

Spring 2006

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SPRING 2006

VOLUME 37, NUMBER 1

FOCAL SPOT

MALLINCKRODT

RADIOLOGY

UNIVERSITY

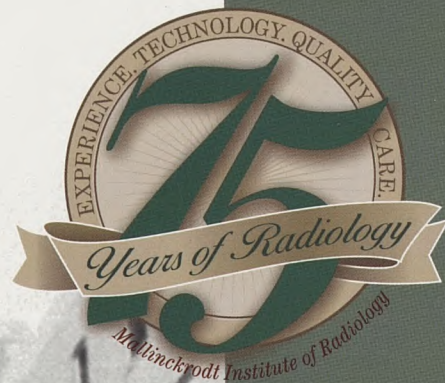


**Virtual
Colonoscopy:**
a Lifesaving Technology

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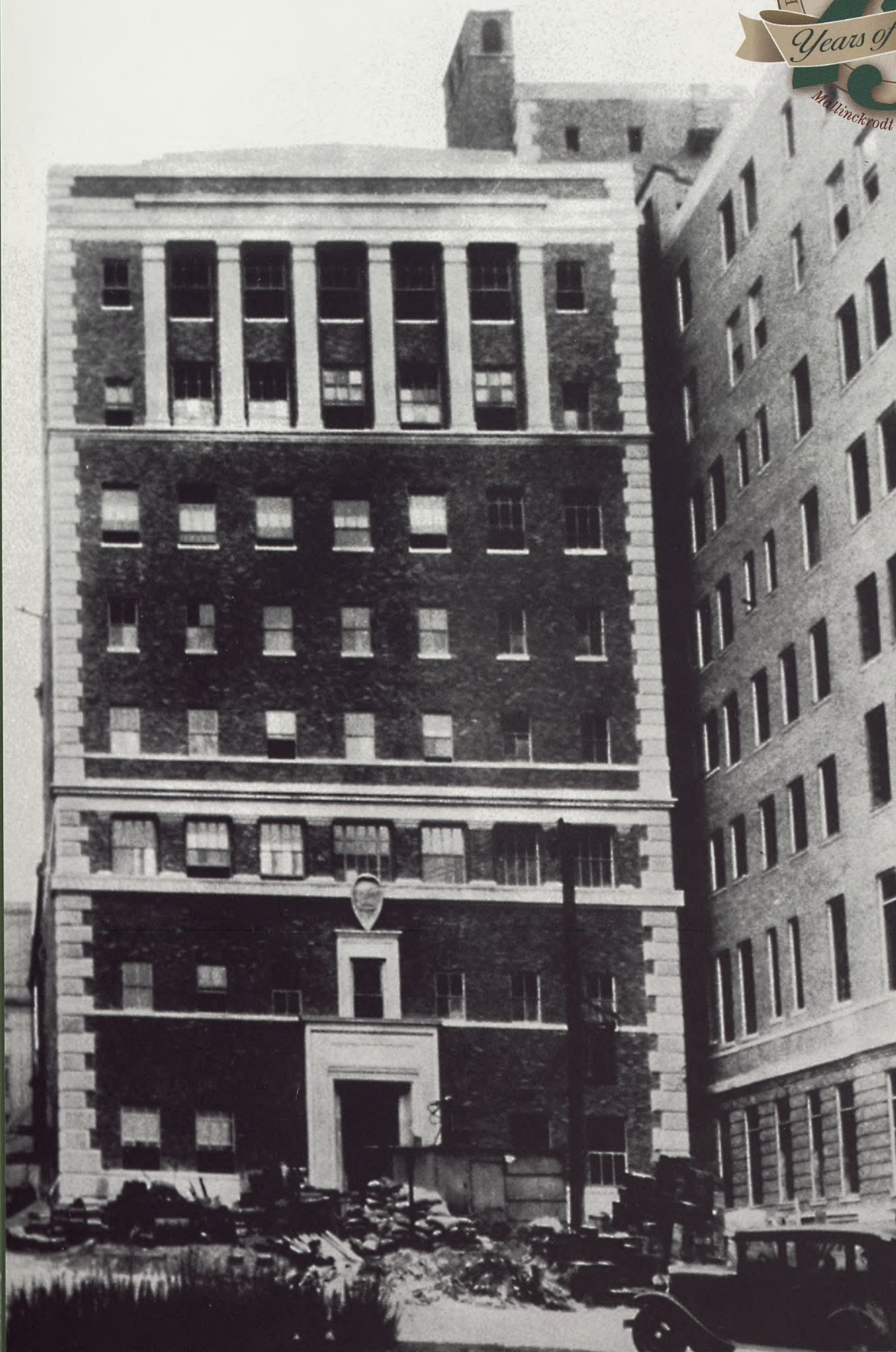
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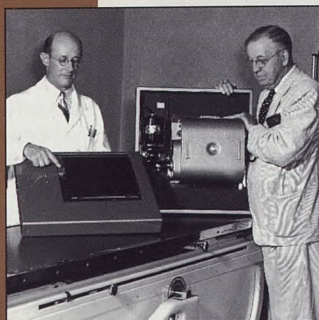
The cornerstone for the Edward Mallinckrodt Institute of Radiology was laid on October 2, 1930. Routine radiography began in August 1931.

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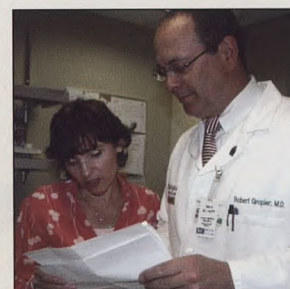
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In the early 1900s, radiology was considered by most medical practitioners as nothing more than photography. In this 75th year of Mallinckrodt Institute's existence, the first of a three-part series of articles will chronicle the rapid advancement of radiology at Washington University and the emergence of MIR as a world leader in the field of radiology.

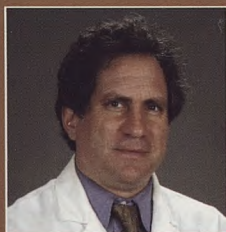
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Washington
University in St. Louis
SCHOOL OF MEDICINE

MIR Mallinckrodt Institute
of Radiology

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

ON THE COVER Colon cancer is the second most deadly cancer in the United States, but health professionals like Christine Menias, MD, and research assistant Ruth Holdener (right) are working to increase awareness about colon cancer and the need for diagnostic screening. Photograph by Tim Parker.

SPOT NEWS

Matching Program results announced

In July, 18 physicians will begin their first year of training in diagnostic radiology. The 2006-2007 trainees come from these institutions:

- Case Western Reserve University School of Medicine, Cleveland, Ohio
- University of Alabama School of Medicine, Birmingham
- University of Virginia School of Medicine, Charlottesville
- Duke University School of Medicine, Durham, North Carolina
- University of Texas Medical School at Houston
- Washington University in St. Louis School of Medicine
- Yale University School of Medicine, New Haven, Connecticut
- University of California, San Francisco School of Medicine
- Columbia University College of Physicians and Surgeons, New York City, New York
- Vanderbilt University School of Medicine, Nashville, Tennessee
- University of Pennsylvania School of Medicine, Philadelphia
- University of Michigan School of Medicine, Ann Arbor.

Siteman Cancer Center accepted into NCCN

The Alvin J. Siteman Cancer Center (SCC), housed in the Center for Advanced Medicine at Washington University Medical Center, is now a member of The National Comprehensive Cancer Network (NCCN). As an NCCN member, the SCC will be involved in the planning, development, and validation of therapies and guidelines representing the future of cancer care. The NCCN is an alliance of 20 nationally acclaimed cancer centers dedicated to improving the quality, efficiency, and effectiveness of oncology practice.

WUSM retains high national ranking

Since 1987, *U.S. News & World Report* has issued an annual ranking of professional and graduate schools. Washington University in St. Louis School of Medicine (WUSM) consistently has placed in the top 10 schools and since 1998 has ranked first in student selectivity, based on both college grade-point averages and MCAT scores. According to the magazine's April 3, 2006 survey, WUSM ranked fourth overall among research-oriented medical schools. The top schools in order are Harvard University; Johns Hopkins University; University of Pennsylvania; WUSM

and University of California, San Francisco (tie); Duke University; Stanford University and University of Washington (tie); Yale University; and Baylor College of Medicine. The U.S. News rankings are online at www.usnews.com/usnews/rankguide/rghome.htm.

Wilson Award presented

The 38th annual Hugh M. Wilson Award for Meritorious Work in Radiology was presented on May 19 to Alexander Ho, a fourth-year medical student. Traditionally given at the senior program following the Washington University in St. Louis School of Medicine (WUSM) commencement exercises, the Wilson Award honors Mallinckrodt Institute's second director, an advocate of the advancement of education.

Ho worked with Daniel Brown, MD, associate professor of radiology and of surgery, in the Institute's interventional radiology section. Prior to the start of the interventional radiology elective, Ho researched published information on chemoembolization and neuroendocrine tumors. He also initiated a database of all patients with neuroendocrine tumors who were treated at the Washington University Medical Center from 1991 to 2005. According to Brown, Ho's review was "extraordinary in its depth and has led to some important findings that may change the way patients with this disease process are treated."

Under Brown's mentorship, Ho was principal investigator on the project "Long term outcomes of hepatic arterial chemoembolization for neuroendocrine malignancy," for which he drafted the abstract and manuscript—which has been submitted for presentation at the annual Radiological Society of North America meeting in Chicago and also is being submitted to the journal *Radiology* for publication.

Ho will begin his first year of diagnostic radiology residency at Mallinckrodt Institute in July 2007, after completing a preliminary training year in internal medicine at the University of California, San Diego.

Workshops address radiology clinical trials training

Approximately 25 participants attended the Clinical Trials Methodology Workshop, sponsored by the Radiological Society of North America (RSNA), held in January in Phoenix, Arizona. Barry Siegel, MD, professor of radiology and of medicine, and Delphine Chen, MD, nuclear medicine resident, represented Mallinckrodt Institute.

This inaugural session's goal was to develop the groundwork for a series of workshops for radiology, nuclear medicine, and radiation oncology faculty, fellows, and senior residents as they develop careers in research.

According to workshop organizers, "there is a need to train radiologists to conduct clinical trials. Imaging is a critical part of many drug trials, and third-party payers and others also are beginning to demand much more rigorous data to justify clinical decisions."

The RSNA training sessions will be based on the successful, long-running clinical trials workshops sponsored by the American Association for Cancer Research and the American Society of Clinical Oncology. Participants will receive training in protocol development for the clinical evaluation of imaging modalities, with courses including didactic sessions, self study, protocol synthesis process, one-on-one mentoring, and discussion sessions.

For more information about the workshop and how to attend future sessions, go online at www.rsna.org/Publications/rsnanews/april06/clinical_april06.cfm.



Career Fair

Washington University in St. Louis School of Medicine (WUSM) held its first Career Fair for Clinical and Research on May 6 in the Farrell Learning and Teaching Center. Kim Whiting (shown at far left in top photo), manager, administrative services, represented Mallinckrodt Institute at the event that provided information about clinical and research opportunities in various WUSM departments. An estimated 150 attendees submitted job applications.

Faculty receive kudos

The following Mallinckrodt Institute clinicians and researchers were recognized for their many achievements:

- Maurizio Corbetta, MD, professor of neurology, of radiology, and of anatomy and neurobiology, received the American Academy of Neurology's (AAN's) Norman Geschwind Prize for his outstanding research in the field of behavioral neurology. The award was presented at the AAN's annual meeting in April in San Diego.

- William McAlister, MD, professor of radiology and of pediatrics, was a recipient of one of three Distinguished Service Awards presented by Washington University in St. Louis School of Medicine at the Reunion 2006 award ceremony in May.
- Kathleen McDermott, PhD, assistant professor of psychology and of radiology, was named an Outstanding Faculty Mentor by the Graduate Student Senate of Washington University

in St. Louis. The award, established in 1999, honors faculty who make a significant contribution to the quality of life and professional development of Arts & Sciences graduate students.

- Marcus Raichle, MD, professor of radiology, of neurobiology, and of neurology, was awarded the honorary degree of Doctor of Science by the University of Chicago.

The following is an excerpt from the nominating statement: "Widely considered the father of cognitive neuroscience, Professor Raichle's technical contributions to the field of neuroimaging and his research contributions ... have revolutionized the study of brain and behavior." Raichle also received the 2006 Distinguished Alumni Award from his alma mater, the University of Washington in Seattle.

*N*early 111 years ago (November 8, 1895, to be precise) Wilhelm Conrad Röntgen, a physics professor, was in his darkened laboratory in Würzburg, Germany, experimenting with the action of electric energy in partially evacuated glass tubes.

After he noticed a glow emanating from the far corner of the lab, Röntgen conducted a series of experiments, which culminated with passing his hand between a fluorescing screen and the tube and then seeing what appeared to be a shadow of the bones in his hand. He verified these observations by capturing the bone shadow images onto photographic plates. The subsequent publishing of Röntgen's data in the Würzburg Physico-

Medical Society's scientific journal and in newspapers worldwide heralded the startling discovery of the new, unknown rays—referred to as X rays.

