

Summer 1996

Focal Spot, Summer 1996

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SUMMER, 1996

VOLUME 27, NUMBER 2

FOCAL SPOT

MALLINCKRODT INSTITUTE OF RADIOLOGY



**DIAGNOSING
BREAST CANCER
WITH PET**



JUNE 1, 1996

More than 400 cancer survivors, family, friends, and caregivers gathered in The Eric P. Newman Education Center on the Washington University Medical Center campus to celebrate life and to share the memories of hard-fought battles and sweet victories over a dreaded disease. ▼

1 Herman Bockstruck, 22-year cancer survivor; Carlos Perez, MD, director of the Radiation Oncology Center; and William Peck, MD, dean of the medical school.

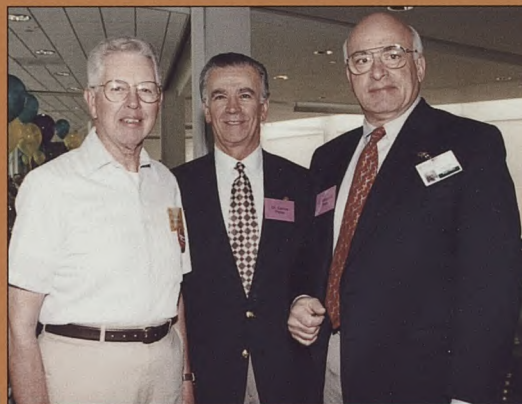
2 Washington University Chancellor Mark Wrighton visited with former patients and their guests.

3 Code Blues provided swinging sounds and a feel-good mood.

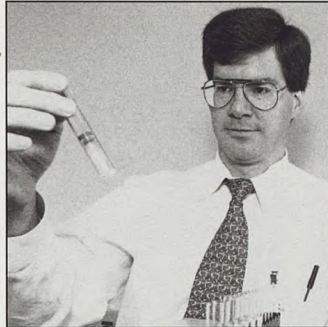
4 Radiation Oncology's Perry Cole and Ernestine Easley welcomed Virgil and Lillian Petty.

5 Dr. Carlos and Susie Perez with Chester Moore (third from left), his family and friends.

6 Dr. Todd Wasserman, who has been organizing Celebration of Life since 1989, and ten-year-old Adam Gacioch, the youngest cancer survivor attending the event.



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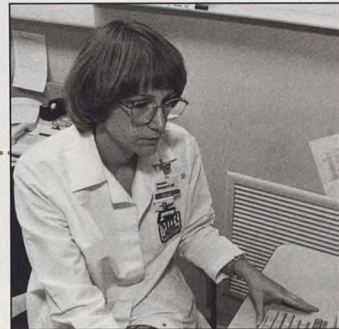


AN ATLAS OF DISCOVERY

Researchers in MIR's molecular radiopharmacology lab are investigating why some tumor cells reject certain chemotherapeutic agents. Information gained from this study could result in improved treatment for patients with cancer.

14 PET: A LOGICAL TOOL IN THE FIGHT AGAINST BREAST CANCER

Two significant clinical trials will determine if positron emission tomography (PET) is an effective, noninvasive method for evaluating lymph-node involvement in breast cancer and for identifying which estrogen-receptor-positive breast tumors will respond to hormonal therapy.



32

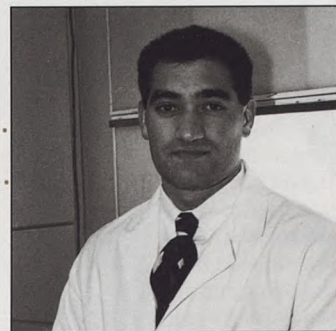


IN MEMORIAM

A tribute to Dr. Michel Ter-Pogossian, an innovative researcher known as "the father of PET," who devoted more than four decades to the improvement of medical imaging.

2 SPOT NEWS

19 FYI



ON THE COVER:

Doctors Farrokh Dehdashti and Barry Siegel are principal investigators in studies involving PET, a 25-year-old technology developed at Mallinckrodt Institute. Photography by Tim Parker.

