improvements are not applicable to radiology.

"Radiology represents a completely different challenge, with much larger and more complex information," he said. "The information is extraordinarily more complex than picking out a dog or a cat. There are so many reasons why it is silly to think we'll be replaced in 20 years or in our lifetimes."

Dr. Siegel expressed concern that the hype around machine learning (ML) is becoming a major and unfounded source of anxiety among radiologists that could hurt recruitment in medical schools. He cited a story in the September 2016 *Journal of the American College of Radiology* that described machine learning as an "ultimate threat" that could "end radiology as a thriving specialty." Two radiology residents recently emailed him asking if they should quit the practice or risk not finding jobs when they graduate.

On the contrary, Dr. Siegel predicted that there will be more radiologists in 20 years, not fewer, and that computers will be regarded as trusted friends, able to create preliminary reports, but not primary ones.

The implementation of DL in radiology faces other hurdles, including the amount of time and money needed to train a machine to learn from vast databases like the National Lung Cancer Screening Trial, Dr. Siegel said. Also, the U.S. Food and Drug Administration (FDA) would be hesitant to approve technology that elevated computers to healthcare decision makers, he said, adding that medicolegal issues abound.

Daily Bulletin* coverage of RSNA 2016 is available at *RSNA.org/Bulletin.

"Who do you sue when a computer that replaced radiologists makes a mistake, even assuming you get FDA clearance?" Dr. Siegel asked.

Dr. Erickson countered that massive investment in the DL space and its associated political power would make regulatory bodies move faster to approve new roles for computers in radiology. He also pointed to the exponentially faster computing processing power as a harbinger of a greater role for DL.

Dr. Siegel remained unimpressed, noting that processing speed is largely irrelevant if the computer is making mistakes in diagnoses.

Machines Could Make Radiology More Vibrant

Despite the good-natured ribbing, the two radiologists reached something of a consensus at the close of the session. They agreed that, in the future, computers will be performing many tasks performed by radiologists today, and that they provide a useful service in areas like quantitative imaging, biometric measures, workflow and patient safety.

"It's a natural reaction for radiologists to think the computer is going to replace them, but this fear represents an oversimplification of what a computer can do and what the profession of radiology is," Dr. Erickson said. "What machine learning can do is help remove the humdrum and make the profession more exciting and vibrant."

"Radiologists judge, explain, quality check, counsel, teach, discover, console, explore, create and dozens of other things computers aren't even close to being able to do," Dr. Siegel added. R

> "There are so many reasons why it is silly to think we'll be replaced in 20 years or in our lifetimes."
>
> ELIOT SIEGEL, MD

Deep Learning May Play a Role in Assessing Breast Texture

BY ELIZABETH GARDNER

Can a computer network that mimics the neural structure of the brain and the visual cortex and is trained to analyze and recognize nonmedical images (deep learning), assess breast texture — and therefore risk of breast cancer — more accurately than standard radiographic texture analysis?

Researchers presented a study showing that deep learning has the potential to help clinicians in assessing mammographic parenchymal patterns for breast cancer risk assessment.

In a study presented during the Hot Topics in Breast Imaging series at RSNA 2016, researchers determined that convolutional neural networks can analyze full-field digital mammographic (FFDM) images and extract features that are missed both by human eyes and by other types of computer analysis.

"I think that in the future, both texture analysis and deep learning will be applied to mammograms on a routine basis," said Maryellen Giger, PhD, A.N. Pritzker Professor of Radiology at the University of Chicago.

Breast cancer is the second leading cause of death in North America for women. Currently, mammography is an effective tool for early breast cancer detection and the reduction of mortality rates. Breast density and mammographic parenchymal patterns can both be useful in assessing the risk of developing breast cancer. Better risk assessment allows physicians to better manage patients and can potentially lead to personalized screening regimens and precision medicine.

Previous work by the Giger Lab at the University of Chicago suggests that parenchymal texture predicts cancer risk more accurately than breast density percentage. A 2014 study published by Dr. Giger and Hui Li, MD, and colleagues in the *Journal of Medical Imaging* used radiographic texture analysis to compare a low-risk population with two high-risk populations (women with BRCA 1 or 2 and women with unilateral breast cancer). The high-risk group had coarser and lower contrast parenchymal patterns than the control group, even though the breast density percentage was not significantly different between the two groups.