The following article is the first of three installments that will follow the history of radiology at Washington University in St. Louis and the establishment of Mallinckrodt Institute of Radiology (MIR). In this 75th year of MIR's existence, it is important to honor our past, highlight the present, and ponder our future. Information for this and subsequent articles was condensed from several sources, including the booklet Mallinckrodt Institute of Radiology 50th Anniversary and an informal text prepared by Sam Merenda, MD, a St. Louis radiologist.

RADIOLOGY AT WASHINGTON UNIVERSITY: PRE-MIR

Functioning X-ray equipment was in place (known as the Photographical Roentgen Ray Department) at Washington University before 1900. However, the University's X-ray service actually came into existence in 1910—just 15 years after Röntgen's discovery—at the Washington University School of Medicine (WUSM), which was affiliated with the Washington University Hospital on Jefferson Avenue.

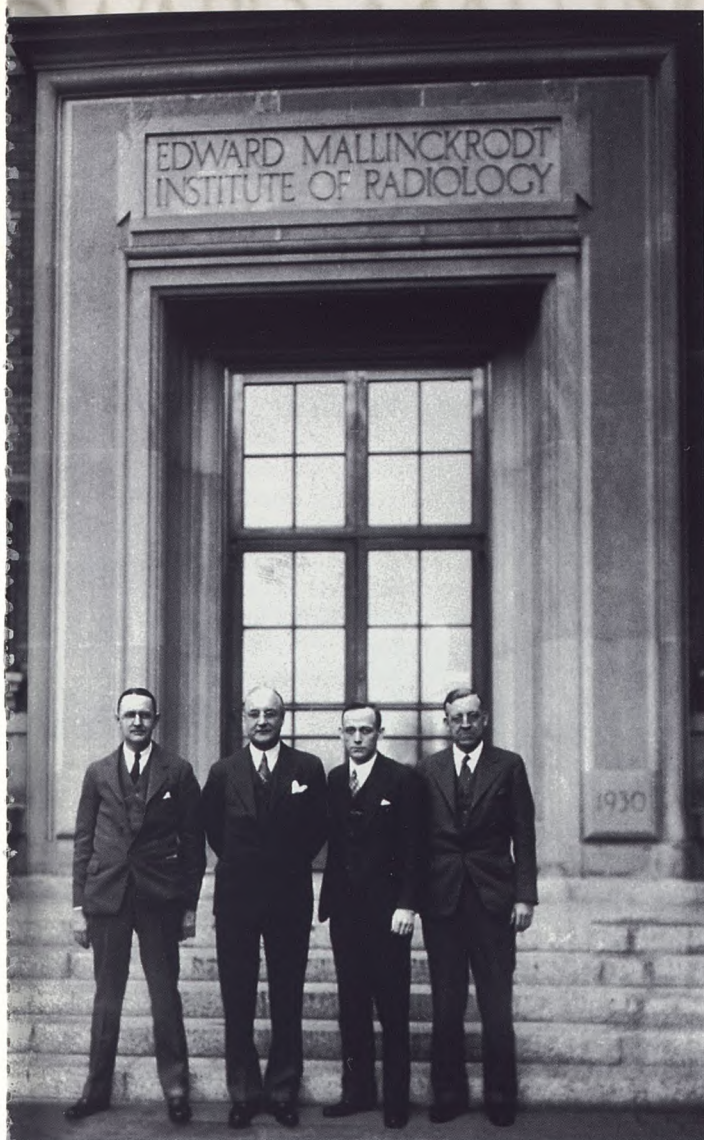
The X-ray service was called the "Actinographic Laboratory" [no data is available as to why it was so named] and was directed by Russell Carman, MD, a pioneer in the clinical use of X rays (particularly in gastroenterology). Carman's academic title was "lecturer in roentgenography." Following a reorganization of WUSM departments in 1912 and 1913, which resulted in the X-ray service being

assigned to the Department of Surgery, Carman became an instructor in roentgenology. Carman left the University in late 1913 to become head of radiology at the Mayo Clinic in Rochester, Minnesota, where he remained until his death in 1926. Charles Mayo, MD, and many other influential physicians at that time considered Carman "the leading radiologist in the country."

Walter Mills, MD, a graduate of the Marion Sims-Beaumont College of Medicine (later known as Saint Louis University School of Medicine), succeeded Carman as head of radiology. He had given up a private general practice in Webster Groves, Missouri, to study gastroenterology in Europe. Mills was later affiliated with WUSM and the Jefferson Avenue hospital where he worked to develop diagnostic techniques for clinical exams, especially the digestive system. He had particular expertise in fluoroscopy and was a pioneer in developing diagnostic imaging techniques. Following Carman's departure in 1913, Mills became head of WUSM radiology.

In 1914, X-ray activities were moved from the Jefferson Avenue hospital to a Kingshighway Boulevard facility that was affiliated with WUSM and Barnes Hospital. Two rooms (called the X-ray Laboratory), then considered adequate for the fledgling service, was established on the second floor of the hospital. A local newspaper's mention of the relocation called the lab "an elaborate photographic gallery for taking X-ray, autochrome, and ordinary pictures."

A piece of diagnostic equipment, an X-ray generator that had been used at the Jefferson Avenue facility by Carman in his fluoroscopic investigations of the gastrointestinal tract, was moved to the new location and subsequently used by other groups in some innovative applications: pyleographic images,



(left to right) doctors
Glover Copher, Evarts
Graham, Warren Cole, and
Sherwood Moore.

(below) Circa 1914—X-ray
generator used in the animal
lab to produce X rays as
cholecystography was being
developed.

using sodium iodide, of the kidney, ureters, and bladder; first arteriogram on record; and the evaluation of animal testing that resulted in the development of cholecystography. As radiographic usage became more widespread, the second-floor quarters soon became obsolete; a new radiology department was being considered.

In 1917, Sherwood Moore, MD, joined Mills at WUSM as a codirector of the new lab. Moore had a broad medical background, ranging from training in obstetrics and gynecology to surgery to radiology.

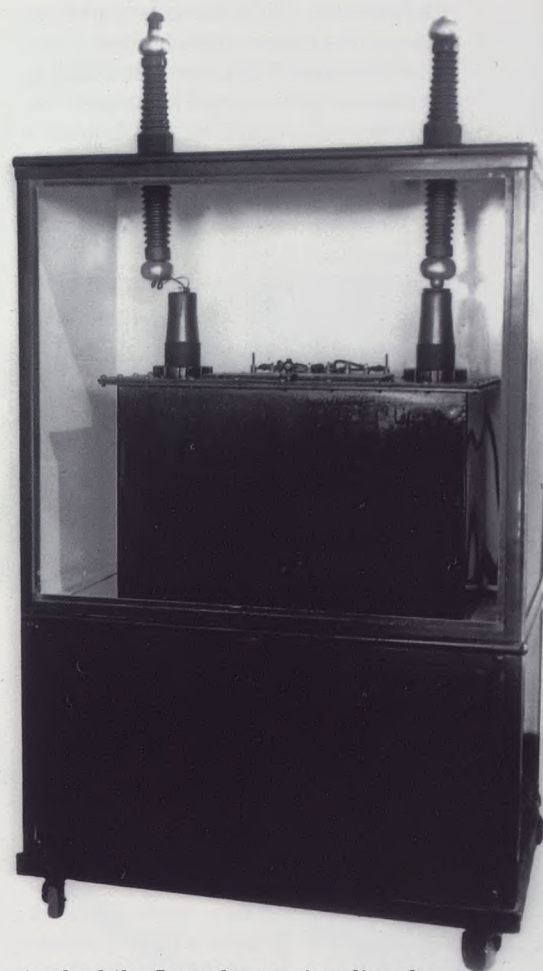
At the time, radiology did not have departmental status, as it was still considered a "new service." In institutions across the country, the

the radiologist as a photographer; radiology continued to occupy this lowly position in medicine for many years before it was recognized as an independent field."

Meanwhile, the X-ray Laboratory was definitely moving forward: The first high-voltage (or deep) X-ray therapy equipment was installed on March 14, 1922, and the first case involved treating a patient with recurrent cancer of the neck. And on February 10, 1922, X-ray film, instead of radiographic plates, was used for the first time for general diagnostic work.

WE OWE IT ALL TO GALLBLADDER RESEARCH

In the 1920s, Evarts Graham, MD, professor of surgery and director of the WUSM Department of Surgery, became interested in developing a test for diagnosing gallbladder disease. Scientific studies at that time showed that a healthy gallbladder produced concentrations of bile and certain compounds excreted almost entirely



in the bile. In order to visualize the gallbladder, a chemical compound had to be developed that would concentrate in bile, be visible by radiography, and be safe for the patients. And certain biochemical investigations suggested there



might be a way to visualize the gallbladder by X ray—although it had never been done. Graham and Moore (WUSM's only radiologist at the time)—along with surgeons Warren Cole, MD, and Glover Copher, MD, began a series of studies in animal models.

The researchers, working with a local chemical company, developed and tested approximately 90 compounds, 13 of which demonstrated the ability to concentrate in the gallbladder. The first successful image of a canine gallbladder was obtained in November 1923. However, subsequent attempts to reproduce other images failed;



Circa 1924—first visualization of a human gallbladder

the researchers discovered that the visualization only worked if the subject was fasting. The first cholecystogram (as the image was now called) of a human gallbladder—a student nurse volunteered for the study—was performed in February 1924.

By 1927 cholecystography, this most important contribution in the field of diagnostic radiology, was universally accepted. Graham and Moore (who had become sole director of radiology after Mills died in 1924) were convinced that radiology had developed to the point that it merited departmental status at WUSM. The lab's quarters on the second floor of Barnes Hospital soon became crowded, and the equipment that had been the best available in 1914 became obsolete. Advancement in the field of radiology was so rapid and the demand for its services so great that a change had to be made.

ESTABLISHING A DEPARTMENT OF RADIOLOGY

Graham agreed that radiology should become a department separate from surgery. He actively began to promote radiology as a recognized specialty and to establish radiology at WUSM. In 1927, Graham and McKim Marriott, MD, then Dean of WUSM, petitioned the Rockefeller Foundation for support in establishing a Department of Radiology. The Foundation agreed to endow an institute of radiology, the first ever to be established in the United States. However, a proviso went with the endowment: None of the money could be used for construction. There was now money for research, but no place in which to conduct that research.

Support

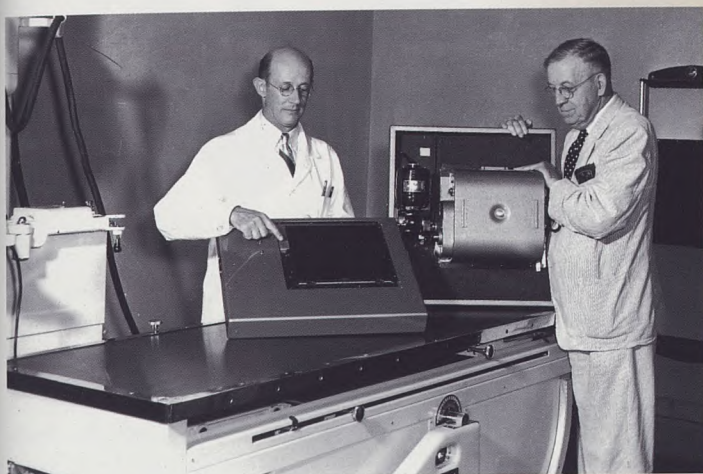
BRICKS AND MORTAR

Graham and Marriott returned to St. Louis and approached Edward Mallinckrodt, Sr., head of Mallinckrodt Chemical Works and a well-known philanthropist, for the funds to build a facility to house the department. Mallinckrodt agreed to fund the construction. Mallinckrodt, Sr. died in 1928, but Edward Mallinckrodt, Jr. sustained his father's commitment by providing additional funds to continue construction of Mallinckrodt Institute of Radiology.

The Institute's cornerstone was laid in October 1930. At completion, MIR was a nine-story building (eight floors plus a basement)—the vertical configuration of the building was considered unique for the times and still is today, as most radiology departments are arranged in a horizontal format. Initially most of the building was not occupied, but with the dramatic growth of radiology in the 1930s and '40s, the additional space would allow the department to expand.

Routine radiography began in August 1931. An additional fund for equipment was provided by John Queeny, a St. Louis businessman, and his son Edgar. Installation of the new X-ray equipment began in July 1931, and the transfer of other equipment to the new facility was completed in September 1932.

MIR's beginning was a combination of Graham's and Moore's ingenuity, the Rockefeller Foundation's support, and the Mallinckrodt family's generosity. At the time, Mallinckrodt Institute was one of five—and the largest—of such institutions in the world, plus it was centrally located in the area of the hospital it served.



Circa 1940s—doctors Wendell Scott (left) and Sherwood Moore in a fourth-floor radiology suite.

RADIOLOGY AT MIR

The 1930s

When the Institute opened in 1931, there were four radiologists (including Moore, the first MIR director) and a physicist on staff. Patient services were assigned as follows:

- Ground floor—Radiotherapy, including a waiting room
- 1st floor—General offices and viewing room
- 2nd floor—General X ray
- 3rd floor—Cystoscopy and surgical radiology
- 4th floor—Fluoroscopy and photography
- 5th and 6th floors—Shell space
- 7th floor—Biological research
- 8th floor—Film storage.

