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Diagnostic Radiology Chief Residents 2007-2008



(LEFT TO RIGHT) Jennifer Demertzis, MD; Meghan Lubner, MD; Sara Rohr, MD

Photograph by MIR Photography Lab

Jni

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Visit the MIR web site at www.mir.wustl.edu





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ON THE COVER Under the leadership of Mark Mintun, MD; John Kotyk, PhD; and Marion Harris, the CCIR is the nation's standard-bearer for radiology research. Photograph by Tim Parker.

SPOT NEWS

Teacher of the

At the residents' and fel-

lows' farewell dinner in June,

Robert McKinstry, MD, PhD,

associate professor of radiology

and chief of pediatric radiology,

was named the 2007 Diagnostic

Radiology Teacher of the Year.

select the faculty member who

has made outstanding contribu-

Radiology senior residents

tions to resident education

during the academic year.

Year



Bhalla receives surgery award

In recognition of his contributions to surgery resident training, Sanjeev Bhalla, MD, associate professor of radiology and chief of cardiothoracic imaging, received the first Friend of the Surgery Resident Award, along with an invitation to the Department of Surgery's Chief Residents' Graduation Dinner at the end of the 2006-2007 academic year. Nominations for the award were submitted by surgery residents; voting via ballots was completed at the 2007 General Surgery Resident Retreat.

Radiology role to increase

As more Washington University School of Medicine faculty establishes practices at Barnes-Jewish West County Hospital (BJWCH), the need for additional imaging and study interpretations is clearly indicated. To ensure the smooth and efficient handling of imaging operations, Vamsidhar Narra, MD, associate professor of radiology, was named chief of radiology clinical operations at BJWCH. Narra will continue to serve as cochief of body magnetic resonance imaging at Mallinckrodt Institute.

Bridging law and science

Marcus Raichle, MD, professor of radiology, will serve on the board of the Law and Neuroscience Project—an innovative effort to integrate new developments in neuroscience into the United States legal system. The initiative is funded by a three-year \$10 million grant from The John D. and Catherine T. MacArthur Foundation. Three working groups, each chaired by a neuroscientist and a legal expert, will address addiction, brain abnormalities, and normal decision making. Raichle, who holds joint appointments in the departments of Neurology, Neurobiology, Psychology, and Biomedical Engineering, is the neuroscience lead for the decision-making group. All three groups will review current research, identify gaps in knowledge and understanding, and develop specific research proposals in each area to improve law, policy, and legal proceedings.

Washington University in St. Louis is one of 25 universities participating in the project, which will be centered at the University of California, Santa Barbara For more information, go to www.macfound.org.



Orthopedic center opens

A \$13 million outpatient orthopedic facility-the Washington University Orthopedics and Barnes-Jewish Hospital Outpatient Orthopedic Center-opened July 2007 in Chesterfield in West St. Louis County. The center, which held its grand opening on October 3, incorporates the latest solutions for reducing costs, improving quality, and limiting wastesuch as a new scheduling process that coordinates office visits with radiologic assessment.

Physician offices previously in the North Mason facility near Barnes-Jewish West County Hospital have been relocated to the new 60,000 square-foot orthopedic center. Mallinckrodt Institute's musculoskeletal radiologists are on site daily and perform all imaging interpretation. Some of the amenities offered at the outpatient center:

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- Ambulatory surgery suites
- Rehabilitation services
- Physical therapy
- Centrally located diagnostic radiology, including arthrography and magnetic resonance imaging
- Picture Archiving Computer System.





Brain Changes FROM CHILDHE D TO ADULTHED

Researchers study shifting brain regions in children and adults by Candace O'Connor

> On his computer screen, Bradley Schlaggar, MD, PhD, can play a graphic version of changes that take place in the human brain between childhood and maturity. He has color-coded the brain regions—black, yellow, red, and blue—according to their function in performing different tasks. In an eightyear-old child, these regions are largely bound together and "talking" in one large, gregarious, clique-type network.

ut as time goes on, this picture changes, as regions realign and acquire new "friends." When a child is around age 13, the red regions pull away and become an integrated unit. One important region for cognition, the dorsal anterior

The shifting life of the brain, in which regions—like social groups—form new allegiances over the years, came as a surprise to Schlaggar and Steven Petersen, PhD, whose study results recently appeared in the scientific journal *Proceedings of the National*

These studies provide a conceptual framework for thinking about how executive control emerges in typically developing people... **99**

cingulate cortex, moves away from its yellow companions and settles at the heart of another network. By the time humans are in their twenties, the last connections break between yellow and black.

Academy of Sciences. Their description of brain changes not only redefines the development of normal brain structure but also may shed light on network malfunction in attention deficit hyperactivity



disorder (ADHD), autism, Tourette's syndrome, and other neurological disorders.

By adulthood, says Schlaggar, the brain regions have completely re-formed into two distinct, control networks—a finding they made in an earlier study also published in *Proceedings*. The cinguloopercular (or sustaining) network is the stable player, active during sustained mental activities, while the frontoparietal network is the adaptive piece, allowing a person to change behavior in response to a problem.

"These studies provide a conceptual framework for thinking about how executive control emerges in typically developing people," says Schlaggar, an assistant professor of neurology, who holds joint appointments in radiology, pediatrics and anatomy, and neurobiology. "That framework is critical because we've been dealing with a literature that has reached a plateau in terms of new insights. This gives us a new injection of energy that I think will take us beyond where we've been previously."

The Research Study

For his study of brain development, Schlaggar recruited three groups of participants: 49 children ages seven to nine, 43 adolescents, and 47 adults over 21 years of age. Instead of asking them to perform a certain task or to answer specific questions (often the way studies have been done in the past), he had participants relax and engage in ordinary reflection or freeranging thought.

Steven Petersen, PhD, and (right) Bradley Schlaggar, MD, PhD

Brain Changes FROM CHILDH D TO ADULTH

Resting state functional connectivity MRI reveals the developmental dynamics of the brain's control networks. The fast/adaptive (yellow) network and the slow/maintenance (black) network segregate and integrate over the course of development.



"When you are in any sort of active situation, the parts of your brain that are doing the work are contingent upon the situation," says Petersen, a professor of neurology and psychology with a joint appointment in radiology. "But when you let the system relax to its free-ranging state, we think that the regions that talk to each other at rest are the ones that talk to each other most over time."

To study the brains of these research participants and to identify the control networks, Schlaggar used functional magnetic resonance imaging (fMRI), which measures, indirectly, regional brain activity. If activity in two regions of the brain correlate during this resting state, they likely are functionally connected.

"Here are two brain regions, on opposite sides from each other—activity for one is shown in yellow and the other in blue," says Schlaggar. "These are two highly correlated regions. The yellow trace is almost entirely mimicked by the blue trace."

When Schlaggar and Petersen looked closely at these correlations, what they found was a shock. Their first study, postulating that there were two control networks in adults, had shown no connectivity between the two. But in children there is marked connectivity. In fact, the two networks, which have not yet differentiated, are in active conversation as a single amalgam of regions. In adolescents, the brain regions are in an intermediate state. Further, within this single clique in children, the cingulo-opercular network is buried within the frontoparietal network What could that mean? While any answer is speculative, it may mean that the sustaining network is simply less well-developed than is the adaptive a possible explanation for the short attention span and distractibility of young children.

Reflections on the Study

When they began this experiment, the scientists had no fixed hypothesis, and their research approach was strictly observational. In fact, they were even uncertain about the value of the experiment. "But the result popped out," says Schlaggar, "and it alleviated our skepticism." "We think these networks are real, they are important, and if we are going to understand the complex processing that is going on in the brain, that's going to require not just focusing on one region but on networks of regions and on how they change in response to development or disease," says Schlaggar.

They have adopted metaphors, such as "cliques," to describe the brain's alignment because they borrowed the applications they use to investigate these networks from scientists who study social networking. "We're using software, visualization tools, and mathematics that come from investigators who have been studying social systems in trade networks, economic systems, even Internet connections," says Petersen.

...if we are going to understand the complex processing that is going on in the brain, that's going to require not just focusing on one region but on networks of regions... ??

What distinguishes their work from studies by earlier investigators, they say, is that they are not looking at activity in individual regions but at *networks* of regions. For example, scientists have previously examined brain activity in children with ADHD and without it, with each group given tasks that require close attention. Researchers then compared differing activity in a small number of brain regions.

Earlier work by Mallinckrodt Institute researchers, particularly Marcus Raichle, MD, a professor of radiology and an internationally acclaimed neuroscientist, has also informed Petersen's and Schlaggar's efforts. Raichle's pioneering use of functional imaging to look at brain function while the patient is at rest has driven a new wave of scientific inquiry nationally, says Schlaggar and Petersen. The interdisciplinary nature of research at Mallinckrodt Institute—locating radiologists next to neurologists, psychiatrists, neurobiologists, and anatomistsalso is vitally important.

"At the Cognitive Neuroscience Society meeting last May, the buzz about the approach we are using was the most focused attention I have seen," says Schlaggar. "It has a lot of advantages. For one thing, studying the brain (that is, without an overt task) unburdens you from having research participantssome who have ADHD or dyslexiafrom performing tasks in the magnetic resonance scanner, which is difficult for them and makes it difficult to interpret the imaging results in comparison to participants who find the same tasks easy."

Still, more questions remain. What about the sleeping brain? Is it in a free-ranging state similar to its waking mode? Does gender make any difference to brain changes? So far Schlaggar and Petersen have looked at only three dozen or so regions of the brain. What about other regions involved in memory and language?

Schlaggar also is undertaking a follow-up study of teen-agers with Tourette's syndrome, to see whether their networks and the relationships between them differ from those of teens without Tourette's. Half of the Tourette'safflicted teens also have ADHD, and Schlaggar will study their brains to see whether the control networks are impaired.

"What's more, there is no reason to think that young adulthood is a stable place," says Petersen. "In humans from age twenty seven to ninety, we could still continue to see these dynamics and perhaps the degradation of some networks. There is not going to be any epoch in which the brain is not dynamic."

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Deciphering THYROID NODULES by Mary Jo Blackwood, RN, MPH with Ultrasound

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FINDINGS FROM A NATION-WIDE STUDY WILL REFINE CLINICAL GUIDELINES.

The thyroid gland is a small butterflyshaped organ in the front of the neck. Physicians can feel the thyroid on either side of the trachea during a patient's physical examination. The thyroid converts iodine from the foods we eat into thyroid hormones that regulate our body's use of fats and carbohydrates, help control body temperature, influence heart rate, and regulate the production of protein.