The retrospective study compared radiomic texture analysis (RTA) with a convolutional neural network, "AlexNet," that had been pre-trained on a library of 1.28 million non-medical images from ImageNet, a large database intended to provide raw material for training visual object recognition software.

The University of Chicago study included 456 clinical FFDM cases from two high-risk groups, BRCA1/2 gene-mutation carriers (53 cases) and unilateral cancer patients (75 cases), and a low-risk group (328 cases). Regions of interest of 256 x 256 pixels were selected from the central breast region behind the nipple in the craniocaudal projection, a location that usually includes the densest part of the breast.

The study compared the use of imaging features, which were automatically extracted using pre-trained convolutional neural networks with transfer learning, and the use of features from radiographic texture analysis.

The convolutional neural network was pre-trained using a database of 1.2 million high-resolution images in about a thousand categories that include animals, modes of transportation and microscopic images, in addition to standard medical images. The area under the receiver operating characteristic (ROC) curve served as the figure of merit in the task of distinguishing between high-risk and low-risk subjects.

The group's analysis showed that the neural network performed similarly to radiographic texture analysis in distinguishing between low-risk and high-risk individuals. When both methods were used together, there was statistically significant improvement in distinguishing the two risk groups.

"Deep learning has potential to help clinicians in assessing mammographic parenchymal patterns for breast cancer risk assessment," the researchers concluded.

Dr. Giger plans to continue research on neural networks. R

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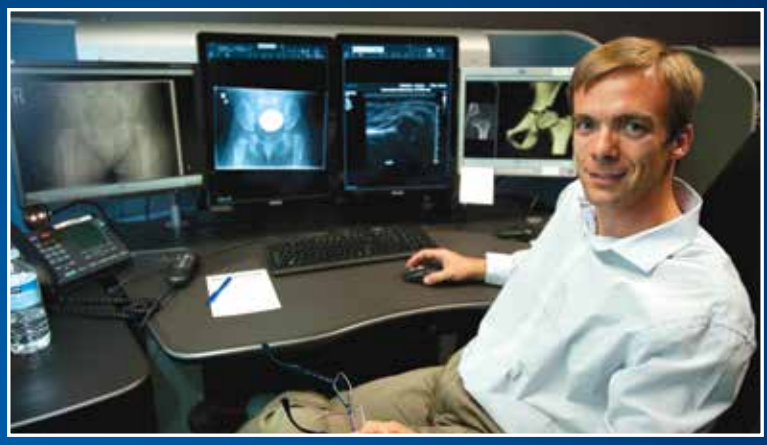
R&E Grant Lays Groundwork for Clinical Applications and Spurs Additional Funding

A 2014 RSNA Research Seed Grant awarded to **Jacob L. Jaremko, MD, PhD**, for the study, "3-D Ultrasound (3-D US) of Infant Hips: Toward an Understanding of Normal Development and Improved Detection of Hip Dysplasia," has led to subsequent funding for numerous research projects.

"The RSNA seed grant helped us advance the analysis of 3-D US and to visually and numerically demonstrate differences between the 3-D shapes of normal and dysplastic infant hips. This analysis will form the foundation for an accurate diagnostic test for hip dysplasia," Dr. Jaremko said. "The shape analysis can also aid in planning and monitoring treatment of established developmental dysplasia of the hip, and the principles developed here will also apply to 3-D US imaging of other musculoskeletal structures, internal organs and tumors."



Jacob L. Jaremko, MD, PhD

The RSNA Research Seed Grant has led to subsequent funding for Dr. Jaremko:

- Canadian Institutes of Health Research Young Investigator Award
- Alberta Innovates Health Solutions Postdoctoral Fellowship Award
- Canadian Medical Association Joule Innovation Award

Dr. Jaremko plans to apply for several major grants over the next two years. He has published six peer-reviewed manuscripts and presented findings at multiple national and international conferences. In addition, he filed a patent for surface modeling of a segmented echogenic structure for detection and measurement of anatomical anomalies.