A steady increase in clinical volume at Washington University Medical Center, expanded experience with radiology techniques, and new procedures developed from research all contributed to the Institute's tremendous growth in the 1930s and into the '40s. In 1936, Jean Kieffer, a self-taught medical technician and radiographer at the Institute, developed the principles of body section radiography, involving the synchronous movement of an X-ray tube and film in opposite directions to image a small "slice" of the body. The resulting instrument, called a laminagraph, was the forerunner

of computed tomography and magnetic resonance imaging. Around that same time, Wendell Scott, MD, the first assistant of radiology at MIR, developed roentgen kymography, a method of recording the movements of various organs and structures on a single X-ray film. In July 1937, the first three-year program for the training of physicians to become radiologists eligible for certification by the American Board of Radiology was established; William Burton, MD, and Allan Phillips, MD, were the first trainees at MIR.

In 1938, University and MIR leaders agreed that applying nuclear physics (a new and rapidly advancing field) to the areas of medicine and biology held great promise for radiology research. A cyclotron, to be designed and built specifically for medical use, was funded in part by a grant from the Rockefeller Foundation. Due to insufficient space at the Medical Center, the cyclotron was constructed and housed on the University's main campus (known as the Hilltop Campus).

The 1940s

Isotopes of cobalt, iron, and phosphorous, produced by the cyclotron, were available for medical use at WUSM in March 1942. In 1943, at the request of the United States government, the cyclotron was used during World War II to produce plutonium for the Manhattan Project.

In 1945, Martin Kamen, a research chemist and a codiscoverer of carbon 14, joined the MIR staff. He developed a laboratory of basic research in the field of intermediary metabolism. The United States War Department released a small amount of radioactive carbon 14 to the Medical Center (and to the Institute) for cancer research.

A Cobalt 60 unit, used to deliver higher energy radiation therapy, was installed on the Institute's ground floor in 1948. Radiologists collaborated with physicians from the Department of Obstetrics/Gynecology in using Cobalt 60 to treat patients with gynecological cancer.

Realizing the need to improve angiographic techniques, Scott envisioned capturing a series of images in rapid sequence as contrast media circulated through organs or vessels. In 1949, he developed the rapidograph, which greatly improved angiography, by adapting a Fairchild A-5 aerial camera used during World War II.

In July 1949, Moore retired as director of the Institute and was succeeded by Hugh Wilson, MD, a WUSM graduate. Wilson, an MIR staff member from 1931 to 1934, was chairman of Yale University's Department of Radiology when he was asked to become director of Mallinckrodt Institute. Shortly after his arrival, Wilson defined his goals for the Institute: establish radiological subspecialties and emphasize education.

Editor's note: The second installment of MIR's history will focus on the 1950s, '60s, and '70s—decades that involved groundbreaking developments in radiology technology as well as rapid expansion at the Medical Center and at MIR. (Special thanks to Sue Day, in MIR's abdominal imaging section, for sharing the Merenda manuscript.)



The Metabolism of the Diabetic Heart:

Not Just a Bystander in Heart Disease

by Candace O'Connor

More patients with diabetes mellitus die from cardiovascular disease than from any other cause. And the number of diabetic patients in the United States is rising rapidly: from 14 million in 2000 to a projected 18 million by 2010. Clearly, finding the underlying reasons for heart problems in these patients is critically important—and for years scientists have been studying various aspects of this problem, including the role played by atherosclerosis, hypertension, and vascular changes in coronary artery disease.

“But physicians and researchers have long ignored the metabolism of the heart,” says Robert Gropler, MD, director of Mallinckrodt Institute of Radiology’s (MIR’s) Cardiovascular Imaging Laboratory. “They have looked at it as a kind of innocent bystander in what happens—not really much of a contributor to what goes on.

But we’re learning that it is much more than just a bystander; in fact, the heart’s metabolism may well be one of the primary mechanisms by which various disease processes, in this case diabetes, have a detrimental effect on heart function.”

Gropler and his colleagues in the Cardiovascular Imaging Laboratory—most notably, Pilar Herrero, MS, a research associate professor of radiology—and key collaborators from other departments—particularly endocrinologist Janet McGill, MD, of the Department of Internal Medicine—have been investigating this problem. Recently, they published two papers in the *Journal of the American College of Cardiology*: the first, in July 2005, demonstrating that high glucose levels impair blood flow to the diabetic heart; and the second,

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in February 2006, examining the impact of increased myocardial fatty acid metabolism on patients with type 1 diabetes and, specifically, on their cardiac function. This work was funded by the National Institutes of Health in the form of a program project grant from the National Heart, Lung, and Blood Institute; Michael Welch, PhD, codirector of MIR's Division of Radiological Sciences, is principal investigator.

The investigators began their work within a research context particularly conducive to this kind of project. At Washington University in St. Louis School of Medicine, scientists have long engaged in a major effort to better understand diabetes: its basic molecular biology, how it affects patients, and evaluating new treatment strategies. Some University-based research groups also have focused on studying how the heart's increased fat metabolism may be detrimental.

Symptoms of Diabetes

Recent studies indicate that early detection of diabetes symptoms and early treatment can decrease the chance of developing complications associated with diabetes.

- Frequent urination
- Excessive thirst
- Extreme hunger
- Unusual weight loss
- Increased fatigue
- Irritability
- Blurred vision.

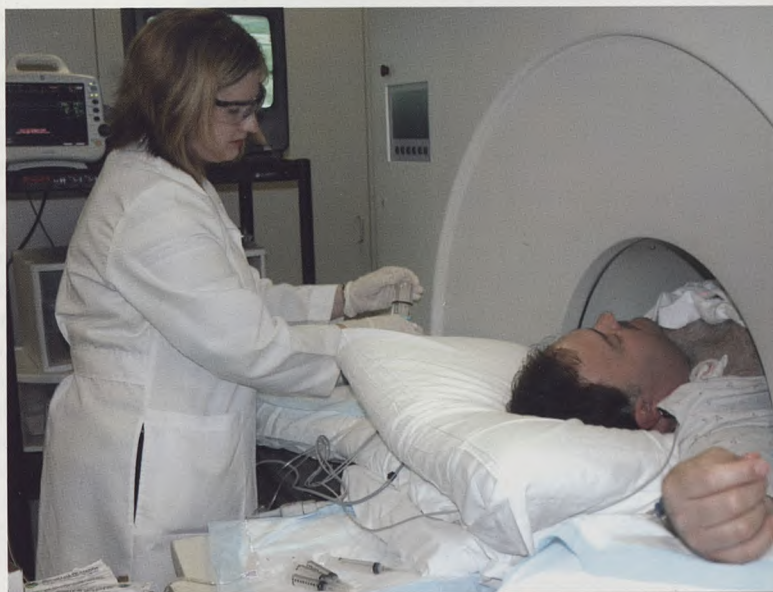
At MIR, Gropler and his group also had a rich history of positron-emission tomography (PET) expertise to draw upon [*PET was developed at MIR in the 1970s.*], including the ability to make novel radio-pharmaceuticals as carbon-11 palmitate and carbon-11 glucose. In addition, work led by Herrero pioneered the primary imaging approach that allows the researchers to use



“...researchers have long ignored the metabolism of the heart...”

PET and these radio-pharmaceuticals to quantify cardiac fat and glucose metabolism.

“Our ability to conduct these in-depth measurements of myocardial substrate metabolism that aren’t being done in other labs worldwide is really a tribute to the quality of the imaging infrastructure at MIR and to the whole PET enterprise,” says Gropler, professor of radiology, of medicine, and of biomedical engineering. “Because of this unique depth and breadth, we can do these highly complex studies that permit a comprehensive and noninvasive assessment of myocardial substrate use.”



(Above) Theresa Butler, RN, research nurse coordinator, prepares the study volunteer for PET scanning. (Below) Butler is injecting C-11 acetate into an IV in the volunteer's left arm. C-11 acetate measures the heart's oxygen usage.



The Metabolism of the Diabetic Heart:

Not Just a Bystander in Heart Disease

Types of Diabetes

Type 1—previously called insulin-dependent diabetes mellitus or juvenile-onset diabetes. Develops when the body's immune system destroys pancreatic beta cells, the body's only cells that produce the hormone insulin that regulates blood glucose. Patients with type 1 diabetes receive insulin via injection or a pump.

Type 2—previously called noninsulin-dependent diabetes mellitus or adult-onset diabetes. Accounts for approximately 90 percent to 95 percent of all diagnosed cases of diabetes. Associated with older age, obesity, family history of diabetes, history of gestational diabetes, impaired glucose metabolism, physical inactivity, and race/ethnicity.

Gestational diabetes—a form of glucose intolerance diagnosed in some women during pregnancy. More common among obese women and those with a family history of diabetes. During pregnancy, gestational diabetes requires treatment to normalize maternal blood glucose levels to avoid complications to the infant.

Other types—result from specific conditions such as maturity-onset diabetes of youth, surgery, drugs, malnutrition, infections, and other illnesses. Such types of diabetes account for 1 percent to 5 percent of all diagnosed cases.

Excerpted from the American Diabetes Association Web site at www.diabetes.org.

Gropler and his colleagues decided to build on the University's existing research base by looking at heart metabolism in diabetic patients. They also had another reason to target this issue: a wealth of data in animal models showing that the diabetic heart becomes overly dependent on fats and loses its ability to process a range of other substrates, such as glucose or lactate. Unfortunately, this flexibility is the key to heart health.

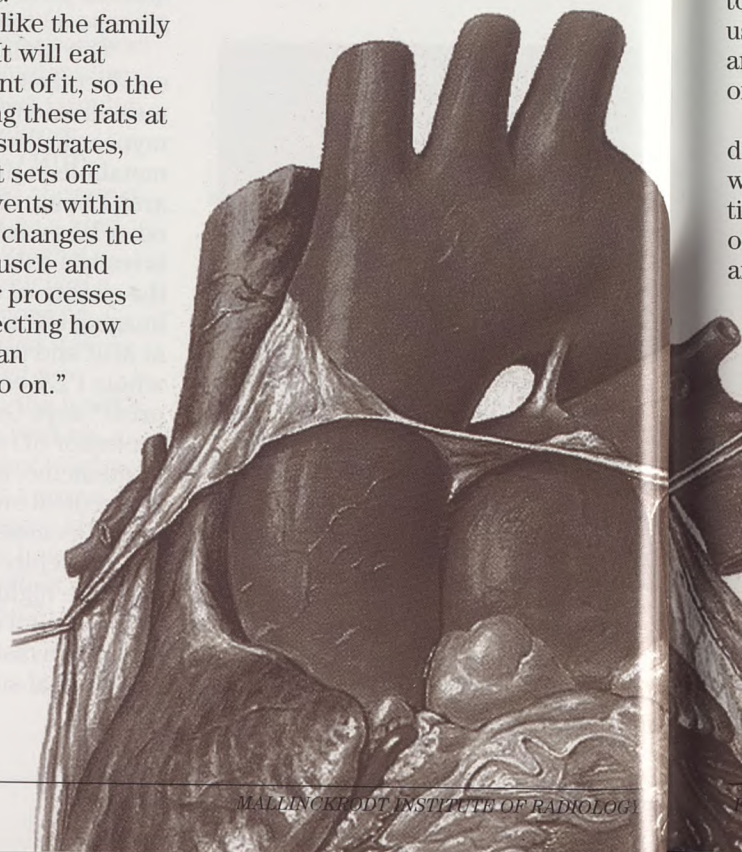
In fact, he adds, the ratio of fat usage by the diabetic heart changes dramatically. Ordinarily, it might represent 60 percent or 70 percent of the various energy substrates, with another 20 percent of glucose, 15 percent of lactate, and a tiny amount of amino acid usage—but now 90 percent of the heart's substrate usage is fat. Other researchers at the University currently are performing novel basic research into why this change occurs.

diabetic heart becomes overly dependent on fats...

Why does this shift to fatty acid dependency occur? It is caused by what is happening elsewhere in the diabetic body. Because of their insulin resistance, diabetic patients develop very high levels of fat in the blood, either in the form of free fatty acids or triglycerides. Day after day, those fats travel through the blood to the heart.

"And the heart is like the family dog," says Gropler. "It will eat whatever is put in front of it, so the heart starts consuming these fats at the expense of other substrates, such as glucose. That sets off a whole cascade of events within the heart muscle that changes the metabolism of that muscle and also can change other processes within the heart—affecting how it contracts, survives an ischemic insult, and so on."