An enlarged thyroid (a goiter) is usually caused by multiple nodules in the gland. Although significant goiters are uncommon, thyroid nodules are very common. In fact, roughly half of us will develop thyroid nodules over our lifetime. We are more prone to them as we age, and women are more likely to develop nodules than are men. Why normal thyroid nodules develop is not clear. Most nodules are benign and asymptomatic, but some of them can become large enough to press on the trachea or esophagus and make it uncomfortable to swallow. While some patients discover the nodules.

most are identified during a routine medical exam or are detected on scans of the neck. Since the neck may be scanned for many reasons such as Doppler exams of the carotid arteries or magnetic resonance scans of the cervical spine—thyroid nodules now are being detected more frequently.

Physicians are faced with the dilemma of separating the 95 percent of benign nodules that can be left alone from the 5 percent of malignant nodules that should be removed. Fine needle aspiration biopsy (FNA) is the primary tool used to distinguish benign and



William Middleton, MD, demonstrates an ultrasound examination of the thyroid.

malignant nodules. Although FNA is a relatively innocuous procedure, the sheer number of nodules present in the population precludes its universal use. Previous research has shown that ultrasound also can help in characterizing thyroid nodules. There are clear trends in the sonographic appearance of thyroid cancer and benign nodules. However, there also is overlap in their appearance, and the risk of malignancy in many nodules is only partially defined.

Ultrasound-Guided Fine Needle Aspiration (FNA)

Thyroid FNA is a type of biopsy that requires only local anesthesia and is usually painless. After the nodule has been identified with ultrasound, a small fine-gauge (usually 1.5 inch, 25 gauge) needle is inserted into the nodule. Continuous ultrasound imaging guides the location of the needle while it gently passes back and forth through the nodule to obtain as much tissue as possible. Four to six samples are usually obtained to ensure that an adequate amount of tissue has been collected. The entire biopsy usually takes less than 20 minutes.

Deciphering THYROID NODULES with Ultrasound

William Middleton, MD, a professor of radiology at Mallinckrodt Institute of Radiology (MIR) at Washington University School of Medicine, believes that too many patients with benign nodules are being biopsied. He is the principle investigator in a multi-institutional study aimed at determining the risk of malignancy based on clinical and ultrasound findings. The data collected will be used to refine guidelines for determining which nodules require FNA and which do not. Middleton is working closely Sonography is becoming the pivotal tool in deciding which thyroid nodules should be biopsied. Unfortunately, the criterion used by different physicians at different institutions varies tremendously. We anticipate that this study will provide essential data for establishing unified criterion for determining which nodules should be biopsied. Sonography is admittedly just one piece of the puzzle—clinical factors, cost concerns, prognostic implications are all important as well. But it is a central piece, and

"BECAUSE OF ITS MULTI-INSTITUTIONAL NATURE, IT WILL BE ONE OF THE LARGEST STUDIES DEALING WITH SONOGRAPHY OF THYROID NODULES EVER PERFORMED."

with coinvestigator Sharlene Teefey, MD, a professor of radiology and head of MIR's ultrasound group, and Charles Hildebolt, DDS, PhD, an associate professor of radiology who is the study's statistician. MIR is the lead institution for seven sites involved in this twoyear study, which will be recruiting patients and collecting data for another year.

Middleton explains the importance of this project: "This is a unique study. Because of its multiinstitutional nature, it will be one of the largest studies dealing with sonography of thyroid nodules ever performed. In addition, the study's prospective design eliminates many of the shortcomings of previous large retrospective studies. we must understand the sonographic features that distinguish benign from malignant nodules before we can address anything else."

STUDY CONTRIBUTIONS

Indiscriminant FNA of thyroid nodules is not only poor use of manpower and medical resources; it also can have negative impacts on patient care. Some patients with benign disease will have inconclusive FNAs, which may lead to unnecessary surgery, additional expense, and potential surgical complications. The radiologist's challenge is to find those small numbers of thyroid cancer that are highly treatable (the 30-year survival rate for thyroid cancer is 90 percent), while avoiding performing FNAs on large numbers of benign nodules.

The major contribution of this study will be allowing radiologists and other physicians to predict the risk of cancer in individual thyroid nodules based on their ultrasound and clinical features. Nodules with a high risk of cancer then would be targeted for FNA, while those with a low risk would be spared from FNA.

WHAT WE KNOW

There are known trends in ultrasound features that separate benign from malignant nodules. Some of the characteristics associated with thyroid cancer include the following:

- Solid composition
- Hypoechogenicity
- Irregular margins
- Calcifications
- · Vascularity.

However, results are inconsistent and no single ultrasound finding combines both high sensitivity and high specificity. Because of this problem, the Society of Radiologists in Ultrasound (SRU) convened a panel in 2005 to develop guidelines for thyroid nodule biopsy. Several other organizations also have issued guidelines. Although Middleton and Teefey both believe that guidelines are greatly needed, they agree that all current guidelines could be further refined with multi-institutional prospective data on a large number of patients.

The current study is collecting thyroid biopsy data from Washington University and six other institutions. The pooled results of all ultrasound-guided FNAs are included in the study. Images of the biopsied nodules are being collected with prospective attention directed at agreed-upon ultrasound parameters. Middleton and Teefey are analyzing the sonograms from all seven sites, which eventually will contain 3,000 nodules. When the study is complete, they hope to present this data to a follow-up panel, thus making the guidelines even more useful.

"The biggest obstacle so far has been finding an available computer system to store all the scans and a program that can be used to review the scans," says Middleton. Fortunately, with the help of Bruce Vendt, an information systems project manager, and Fred Prior, PhD, a research associate professor of radiology and chief of MIR's Electronic Radiology Laboratory (ERL), that problem has been solved. Ed Dailey, a programmer analyst from Washington University's Information Technology Services, also has been a valuable contributor by designing and creating an easy-to-use database for all clinical, sonographic, and pathologic data.

Top: Arrows indicate a typical benign thyroid nodule that is partially solid and partially cystic with a honeycomb apprearance.

Middle: Arrows indicate a typical thyroid cancer that is solid, hypoechoic and contains microcalicification.

Bottom: Arrows indicate a needle entering a small thyroid cancer (+).







Study Sites

- Stanford University
- Mayo Medical Center
- Rhode Island Hospital Medical Center
- Hospital of the University of Pennsylvania
- Dartmouth-Hitchcock Medical Center
- H. Lee Moffitt Cancer Center and Research Institute
- Mallinckrodt Institute of Radiology

William Middleton, MD, and Jeanine Wade, RT(R)

Jeanine Wade, RT(R), clinical research coordinator for the study, primarily has been responsible for coordinating efforts with the other sites, interfacing with funding and regulatory groups, and— along with Kathy Taylor, a patient research coordinator—inputting data into the MIR database. Currently, there are approximately 1,000 case files in the database, with 500 of those collected in St. Louis. "The process is simple now that the computer issues have been resolved with the help of the ERL. All sites send their records via FedEx. Patient information data sheets are in hard-copy format, and the ultrasound films are on CD *[compact disk]*. The data files are entered into the database while the CDs are downloaded and transferred into the computer system so Doctor Middleton is able to interpret them," says Wade.

"... I AM CONVINCED THAT WE HAVE A GREAT OPPURTUNITY TO MAKE A SIGNIFICANT IMPACT..."

According to Middleton, a large multi-institutional study of this type could not be performed without the help of a dedicated group of investigators at all sites who are passionate about refining the use of ultrasound-guided FNA. "This study is very painstaking and time-consuming," he says. "But I am convinced that we have a great opportunity to make a significant impact on the workup of patients with thyroid nodules."

EVALUATE: STATE OF THE STATE O



MRI RESEARCH SHOWS PROMISE

lioblastoma multiforme, or GBM, is the most common, primary malignant tumor of the adult brain. Even with a combination of therapy types, outcomes remain poor. Monitoring tumor progression and response to therapy is difficult at best because of the skull barrier. Small-animal imaging techniques, however, offer a powerful and versatile option for applying accelerated learning to produce better clinical outcomes.

Characterizing Gliomas and their Response to Therapy

hen a patient is undergo-

ing treatment for leukemia or another type of blood disorder, a simple blood test can be taken frequently to determine if the treatment is working. It is not as straightforward when the condition is a malignant brain tumor. The only way to directly assess response to treatment is to biopsy the tumor, which is not an option when treatment effectiveness must be monitored frequently. Joel Garbow, PhD, a research associate professor at Mallinckrodt Institute of Radiology, hopes to obtain treatment response data by using a set of metrics and noninvasive imaging.

Garbow, a member of the Institute's Biomedical Magnetic Resonance Laboratory and of the Alvin J. Siteman Cancer Center, uses mouse models to develop imaging techniques that one day will be applicable to patients with glioma. *[Primary brain tumors collectively are known as gliomas.]* His research is a part of the growing field of magnetic resonance (MR) imaging of the brain, used for both structural (anatomy) and functional (response to various stimuli) analysis.

The importance of his research is obvious: "MR images provide exquisite detail for looking at brain tumors anatomically. The missing piece is being able to see the response to treatment," says Garbow. "If tumor shrinkage is used as the metric, time is wasted because it takes too long after administering therapy before the shrinkage can be seen on an MR image. In the meantime, two things are happening: the patient is on a treatment that might not be working, and the treatments can have some toxicity and morbidity involved. If we knew sooner that the tumor was not responding, we could switch to a more effective therapy sooner."

Several key studies are using mouse models to find that measure of effectiveness at an earlier stage. The research involves taking a baseline scan with different imaging techniques. These images can be compared to subsequent images, looking for signs of treatment—whether chemotherapy or radiation—effectiveness.

"We are looking for early biomarkers that will be consistent for a specified period. If there is no change in these markers, then treatment can be changed to one that might be more effective," says Garbow. "Doctor David Gutmann's [professor of neurology at Washington University] work with mouse models on low-grade optic

In vivo MR images of healthy optic nerve (left panels) and optic pathway glioma (right panels, arrow) in a mouse model of Neurofibromatosis-1.

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In vivo MR image (left) and oxygen extraction fraction (OEF) map (right) for a mouse with a high-grade brain tumor. The tumor is clearly seen as the bright region on the image of the brain; the OEF map, which provides a measure of tumor oxygenation, shows a clear distinction between tumor and healthy tissue.

pathway gliomas has been a great foundation for our research." Using specific MRI techniques, Garbow is looking at three markers that show promise: water diffusion, oxygen levels, and vascularity.

Water diffusion as a marker

Diffusion weighted imaging (DWI) is an MR technique used to measure the restricted diffusion of water in tissue. "Diffusion of water depends on the density of cells," We are using DWI in mouse models for measuring the effectiveness of chemotherapy and radiation therapy, either alone or together."