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Lindsey B. Wilson, MD
Rongli Wu, MD
Jessica & Brandon J. Wynn, DO
Peter J. Wynne, MD
Rolf Wyttenbach, MD
Steven Yevich, MD, MPH
Christopher J. Yoo, MD
Kyung-Ran & Jung Kee Yoon, PhD
Angela & Gerald E. York II, MD
Patrick Younes, MD
June Lee & Ernest M. Yuen, MD
Vanessa M. Zayas-Colon, MD & Walter Radosta
Di Zhang, PhD
Binghui Zhao, MD
Binyan Zhong, MD, PhD
Troy Zhou, PhD
Elise Q. Zhu, MD
William B. Zucconi, DO
Nicolas A. Zugbe, MD

Journal Highlights

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

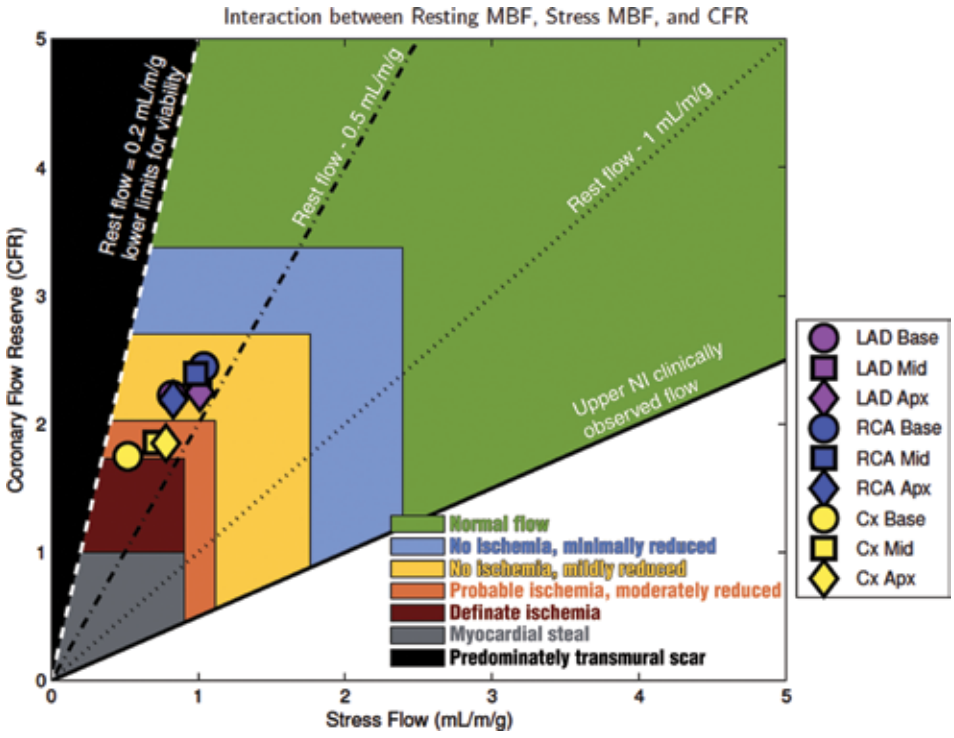
Imaging of Heart Disease in Women

A growing body of evidence suggests that women have a worse prognosis from ischemic heart disease than men despite lower prevalence and decreased severity of obstructive coronary artery disease. Ischemic heart disease is the number one cause of death of women in the U.S., accounting for over a quarter of a million annual female deaths.

In the January issue of *Radiology (RSNA.org/Radiology),* Tina D. Tailor, MD, of the Duke University Medical Center in Durham, NC, and colleagues discuss challenges for the detection of heart disease in women, examine performance of noninvasive modalities in the detection of ischemic heart disease, and discuss nonischemic cardiomyopathies unique to or prevalent in women. Considerations for cardiac imaging in pregnancy are also discussed.

"Women with heart disease comprise a unique population with a number of important imaging and diagnostic considerations. With the rising utilization of imaging for diagnosis, risk assessment and management, it is important for radiologists to be familiar with sex-specific differences in the presentation and pathogenesis of heart disease in women, sex differences in diagnostic performance of noninvasive testing, and the imaging evaluation of pregnant patients," the authors write.