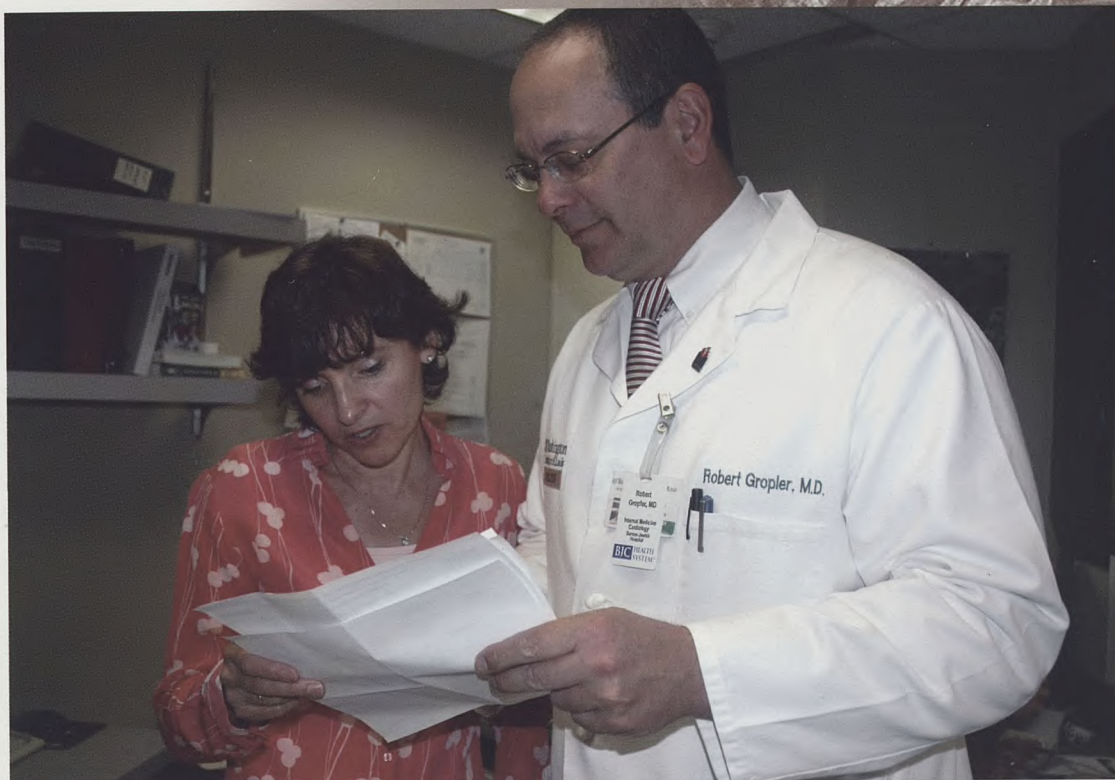
Gropler and his colleagues chose to look at another aspect of the problem: With most of these findings from animal models, what exactly was happening in the human heart? They knew that glucose metabolism was down but did not have much data to prove that fat metabolism was accelerated.



"So that's what our study was based on," says Gropler. "In diabetic hearts, do we see this shift in metabolism to predominantly fats, and could we begin to understand why that was occurring, even obtaining data to suggest that it was this fat delivery problem?"

They decided to begin with a proof-of-concept study, comparing a group of young, healthy type-1 diabetic patients to age-matched and gender-matched volunteers without diabetes. The researchers ensured that glucose and insulin levels were similar between the two groups and then used PET to measure the blood flow, oxygen usage, glucose metabolism, and fatty acid metabolism in all of the study participants.

"We found that the diabetic participants were burning three times as much fat as the ones without diabetes, and the data suggested that this was being driven primarily by the increased fat delivery to the heart muscle," says Gropler.



Robert Gropler, MD, and Pilar Herrero, MS, research associate professor of radiology, are coauthors of the paper "Increased myocardial fatty acid metabolism in patients with type 1 diabetes mellitus."

(Left) Janet McGill, MD.



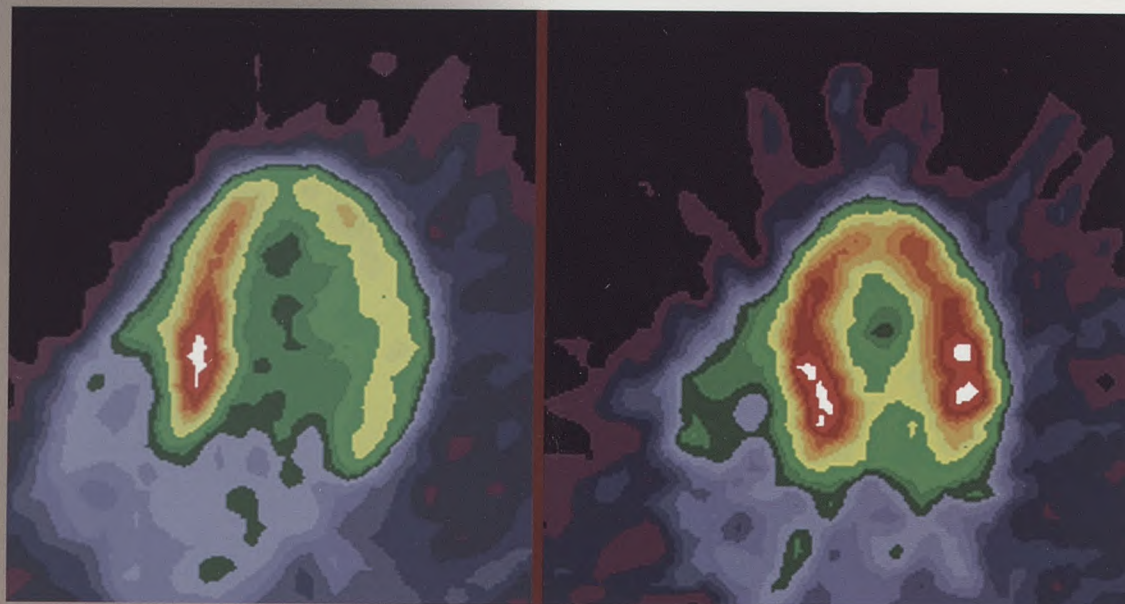
"This increased delivery caused the heart to rev up its oxidative machinery to burn the fat. A byproduct of that increased fat burning, known as reactive oxygen species, may ultimately damage the machinery, leading to a decline in the capacity of the heart to burn the fats it takes up. As a consequence, fats accumulate in the heart, initiating a process called 'lipotoxicity.'"

As a concept, lipotoxicity is relatively new and currently is being investigated as to its relevancy in humans, though its impact has already been shown by Washington University investigators in numerous animal models.

But Gropler and his team believe that, over a period of time, the increased fat delivery will have detrimental effects on the heart muscle, reducing the glucose uptake in the heart and affecting processes related to cardiac function as well as cell survival.

How long it takes for this kind of effect to occur is unclear. "What we can say, based on a few initial studies, is that a person only has to ingest fats and, thus, have high fat delivery to the heart for just a few weeks to see a reduction in its energy production," says Gropler.

The Metabolism of the Diabetic Heart: Not Just a Bystander in Heart Disease



Control-Palmitate

Fatty Acid Uptake: 145 nmol/g/min
Fatty Acid Oxidation: 140 nmol/g/min

Myocardial images of C-11 palmitate uptake in a normal control and a diabetic patient. Highest uptake is white and lowest uptake is black. C-11 palmitate uptake and, thus, fatty acid uptake is higher in the diabetic patient. Measurements of fatty acid uptake and oxidation, as measured by mathematical modeling of the PET data demonstrate quantitatively higher fatty acid uptake and oxidation in the diabetic heart.

A key clinical question is how to prevent these cardiac consequences altogether—and that question will guide the next phase of the group's work. The working hypothesis is that a major driver of this problem is the level of insulin resistance in diabetic patients: Improving their insulin sensitivity may reduce the fat release by adipose tissue, decreasing the fat level

Diabetic-Palmitate

Fatty Acid Uptake: 201 nmol/g/min
Fatty Acid Oxidation: 179 nmol/g/min

in the blood and its delivery to the heart. If so, lifestyle changes—such as weight loss, exercise, and agents to increase insulin resistance—may be the answer.

To prove this hypothesis, the group has currently undertaken a comprehensive study involving volunteers with type 2 diabetes, who are screened to exclude those with sub-clinical cardiovascular disease and then randomly assigned to several groups: one group will be treated with conventional agents to keep their blood sugar within normal range, and other groups will be treated with agents designed to lower the fat delivery to the heart. Confirmation of reduced fat delivery to the heart will be achieved by performing stable isotopic measurements of fat release by adipose tissue—aided by nutrition expert

Samuel Klein, MD, of the Department of Internal Medicine. Combining these measurements with PET studies of heart metabolism and echocardiographic studies of cardiac function will permit a comprehensive understanding of how decreasing fat release by the body's fat stores may ultimately improve cardiac metabolism and function in patients with diabetes.

"This study will define for us whether, in fact, fat delivery is playing a role in cardiac

disease that afflicts diabetic patients and why it is playing that role," says Gropler. "The study also will provide guidance as to whether we should begin altering our therapeutic strategies to include paying greater attention to the level of fats in the blood and not just the level of glucose."

At the same time, the Cardiovascular Imaging Laboratory is looking at other related problems. Do obesity and insulin resistance contribute to these same alterations in metabolism? What role does aging or gender play in substrate metabolism?

"We are excited about this work," he says. "The beauty of this technology and the strength of these studies are that they provide concrete information as to what is happening in the diabetic heart." **MIR**

Virtual Colonoscopy: a Lifesaving Technology

by Anne Kessen Lowell

The dreaded colonoscopy has long been a staple of the late-night comedy circuit—to wit the popular lead-in, “I’d rather have a colonoscopy than... .”

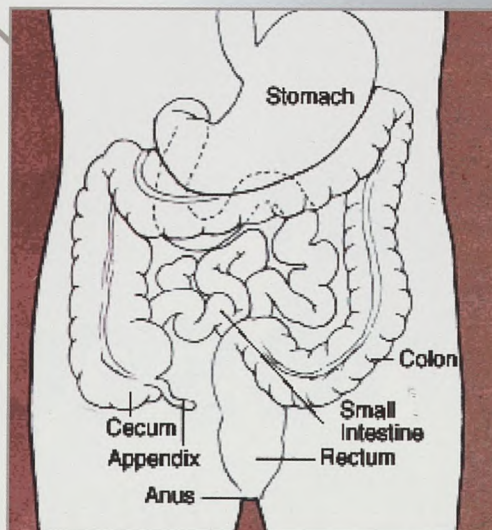
But the descent of popular culture into prurient and scatological “humor”—via television, music, and Howard Stern—has not led the American public to talk openly about problems with, well, our bottoms. That, say health experts, is keeping millions of Americans from getting the screening test they need and putting them at risk for colon cancer.

Granted, a colonoscopy is not a walk in the park; it is a pain in the (you fill in the blanks). But the procedure has the power to prevent the second most deadly cancer in the United States. Health professionals and advocates are fighting to increase awareness about colon cancer and the need for screening. And clinical researchers are evaluating new noninvasive technologies to make colon screening easier, faster, and more comfortable.

Virtual Colonoscopy: a Lifesaving Technology

At Mallinckrodt Institute of Radiology (MIR), researchers are collaborating with some extraordinary volunteers in a promising study involving computed tomography (CT) colonoscopy, or "virtual" colonoscopy. More than 150 volunteers to date have undergone not one but two colon screening procedures in one day. Christine Menias, MD, assistant professor of radiology at Washington University in St. Louis School of Medicine and a staff physician at Barnes-Jewish Hospital, is leading the effort at MIR, one of 15 sites across the country involved in the National CT Colonography Trial. The trial is funded by the National Cancer Institute (NCI) and coordinated by the American College of Radiology Imaging Network (ACRIN); nationally 2,300 volunteers will participate. CT colonography uses noninvasive technology to look inside the colon. The test can be completed more quickly and comfortably than optical colonoscopy, the most effective screening test in use today. The purpose of the ACRIN trial is to determine whether CT colonography is as effective as colonoscopy in detecting polyps (the precursors to cancer) and in detecting growths that have already become cancers.

"We have to do everything we can to increase preventive screening," says Menias. "I see two nonresectable colon cancer cases every week at Barnes-Jewish Hospital alone. This is simply unacceptable. We must continue to develop technologies that will put patients at ease while providing the same level of diagnostic accuracy we are accustomed to having."



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Colon Cancer Is Preventable

Cancers of the colon and rectum are ranked as the second deadliest cancer, with more than 55,000 American deaths each year. (According to the *Annual Report to the Nation on the Status of Cancer*, published in 2005 in the *Journal of the National Cancer Institute*, lung cancer is the leading cause of deaths in men and women—more than 160,000 deaths annually.) About 147,000 Americans were diagnosed with colon cancer in 2005, and treatment costs in the United States annually exceed eight billion dollars. But colon cancer (the term is commonly used to include cancer of the colon and rectum) also is the most preventable cancer. Controlling the usual suspects—obesity, poor diet, lack of exercise, and smoking—can reduce individual risk, but the most effective weapon against colon cancer is early screening and detection.

Colon cancer is stealthy, taking years to become a threat. It can be prevented if polyps, the precursor to cancerous tumors, are found and removed early. Polyps are growths on the lining of the colon that can mutate and grow into a cancerous tumor mass. Polyps are imperceptible without a view inside the colon; they do not cause symptoms. By the time one notices blood in the fecal stool or changes in bowel movements, or experiences pain, colon cancer may have spread outside the intestine to other organs. At that point, the disease may be untreatable.