Garbow anticipates an obstacle in using the technique for human patients: distinguishing radiation necrosis (tissue damage) from tumor regrowth. An abnormality detected on an MR scan taken three months after the end of radiation treatment could indicate necrosis, which would repair itself over time. Or the tumor may be growing, and treatment should be started quickly. On a standard MR scan, the two are difficult to distinguish.

"We are looking for a signature to identify the difference in diffusion between the two conditions.

"When cells are dense, as in an actively growing tumor, water has a hard time moving around."

explains Garbow. "When cells are dense, as in an actively growing tumor, water has a hard time moving around. When chemotherapy begins to have an effect—even before the tumor shrinks—the tumor should become less dense, and water should move more easily. With the mouse model, we can obtain histology and tissue analysis and establish a tight correlation between what the MR image is showing and what is actually occurring. Doctor Sarah Jost *[a researcher and a neurosurgeon]* has contributed a great deal to our efforts."

Gioblastoma multiforme (GBM)

- Also known as grade-IV astrocytoma
- Most common and aggressive type of primary brain tumor
- Accounts for 52 percent of all primary brain tumor cases and 20 percent of all intracranial tumors
- Occurs in only two to three cases per 100,000 people in Europe and North America
- Grows rapidly, invading and altering brain function
- Common symptoms: seizure, nausea/vomiting, headache, partial paralysis
- Five-year survival rate: less than three percent
- Modern effective treatment: surgery, radiation therapy, chemotherapy

Characterizing Gliomas and their **Response** to **Therapy**



important collaborator. Physics is prominently involved in studying oxygen in the blood. For this part of the search for reliable markers, investigators are using blood oxygenation level dependent (BOLD) MR, a technique that looks for changes and regions of the brain that 'light up' on the image, representing oxygen in the blood in the brain. Doctor Yablonskiy and his

physics/ has been an

Joel Garbow, PhD, with the massive 11.7 Tesla magnetic resonance scanner housed in the Institute's imaging research facility on Scott Avenue.

"We are looking for a signature to identify the difference in diffusion between the two conditions."

Tumor hypoxia

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Physicians have long recognized the importance of oxygen levels in tumors to predict response to therapy, especially in radiation therapy. Generally, a lower level of oxygen in the tumor equates to a lower treatment response. Researchers want to assess oxygen levels for treatment planning and for monitoring therapy.

"For this type of work, collegial relationships are key elements for designing a good study," says Garbow. "Doctor Dmitriy Yablonskiy [professor of radiology and of colleagues are trying to extend the BOLD experiment to be more quantitative and to provide an actual measurement of blood volume and oxygenation. Preliminary data shows that oxygen levels in a tumor are different than oxygen levels in healthy tissue."

Future research will probe the response of oxygen levels to treatment in an effort to determine if this is an effective and early-enough marker for treatment response. The researchers already know that hypoxia is a detriment for radiation response, but can they change oxygen levels to make treatment more effective?

Angiogenesis

Some treatments are cytotoxic and kill cancer cells directly. Others are angiogenic and prevent development of a tumor blood supply. While the angiogenic approach may never shrink the tumor, it can prevent any further growth and would be considered as a successful treatment. Another approach to finding an early marker for treatment success or failure involves using MRI to assess the vasculature in and around the tumor and to monitor changes. Measuring a dramatic change in blood supply to the tumor or "leakiness" of blood vessels would indicate treatment success.

Garbow sums up his group's research efforts: "The 'Holy Grail' of cancer treatment is early detection, accurate staging, choosing the most effective therapy, and determining early on if it is working as intended. If not, the physician then can prescribe a more effective treatment and spare the patient from the adverse effects of a less-than-beneficial therapy. Animal models are the safest way to determine how best to measure those effects, so information can be moved to the clinical level as quickly as possible."

Washington University in St.Louis School of Medicine Mallinckrodt Institute

CCIR Center for Clinical Imaging Research

The Center for Clinical Imaging Research

A COMPREHENSIVE IMAGING CENTER DEDICATED TO RESEARCH

by Candace O'Connor

When Mark Mintun, MD, surveys the brand-new Center for Clinical Imaging Research (CCIR) at Mallinckrodt Institute of Radiology, he sees more than the gleaming equipment, examining rooms, labs, and offices. He also sees the future: innovative research projects filling the CCIR with patients and physicians. State-of-the-art imaging equipment ultrasound, magnetic resonance (MR), computed tomography (CT), positron emission tomography (PET), and PET/CT—producing results that will advance medical science and improve clinical care.



The Center for Clinical Imaging Research

CCIR Center for Clinical Imaging Research

e points out a well-appointed lab that will test blood samples and a processing room where scientists will view images at top-of-the-line workstations. One of the side rooms will store carts that hold researchers' supplies used for the imaging studies. Though it is nearly empty now, the "room will

> be lined with carts," predicts Mintun, the

CCIR director, with enthusiasm. "They will need to have parking spots inside!"

For now, the CCIR is just getting started. The 8,800-square-foot facility, on the tenth floor of the Barnes-Jewish Hospital West

Mark Mintun, MD

Pavilion and near the Neurosurgery Intensive Care Unit (ICU), has been open since the end of June. While the staff is still adding some finishing touches, the opening fanfare is yet to come, with a gala reception scheduled for later this year.

Yet this young CCIR already is setting the standard for radiology research nationwide because of its meticulously planned layout and extraordinary location. Not only are neurosurgery patients just steps away, but the Surgery ICU is two floors down, so that inpatients can be transported for studies with

Real-time, 3-D/4-D ultrasound technology has advantages over the conventional 2-D method, including shorter exam times; data manipulation for obtaining more information for treatment planning, chemotherapy, radiotherapy, and surgery; and tracking volume changes with treatment.

In the CCIR's radiopharmacy, Linda Becker, CNMT, prepares radioactive doses used for PET and PET/CT studies.

little fuss or risk. In other medical centers, imaging research facilities are often blocks away.

"A comprehensive imaging center and a research-dedicated imaging center, right in the middle of a hospital—we don't know of any other medical group that has done this," says Mintun, a professor of radiology who also holds joint appointments in psychiatry, neurobiology, and biomedical engineering.

"It is a huge advantage to have a state-of-the-art imaging facility that allows us to routinely conduct clinical research involving inpatients as well as outpatients," adds Gilbert Jost, MD, director of Mallinckrodt Institute and chair of Washington University's Department of Radiology.

THE CCIR TAKES SHAPE

In 2003, Mintun began discussing the idea of such a center with Jost and colleagues Marcus Raichle, MD, then cochief of the Division of Radiological Sciences; William Powers, MD, a renowned neurologist at Washington University; and Barry Siegel, MD, chief of the Division of Nuclear Medicine. They knew that a Mallinckrodt Institute-owned, clinical radiology area inside Barnes-Jewish Hospital would soon be vacant as equipment was being moved to the Center for Advanced Imaging. What would be the best use for that empty space?

The group was inspired by a well-used PET scanner inside the neuro-ICU, a valuable tool for researchers because of its close proximity to patients. "Because of its location, that PET scanner has greatly advanced the understanding of what goes on in traumatic brain injury and stroke, and the scanner also has been used for research studies of depression," says Mintun, who has conducted some of his own studies on that machine.

In 2005, Mallinckrodt Institute signed an agreement with Siemens Medical Solutions: The medical equipment manufacturer would provide its most advanced, Food and Drug Administration-approved imaging technology, and the Institute would use it for cutting-edge therapy research. They would "push this equipment to the limit," says Mintun, "and find out what it can do."

BUILDING THE CCIR

Designing and building the CCIR required much of Mintun's time for three years. Once the architects had sketches in place, focus groups (including cardiac, cancer, and brain researchers) spent hours discussing how many scanners to acquire or what special-use rooms to construct.



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Jennifer Halliday, a lab assistant, is preparing a cardiac PET study. In the background are Jo Ann Marsala, RN, clinical research nurse coordinator, and Todd Cade, PT, PhD, assistant professor in physical therapy.

This imaging equipment entailed special construction requirements. "Since this facility was being built inside a working hospital," Mintun says, "we had to be highly aware of safety issues, such as lead shielding to contain the radiation and steel shielding for the magnetic fields of the scanners."

Other needs also posed challenges. In one room, pneumatic tubing was installed to transport radiotracers (used in PET imaging) directly from the three cyclotrons housed at Mallinckrodt Institute. Throughout the CCIR area, the planners had to devise ways to receive ill—sometimes bedridden patients and to ensure their continuous care.

IMAGING GOALS

Behind all the planning for the physical plant is a carefully developed concept for the CCIR's imaging work. While research in animal models can be invasive, human studies must be as noninvasive as possible. "Imaging provides a dramatic way of taking measurements in living people with a minimum of invasive procedures," says Mintun.

According to Mintun, imaging has blossomed over the past decade. CT scanners are at least 100 times faster than they once were, and MR scanners now provide high-resolution images. PET scanners, in conjunction with new tracers, allow scientists to see cell activity that previously could only be captured by removing the targeted tissue and examining it under a microscope.

IT TOOK A VILLAGE...

The concept of the CCIR became a reality as a result of the collaborative efforts of several people and groups, including the following:

- The CCIR staff
- Electronic Radiology Laboratory (ERL): Fred Prior, PhD, research associate professor and ERL director; Lawrence Tarbox, PhD, research assistant professor; Stephen Moore, MS, research assistant professor
- Clinical Research Laboratory: Shelly Meese, clinical research development coordinator; Robin Haverman, manager, research operations
- Gilbert Jost, MD, chair, Department of Radiology, and director, Mallinckrodt Institute



The CCIR will focus on three major imaging applications:

- A place where physicians can conduct the final clinical tests of an imaging application that is nearly ready to for patient use
- Help scientists better understand a disease or its treatment at a basic, biological level by examining its biomarkers—"Perhaps there are treatments for Parkinson's disease that don't work perfectly," Mintun explains. "Then, researchers hypothesize that the disease could actually be reversed by making the dead brain cells grow back. Before those researchers start a clinical trial, they must know if imaging can see these cells being formed."
- Promote work at a more fundamental level. How did a disease occur in the first place? What is the normal development of the brain in childhood? What is normal aging and what causes the brain to decline? Is it a gradual process or a series of small insults that add up to dramatic change?

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CCIR'S NEW TECHNOLOGY

Already, two major studies have moved into the CCIR: • an ongoing protocol measuring

- the metabolism of the heart • a study looking at amyloid imaging
- in Alzheimer's disease.

As scientists write grants and acquire regulatory approvals, additional clinical trials will be added.

This research will take place using the latest equipment. In one room is the Antares® ultrasound machine, with adapters for vascular, body, and cardiac imaging. Down the hall are two Siemens MR scanners: an imposing 3-Tesla scanner, often used for brain studies because of its high resolution; and a smaller 1.5-Tesla unit that allows fewer artifacts on the imaging field. Both have Total Imaging Matrix capability, in which coils positioned around the patient allow the machine to acquire a large amount of data simultaneously.