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



Based on interactions of myocardial blood flow (MBF) and coronary flow reserve (CFR) described by Johnson and Gould, findings are suggestive of probable ischemia in the left circumflex territory, which was not evident by means of visible inspection, as well as mildly reduced flow capacity in the left anterior descending (LAD) and right conorary artery (RCA) territories.
(Radiology 2017;282;1:34–53)

Tumor-Vessel Relationships in Pancreatic Ductal Adenocarcinoma at Multidetector CT: Different Classification Systems and Their Influence on Treatment Planning

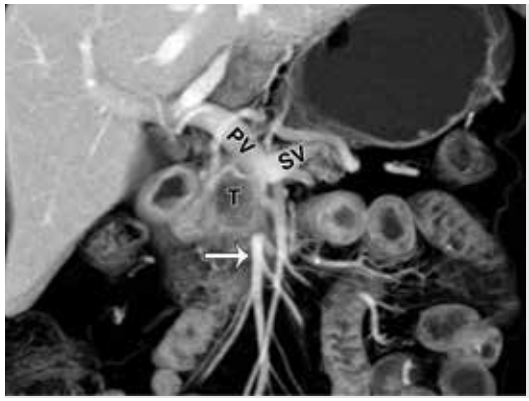
Treatment of pancreatic ductal adenocarcinoma (PDAC) remains a challenge, given its propensity for early systemic spread and growth into the adjacent vital vascular structures.

In the January issue of *RadioGraphics* (*RSNA.org/RadioGraphics*), Ahmed M. Zaky, MD, of the Johns Hopkins Medical Institutions in Baltimore, and colleagues describe the staging of PDAC at multidetector CT, with reference to the evaluation of the tumor-vessel interface as it guides treatment planning, along with a discussion of the key descriptors of PDAC at multidetector CT and their importance.

RadioGraphics

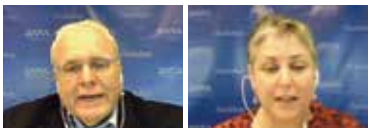
Examples are provided of the imaging findings of borderline resectable disease and different surgical approaches, along with a discussion on the importance of standardized terminology and template-based reporting.

"An understanding of the key descriptors of PDAC and their importance, especially in relation to the perivascular spread of disease, provides essential information that helps determine treatment options. Borderline resectable PDAC is an important clinical entity because of the large percentage of patients presenting with stage III disease and the increasing number of treatment options available for such patients," the authors write.



Pancreatic ductal adenocarcinoma (PDAC) in the pancreatic head in a 56-year-old woman. Coronal contrast-enhanced maximum intensity projection image shows a tumor (T) arising in the pancreatic head, with unilateral narrowing of the portal vein (PV) and the superior mesenteric vein at the portosplenic junction, with an adequate uninvolved length of the distal superior mesenteric vein (*arrow*) for venous reconstruction. SV = splenic vein. *(RadioGraphics* 2017;37;1:InPress)

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



Radiology PODCASTS

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

- "Chasing a Ghost': Factors That Influence Primary Care Physicians to Follow Up on Incidental Imaging Findings," Hanna M. Zafar, MD, and colleagues.
- "Multimodal Randomized Functional MR Imaging of the Effects of Methylene Blue in the Human Brain," Pavel Rodriguez, MD, and colleagues.
- "Hepatic Gadolinium Deposition and Reversibility after Contrast Agent–enhanced MR Imaging of Pediatric Hematopoietic Stem Cell Transplant Recipients," Natalia Maximova, MD.

Access *RadioGraphics* and *Radiology* CME Tests

Earn CME credit through RSNA's RadioGraphics and Radiology CME tests offered in an interactive online format.

Access convenient features such as a "view article" button linking to the related CME journal article and "preview test" enabling users to see question content before beginning the graded exercise. During tests, users can enlarge images and receive instant feedback. Users can also revisit the question and remediation for deeper understanding.

RadioGraphics and Radiology online CME tests offer 1.00 AMA PRA Category 1 Credit™ as well as SA-CME credit toward the American Board of Radiology (ABR) Maintenance of Certification (MOC) requirements.