One of the biggest risk factors for colon cancer is age, with 90 percent of cancers appearing in people age 50 and older. The disease hits the African-American community especially hard; the colon cancer death rate among African-Americans is 40 percent higher than for whites. Inadequate screening may be a primary reason for this disparity. Studies have estimated that only 30 percent to 50 percent of Americans over age 50—perhaps 42 million in all—have been screened for colon cancer. By comparison, 72 percent of women over age 50 have received a mammogram, the screening test for breast cancer.



A CT look inside the colon.

Obstacles to Screening

Embarrassment and trepidation contribute to low colon cancer-screening rates. "Paradoxically, people don't get screened because they think we'll find something. And, let's face it, people don't like to talk about colons," explains Menias.

But awareness and cost also are culprits. Celebrity activism has been effective in raising awareness, notably by morning talk-show host Katie Couric, who underwent a colonoscopy before a national television audience during a *Today Show* segment in 2000. Former major league baseball player Eric Davis, a St. Louis Cardinal in the 1999-2000 season, overcame colon cancer and is a determined advocate for screening.

**"There is not enough awareness
...about the importance of screening,
especially for people at high risk."**

Menias stresses that much more should be done, especially in the area of informing primary care physicians. "There is not enough awareness among primary care physicians about the importance of screening, especially for people at high risk. It is a tragedy to see patients in the emergency department with urgent symptoms indicating colon cancer. We need to give this disease the same priority as other cancer screenings that are now considered as routine."

Lack of insurance coverage prevents many people from being screened. It was only in 2001 that Medicare approved reimbursement for screening colonoscopy for people of "average" risk—that is, beneficiaries age 50 and older. Prior to that change, only fecal occult blood tests (known as FOBT) and sigmoidoscopy were covered, with colonoscopy reserved for those patients considered at high risk. In many states, private insurance may not cover the procedure. In 2006, the National Colorectal Cancer Research Alliance (known as NCCRA and founded by Couric) rated state-mandated private insurance coverage for screening colonoscopies. Missouri and Illinois are among 14 states, along

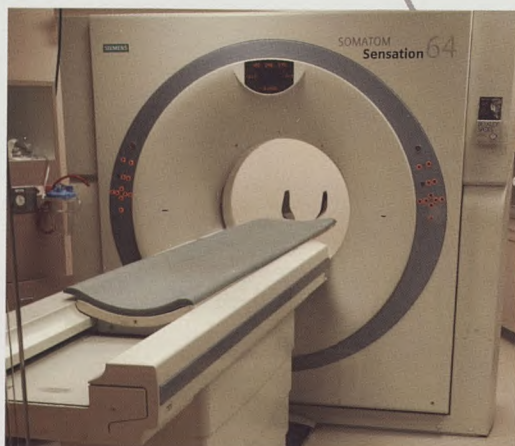
colon cancer screening. *[At press time, according to the American Cancer Society, a bill before the United States Senate (Senate Bill 1955) may override state regulations and allow private plans to exclude screening tests such as colonoscopies and mammograms.]*

Common symptoms of colorectal cancer

- Change in bowel habits
- Diarrhea, constipation, or feeling that the bowel does not empty completely
- Blood (either bright red or very dark) in the fecal stool
- Fecal stools that are narrower than usual
- General abdominal discomfort (frequent gas pains, bloating, fullness, and/or cramps)
- Weight loss with no known reason
- Constant fatigue
- Nausea and vomiting.

These symptoms are not unique to colorectal cancer and may be caused by other health issues. If you experience any of the above problems, contact your physician for a proper diagnosis.

Information provided by the National Cancer Institute.



Ruth Holdener (seated) and Christine Menias, MD, review images obtained by a 64-detector CT scanner that provides superior resolution and sharp images, plus its surprising speed is a plus for patients.

Testing Day

Colonoscopy is the screening tool most favored by physicians. It has the highest accuracy rate in detecting polyps and allows for the removal of polyps during the procedure. But a colonoscopy can be uncomfortable, may require hours of recovery, and carries some risk. Currently, technology cannot help patients avoid the most unpleasant part of either optical colonoscopy or CT colonography: the "prep."

"...a test with about five minutes of discomfort and a half hour of recovery. The patient could return to work after the test."

For both tests the colon must be vigorously cleansed: a feat accomplished by the patient consuming up to one gallon of a laxative fluid the night before the procedure. Menias believes that the greater convenience of CT colonography on the day of the procedure will convince more people to come in for the screening test.

"A colonoscopy requires about forty-five minutes for the procedure and up to an hour for recovery," she notes. "Typically a sedative is given, so the patient must have someone drive them home, and the patient likely will miss an entire day of work. CT colonography is a test with about five minutes of discomfort and a half hour of recovery. The patient could return to work after the test."

The promise of CT colonography to match or to better colonoscopy as a diagnostic tool was first demonstrated in 2003 by Perry Pickhardt, MD, a 1999 graduate of the MIR diagnostic radiology residency training program and now an associate professor in the Department of Radiology at the University of Wisconsin-Madison Medical School. In a study of 1,233 asymptomatic adults, Pickhardt

achieved polyp detection rates in line with optical colonoscopy, even in polyps as small as 6 millimeters in diameter. Intrigued by these results, NCI decided to support a multicenter trial comparing the two procedures.

Ruth Holdener is a research assistant at MIR who is responsible for recruiting volunteers for the CT colonoscopy study. Holdener culls the list of people scheduled for colonoscopy for those eligible for the trial. "Once I explain the objectives of the study, people are usually

willing to volunteer. When the trial first started, we ran one TV ad and received about two hundred and fifty telephone calls. We've already exceeded our target enrollment for the study."

In order to obtain comparative data, each volunteer must undergo both the CT colonography and optical colonoscopy. Fortunately only a single prep is required the day before the procedures. For CT colonography, patients also must consume a small amount of barium and another liquid called Gastro-view®, which coats (or "tags") any remaining fecal stool to distinguish it on the CT image from polyps or cancerous growths. No sedation is given. As the patient lies on the examination table, a small quantity of carbon dioxide (CO2) is introduced into the colon, scans are taken in both the supine and prone positions. "Most patients experience about four to five minutes of discomfort," explains Menias. "The carbon dioxide is absorbed or expelled within half an hour."

After recovery from the colonography, volunteers proceed to the colonoscopy suite for the second procedure. Later, they are asked to compare their experience with each test, to recount how much time was required to recover

from the colonoscopy, and the time spent by others to provide transportation and at-home care. The CT colonography is provided free-of-charge; the colonoscopy is charged to the patient's insurance provider.

Future Advances

Menias looks forward to the conclusion of the trial and the release of the data. CT colonography does have some advantages over colonoscopy; it can measure polyps with greater precision and allows radiologists to quickly scan other abdominal organs. So far in the MIR trial, CT colonography has detected kidney stones, gallstones, and an adrenal cancer in volunteers.

"If we continue to perfect software technology and radiologist training, CT colonography could be an excellent complement to colonoscopy," says Menias. "Everyone could be screened when they should be, faster and with less discomfort. No one would have to miss a day's work to get this important test. If polyps are detected in CT colonography, the patient will go straight to colonoscopy to have the polyps removed. And one day we may be testing a low-prep or no-prep CT colonography, using advanced fecal stool tagging methodologies."

Resources

For information about **MIR's CT Colonography Trial**, call **(314) 747-2034** or send an e-mail to holdenerr@mir.wustl.edu.

Call **St. Louis Connect Care** at **(314) 879-6392** for information about free fecal occult blood test screening.

For colon and rectum cancer information online, visit these Web sites:

- American Cancer Society:
www.cancer.org
- National Colorectal Cancer Research Alliance: www.nccra.org
- National Cancer Institute:
www.cancer.gov

Menias concedes this could be years away and emphasizes that raising awareness now is imperative. People at high risk for colon cancer and those over age 50 should talk to their doctor now about a screening test. Everyone else should plan to give themselves a lifesaver for their fiftieth birthday: a colon cancer-screening test. **MIR**

Preventable



Uterine Fibroid *Embolization*

An Alternative to Hysterectomy for Treating Fibroids

In the United States,
an estimated 5.5 million
women suffer with symptomatic
uterine fibroids. These are benign
tumors, or myomas, and can
cause significant problems that
may severely impact women's health.

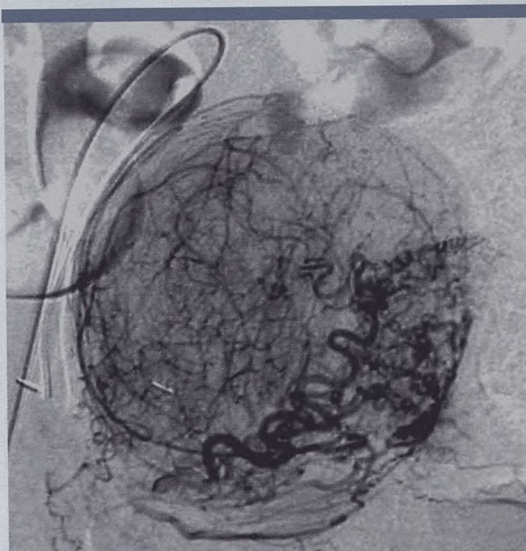
by Mary Jo Blackwood, RN, MPH, CHES

They often compress the bladder, causing urinary frequency, urgency, and incontinence. Or they may create bowel problems or pain during intercourse. Over eighty-five percent of the time, symptoms include excessively heavy, painful [menstrual] periods; some patients can become severely anemic. Symptomatic fibroids can range in size from several millimeters to larger than [the equivalent of] a pregnancy," says David Hovsepian, MD, an interventional radiologist with Mallinckrodt Institute of Radiology and a staff physician at Barnes-Jewish Hospital.

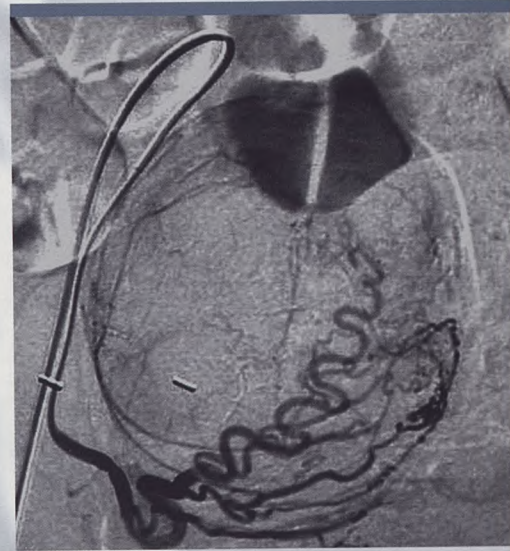
Fibroids usually will shrink on their own once menopause has begun, because of the decrease in circulating estrogen. But many women experience symptoms long before that point. Treatment options include hormonal therapies or surgery, either myomectomy (excision of individual fibroids) or, more commonly, hysterectomy (surgical removal of the entire uterus). An option preferred by many women is one of Hovsepian's specialties—uterine fibroid embolization (UFE).

How UFE Works

UFE (sometimes referred to as uterine artery embolization or UAE) takes about an hour and only requires intravenous sedation and local anesthesia. Similar to a heart catheterization, a small plastic tube (catheter) is inserted first into the femoral artery in the groin, which is then threaded into the uterine arteries where tiny embolic particles—about the size of grains of sand—are released. Propelled by blood flow, the particles become lodged in the tiny branches that



(Left) Pre-UFE: Here, the fibroids fill the uterus. The catheter is seen on the left.



(Right) Post-UFE: The fibroids have diminished because their blood supply was blocked by the embolic particles fed through the catheter.

feed the uterus and fibroids and block their blood supply. The uterus is able to draw on other vessels to sustain itself and is totally recovered within a few days. Fibroids have no such capacity and quickly starve to death. On average, fibroids will shrink to 50 percent or 60 percent of their volume and become soft and spongy, relieving pressure on adjacent organs.

Interestingly, says Hovsepian, UFE as a primary treatment for fibroids was discovered by accident in France in the early 1990s. A severe nationwide blood supply shortage prompted surgeons to request that a patient have uterine embolization a few weeks before myomectomy to help reduce blood loss during what can be very bloody surgery. A significant number of those women who had undergone embolization later refused myomectomy because their symptoms were improving.

Before the '90s, UFE commonly was performed by interventional radiologists for postpartum hemorrhage and for pelvic trauma—its use as an adjunct or stand-alone treatment for uterine fibroids has been adopted rapidly, and the number of procedures performed worldwide probably tops 100,000.

"The symptoms, such as excessive bleeding or pelvic pressure, are permanently relieved approximately eighty-five percent of the time. Shrinkage is often modest, and softening probably accounts for a lot of the improvement in symptoms. So if a woman expects her stomach to be flat when the procedure is done, she will be disappointed," says Hovsepian. "Our goal is to treat symptoms. This is not a cosmetic procedure. UFE generally turns the clock back about five years for women with fibroids and returns them to a point where they had not yet begun to experience symptoms."