In another lab is a new PET/CT scanner that is highly effective in overlapping biochemistry and anatomy in one image. According to Mintun, most clinical PET scanners have PET/CT capability because of the diagnostic advantages



Michael Harrod, CNMT, in the control room for the positron emission tomography (PET) scanner, which provides 2-D and 3-D acquisitions.

Betsy Thomas, RN, is shown in the nursing area, where study patients will complete medical forms and study questionnaires, have blood drawn, and, depending on the study, undergo an electrocardiogram of the heart or receive intravenous fluids.

they offer, especially for patients with cancer. For example, with PET/CT, physicians can now pinpoint a suspicious spot in the abdomen that might be a small, cancerous lymph node.

"Not only can PET/CT provide cancer evaluation, especially how the cancer has

responded to therapy," says Mintun, "but it also has the promise of showing biochemical changes in the tumor long before the anatomical changes are seen." Another new piece of equipment is a Siemens Definition[®] CT unit that contains two fully functioning CT



Dott Wallace, special projects administrator

scanners. They can operate simultaneously to collect data twice as fast, or they can work independently to gather different types of data.



MAKING WORK EASIER

Researchers already have been contacting Mintun, saying that the CCIR will make their work much easier. When researchers need two imaging methods for a study, they will find both in the same location. If they need to combine imaging plus heart monitoring or imaging plus a computerized assessment, those are possible in the CCIR as well.



Ruth Holdener, RT, with the SOMATOM Definition computed tomography scanner: uses two X-ray sources and a two-detector system simultaneously, has a 64-sliceper-rotation acquisition.

The work of the Institute's Electronic Radiology Laboratory (ERL) also will facilitate research. Thanks to the ERL's innovative programming, the CCIR will have web-based scheduling in which a patient's protocol is immediately available. The images of that patient, with all personal identification removed, are downloaded into the computer system, archived with a protocol number, and routed to any computer specified by the scientist.

And the Clinical Research Laboratory staff is available to help investigators design protocols properly, making sure they have the correct regulatory approvals and research coordination. "The techni-

cal aspects of imaging are complicated and daunting for many investigators," says Mintun. "We want to make sure they can take advantage of our expertise."

Altogether, Mintun says, he is thrilled with the start the CCIR has made. "For years, it was something we were planning to do and then working on. Now it is very exciting to actually walk around the center and to see what is happening."

Editor's note: Learn more about the CCIR at http://ccir.wustl.edu.

The Magnetom Trio, a 3-Tesla magnetic resonance imaging (MRI) unit, scans up to 32 coil channels simultaneously. The image on the monitor was obtained by a procedure called tractography, which uses diffusion tensor imaging to study bundles of fiber tracts in the brain.

CCIR STAFF

Administration

- Mark Mintun, MD, director
- Jeffrey Brown, MD, associate director
- John Kotyk, PhD, associate director
- Marion Harris, administrator, Division of Research Development
- Dott Wallace, special project administrator
- Robin Link, administrative coordinator

Clinical

- Betsy Thomas, RN, nurse specialist
- Ruth Holdener, RT, research patient coordinator

Information technology

- Matthew House, systems manager
- Steve Baldwin, data analyst
- Wiemen Shen, senior programmer analyst

Magnetic resonance imaging

- Glenn Foster, RT, supervisor
- Scott Love, RT, technologist
- Mark Nolte, RT, technologist

Positron emission tomography

- Michael White, CNMT, supervisor
- Linda Becker, CNMT, technologist
- Michael Harrod, CNMT, technologist

Computed tomography

• Christopher Allen, RT, technologist

GUATEMALA

Earlier this year, during a six-week radiology rotation at the Armed Forces Institute of Pathology in Washington, DC, Kevin Johnson, MD, a fourth-year diagnostic radiology resident at Mallinckrodt Institute, was inspired by one of the speakers—a practicing radiologist from Vermont who was an active member of Omni Med, a nongovernmental organization that encourages health professionals to volunteer in developing countries. Johnson was no stranger to volunteer work, having helped families in Boston to enroll in state-sponsored health insurance plans and free home-heating programs and having spearheaded a drive to donate hospital supplies to the University Hospital of Ghana Medical School.

After searching the Internet for international volunteer opportunities and sending e-mails to groups that interested him, Johnson found the perfect match—a small hospital in a remote village in Guatemala that was in dire need of radiology training. Armed with his fluency in Spanish and a "can-do" attitude, Johnson headed to Santiago Atitlán. The following is a first-hand account of Johnson's experiences at the hospital.

PHOTOGRAPHS PROVIDED BY KEVIN JOHNSON, MD



WELCOME TO THE HOSPITALITO

The Hospitalito Atitlán is a small clinic that provides the only emergency and inpatient services and surgical care for approximately 45,000 indigenous Tz'utujil Mayans in the highlands of southwestern Guatemala. The hospitalito, as it is affectionately called by the locals, was founded approximately 25 years ago but was closed in 1990 at the height of Guatemala's civil war—a 35-year armed conflict that ended in 1996. The facility reopened in April 2005, only to be destroyed by mudslides caused by Hurricane Stan in October of that same year. It has been more than a year since the hospital opened again in a new location in Santiago Atitlán.

Left: According to English novelist Aldous Huxley, Lake Atitlán—surrounded by three dormant volcanoes—is considered one of the most beautiful lakes in the world.

The hospital is supported by the government and parochial charities, allowing it to provide steeply discounted services, based on the patient's level of income and ability to pay, and free medical care to the most impoverished patients. The facility is staffed by a small group of local physicians plus a rotating group of volunteer physicians from Europe and the United States. On any given day, there are three to five nurses on staff and an equivalent number of ancillary staff, including radiology technologists who wear several hats such as custodian. blood and chemistry lab technologist, and surgical equipment sterilizer.

Upon my arrival, it was clear that the small two-story hospital was fully resurrected and thriving. There were at least a dozen patients waiting to be seen in the clinic. "We are so glad you are here!" exclaimed the chief of staff, Leah Abraham, MD, an attending physician trained in family medicine and fellowship-trained in obstetrics.

HOSPITALITO CASES

A few of my more memorable cases:

Day 1

CASE 1—6-month old inpatient with respiratory distress. Suspected congenital diaphragmatic hernia, based on the hospital staff's interpretation.

Findings on chest X ray: Absence of lung markings in right hemithorax with large septated lesion deviating mediastinum to the left; infiltrates and atelectasis in left lower lobe.

My interpretation: Longstanding congenital diaphragmatic hernia versus congenital cystic adenomatoid malformation (CCAM) and superimposed pneumonia.

Follow-up: Subsequently seen at larger clinic in Sololá; general surgeons found no congenital diaphragmatic hernia. Patient sent to public hospital (Roosevelt) in Guatemala City; underwent surgery for "some cystic problem in her lungs." Official report never received from Roosevelt, but description fits CCAM diagnosis. Patient hospitalized for 42 days. At last report, patient released and doing well.



GUATEMALA





Above: Technologist Cristobal Ramirez Quieju, wearing a lead apron donated by Mallinckrodt Institute's Interventional Radiology section, prepares a patient for a posterior to anterior chest X-ray. The X-ray suite doubles as the hospital's lab.

Left: Morning X-ray teaching rounds

HITTING THE GROUND RUNNING

Within minutes of my arrival, I was put to work—so much for a quick tour or a welcome reception. While the hospital is officially run by local physicians and an administrative board, much of the day-today, patient-care activities were done by Leah Abraham and the staff of volunteer physicians.

A significant portion of the hospital visits were obstetric related: prenatal care or labor and delivery. While most deliveries are uncomplicated vaginal births, emergency C-sections were performed on occasion. During my week at Hospitalito Atitlán, one of the longer term inpatients was a woman in her thirties who underwent an emergency C-section as a result of having preeclampsia. By the time I left Guatemala, the neonate was doing well and the mother was beginning to recover from acute renal insufficiency and volume overload. Had the mother needed dialysis, she would have been transported to a larger, more advanced medical clinic about an hour away in Sololá.

Our days usually began with morning rounds, reviewing the previous night's call cases and giving updates of the current inpatients to the daytime clinicians. Invariably there was at least one obstetric patient who was either in labor or had just given birth. Subsequently, I would routinely review any radiographs done in the past 24 hours, which were primarily chest X rays and a few abdominal films.

The hospital's radiology equipment consists of two ultrasound machines and one portable X ray. My teaching efforts with the hospital's physicians were primarily comprised of daily sessions—using films from the clinic's archives of outpatients and inpatients from the previous year— in conjunction with a daily talk on abdominal sonography. My communication with the staff went fairly smoothly. Although Spanish is the official language of Guatemala, it is not universally spoken among the indigenous population—not even as a second language. There are approximately 20 Mayan languages spoken in rural areas. Fortunately, if the patient was not accompanied by Spanish-speaking family members, hospital staff was available to translate from Tz'utujil to Spanish. With their help, I was able to conduct ultrasound studies with little difficulty and to explain my findings to the patient.

RADIOGRAPHY 101

My training of the X-ray technologists, Cristobal Ramirez Quieju and Antonito Chichom Ramirez, involved hour-long teaching sessions at the end of the work day. These technologists had never received formal training and had multiple responsibilities in the hospital. In spite of their lack of training, I was impressed by their resourcefulness and willingness to learn. I prepared a Spanish-translated positioning chart, listing positioning guidelines for the most common musculoskeletal, chest, and abdomen examinations. During the afternoon sessions, we reviewed basic

anatomy and physics in addition to standard radiographic positioning techniques. We reviewed topics ranging from the inverse square law to quality control topics such as contrast and density.

Probably the most important lesson I imparted to the technologists was about exposure technique. The hospital's only piece of X-ray equipment, a portable Siemens machine, was operated by manual exposure (unlike more modern X-ray equipment with an automated exposure control using ionization chamber detectors). Too often, the films were overexposed or underexposed. Using an exposure chart provided with the X-ray machine's product manual, I showed Cristobal and Antonito how to create a customized chart to suit their routine imaging needs, given the space limitations of their facility. By the time I left the hospital, the technologists had already improved the quality of their radiographs. More importantly, they had a better understanding of quality control and were better able to modify the exposure factors.

HOSPITALITO CASES Day 1

CASE 2—Middle-aged female with hand swelling and erythema, reportedly due to accident involving sewing machine.

Findings on 2-view X Ray (image below): Metallic foreign body (broken needle) palmar soft tissues in region of thenar eminence anterior to capitate or *hueso* grande. High-frequency ultrasound probe used to help localize lesion prior to extraction. Tiny 1-2 mm fragment of broken needle tip not found during extraction.