Access the CME tests at *RSNA.org/eLearn.*

Radiology in Public Focus

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

MRI Shows Brain Disruption in Children with Post-traumatic Stress Disorder

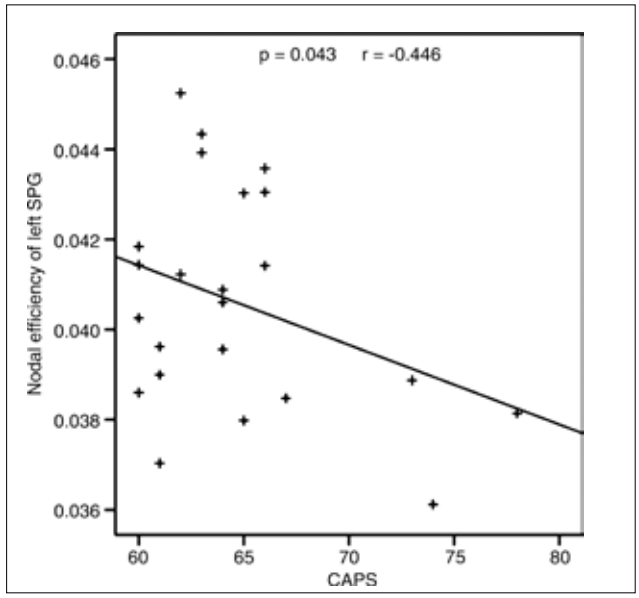
Brain MRI in children with post-traumatic stress disorder (PTSD) revealed that the structural connectome showed a shift toward "regularization," providing a structural basis for functional alterations of pediatric PTSD, according to recent Radiology research.

In the study, Xueling Suo, MM, from West China Hospital of Sichuan University in Chengdu, China, and colleagues used MRI to compare brain structure in 24 pediatric patients with PTSD and 23 control subjects exposed to trauma but without PTSD. The children had experienced the 2008 Sichuan earthquake, a massive disaster in south central China that killed almost 70,000 people and injured more than 370,000.

Researchers constructed the structural connectome using diffusion-tensor imaging tractography and thresholding the mean fractional anisotropy of 90 brain regions to yield 90 × 90 partial correlation matrixes. Graph theory analysis was used to examine the group-specific topologic properties and nonparametric permutation tests were used for group comparisons of topologic metrics.

Brain MRI in PTSD pediatric patients revealed higher values of characteristic path length (*P* = *.0248*) and lower values of local efficiency (*P* = *.0498*) and global efficiency (*P* = *.0274)* relative to those in stress-exposed control subjects without PTSD indicating that the structural connectome of individuals with PTSD shifts toward "regularization."

The widespread abnormalities were compatible with the notion that PTSD can be understood by investigating the dysfunction of large-scale, spatially distributed neural networks.



Scatterplot of nodal efficiency of left superior parietal gyrus (SPG) against CAPS scores in pediatric post-traumatic stress disorder. *(Radiology 2017;282;3:InPress)* ©RSNA 2017. All rights reserved. Printed with permission.

"The results of this study provide a structural basis for the alterations of brain function in pediatric PTSD and might help to define early interventions, which may attenuate adverse brain development," the authors write.

Heart Disease Protein Linked to Brain Damage

In community-dwelling middle-aged and elderly persons, subclinical cardiac dysfunction as reflected by serum N-terminal pro–B-type natriuretic peptide (NT-proBNP) levels is associated with global and microstructural MRI markers of subclinical brain damage, new research shows.

Hazel I. Zonneveld, MD, of Erasmus MC University Medical Center in Rotterdam, the Netherlands, and colleagues measured serum levels of NT-proBNP in 2,397 participants without dementia or stroke and without clinical diagnosis of heart disease who were drawn from the population-based Rotterdam Study.

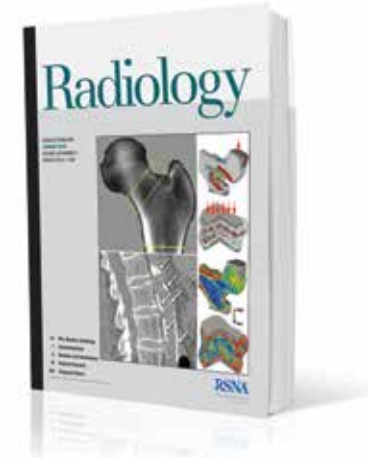
They found a higher NT-proBNP level was associated with smaller total brain volume and was predominantly driven by gray matter volume. Higher NT-proBNP level was associated with larger white matter lesion volume, with lower fractional anisotropy and higher mean diffusivity of normal-appearing white matter.

"Our findings suggest that the heart and brain are intimately linked, even in presumably healthy individuals. This is essential since cardiac dysfunction and subclinical brain damage are growing problems," the authors write.

January Public Information Outreach Activities Focus on Pediatric Radiation Safety

In January, RSNA's 60-Second Checkup audio program, distributed to nearly 65 radio stations across the country, will focus on children and radiation safety and discuss what parents need to know about pediatric medical imaging.