David Hovsepian, MD. In the background are monitors connected to a digital fluoroscopy unit, which displays the UFE procedure in real time.

The most common symptoms following UFE are cramps and fatigue. For that reason, Hovsepian admits his patients to the hospital overnight after UFE to optimize their comfort. "Some centers allow patients to go home the same day, but recovery can sometimes be more than oral medications can handle. A significant percentage of women, perhaps as high as fifteen percent, will return to the hospital because of inadequate pain control. That is unacceptably high for me," says Hovsepian.

Following UFE, cramping is usually intense for four hours to six hours, tapering off over the next day or so. Patients may take pain-relief medication for a few days and are given an anti-inflammatory medication for a week. Most women recuperate within a few days but often are surprised by the degree of fatigue as the body musters resources to heal itself.

According to Hovsepian, "Some women go back to work within a week but find they 'run out of steam' by late afternoon for a few days longer. I encourage them to try to take two weeks off from work, with the option of working from home or returning part time during the second week, if they feel it's necessary."

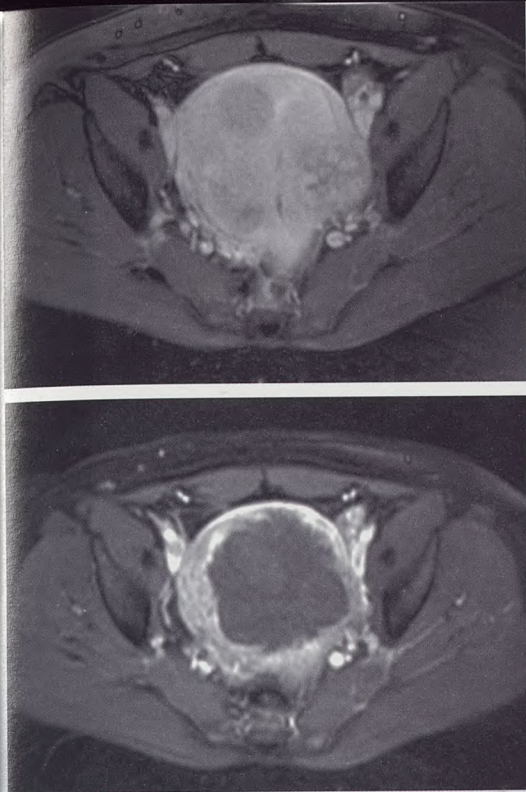
Diagnosis and Treatment Planning

Hovsepian, an associate professor of radiology at Washington University in St. Louis School of Medicine, believes the most effective diagnostic tool available for differential diagnosis of fibroid symptoms is pelvic magnetic resonance imaging (MRI). "Most gynecologists are extremely comfortable with using US [ultrasound] and often have US labs in their offices. It has been difficult to convince them that the

diagnostic information provided by MRI justifies the cost. My experience, and that of other physicians, is that the results of a pelvic MRI change the treatment plan about fifteen percent of the time," he says. Hovsepian notes that MRI effectively has replaced the need for a physical examination and shows not only the uterus and its internal architecture but all of the other pelvic organs to best advantage.

"MRI can demonstrate uterine anomalies and conditions such as endometriosis and often displays the ovaries when an ultrasound was unable to distinguish them. MRI often shows many more fibroids than the US exam revealed and allows the physician to correlate symptoms better because the location, with respect to the uterus and adjacent organs, is clearly visible," says Hovsepian. "Fibroids don't have to be very large to cause severe bleeding if they arise just beneath the endometrial lining. There also are mimickers of fibroids that can be discerned by MRI, such as adenomyosis [*endometriosis within the uterine wall*] that can cause menstrual pain and heavy bleeding."

After a patient has had a pelvic MRI and has been determined to be a candidate for UFE, she and her husband or partner are encouraged to come in for consultation. The clinic visit includes an informational video and a question-and-answer segment. Hovsepian then meets with each couple individually to review the MRI scan, answer more personal questions, and address issues relevant to each patient's situation.



(Top) MRI scan of uterine tumor taken prior to UFE.
(Bottom) MRI scan taken after UFE.

"Before we started doing the group seminars, consultations were taking longer and longer—sometimes hours—and I was largely repeating myself. The video allows me to cover a lot of information without accidentally leaving things out," he says. "The time I then spend with patients, both in the group Q-and-A session and individually, is put to much better use. Many of the attendees already have been using the Internet, 'Googled' me, and come in with a list of questions. Now I can usually make sure all of their questions are answered."

Track Record

Gynecologists perform approximately 250,000 surgeries for fibroids each year nationwide. According to a *Wall Street Journal* article (August 24, 2004), most women with symptomatic fibroids are not informed by their gynecologists that UFE is an option. The article postulated why this alternative to hysterectomy often goes unmentioned—namely, money.

Gynecologists have not been trained to perform UFE, which is being performed and promoted by interventional radiologists, so the potential loss in income for gynecologists has been estimated to be as high as \$400 million.

The article went on to note that some gynecologists view UFE as an experimental procedure, although this view is changing. However, many women still have to mention UFE when discussing fibroid treatment options with their gynecologist, and many patients going in for an office visit are better informed about UFE than are their doctors—thanks in part to the Internet.

Hovsepian is happy to hear that UFE is increasingly mentioned as an alternative but is disappointed at how often misinformation is passed along to patients. "Many times, women might have been informed about UFE but were quickly told that it was not an option for them because there were too many fibroids or the fibroids were too large—when that was not the case at all. I am always grateful when I hear a woman say that her doctor told her that he didn't know much about the procedure and to contact us to learn more about it," he says. "At the Washington University Comprehensive Fibroid Center, we have treated approximately four hundred women since we started doing UFE in 1998. Fortunately, UFE has become widely accepted by insurance carriers and health plans, including Medicare and Medicaid."

Facts & Figures

- An estimated 40 percent of all women have uterine fibroids. While most women have no symptoms, one in four eventually has symptoms severe enough to require treatment.
- African-American women are two times to three times more likely to have symptomatic uterine fibroids, typically at a younger age than the rest of the population of women with uterine fibroids.
- Asian women have a lower incidence of symptomatic uterine fibroids.
- Average age range in which fibroids become symptomatic is 35 years to 50 years.
- Obesity is associated with the presence of uterine fibroids.
- High consumption of red meat and ham has been associated with the presence of uterine fibroids.
- Research has shown some reduced incidence of uterine fibroids in women whose diet was high in green vegetables, fruit, and fish.
- Changes in a woman's hormone levels may impact fibroid growth.
- Fibroids grow rapidly during pregnancy when hormone levels are elevated and tend to shrink after menopause when hormone levels are decreased.

Information excerpted from the National Uterine Fibroids Foundation Web site at www.nuff.org/health.htm.

Pricewise, though, UFE has no advantage over hysterectomy or myomectomy, he adds. "The real savings come after the procedure. Patients recover quickly and return to work earlier, and there is no incision to heal. Patients' quality of life is improved because they are back to their usual activities sooner. That's a savings for employers, patients, and insurers," says Hovsepian.

A female flight attendant cited in the *Wall Street Journal* article was recommended to have a hysterectomy for her fibroids but then found out about UFE and had it performed. She was back at work in a week, as compared to the usual four weeks to eight weeks she would have been off the job after surgery.

National statistics show that 10 percent to 15 percent of women who have UFE will need a follow-up procedure, usually some years later, because of recurrent symptoms from fibroids that either did not fully succumb or from growth of new fibroids. "UFE kills the majority of existing fibroids, but these women have already demonstrated that their uterus has a propensity to make fibroids. A significant number of women we have treated with UFE already have had one or more myomectomies in the past," explains Hovsepian.

According to Hovsepian, myomectomy is still considered the treatment of choice for women who want to conceive; although, if there are too many fibroids or if the fibroids are too large, myomectomy surgery can be challenging and a hysterectomy may be necessary because the surgical defects are too extensive to close. "For those women, UFE may

"The procedure was so comfortable, it was almost a nonevent. That certainly wouldn't have been true of the hysterectomy my doctor wanted me to have." Linda Whiteside is talking about uterine fibroid embolization [UFE], a procedure she underwent to treat symptoms from large uterine fibroids. She was having painful, heavy-flow menstrual

periods that caused anemia, and she experienced urinary urgency from the fibroids pressing on her bladder.

"My doctor didn't give me a choice of not having a body part removed. I was afraid of the shock on my body that sudden menopause would cause and the length of time I would have to be off work, so I researched other options and came up with UFE. I had a pelvic MRI done and then sat down with my husband and Doctor Hovsepian to go over the results. He [Hovsepian] showed me the fibroids [on the MRI] and where they were exerting pressure. He even pointed out a bulging disc in my spine. It



Linda Whiteside

was very interesting and comforting. I really understood what I could gain by having this procedure," she says.

More importantly, the procedure accomplished what she had hoped it would. Her urinary symptoms were alleviated almost immediately, and her next menstrual period was much lighter. She received intravenous sedation and was connected to a "pain pump" before the procedure began. Whiteside experienced only some mild cramping and nausea afterwards. She was in the procedure room for less than an hour and went home after one night in the hospital. She was back at work as a hairdresser one week later.

"When I told other women about this procedure, several said that if they had known about it, they would never have had a hysterectomy. Condoleezza Rice [United States Secretary of State] even chose UFE as treatment for her fibroids, so I'm in good company," says Whiteside.

be a reasonable alternative, but there are no studies to date that prospectively have evaluated the issue of fertility after UFE. There have been reports of normal pregnancies and vaginal deliveries, but it is too early to say whether UFE will be an appropriate choice for women desiring to preserve fertility," he says.

Referrals

Fortunately, enlightenment about UFE seems to be building. Across the country, more and more gynecologists are proponents of embolization because it is, in their opinion, an excellent treatment option for the all-too-common

uterine fibroid problem. Hovsepian gets most of his referrals from gynecologists in the St. Louis area, and the Washington University Comprehensive Fibroid Center has the largest experience with UFE in the region. Approximately ten percent of Hovsepian's patients are self-referred and learned about the procedure from family, friends, media, or the Internet. **MIR**

Editor's note: To speak to a doctor or nurse about UFE, call (314)362-2375 or toll-free at 1-866-254-7237. For more information about UFE and the Washington University Comprehensive Fibroid Center, go online at www.mir.wustl.edu/patient/internal.asp?NavID=563.

Hovsepian and his interventional radiology colleagues perform a **variety of inpatient and outpatient procedures** for gynecological patients:

- Fallopian tube recanalization for infertility
- Treatment of pelvic venous congestion syndrome
- Vascular access for chemotherapy and/or nutrition
- Gastrostomy tube placement for nutrition or decompression
- Abscess drainage
- Vena cava filter placement.

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

James Quirk, PhD, research instructor in radiology, Division of Radiological Sciences.

Rajendra Singh, PhD, research instructor in radiology, Division of Radiological Sciences.

Yuan-Chuan Tai, PhD, assistant professor of radiology, as principal investigator, received a two-year grant from The Susan G. Komen Breast Cancer Foundation for "Feasibility study of a high-resolution breast coil for PET-CT scanners." Coinvestigator for the \$249,349 grant is Joseph O'Sullivan, PhD, professor of electrical and systems engineering and of radiology

GRANTS

Jennifer Gould, MD, assistant professor of radiology, received a three-year grant from the Society of Interventional Radiology Clinical Fellowship Research Training Program. The \$30,000 grant will fund projects conducted by Mallinckrodt Institute interventional radiology fellows.

Vamsidhar Narra, MD, associate professor of radiology, received a six-month grant in the amount of \$30,000 from the Barnes-Jewish Hospital Auxiliary for research on "Body MRI for quicker evaluation of cancer response to chemotherapy."

APPOINTMENTS/ELECTIONS

Maurizio Corbetta, MD, professor of neurology, of radiology, and of anatomy and neurobiology, was appointed chairman of the Program Committee for the 12th Annual Meeting of the Organization for Human Brain Mapping, Florence, Italy, June 11-15.

Michael Darcy, MD, professor of radiology, was elected to a two-year term as vice chairman of the Society of Interventional Radiology Foundation. He will become chairman of the Foundation in 2008.

Colin Derdeyn, MD, associate professor of radiology, was elected chairman of the National Institutes of Health Data Safety and Monitoring Board for the National Institute of Neurological Disorders and Stroke projects—P50NS044378 "MR and Mechanical Revascularization of Stroke Clots Using Embolectomy (MR Rescue)," and P50NS044148 "Intravascular Cooling in the Treatment of Stroke—Longer tPA Window (ICTuS-L)." He also was appointed to the Program Committee for the 31st Annual International Stroke Conference, Kissimmee, Florida, February 16-18.

Igor Efimov, PhD, associate professor of biomedical engineering and of radiology, was elected chairman of the Cardiac Arrhythmia Mechanisms Gordon Research Conference to be held in Ventura Beach, California, March 18-23, 2007. He also was elected to the editorial boards of the scientific publications *Circulation Research*, *Heart Rhythm*, *Journal of Cardiovascular Electrophysiology*, *Journal of Molecular and Cellular Cardiology*, and *Experimental Physiology*.