Follow-up: Released with course of oral antibiotics.



CASE 3—30+ year-old female with intermittent left lower quadrant pain. Urine HCG positive. Last menstruation 7 weeks prior to current visit.

Findings on transvaginal ultrasound: Complex right adenexal mass; no intrauterine pregnancy visualized.

Follow-up: Presumptive diagnosis of ectopic pregnancy; referred to Sololá clinic. Surgical management of ectopic pregnancies beyond expertise of hospitalito staff. At Sololá, diagnosis of ectopic pregnancy confirmed; surgical intervention required. No complications; patient released.



Kevin Johnson, MD, spent a large part of his time reviewing recent studies and generating reports.

GUATEMALA



(Front) Kate Hall, MD, volunteer family practice resident; (Second row, left to right) Leo Gurney, MD, volunteer family practice resident, United Kingdom; Juan Manuel Chuc, MD, hospitalito director; Irene Quieju, MD, local attending; Leah Abraham, MD, chief of staff; Eliseo Cojon, local medical student. (Back, left to right): Erin Lundee, MD, volunteer family practice resident, California; and Kevin Johnson, MD.

LOOHING BACK

We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard.—John F. Kennedy, 35th president of the United States

Doing volunteer work in Guatemala—instead of taking a vacation to a Miami resort—was my personal moon voyage. The experience took me from my comfortable life in St. Louis to a remote village whose citizens endure many hardships, but that journey gave me the opportunity to work with amazing people who are selflessly dedicating their lives to helping the poor and underserved people of Santiago Atitlán. In spite of the lack of resources, I was impressed by their sense of optimism and their professionalism. The staff believes in the hospital and its mission. Patients are treated equally with the utmost respect, regardless of gender or socioeconomic standing. The staff's "glass-is-half-full" outlook is infectious, making them very pleasant to work with. Although I was there for only one week, I believe my visit to Santiago may have made a small difference.

HOSPITALITO CASES Day 2

subacute shortness of breath, possibly caused by cooking over open flame in poorly ventilated house—chronic smoke-inhalation-related lung disease: common problem affecting significant number of area's poor patients.

Findings on chest X ray: Negative.

Follow-up: Treated with bronchodilators, released.

CASE 2—Female, mid 20s, with abdominal pain and dirty urinanalysis

Findings on renal ultrasound: Kidneys normal, no hydronephrosis or nephrolithiasis.

Day 3

Teenage female on birth control with intermittent vaginal bleeding.

Findings on transvaginal ultrasound: Normal, no obvious masses. Breakthrough uterine bleeding related to oral contraceptives.

Day 4

CASE 1—Young adult female with fever and episodic abdominal pain.

Findings on abdominal ultrasound: Several gallstones and mild gallbladder wall thickening (4-5mm). Normal common bile duct. Negative Murphy's sign.

Follow-up: Observed for 24 hours; discharged on antibiotics. Biliary colic perhaps related to gallstone passage. Possible component of chronic cholecystitis. Hospital not equipped to perform alkaline phosphatase and bilirubin lab studies.

CASE 2—30+ year-old female with vague low abdominal pelvic pain.

Findings on abdominal and transvaginal ultrasound: 6-7mm cystic mass with appearance of double decidual sign. Beating heart, on further evaluation with transvaginal ultrasound.

Follow-up: Patient's last menstruation 8 weeks prior to clinic visit. Diagnosis 6-week intrauterine pregnancy; no heterotopic pregnancy detected.

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In this section, the names of employees who are full-time faculty or staff or who have an appointment in the Department of Radiology are highlighted in boldface type.

NEW FACULTY

Paul Commean, research instructor in radiology, Electronic Radiology Laboratory, Division of Radiological Sciences.

Neha Dahiya, PhD, research instructor in radiology, Optical Radiology Laboratory, Division of Radiological Sciences.

Heather Garrett, MD, instructor in radiology, Division of Diagnostic Radiology, Barnes-Jewish St. Peters Hospital.

Bennett Greenspan, MD, instructor in radiology, Musculoskeletal Radiology Section, Division of Diagnostic Radiology, and Division of Nuclear Medicine.

Michael Lin, MD, instructor in radiology, Abdominal Imaging Section, Division of Diagnostic Radiology.

Judy Liu, MD, instructor in radiology, Abdominal Imaging Section, Division of Diagnostic Radiology.

Daniel Marcus, PhD, research assistant professor of radiology, Electronic Radiology Laboratory, Division of Radiological Sciences.

Joanne Markham, MD, research associate professor of radiology, Division of Radiological Sciences.

Ibrahim Alpay Ozcan, DSc, research assistant professor of radiology, Biomedical Magnetic Resonance Laboratory, Division of Radiological Sciences. **Hui Hua Shu, MD**, instructor in radiology, Division of Diagnostic Radiology, Barnes-Jewish St. Peters Hospital.

Daniel Wessell, MD, PhD, instructor in radiology, Musculoskeletal Radiology Section, Division of Diagnostic Radiology.

PROMOTIONS

Sanjeev Bhalla, MD, assistant professor of radiology, was promoted to associate professor of radiology, Division of Diagnostic Radiology.

Charles Hildebolt, DDS, PhD, associate professor of radiology, was promoted to professor of radiology, Division of Radiological Sciences.

JoAnne Lacey, MD, instructor in radiology, was promoted to assistant professor of radiology, Division of Diagnostic Radiology.

Christine Menias, MD, assistant professor of radiology, was promoted to associate professor of radiology, Division of Diagnostic Radiology.

JOINT APPOINTMENTS

Lihong Wang, PhD, professor of biomedical engineering, was appointed professor of radiology, Division of Diagnostic Radiology.

FIRST-YEAR Fellows

Omar Agosto, MD, abdominal imaging clinical fellow, received an undergraduate degree from Emory University, Atlanta, Georgia, and a medical degree from Universidad Central del Caribe School of Medicine, Bayamon, Puerto Rico. He completed an internship at Frankford Hospitals, Philadelphia, Pennsylvania, and a residency at Drexel University College of Medicine, Philadelphia.

Jason Campbell, MD, interventional radiology clinical fellow, received an undergraduate degree from Louisiana State University, Baton Rouge, and from Northwestern State University, Natchitoches, Louisiana. He received a medical degree from St. George's University School of Medicine, Grenada, and completed an internship and a residency at Henry Ford Hospital, Detroit, Michigan.

Jeffrey Carenza, MD, abdominal imaging clinical fellow, received an undergraduate degree and a medical degree from Texas A&M University, College Station. He completed an internship at Austin Medical Center, Texas, and four years of diagnostic radiology training at Mallinckrodt Institute of Radiology. Naveen Chapa, MD, interventional radiology clinical fellow, received an undergraduate degree and a medical degree from Saint Louis University, Missouri. He completed an internship at Forest Park Hospital, St. Louis, Missouri, and a residency at Saint Louis University Hospital.

Kristopher Cummings,

MD, cardiothoracic imaging clinical fellow, received an undergraduate degree and a medical degree from the University of Alabama, Birmingham. He completed an internship at Barnes-Jewish Hospital, St. Louis, Missouri, and four years of diagnostic radiology training (chief resident, 2006-2007) at Mallinckrodt Institute of Radiology.

Rahul Desai, MD, musculoskeletal radiology clinical fellow, received an undergraduate degree from Ohio State University, Columbus, and a medical degree from The Medical College of Ohio, Toledo. He completed an internship at Mount Carmel West Medical Center, Columbus, Ohio, and a residency at Medical College of Ohio, Toledo.

David DuBois, MD, musculoskeletal radiology clinical fellow, received an undergraduate degree from Columbia University, New York, and a medical degree from the University of Illinois, Chicago. He completed an internship at Swedish Covenant Hospital, Chicago, Illinois, and a residency at McGaw Medical Center of Northwestern University, Chicago.

FIRST-YEAR FELLOWS

Continued from page 27

Heather Garrett, MD, magnetic resonance imaging clinical fellow, received an undergraduate degree from the University of Virginia, Charlottesville, and a medical degree from Washington University in St. Louis School of Medicine. She completed an internship at Saint Louis University Health Sciences Center, St. Louis, Missouri, and four years of diagnostic radiology training at Mallinckrodt Institute of Radiology.

Benjamin Griffin, MD, neuroradiology clinical fellow, received an undergraduate degree from Davidson College, Davidson, North Carolina, and a medical degree from the University of Tennessee Medical School, Knoxville. He completed an internship at Methodist University Hospital, Memphis, Tennessee, and a residency at University of Tennessee-Methodist Healthcare, Memphis.

musculoskeletal radiology clinical fellow, received an undergraduate degree from the University of Minnesota, Minneapolis; a master's degree from Massachusetts Institute of Technology, Cambridge; and a medical degree from Harvard-MIT **Division of Health Sciences** and Technology, Cambridge, Massachusetts. She completed an internship at Mayo Clinic, Rochester, Minnesota, and a residency at the University of Washington, Seattle.

Dawn Hastreiter, MD, PhD,

Aaron Hendon, MD, abdominal imaging clinical fellow, received an undergraduate degree from the University of Wisconsin, Madison, and a medical degree from the University of Wisconsin School of Medicine and Public Health, Madison. He completed an internship at Michigan State University, East Lansing, and a residency at University of Kentucky Chandler Medical Center, Lexington.

William Holloway, MD, neuroradiology clinical fellow, received an undergraduate degree from the University of South Carolina, Columbia, and a medical degree from the University of Chicago, Pritzker School of Medicine, Illinois. He completed an internship at Louis Weiss/University of Chicago, Illinois, and four years of diagnostic radiology training at Mallinckrodt Institute of Radiology.

Jack Jennings, MD, PhD,

musculoskeletal clinical fellow, received an undergraduate degree from Wheaton College, Illinois, and a medical degree from the University of South Florida, College of Medicine, Tampa. He completed an internship at the University of South Florida Health Sciences Center and four years of diagnostic radiology training (chief resident, 2006-2007) at Mallinckrodt Institute of Radiology.

Marcus Kessler, MD, pediatric radiology clinical fellow, received a medical degree from the University of Cologne School of Medicine, Germany. He completed additional training at the Institute of Radiology at the University of Cologne.

Michelle Lee, MD, breast imaging clinical fellow, received undergraduate degrees from Washington University in St. Louis and Southern Illinois University at Edwardsville, and a medical degree from Northwestern University Feinberg School of Medicine, Evanston, Illinois. She completed an internship at MetroHealth Medical Center, Cleveland, Ohio, and four years of diagnostic radiology training at Mallinckrodt Institute of Radiology.