Media Coverage of RSNA



In September, 591 RSNA-related news stories were tracked in the media. These stories reached an estimated 319 million people.

Coverage included *U.S. News & World Report, Chicago Tribune, Orlando Sentinel, Houston Chronicle,* HealthDay, KTLA-TV (Los Angeles), WLS-TV (Chicago), WGN-TV (Chicago), WFLD-TV (Chicago), *Philly.com, MSN.com, Radiology Today, Auntminnie.com* and *Healthcare Business News.*

RadiologyInfo.org Content Review Program

RadiologyInfo.org, produced by the RSNA and ACR, is dedicated to being the trusted source of information for the public about radiology and the unique and vital role radiologists play in healthcare. The website, which consists of more than 225 procedure descriptions, diseases/conditions, screening/wellness and safety topics, receives over a million visitors each month.

Each year, beginning in January, content on *RadiologyInfo.org* is reviewed by physicians to ensure the public has access to the most up-to-date and accurate radiologic information. These physicians are then recognized on the *RadiologyInfo.org* Medical Advisors page.

Are you interested in becoming a medical advisor to review and contribute your expertise to patient-friendly content? Send your curriculum vitae to Joshauna Strong at *jstrong@rsna.org*, noting your area of expertise and interest.

RadiologyInfo.org
For patients

Education and Funding Opportunities

Thank You to RSNA 2016 Faculty

RSNA thanks the faculty members who participated in recording their courses at RSNA 2016. The courses will be posted online over the coming months in a tablet-accessible online format so members can supplement their continuing professional development and earn SA-CME credit throughout the year.

RSNA also thanks the self-assessment module (SAM) faculty for participating in SAM courses at the annual meeting. As part of presenting a SAM, faculty members write questions for their courses, as well as research and provide references for each question. With the help of faculty, RSNA was able to provide 47 SAM courses at RSNA 2016.

Visit *RSNA.org/Library* to access a full range of educational resources and tools to advance your career and earn CME credits. For any questions regarding educational offerings, please contact *ed-ctr@rsna.org* or 1-800-272-2920.

Register Now for the Writing a Competitive Grant Proposal Program

March 10-11
RSNA Headquarters
Oak Brook, IL

Seats are still available for the Writing a Competitive Grant Proposal workshop, designed for researchers in radiology, radiation oncology, nuclear medicine and related sciences who are interested in actively pursuing funding from the federal government, societies or foundations.

Participants will receive tools for getting started in the grant writing process and developing realistic expectations. Faculty includes Udo Hoffmann, MD, MPH, of Massachusetts General Hospital in Boston; Ruth Carlos, MD, of the University of Michigan Health System in Ann Arbor, MI; Martin Pomper, MD, PhD, of Johns Hopkins School of Medicine in Baltimore; David Shuster, MD, of Emory University in Atlanta; and Antonio Sastre, PhD, of the National Institute of Biomedical Imaging and Bioengineering in Bethesda, MD.

The course fee is $225. Register online at *RSNA.org/CGP.* Contact Fiona Miller at *dor@rsna.org* or 1-630-590-7741 for more information.

For Your Calendar

JAN. 7-13
Clinical Trials Methodology Workshop
Coronado Island Marriott Resort & Spa
Coronado, CA
• *RSNA.org/CTMW*

JAN. 27-28
Advanced Grant Writing Session III
RSNA Headquarters
Oak Brook, IL
• *RSNA.org/AGW*

FEB. 15-18
Mexican Society of Radiology and Imaging (SMRI)
Mexico City, Mexico
Visit the RSNA booth
• *SMRI.org.mx*

MARCH 1-5
European Congress of Radiology (ECR)
Vienna, Austria
Visit the RSNA booth
• *MyESR.org*

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

Annual Meeting Watch

RSNA 2017 Online Abstract Submission Opens mid-January

The online system to submit abstracts for RSNA 2017 will be activated in mid-January. The submission deadline is noon Central Time (CT) on Wednesday, April 12, 2017. Abstracts are required for scientific presentations, education exhibits, applied science, quality storyboards and quantitative imaging reading room showcases.

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

The top neuroradiology scientific paper as selected by the Scientific Program Committee will receive a $3,000 award at RSNA 2017.