Jay Heiken, MD, professor of radiology, was appointed to a four-year term (2005-2009) on the Board of Trustees of the International Cancer Imaging Society and to a six-year term (2006-2012) on the Board of Directors of the Society of Gastrointestinal Radiologists.

Fred Prior, PhD, research associate professor of radiology, was appointed to the National Alliance for Medical Image Computing Advisory Board.

Douglas Rowland, PhD, research instructor of radiology, was elected to a second term as treasurer of the National Postdoctoral Association.

Sally Schwarz, RPh, MS, research associate professor of radiology, was elected to a three-year term as a member of the Certification Board of Nuclear Cardiology.

Yuan-Chuan Tai, PhD, assistant professor of radiology, was elected to a two-year term as a member of the Nuclear and Imaging Sciences Council of the Institute of Electrical and Electronic Engineers Nuclear and Plasma Sciences Society.

Franz Wippold, MD, professor of radiology, was appointed to a one-year term as a member of the American College of Radiology Appropriateness Criteria Committee.

Pamela Woodard, MD, associate professor of radiology, was appointed to a two-year term as a member of the American Heart Association Program Committee for Annual Scientific Sessions.

HONORS/AWARDS

Carolyn Anderson, PhD, associate professor of radiology and of molecular biology and pharmacology, organized Frontiers in Biological Imaging: From Cells to Humans at the annual meeting of the American Association for the Advancement of Science, St. Louis, Missouri, February 16-20.

Louis Gilula, MD, professor of radiology and of surgery, and coauthor Douglas Smith, MD, South Texas Radiology Group, San Antonio, received the award for Best Paper Presentation—Interventional Spine for “A previously unreported and novel approach to sacroplasty” at the American Society of Spine Radiology 2006 Annual Symposium, Las Vegas, Nevada, February 22-26.

Robert Gropler, MD, professor of radiology, of medicine, and of biomedical engineering, served as course chairman of Images to Outcomes VI: Cardiovascular Imaging, Nuclear Cardiology, and Beyond, presented by the Division of Nuclear Medicine at Mallinckrodt Institute of Radiology and the Cardiovascular Division of the Department of Medicine, St. Louis, Missouri, April 28 and 29.

Fred Prior, PhD, research associate professor of radiology, served as session chairman and program committee member for the Open Source Strategy for Multi-Center Image Management Conference, Las Vegas, Nevada, March 6-9.

Marcus Raichle, MD, professor of radiology, of neurobiology, and of neurology, served as a moderator for Frontiers in Biological Imaging: From Cells to Humans at the annual meeting of the American Association for the Advancement of Science, St. Louis, Missouri, February 16-20.

Lawrence Tarbox, PhD, research assistant professor of radiology, served as a session panelist for the Open Source Strategy for Multi-Center Image Management Conference, Las Vegas, Nevada, March 6-9.

LECTURES

Carolyn Anderson, PhD, associate professor of radiology and of molecular biology and pharmacology, presented “Education in imaging sciences: the next frontier,” at the American Association for the Advancement of Science annual meeting, St. Louis, Missouri, February 16-20.

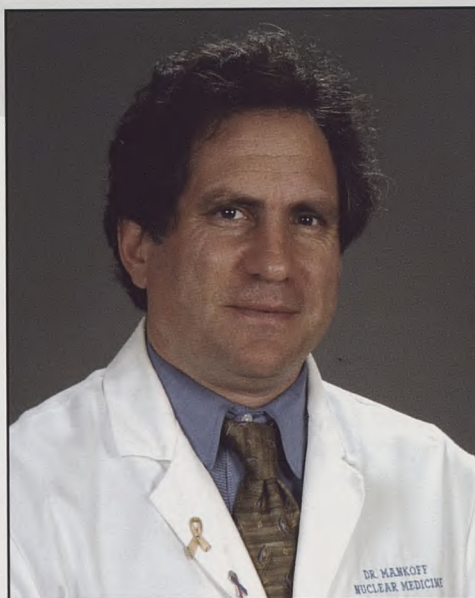
Jeffrey Brown, MD, professor of radiology, spoke on “MRI of cholangiocarcinoma and gallbladder cancer”; “MRI of the indeterminate renal mass”; “Body MRI: Should it replace CT?”; and “Successful investment strategies for physicians” at the Los Angeles Radiology Society 58th Annual Mid Winter Conference, Los Angeles, California, January 28 and 29.

Maurizio Corbetta, MD, professor of neurology, of radiology, and of anatomy and neurobiology, presented “Prospective of physician scientists in the 21st century” at the Winship Cancer Institute, Emory University, Atlanta, Georgia, April 22.

Colin Derdeyn, MD, associate professor of radiology, of neurology, and of neurological surgery, spoke on “Acute stroke intervention” at Medical Grand Rounds, St. Joseph’s Hospital, St. Charles, Missouri, February 7. He presented “Evidence based management of ruptured intracranial aneurysms” at the 31st Annual International Stroke Conference, Kissimmee, Florida, February 16-18.

Biello Lecture

On March 8, David Mankoff, MD, associate professor of radiology, University of Washington, Seattle, presented the Twentieth Annual Daniel R. Biello Memorial Lecture. He spoke on “Molecular imaging to direct cancer therapy: from early drug trials to clinical practice.”



He spoke on "Diagnosis of vasospasm" at the 9th Annual Joint Meeting of the American Association of Neurological Surgeons/Congress of Neurological Surgeons Joint Section on Cerebrovascular Disease and American Society of Interventional and Therapeutic Neuroradiology, Orlando, Florida, February 17-20.

Igor Efimov, PhD, associate professor of biomedical engineering and of radiology, as the Doris J. W. Escher, M.D. Lecturer, presented "History and mechanisms of defibrillation: toward painless defibrillation" at Cardiology Grand Rounds, Albert Einstein College of Medicine, Montefiore Medical Center, New York City, New York, February 14. He presented "Imaging cardiac arrhythmias" to the Department of Biomedical Engineering, Saint Louis University, St. Louis, Missouri, February 18. As the Astor Visiting Fellow, Efimov spoke on "Structure/function relationship of the pacemaking and conduction system of the heart," "Towards painless defibrillation: virtual electrode theory of electrical stimulation of the heart," and "Imaging arrhythmias in 3D: the final frontier" at the University of Oxford, Oxford, England, March 13-17. He spoke on

"Structure/function of the supraventricular pacemaking and conduction system of the rabbit heart" at Experimental Biology 2006: Advancing the Biomedical Frontier, sponsored by the Federation of American Societies for Experimental Biology, San Francisco, California, April 1-5.

Dione Farria, MD, associate professor of radiology, as keynote speaker, presented "Disparities in breast cancer screening and diagnosis" at 2006: Genomics of Health Disparities Symposium, sponsored by the Federation of American Societies for Experimental Biology, San Francisco, California, April 1-5.

David Gierada, MD, associate professor of radiology, spoke on "CT evaluation of the chest wall" and "Lung cancer screening: pros and cons" at the Medical College of Wisconsin, Milwaukee, March 6.

Louis Gilula, MD, professor of radiology and of surgery, spoke on "Longitudinal approach to sacroplasty" at the American Society of Spine Radiology 2006 Annual Symposium, Las Vegas, Nevada, February 22-26. As visiting professor, he presented "Musculoskeletal board review" at Oregon Health and Science University, Portland, April 10 and 14.

Perry Grigsby, MD, professor of radiation oncology and of radiology, presented "Clinical and translational science for FDG-PET in cervix cancer" at Grand Rounds, Rambam Medical Center, Haifa, Israel, January 9. He presented "Brachytherapy for cervical cancer" and "Current radiotherapy approach to pelvic malignancies" to the Israeli Society for Clinical Oncology and Radiation Therapy, Eilat, Israel, January 11-14. Grigsby spoke on "Technique and results of HDR intracavitary brachytherapy for cervical cancer" at the 16th Annual Meeting of the Association of Clinical Research organizations, Orlando, Florida, February 23-25. He spoke on "Cervix cancer" at the American Society for Therapeutic Radiology and Oncology Spring Refresher Course, Miami, Florida, March 24-26. He presented "Radiotherapy vs. chemotherapy in advanced staged endometrial cancer," "Role of radiotherapy in surgically staged endometrial cancer," and "Adjuvant radiotherapy in cervical cancer" at the 10th Biannual Congress of Turkish Gynecological Oncology Society, Antalya, Turkey, April 18-23.

Robert Gropler, MD, professor of radiology, of medicine, and of biomedical engineering, spoke on "SPECT evaluation post-revascularization," "SPECT evaluation in heart failure," and "Read with the experts: SPECT and SPECT/CT" at Images to Outcomes VI: Cardiovascular Imaging, Nuclear Cardiology, and Beyond, presented by the Division of Nuclear Medicine at Mallinckrodt Institute of Radiology and the Cardiovascular Division of the Department of Medicine, St. Louis, Missouri, April 28 and 29.

Jay Heiken, MD, professor of radiology, presented "Virtual colonoscopy: update 2006," "Acute small bowel obstruction: CT evaluation," "Principles of contrast administration and scan timing for MDCT," and "Abdominal aorta: aneurysm rupture and post-operative complications" at Radiology at the Seashore: A Practical Approach, sponsored by the University of Michigan Medical School, Naples, Florida, February 6-10. He presented "Optimizing contrast enhancement for MDCT" and participated in the Special Focus Session: MDCT in Theory and Practice at the European Congress of Radiology, Vienna, Austria, March 3-7. He spoke on "Emergency radiology of the abdomen" at the 38th International Diagnostic Course in Davos: Diseases of the Abdomen and Pelvis, Davos, Switzerland, April 1-7.

LECTURES

Continued from page 25

Linda Larson-Prior, PhD, research associate professor of radiology, spoke on "Imaging neural function across scale: the promise of multi-modal imaging" in the Center for Neurodynamics, Department of Physics and Astronomy, University of Missouri—St. Louis, March 24.

Jason Lewis, PhD, assistant professor of radiology, presented "Imaging tumor hypoxia: the translation of Cu-ATSM from the bench to the clinic" at St. Thomas Hospital, London, England, May 22. He spoke on "Metal-based PET radiopharmaceuticals: from pre-clinical development to clinical application" at Oxford University, Oxford, England, May 23.

Vamsidhar Narra, MD, associate professor of radiology, spoke on "Contrast enhanced MRA of the abdominal aorta and the renal arteries," "Contrast enhanced MRA run-off," and "MRCP: techniques and clinical applications" and presented a workstation demonstration at the 6th Annual Snowmass 2006: New Advances in MR and CT, Snowmass Village, Colorado, February 19-24.

Joel Perlmutter, MD, professor of neurology, of radiology, and of physical therapy, spoke on "Population studies of dystonia" at Genetic Advances in Dystonia Workshop, sponsored by the Dystonia Medical Research Foundation, Phoenix, Arizona, January 30. He presented "Neuroimaging biomarkers of P.D. progression" at the World Parkinson Congress, Washington, DC, February 22-26.

Fred Prior, PhD, research associate professor of radiology, presented "Image management for research and clinical trials" at the Open Source Strategy for Multi-Center Image Management Conference, Las Vegas, Nevada, March 6-9. He spoke on "Current status: CAB16 imaging software" at the Cancer Bioinformatics Grid annual meeting, Washington, DC, April 9-11.

Marcus Raichle, MD, professor of radiology, of neurobiology, and of neurology, presented the George C. Cotzias Lecture—"The visible brain: an evolving perspective"—at the 58th Annual Meeting of the American Academy of Neurology, San Diego, California, April 1-8.

Stuart Sagel, MD, professor of radiology, as visiting professor, presented "Interactive case discussions" to the Department of Radiology, University of Arizona, Tucson, March 30.

Gordon Shulman, PhD, research associate professor of neurology and of radiology, presented "Brain systems for voluntary control of human spatial attention" to the Department of Psychology, University of Missouri—Columbia, March 10.

Barry Siegel, MD, professor of radiology and of medicine, presented "The female genitourinary tract," "PET/CT of the breast," "Evaluation of melanoma," "The National Oncologic PET Registry," and "Monitoring and predicting response to therapy in oncology" at Nuclear Medicine 2006: PET and PET/CT Imaging, Palm Beach, Aruba, January 22-26. He spoke on "PET and PET/CT artifacts and variants," "PET/CT in lung cancer," and "PET/CT in women's cancer" and

participated in Interesting Cases: Read with the Experts at The Next Step in Molecular Imaging—PET/CT Scanner, sponsored by the Positron Emission Tomography Center, St. Luke's Medical Center, Quezon City, Philippines, March 3. As visiting professor, Siegel spoke on "PET and PET/CT in women's cancers" at Robert Wood Johnson Hospital, University of Medicine and Dentistry of New Jersey, New Brunswick, March 16. He spoke on "Applications of PET and PET/CT in clinical oncology" and "PET and PET/CT in women's cancers" at Allegheny General Hospital, Pittsburgh, Pennsylvania, March 20. He presented "Clinical applications of PET for cancer diagnosis and staging," "PET in oncology: monitoring and predicting

Senturia Lecture

Cheryl Petersilge, MD, assistant clinical professor of radiology and orthopedic surgery at Case Western Reserve University, Cleveland, Ohio, presented the Twelfth Annual Hyman R. Senturia Lecture on February 6. She spoke on "Imaging of the painful hip and pelvis."



response to therapy," "PET in breast cancer," and "PET in oncology: beyond FDG" at the 26th Annual Course in Computed Tomography, Magnetic Resonance Imaging and Positron Emission Tomography, Auchterarder, Scotland, April 9-13. As the Wendell Scott Lecturer, Siegel spoke on "Positron emission tomography in breast cancer" at the 32nd National Conference on Breast Cancer, sponsored by the American College of Radiology, San Diego, California, April 28-30.