Paula Leiva, MD, neuroradiology clinical fellow, received a medical degree from Universidad Nacional de Cuyo, Mendoza, Argentina. She completed an internship and a residency at Saint Louis University Hospital, St. Louis, Missouri.

Shao Pow Lin, MD, neuroradiology clinical fellow, received an undergraduate degree from Stanford University, Stanford, California, and a medical degree from Washington University in St. Louis School of Medicine, Missouri. He completed an internship at St. John's Mercy Medical Center, St. Louis, Missouri, and four years of diagnostic radiology training at Mallinckrodt Institute of Radiology.

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Brandon Liu, MD, breast imaging clinical fellow, received an undergraduate degree from the Sophie Davis School of Biomedical Education, The City College of New York, New York City, and a medical degree from Stony Brook School of Medicine, State University of New York, Stony Brook. He completed an internship at Newton-Wellesley Hospital, Newton, Massachusetts, and a residency at Maimonides Medical Center, Brooklyn, New York.

Thelma Lopes, MD, neuroradiology clinical fellow, received an undergraduate degree from Dom Bosco School, Parana, Brazil, and a medical degree from Universidade Federal do Parana, Brazil. She completed a residency at Hospital Real da Beneficencia, Brazil; an internship at the University of Iowa, Iowa City; and diagnostic radiology training at Mallinckrodt Institute of Radiology.

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Louis Magas, MD, neuroradiology clinical fellow, received an undergraduate degree from the University of Utah, Salt Lake City, and a medical degree from Saint Louis University, St. Louis, Missouri. He completed an internship and a residency at Saint Louis University.

Jeffrey Miller, MD, neuroradiology clinical fellow, received an undergraduate degree from the University of California, San Diego, and a medical degree from Semmelweis Medical University, Budapest, Hungary. He completed an internship at St. Luke's Hospital, Chesterfield, Missouri, and a residency at Saint Louis University, St. Louis, Missouri.

Michelle Miller-Thomas, MD, received an undergraduate degree from California Institute of Technology, Pasadena, and a medical degree from Saint Louis University, St. Louis, Missouri. She completed an internship at St. John's Mercy Medical Center, St. Louis, Missouri, and a residency at the University of Texas Health Science Center, Houston.

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Venkat Reddy, MD, interventional radiology clinical fellow, received an undergraduate degree from GVRR Junior College, India, and a medical degree from Bijapur Liberal District Education's Shri BM Patil Medical College, India. He completed a residency at the University of Illinois, College of Medicine at Urbana-Champaign.

Kathryn Robinson, MD. abdominal imaging clinical fellow, received an undergraduate degree from the University of Pennsylvania, Philadelphia, and a medical degree from Stony Brook School of Medicine, State University of New York, Stony Brook. She completed an internship at Winthrop-University Hospital, Mineola, New York, and a residency at Nassau University Medical Center, East Meadows, New York.

John Ryan, MD, abdominal imaging clinical fellow, received an undergraduate degree and a medical degree from Dalhousie University, Halifax, Nova Scotia. He completed an internship at Montreal General Hospital, McGill University Health Centre, Quebec, and a residency at the University of Ottawa, Ontario. Nael Saad, MD, interventional radiology clinical fellow, received a medical degree from the Faculty of Medicine, Ain Shams University, Cairo, Egypt. He completed a residency at Metropolitan Group Hospitals, University of Illinois, Chicago.

Jarret Sanders, MD, musculoskeletal radiology

clinical fellow, received an undergraduate degree from the University of Arkansas and a medical degree from the University of Arkansas for Medical Sciences, Little Rock. He completed an internship and a residency at the University of Arkansas for Medical Sciences Medical Center.

Shawyon Shadman, MD, magnetic resonance imaging clinical fellow, received an undergraduate degree from Duke University, Chapel Hill, North Carolina, and a medical degree from Washington University in St. Louis School of Medicine, Missouri. He completed two years of orthopedic training at the University of Rochester, New York, and four years of diagnostic radiology training

at Mallinckrodt Institute of

Radiology.

Michael Smith, MD, magnetic resonance imaging clinical fellow, received an undergraduate degree from the University of Utah, Salt Lake City, and a medical degree from Washington University in St. Louis School of Medicine, Missouri. He completed an internship at Carilion Health System of Virginia and four years of diagnostic radiology training at Mallinckrodt Institute of Radiology.

Sushilkumar Sonavane, MBBS, pediatric radiology clinical fellow, received an undergraduate degree and a medical degree from Seth Gordhandas Sunderdus Medical College, Mumbai, India. He completed an internship at KEM Hospital, Mumbai, India, and a residency at Sri HBM General Hospital, at Dr. RNCM General Hospital, and at LTMMC & LTM General Hospitals, India.

Jason Stewart, MD, neuroradiology clinical fellow, received an undergraduate degree from Indiana University, Bloomington, and a medical degree from Indiana University School of Medicine, Indianapolis. He completed an internship at Mercy Hospital of Pittsburgh, Pennsylvania, and a residency at West Virginia University, Morgantown.

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FIRST-YEAR DIAGNOSTIC RADIOLOGY RESIDENTS

Absar Ahmed, MBBS,

received a medical degree from Aga Khan University, Karachi, Pakistan. He completed an internal medicine residency at Barnes-Jewish Hospital, St. Louis, Missouri.

Joseph Azok, MD, received an undergraduate degree and a medical degree from Case Western Reserve University, Cleveland, Ohio. He completed an internship at Metro Health Medical Center, Cleveland.

Sanjiv Bajaj, MD, received an undergraduate degree from Princeton University, New Jersey, and a medical degree from the University of Alabama School of Medicine, Birmingham. He completed an internship with the Baptist Health System, Alabama.

Calvin Barnes, MD,

received an undergraduate degree from Oberlin College, Ohio, and a medical degree from Yale University School of Medicine, New Haven, Connecticut. He completed an internship at Greenwich Hospital, Connecticut.

Nicole Bolton, MD,

received an undergraduate degree from the University of Kansas, Lawrence, and a medical degree from Washington University in St. Louis School of Medicine, Missouri. She completed an internship at St. John's Mercy Medical Center, St. Louis, Missouri.

Mittul Gulati, MD,

received an undergraduate degree from Harvard University, Cambridge, Massachusetts, and a medical degree from the University of California, San Francisco. He completed an internship and a urology residency at the University of California, Los Angeles.

Alexander Ho, MD,

received an undergraduate degree from the University of Illinois at Chicago and a medical degree from Washington University in St. Louis School of Medicine, Missouri. He completed an internship at the University of California San Diego Medical Center.

Michael Holcombe, MD,

received an undergraduate degree from Davidson College, Davidson, North Carolina, and a medical degree from the University of Alabama School of Medicine, Birmingham. He completed an internship with the Baptist Health System, Alabama.

Jessica Huang, MD,

received an undergraduate degree from Yale University, New Haven, Connecticut, and a medical degree from Washington University in St. Louis School of Medicine, Missouri. She completed an internship at the University of Hawaii, Honolulu.

Caitlin Lopez, MD,

received an undergraduate degree from Williams College, Williamstown, Massachusetts, and a medical degree from the University of Pennsylvania School of Medicine, Philadelphia. She completed an internship at Berkshire Medical Center, Pittsfield, Massachusetts.

Norna Ludeman, MD,

received an undergraduate degree from Stanford University, Stanford, California, and a medical degree from the University of California San Francisco School of Medicine. She completed an internship at Kaiser Permanente, Northern California.

Vincent Mellnick, MD,

received an undergraduate degree from the University of Notre Dame, Indiana, and a medical degree from the University of Texas Medical School, Houston. He completed an internship at Methodist Hospital, Houston, Texas.

Joseph Mettenburg, MD,

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PhD, received an undergraduate degree from James Madison University, Harrisburg, Virginia, and a medical and doctoral degree from the University of Virginia School of Medicine, Charlottesburg. He completed an internship at Barnes-Jewish Hospital, St. Louis, Missouri.

Rex Parker, MD, received an undergraduate degree from the University of California, Los Angeles, and a medical degree from the University of Pennsylvania School of Medicine, Philadelphia. He completed an internship at the University of Kansas Medical Center, Kansas City.

Srinivas Peddi, MD,

received an undergraduate degree from Johns Hopkins University, Baltimore, Maryland, and a medical degree from Duke University School of Medicine, Durham, North Carolina. He completed an internship at Barnes-Jewish Hospital, St. Louis Missouri.

Martin Reis, MD, received an undergraduate degree from Princeton University, New Jersey, and a medical degree from the College of Physicians and Surgeons, Columbia University, New York City, New York. He completed an internship and a residency in internal medicine at the Hospital of the University of Pennsylvania, Philadelphia.

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Jennifer Salcman, MD,

received an undergraduate degree from Princeton University, New Jersey, and a medical degree from New York Medical College, Valhalla. She completed an internship and an otolaryngology residency at Barnes-Jewish Hospital, St. Louis, Missouri.

Monika Tataria, MD,

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received an undergraduate degree from the University of Pennsylvania, Philadelphia, and a medical degree from Washington University in St. Louis School of Medicine, Missouri. She completed an internship and a surgery residency at Stanford University, California.

Kristy Wolske, MD,

received an undergraduate degree from Yale University, New Haven, Connecticut, and a medical degree from Vanderbilt University School of Medicine, Nashville, Tennessee. She completed an internship at Spartanburg Regional Healthcare, South Carolina.

FIRST-YEAR NUCLEAR MEDICINE RESIDENTS

Kartikeya Kantawala, MD, first-year nuclear medicine resident, received an MBBS degree and a diploma in Medical Radio-diagnosis from Lokmanya Tilak Municipal Medical College, University of Mumbai, India. He received a medical degree from the University of Seychelles. He completed an internship (medicine, surgery, obstetrics/gynecology, and community medicine) and a radiology residency at Lokmanya Tilak Medical College Hospital.

Oneil Lee, PhD, MD, firstyear nuclear medicine resident, received an undergraduate degree from the University of Michigan, Ann Arbor, and a doctoral degree and a medical degree from Dartmouth Medical School, Hanover, New Hampshire. He completed an internship (internal medicine) and a radiology residency at the University of Chicago Hospitals, Illinois. Peter Phan, MD, first-year nuclear medicine resident, received an undergraduate degree from the University of California, Berkeley, and a medical degree from the University of California San Diego School of Medicine. He completed an internship (internal medicine) at the Alameda County Medical Center Highland Hospital, California, and a radiology residency at Santa Clara Valley Medical Center, California.

Melson Lecture

On September 19, Anwar Padhani, MBBS, head of imaging research at the Paul Strickland Scanner Centre, Mount Vernon Cancer Centre, in Middlesex, England, was guest lecturer for the Fifteenth Annual G. Leland Melson Visiting Professorship and Lecture. He spoke on "Functional body MRI as a predictive biomarker for tumor treatment response."