Students, clinical trainees and post-doctoral trainees are eligible to receive $500 travel awards for top-rated abstracts accepted for presentation at RSNA 2017. Trainees are also eligible to receive a $1,000 research prize.

Full eligibility requirements for all awards will be available with the 2017 Call for Abstracts in mid-January.

Value of Membership

SAM Credit Deadline Approaches for *Radiology* Select Volume 4

Those who have purchased *Radiology* Select Volume 4: Breast Cancer Screening should be aware of two important deadlines.

On Feb. 27, the opportunity to earn self-assessment module (SAM) credits associated with *Radiology* Select Volume 4 will expire. Those who have previously purchased access to the Volume 4 online tests will need to complete the tests by Feb. 26 to earn credit. After this date, access to the online tests expires.

The online educational edition of Volume 4 will be available at a 50 percent discount off the standard price until Feb. 26. This offer applies to the online educational edition only and does not apply to print or tablet editions.

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

Coming in February:

Latest *Radiology* Select Volume Spotlights Breast Imaging

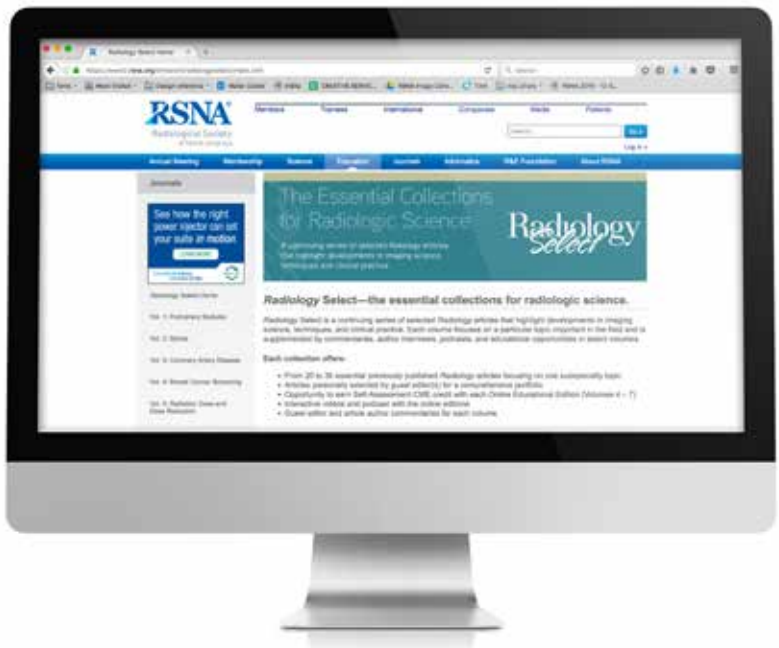
Radiology Select Vol. 8: Breast Imaging — Beyond Mammographic Screening will be released in February. Guest editors Donna D'Alessio, MD, and Elizabeth Morris, MD, curated 32 *Radiology* articles for new volume. The articles represent important advances made by breast imaging in breast cancer diagnosis and in the evaluation of women being treated for the disease.

Subject areas include:

- Breast density (legislation surrounding breast density in mammography and advances in breast imaging techniques for women with dense breasts)
- Tomosynthesis (digital breast tomosynthesis in the screening and diagnostic setting and imaging techniques)
- Ultrasonography (issues surrounding breast US technique, management of findings at supplemental screening, and the challenges involved with implementing such a program)
- Biomarkers (utilization of breast MRI techniques and findings that may shed light on a patient's risk for breast cancer and identification of imaging features to determine which cancers may progress or recur)
- MRI in breast disease management (advances in breast MRI as a critical player in both the surgical and medical management of the disease)

The online educational edition includes 17 tests with an opportunity to earn up to 17 SA-CME credits. This enduring material can be applied toward the ABR self-assessment requirement.

Access all volumes of *Radiology* Select at *RSNA.org/RadiologySelect*.



COMING NEXT MONTH

Next month, *RSNA News* shares the winners of the RSNA Image Contest selected at RSNA 2016 and delves into the stories behind the photos.

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The Benefits You Want.

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- **eLearn** online education resources
- **Grant opportunities** that launch careers
- **Community** for networking, collaboration and innovation
- Free subscriptions to ***Radiology*** and ***RadioGraphics***

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Valerie Vilgrain, MD, PhD
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