Marilyn Siegel, MD, professor of radiology and of pediatrics, spoke on "Imaging the child with acute abdominal pain" and "Congenital abnormalities" and presented "Advances in congenital heart disease imaging" at a Special Focus Session at St. Luke's Medical Center, Quezon City, Philippines, March 3. She spoke on "Pediatric pelvic masses," "Pediatric hepatic lesions," and "CT of vascular mediastinal abnormalities" at the 26th Annual Course in Computed Tomography, Magnetic Resonance Imaging and Positron Emission Tomography, Auchterarder, Scotland, April 9-13.

Lawrence Tarbox, PhD, research assistant professor of radiology, spoke on "Application hosting: a standardized API for launching and communicating with 'plug-in' applications" at the Open Source Strategy for Multi-Center Image Management Conference, Las Vegas, Nevada, March 6-9. He presented "Using MIRC to

access research images in a HIPAA world" at Imaging Informatics in Focus, the 2006 Annual Meeting of the Society for Computer Applications in Radiology, Austin, Texas, April 27-30.

Franz Wippold, MD, professor of radiology, presented "Imaging and the law: judging the book by its cover" at the United States Attorney's Office of the Eastern District Legal Seminar, St. Louis, Missouri, February 16. He spoke on "Imaging the degenerative lumbar spine" at the annual meeting of the American Academy of Orthopedic Surgeons, Chicago, Illinois, March 24.

Pamela Woodard, MD, associate professor of radiology, as visiting professor, presented "Delayed contrast-enhanced cardiac MR" and "Coronary CT angiography" at the University of Indiana Medical Center, Indianapolis, March 1 and 2. She spoke on "Evaluation of pulmonary arterial hypertension and right ventricular function with MR" at the Society of Thoracic Radiology annual meeting, Orlando, Florida, March 14. She spoke on "Read with the experts: CT" at Images to Outcomes VI: Cardiovascular Imaging, Nuclear Cardiology, and Beyond, presented by the Division of Nuclear Medicine at Mallinckrodt Institute of Radiology and the Cardiovascular Division of the Department of Medicine, St. Louis, Missouri, April 28 and 29.

SYMPOSIA

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

SOCIETY OF GASTROINTESTINAL RADIOLOGISTS AND SOCIETY OF URO RADIOLOGY

*Abdominal Radiology Course 2006
Kauai, Hawaii
February 26—March 3, 2006*

WORKSHOPS

Dennis Balfe, MD, "American Board of Radiology: update 2006."

Jay Heiken, MD, "Cystic neoplasms of the pancreas."

Christine Menias, MD, "CT of the right lower quadrant pain."

Sharlene Teefey, MD, "Duplex color Doppler of liver."

MULTIDETECTOR CT

Jay Heiken, MD, "Radiation and contrast issues for MDCT."

ABDOMINAL MULTIDETECTOR CT
Dennis Balfe, MD, moderator

SELF ASSESSMENT MODULE (SAM)
Dennis Balfe, MD, "Liver—focal benign lesions; focal malignant lesions; diffuse liver disease."

ACADEMY OF MOLECULAR IMAGING

*Annual Conference
Orlando, Florida
March 25-29, 2006*

Barry Siegel, MD, "An overview of the National Oncologic PET Registry."

PLENARY SESSIONS

Gynecological and Breast Cancers
Farrokh Dehdashti, MD, "PET/CT in ovarian and uterine cancer."

Perry Grigsby, MD, "PET imaging of cervical cancer."

Role of Imaging in Diabetes
Robert Gropler, MD, "Imaging of substrate metabolism in diabetes."

Radiotracer Imaging in Heart Failure—The Role of Molecular Imaging
Robert Gropler, MD, "Imaging metabolism in heart failure."

SOCIETY OF INTERVENTIONAL RADIOLOGY

*31st Annual Scientific Meeting
Toronto, Ontario
March 30—April 4, 2006*

CATEGORICAL COURSES

Daniel Brown, MD, panelist, Case Based Review: Non-vascular Interventions.

Michael Darcy, MD, moderator, GI Bleeding; panelist, Case Based Review: Non-vascular Intervention; "Introduction to course and MOC self assessment"; "Pre-procedure clinical assessment and management"; "Update on results for bleeding and ascetic indications."

Jennifer Gould, MD, "Management of lower GI bleeding."

SYMPOSIA

Continued from page 27

PLENARY SESSIONS

Daniel Brown, MD, "Ablation of hepatic malignancy: When are we helping the patient and when are we kidding ourselves?"

Suresh Vedantham, MD, moderator, Venous Thromboembolic disease: Big Problem, No Easy Answers; "Lower extremity DVT: When is intervention indicated?"

WORKSHOPS

Daniel Brown, MD, coordinator, Gastrointestinal IR: Techniques and Management.

Suresh Vedantham, MD, coordinator, Thrombolytic Therapy for Venous Thrombolysis Disease.

SOCIETY OF COMPUTED BODY TOMOGRAPHY AND MAGNETIC RESONANCE

*29th Annual Course
Phoenix, Arizona
April 3-7, 2006*

GASTROINTESTINAL IMAGING

Kyongtae Bae, MD, PhD, "PET/CT of the abdomen and pelvis: strengths and weaknesses from a body imager's perspective"; "Principles and practice of contrast material delivery in MDCT"; "Interactive case review: GI."

Dennis Balfe, MD, "MDCT for diagnosing ischemia of the small bowel and mesentery."

Marilyn Siegel, MD, "MDCT in children: techniques, applications and risks"; "CT/MR of pediatric mediastinal masses."

GENITOURINARY IMAGING

Dennis Balfe, MD, "Imaging of the subperitoneum: What is it and why is it important?"

THORACIC IMAGING

Stuart Sagel, MD, moderator, Thoracic Imaging—Session II; "Lung cancer screening: status in 2006"; "CT of the pleura"; "Interactive case review: chest."

IMAGING SCIENCES RETREAT

*St. Louis, Missouri
April 21 and 22, 2006*

EDUCATION IN IMAGING SCIENCES

Carolyn Anderson, PhD, "Graduate education in imaging sciences at WU."

STATE-OF-THE-ART IN BIOMEDICAL IMAGING AT WASHINGTON UNIVERSITY

Joseph Ackerman, PhD; **Robert Gropler, MD**, moderators.

Gilbert Jost, MD, introduction, keynote presentation.

Mark Mintun, MD, "The Center for Clinical Imaging Research at WU."

David Piwnica-Worms, MD, PhD, "Molecular imaging and high throughput screening as real time discovery tools in vivo."

Marcus Raichle, MD, "Neuroimaging at Washington University."

Michael Welch, PhD, "NIH translational PO1 and R24 grants supporting imaging research at WU."

IMAGING SCALES IN TIME AND SPACE

Joseph Culver, PhD, moderator.

Joseph O'Sullivan, MD, PhD, "Image reconstruction as optimal information extraction."

PUSHING THE LIMITS OF IMAGING

Steven Petersen, PhD, "Studying cognitive development and task control in humans with MRI."

AMERICAN ROENTGEN RAY SOCIETY

*106th Annual Meeting
Vancouver, British Columbia
April 30—May 5, 2006*

CASE-BASED IMAGING REVIEW: CARDIOVASCULAR IMAGING

Sanjeev Bhalla, MD, "Pericardial disease"; "CT angiography of the pulmonary arteries."

Cylen Javidan-Nejad, MD, "Myocardial."

CASE-BASED IMAGING REVIEW: GASTROINTESTINAL IMAGING

Christine Menias, MD, "CT evaluation of nontraumatic abdominal pain."

Pamela Woodard, MD, "Read cases with the experts: abdominal."

CASE-BASED IMAGING REVIEW: THORACIC IMAGING

Fernando Gutierrez, MD, "MDCT: Principles and applications in the thorax."

CATEGORICAL COURSE ON BODY MRI

Marilyn Siegel, MD, "MRI of bone marrow."

Pamela Woodard, MD, "MRI of chest pain in the young"; "Read cases with the experts: cardiac imaging."

SCIENTIFIC SESSIONS

Pamela Woodard, MD, "MRI of chest pain in the young."

Marilyn Siegel, MD, "Pediatric mediastinum: vascular and nonvascular masses."

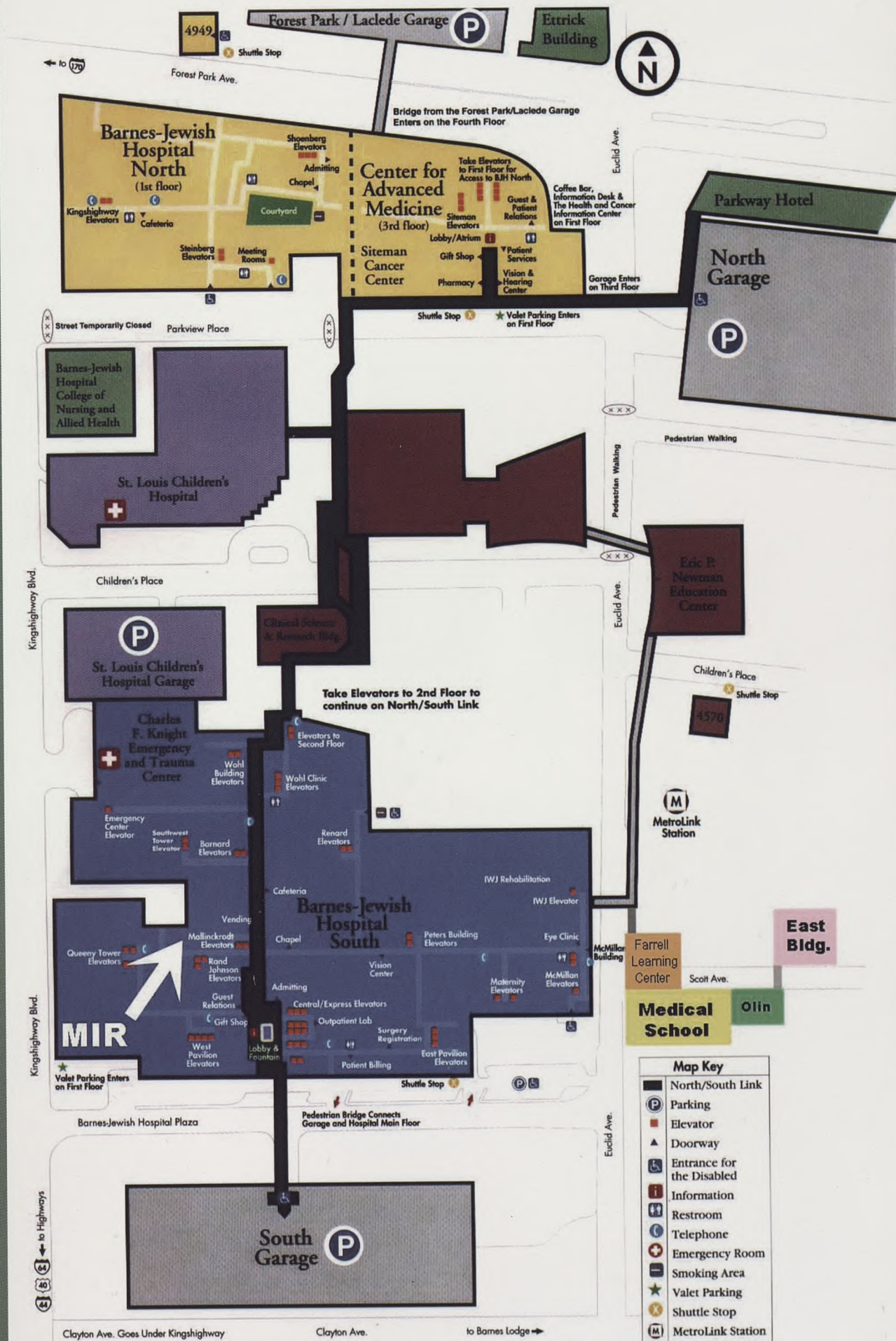
INTRODUCTION TO RESEARCH PROGRAM

Pamela Woodard, MD, "Research funding opportunities."

Editor's Note: An abstract presented at the Society for Molecular Imaging (listed on page 31 in the Winter 2005/2006 issue of Focal Spot) should have read as follows: Scott Harpstrite; Julie Prior; Jiling Song; David Piwnica-Worms, MD, PhD; Vijay Sharma, PhD, ^{99m}Tc-Technetium-complexes for imaging β -amyloid in the brain."

Latest available map for patients and visitors to the Washington University Medical Center.

Additional maps will be published in the magazine as changes occur.



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