Jay Heiken, MD, chief of MIR's abdominal imaging, presented Padhani (left) with a commemorative plaque.

GRANTS

Igor Efimov, PhD, associate professor of biomedical engineering and of radiology, as principal investigator, received a four-year grant in the amount of \$1.9 million from the National Institutes of Health for research on "Virtual electrode hypothesis of defibrillation."

Fred Prior, PhD, professor of radiology, as principal investigator, received a \$836,073 grant from the National Institute of Diabetes and Digestive and Kidney Diseases to study "Biomarkers for Charcot arthropathy in diabetic patients." Coinvestigators for the three-year grant are Charles Hildebolt, PhD, professor of radiology and adjunct associate professor of anthropology; Paul Commean, research instructor in radiology; Kirk Smith, senior research engineer; David Sinacore, PT, PhD, and Mary Hastings, PT, DPT, Program in Physical Therapy; Tau Ju, PhD, Department of Computer Science and Engineering; Dennis Villareal, MD, Department of Medicine; Jeffrey Johnson, MD, Othopedic Surgery Center. Kay Bohnert, MS, Program in Physical Therapy, is the study's research patient coordinator.

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Vijay Sharma, PhD, assistant professor of radiology, as principal investigator, received a \$581,400 grant from the National Institutes of Health/National Institute of Aging to study "Technetium99m-SPECT agents for imaging β amyloid in Alzheimer's disease." Coinvestigators for the three-year grant are David Piwnica-Worms, MD, PhD, professor of radiology and of molecular biology and pharmacology; Scott Harpstrite, senior research technician; Julie Prior, laboratory supervisor; and Silvia Collins, junior research technician. Collaborators are David Holtzman, MD, and John Morris, MD, Department of Neurology. As principal investigator, Sharma also received a \$150,000 grant from the American Health Assistance Foundation for research on "Imaging Pgp-mediated transport activity in Alzheimer's disease." Coinvestigators for the two-year award are Piwnica-Worms, Harpstrite, Prior, and Collins with Holtzman as project collaborator. In addition,

Sharma received a \$35,000 pilot grant from the Alzheimer's Disease Research Center to study "PET agent for imaging of Pglycoprotein (Pgp) mediated transport activity at the blood-brain barrier in Alzheimer's disease." Piwnica-Worms, Harpstrite, and Prior are coinvestigators for this one-year grant.

Pablo Soto, MD, assistant professor of medicine and of radiology, as principal investigator, received a five year Mentored Patient-Oriented Research Career Development Award in the amount of \$720,854 from the National Institutes of Health plus a four-year grant in the amount of \$365,400 from The Robert Wood Johnson Foundation Harold Amos Medical Faculty Development Program for research on the "Role of estrogen/SERMs on cardiac fatty acid metabolism."

APPOINTMENTS/ ELECTIONS

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Colin Derdeyn, MD, associate professor of radiology and of neurology and neurological surgery, was appointed to a three-year term as chair of the American Society of Neuroradiology Research Committee and to a two-year term as memberat-large of the American Heart Association Stroke Council Leadership Committee. He was elected as vice president of the American Society of Interventional and Therapeutic Neuroradiology and will be the Society's president in 2008.

Franz Wippold, MD, professor of radiology, was appointed vice chair of the American College of Radiol-

appointed vice chair of the American College of Radiology Appropriateness Criteria Committee, Neuroradiology.

Dmitriy Yablonskiy, PhD, professor of radiology and of physics, was elected chair of the Hyperpolarized Media MR Study Group of the International Society of Magnetic Resonance in Medicine.

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Kevin Johnson, MD, fourth-year diagnostic radiology resident, and Yihua Zhou, MD, second-year diagnostic radiology resident, will again participate in the Barnes-Jewish Hospital (BJH) Residents and Fellows Diversity Initiative. In 2006-2007, Johnson and Zhou were selected as members of this new program aimed at building and strengthening a diverse culture at BJH and the Washington University Medical Center.

Linda Larson-Prior, PhD, research associate professor of radiology, chaired and organized Frontiers in the Neuroimaging of Human Sleep Symposium at SLEEP 2007, the 21st Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, Minnesota, June 11-14. Jeffrey Miller, MD, pediatric radiology clinical fellow, received the American Society of Pediatric Neuroradiology Fifth Annual Award in Pediatric Neuroradiology Research. The \$7,500 award was presented for Miller's work on "Diffusion tensor MR imaging of phenylketonuria. Structural white matter changes characterized by diffusion tensor imaging and classified with automated indices of myelin anisotropy."

Michael Mueller, PT, PhD, associate professor of physical therapy and of radiology; Donovan Lott, PT, Program in Physical Therapy; Mary Hastings, PT, DPT, Program in Physical Therapy; Paul Commean, research instructor in radiology; Kirk Smith, senior research engineer; and Thomas Pilgram, PhD, instructor in radiology received the American Physical Therapy Association 2007 Chattanooga Research Award for their paper "Efficacy and mechanism of orthotic devices to unload metatarsals heads in people with diabetes and history of plantar ulcer." The award is given to "recognize the best clinical research article published in [the journal] Physical Therapy."

LECTURES

Carolyn Anderson, PhD. professor of radiology and of molecular biology and pharmacology, spoke on "Coordinating the chemistry with PET imaging applications for gallium-68 and copper-64 radiopharmaceuticals" at the COST D38 Meeting for Metalbased Imaging Agents, Eindhoven, The Netherlands, May 4. She presented "Multimodality imaging for cancer biologists' at the National Cancer Institute Cancer Imaging Camp, Duke University, Durham North Carolina, June 28.

Kevin Black, MD, associate professor of psychiatry, of neurology, of radiology, and of anatomy and neurobiology, spoke on "Diagnosis and treatment of Tourette syndrome, 2007" at the CDC/ Tourette Syndrome Association medical education lecture, Department of Psychiatry Grand Rounds, University of Nevada, Reno, June 20.

Colin Derdeyn, MD, associate professor of radiology and of neurology and neurological surgery, presented "Hemodynamics and human cerebrovascular disease" at the 18th Annual George Ehni Lecture, Houston Neurological Society, Texas, May 9. He spoke on "Pathophysiology of acute ischemic stroke" at the American Society of Neuroradiology 45th Annual Meeting, Chicago, Illinois, June 12.

Igor Efimov, PhD, associate professor of biomedical engineering and of radiology, spoke on "Biophotonic imaging of embryonic heart" at the Weinstein Cardiovascular Development Conference, Indianapolis, Indiana, May 11. He presented "New approaches to defibrillation and resynchronization therapies learned from optical mapping" at Grand Rounds, Division of Cardiology, Weill Cornell Medical College, New York City, New York, May 14. He spoke on "Atrial pacemaker complex: orchestrating cardiac rhythm" at Cardiology Grand Rounds, University of Iowa Medical Center, Iowa City, August 22.

Jay Heiken, MD, professor of radiology, presented the keynote lectures "CT colonography for colorectal cancer screening: current status" and "Optimizing contrast enhancement for MDCT: 4 to 64 row" at the United Kingdom Radiological Congress 2007, Manchester, England, June 11-13. As the **Robert Shapiro Visiting** Professor and Lecturer, he spoke on "Cystic pancreatic neoplasms: diagnosis and management" and presented two additional lectures-"Abdominal aorta: diagnosing aneurysm rupture" and "Acute abdomen: mesenteric ischemia and bowel obstruction"-at the University of Miami, Florida, June 21-23.

LECTURES

Continued from page 33

Tamara Hershey, PhD, assistant professor of psychiatry, of neurology, and of radiology, spoke on "Brain structure and glycemic extremes in youth with type 1 diabetes" at the American Diabetes Association symposium, Chicago, Illinois, June 24.

John Kotyk, PhD, research associate professor of radiology, presented "Imaging and translational research at Washington University School of Medicine" at the Academy of Molecular Imaging and Society of Molecular Imaging Meeting: Joint Molecular Imaging Conference, Providence, Rhode Island, September 7-11.

Richard Laforest, PhD, assistant professor of radiology, spoke on "Images to outcome VII: cardiovascular imaging—nuclear cardiology and beyond" at the Advances in SPECT and Instrumentation meeting, St. Louis, Missouri, August 25.

Linda Larson-Prior, PhD, research associate professor of radiology, presented "Functional connectivity in the sleeping brain" at SLEEP 2007, the 21st Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, Minnesota, June 11-14.

James Quirk, PhD,

research instructor in radiology, presented "What can be learned about emphysema from 3He diffusion MR measurements" to the Hyperpolarized Media Study Group and spoke on "In vivo lung morphometry with hyperpolarized 3He MRI in a mild COPD population" in a scientific session at the 15th Scientific Meeting and Exhibition, International Society for Magnetic Resonance in Medicine, Berlin, Germany, May 19-25.

Yoram Rudy, PhD, professor of engineering, cell biology, and physiology, and of medicine, and research professor of radiology, presented "Imaging activation of the human heart" at the 28th Annual Scientific Sessions of the Heart Rhythm Society, Denver, Colorado, May 9 and 10. He spoke on "Noninvasive imaging of cardiac excitation" at the Cardiovascular Research and Training Institute, University of Utah, Salt Lake City, May 18. He spoke on "Noninvasive electrocardiographic imaging (ECGI) of cardiac electrophysiology and arrhythmia" at Grand Rounds in Cardiology. St. Luke's-Roosevelt Hospital, Columbia University, New York City, New York, May 30. Rudy presented "Images of clinical cardiac arrhythmias" at Grand Rounds in Cardiology,

Hôpital Cardiologique CHU du Haut-Lévêque, Bordeaux-Pessac, France, June 20. He presented "The molecular basis of cardiac repolarization" at the Denis Escande Symposium on Cardiovascular Diseases, Nantes, France, June 22. He spoke on "Imaging cardiac activation, repolarization, and arrhythmias using ECGI" at Medtronic, Inc., Minneapolis, Minnesota, July 27.

Barry Siegel, MD, professor of radiology and of medicine, spoke on "PET and PET/CT in oncology: principles and overview of clinical applications"; "PET in women's cancers"; and "PET and PET/CT in thoracic oncology" at the IX National Congress of Oncology Imaging Symposia, Panama City, Panama, June 25 and 26.

Marilyn Siegel, MD, professor of radiology and of pediatrics, presented "CTA of the pediatric abdomen" and "Whole-body MRI" at the European Society of Pediatric Radiology, Barcelona, Spain, June 3-5. She spoke on "MRI of bone marrow in oncologic diseases" and "Advance in MRI in cancer imaging" at the IX National Congress of Oncology Imaging Symposia, Panama City, Panama, June 25 and 26. She presented "CTA of vascular anomalies of the chest" and "CT of adult congenital heart disease" at the 2007 Summer Practicum of the Society of Computed Body **Tomography and Magnetic** Resonance, Banff, Canada, August 5-7.

Pablo Soto, MD, assistant professor of medicine and of radiology, spoke on "Metabolic remodeling in heart failure" at the International Conference of Nuclear Cardiology, Prague, Czech Republic, May 1.

Lihong Wang, PhD, professor of biomedical engineering and of radiology, presented "Tutorial on biomedical optics" and "Ultrasound-aided highresolution biophotonic imaging" at the Workshop on Optical and Ultrasonic Technologies for Biomedical Applications, Industrial Materials Institute, National Research Council Canada, Boucherville, Québec, May 4. He spoke on "High-resolution photoacoustic tomography" at Translational Optical Molecular Imaging: Nano to Macro, Rice University, Houston, Texas, May 22, and at the University of Toronto, Canada, August 22. He spoke on "Ultrasound-aided highresolution biophotonic imaging" at the Institute of Electrical Engineering, Chinese Academy of Science, Beijing, May 30, and at the College of Electronics and Information Engineering, South-Central University for Nationalities, Wuhan, China, June 21. Wang spoke on "Photoacoustic tomography" at the Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology Wuhan, China, June 22, and at Enlight Inc., Boston, Massachusetts, August 1. He presented "Advances in photoacoustic tomography" at Frontiers of Biomedical Imaging Science, Vanderbilt University, Nashville, Tennessee, July 27.

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research assistant professor of radiology, spoke on "Noise stationarity in spiral CT" at the American Association of Physicists in Medicine meeting, Minneapolis, Minnesota, July 24.

Franz Wippold, MD, professor of radiology, presented "Imaging in the hot zone: new viruses, flus, and tics" at the American Society of Neuroradiology Annual Meeting, Chicago, Illinois, June 13.

Karen Wooley, PhD, professor of chemistry and of radiology, as the Dow Lecturer in Organic Chemistry, presented "Advancing synthetic organic chemistry concepts toward nanoparticles and nanocages: convergent and divergent approaches, originating from well-defined block copolymers and brush block copolymers, respectively" to the Department of Chemistry, Massachusetts Institute of Technology, Cambridge, May 4. She presented "Application of synthetic organic chemistry concepts and methodologies toward the construction of nanoscope target molecules" at the 40th National Organic Chemistry Symposium, Duke University, Durham, North Carolina, June 5. She presented "Amphipilic, nanoscopically resolved crosslinked networks: unusual surface anti-fouling character, sub-surface host behavior, and bulk modulus property" at The Young(ish!) Giants of Chemistry-A symposium to celebrate the 65th

birthday of Sir J. Fraser Stoddart, sponsored by the School of Chemistry, University of Edinburgh, Scotland, June 8. Wooley spoke on "Current research in nanotechnology and its applications to medicine" at the Cornerstone Life Science Connections Program, Washington University in St. Louis, Missouri, June 25. She presented "From dendrimers to supramolecular and covalent nanostructures" at the 234th American Chemical Society National Meeting, Boston, Massachusetts, August 19.

Dmitriy Yablonskiy, PhD, professor of radiology and of physics, spoke on "Physics and mathematical theory of the BOLD effect" at the MR Physics for Physicists Weekend Educational Program of the International Society for Magnetic Resonance in Medicine/European Society for Magnetic Resonance in Medicine and Biology Annual Meeting, Berlin, Germany, May 19-25.

SYMPOSIUM

In this section of FYI, only those faculty and staff who have Department of Radiology appointments are listed.

SOCIETY OF NUCLEAR MEDICINE

54th Annual Meeting Washington, DC June 2-6, 2007

Delphine Chen, MD; Lynne Jones; Michael Welch, PhD; Robert Mach, PhD, "FLT vs FMAU as a marker of proliferation in pancreatic cancer."

Robert Mach, PhD, "Use of flow cytometry, confocal and two photon microscopy to validate molecular marker of cell proliferation for PET.'

Mark Mintun, MD, "Molecular basis of functional of brain imaging."

Henry Royal, MD, Things you shouldn't miss on CT,' "Pitfalls and artifacts in PET."

Yuan-Chuan Tai, PhD; Heyu Wu; Joseph O'Sullivan, PhD: Sergev Komarov, "A sub-millimeter resolution full-ring microinsert for microPET-F220."

Zhude Tu, PhD; Jinbin Xu; Shihong Li; Lynne Jones; **Delphine Chen, MD;** Michael Welch, PhD; Robert Mach, PhD, "Dual isotope study of a novel σ_2 receptor ligand for PET and SPECT imaging studies of solid tumors."

Zhude Tu, PhD; Jinbin Xu; Lynne Jones; Shihong Li; Suwanna Vangveravong; Michael Welch, PhD; Robert Mach, PhD, "Evaluation of two σ_2 PET tracers in mouse and human breast tumors."

Jerold Wallis, MD, "Using IHE to improve nuclear medicine cross-vendor connectivity."

Lihu Wei; Yunpeng Ye; Thaddeus Wadas; Jason Lewis, PhD; Michael Welch, PhD; Carolyn Anderson, PhD, "64Culabeled CB-TE2A and Sar conjugated RGD peptide analogs for targeting angiogenesis: comparison of their biological activity."

Dong Zhou, PhD; Terry Sharp; Michael Welch, **PhD**, "[Br-76] 16*a*, 17*a*-Dioxolane progestin for breast tumor imaging and radiotherapy."

ALUMNI NEWS

Amy Nordmann, MD, a former instructor in radiology in the Institute's Breast Imaging Section, was inducted into the College Sports Information Directors of America (CoSIDA) Academic All-American Hall of Fame[®]. During her three years of playing volleyball at Washington University, the university won three NCAA Division III championships. Nordmann was selected two times as a first-team Division III All-American and earned two GTE Academic All-America of the Year for the college division.

Nordmann, who also completed a diagnostic radiology residency and a fellowship at Mallinckrodt Institute, is a breast imaging specialist at Rose Imaging Specialists in Houston, Texas.

IN MEMORIAM

Fred Jenner Hodges III, MD—known to all as Ted— died on August 9, 2007, at his home in Webster Groves, Missouri. He was emeritus professor of radiology at Washington University's Mallinckrodt Institute of Radiology. Ted Hodges was a gifted radiologist, a dedicated teacher, and a dear friend to many. He will be missed by everyone who was fortunate to have known him.

Ted was born on September 23, 1922, in Madison, Wisconsin. His love of the medical field came quite naturally, having been born into a family of physicians. His father, Fred Jenner Hodges II, was professor and chair of the Department of Radiology at the University of Michigan; his uncle, Paul Hodges, MD, was professor and chair of the Department of Radiology at the University of Chicago; and the family's ancestors include Edward Jenner, MD, who developed the smallpox vaccine.



Ted attended the University of California, Berkeley, and the University of Michigan, Ann Arbor. He received an undergraduate degree and a medical degree from the University of Wisconsin, Madison. He completed an internship at Strong Memorial Hospital in Rochester, New York, and a medicine residency and a radiology residency at the University of Michigan, Ann Arbor.

Ted first came to Mallinckrodt Institute of Radiology at Washington University in St. Louis, Missouri, in 1957 as an assistant professor. In that same year, Hugh Wilson, the Institute's director, with the assistance of Torgny Greitz, MD, from Sweden, established the neuroradiology section—one of the first in the United States. Ted was named head of the Institute's neuroradiology program in 1958. During his early years at the Institute, Ted received a National Institutes of Health Fellowship in Neuroradiology and spent one year in Gothenburg, Sweden, where he learned the nuances of this promising subspecialty. He left Mallinckrodt Institute in 1966 to become chief of neuroradiology at Johns Hopkins Hospital in Baltimore, Maryland, but returned "home" in 1980 as

professor of radiology and codirected the Institute's neuroradiology section with Mokhtar Gado, MD. He became professor emeritus in 1993 and officially retired in 2003, closing a career that spanned nearly six decades.

He was a charter member of the American Society of Neuroradiology (president, 1971-1972) and the Association of University Radiologists as well as a member of the Radiological Society of North America, the American Roentgen Ray Society, and the Fred Jenner Hodges Society (named in honor of his father). Ted was highly respected as a reviewer for the American Journal of Neuroradiology. In 1975, he served on the Panel of Consultants to the Commission on CIA Activities within the United States, reviewing the assassination of President John F. Kennedy. He served for 21 years as a guest examiner for the American Board of Radiology.

Ted served as an attending physician in neuroradiology at Barnes-Jewish and St. Louis Children's hospitals and as a consultant to Barnes-Jewish West County and Barnes-Jewish St. Peters hospitals. Over the course of his 32 years at the Institute, Ted was a patient, enthusiastic, and generous teacher who enriched the careers of numerous fellows, residents, and medical students at Washington University Medical Center.

- Franz Wippold, MD

Diagnostic Radiology and Nuclear Medicine Fellows and Residents for **2006-2007**

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(SEATED, LEFT TO RIGHT) Doctors Xiaoni Hong; Kathyrn Fowler; Meghan Lubner; Joseph Erinjeri, diagnostic radiology chief resident; Robert McKinstry, research residency program director; Jennifer Gould, diagnostic radiology residency program director; Gilbert Jost, director, Mallinckrodt Institute; Kristopher Cummings, diagnostic radiology chief resident; Jack Jennings, diagnostic radiology chief resident; Neil Kennedy; Shawyon Shadman; Heather Garrett. (SECOND ROW) Doctors Michael Lin; Benjamin Pettus; Jeffrey Lin; Yihua Zhou; Cade McDowell; Kyle Shipley; Travis Henry; Yasha Kadkhodayan; Edward Hwang; James Kelly; Matthew Gipson; Edward Pillsbury; Lance Reinsmith; Asif Moinuddin; Shane Inoue; Salil Patel; David Loy; Wincha Chong; Kathryn Robinson; Victoria Chen; Patricia Richmond; Ambrose Huang. (THIRD ROW) Doctors Brandon Peters; Seth Cardall; Alexander Sevrukov; Kelsey Moran; Eric Hatfield; John Anderson; Phoebe Freer; Sushil Sonovane; Jeffrey Carenza; Prakash Masand; Jonathan McConathy; Mark Wall; Monika Tataria; Catherine Young; Celine Buckley; Robert Cargile; Ferenc Czeyda-Pommersheim; Kavita Gorantla; John Burkett; David Niebruegge; Will Grande; Jason Stephenson; Paul Frohnert; Jonathan Baker.

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