SPOT NEWS

Highest honors to Raichle

Marcus Raichle, MD, professor of radiology and codirector of the Division of Radiological Sciences, is one of 60 new members of the National Academy of Sciences who were elected in recognition of their distinguished and continuing achievements in original research. Election into the Academy is one of the highest honors accorded a United States scientist or engineer. Established in 1863 by the U.S. Congress, the Academy acts as an official adviser to the federal government in matters concerning science or technology.

As far back as 1971, at a time when other neurosciences researchers were unfamiliar with cyclotron-produced, short-lived radionuclides, Raichle pioneered the use of these nuclear medicine tools for the measurement of cerebral

blood flow and metabolism. For the past decade, his research has focused on the application of positron emission tomography to the study of the human brain. That research has produced groundbreaking discoveries in psychiatric disorders and in the development of functional maps of the brain's sensory and language information-processing areas.

Raichle holds joint appointments as a professor of neurology and of anatomy and neurobiology. He is a senior fellow with the McDonnell Center for Studies of Higher Brain Function. Raichle joined the Washington University Department of Neurology in 1971 as a research instructor and was appointed professor of neurology in 1978. He was named professor of radiology in 1979 and professor of anatomy and neurobiology in 1993. Raichle was appointed in 1995 as codirector of MIR's Division of Radiological Sciences.



Dennis Choi, MD, PhD, professor and head of the Department of Neurology, congratulates Marcus Raichle, MD, (right) on his election to the National Academy of Sciences. James Blaine, DSc, head of MIR's electronic radiology lab, is in the background.

Herman assists Ukrainian radiologists

As a member of the Friends of Ukrainian Radiology, pediatric radiologist Thomas Herman, MD, associate professor of radiology, recently traveled to the former Soviet state to participate in a symposium on modern radiological imaging. Hundreds of Ukrainian physicians and medical students attended the symposium where Herman gave talks on contemporary cranial sonography and Doppler sonography in infants and on contemporary imaging of Wilms tumors and other malignant renal tumors of childhood.

While in the republic of Ukraine, Herman spent two days caring for patients at the Lviv Regional Children's Hospital, where he saw children with illnesses ranging from bacterial infections to acute leukemia to Burkitt lymphoma. Because Ukraine lacks even the most basic modern medical necessities, like penicillin, a treatable infection often results in a child's death.

Herman observed that the citizens of Lviv, like most other people in the regions surrounding the site of the 1986 Chernobyl nuclear accident, attribute perceived increases in disease to the accident. However, based on the scientific evidence available, it seems much more likely that any increase in disease is the result of the overall poor health of the people in that region and the primitive quality of the Ukrainian medical system.

"The needs of the Ukrainian radiology community are great because sonography and computerized tomography have been introduced very recently to Lviv, and magnetic resonance has appeared only recently in Ukraine," says Herman. "Resources that physicians in the United States take for granted — books, journals, equipment — are not easily available to Ukrainian doctors."

If you have medical items to donate to the Lviv Medical School and the Ukrainian Association of Radiologists, contact Herman at 314-454-6229.



(left to right) Dennis Balfe, MD, and Diagnostic Radiology residents Donald Heck, 1996-1997 chief resident; Eric Weidman, 1995-1996 chief resident; Farrel VanWagenen, 1995-1996 cochief resident; and Thomas Vaughan, 1996-1997 chief resident, were on hand for the presentation of the AUR Gold Medal to Dr. Ronald Evens (third from left).

Gold Medal goes to Evens

Annually, the Association of University Radiologists (AUR) presents the Gold Medal in recognition of outstanding contributions to the specialty of radiology. Ronald Evens, MD, director of Mallinckrodt Institute, was one of two honorees to receive the 1996 award at the AUR Annual Meeting on April 20 in Birmingham, Alabama. The first AUR Gold Medal was awarded in 1978, with Dr. Hugh Wilson, the Institute's second director, as one of the two recipients.

Evens, who is celebrating his 25th year as director of the Institute, is noted for his expertise in a variety of radiologic technologies and is highly regarded in business issues and the socioeconomics of medicine.

Under his direction, the Institute underwent a major expansion program and is now one of the largest academic radiology departments nationwide, with responsibility for more than 500,000 radiologic examinations per year.

AUR is an international organization of physicians and scientists with university-granted faculty appointments in the fields of radiology, radiation oncology, or nuclear medicine. Established in 1953, the AUR is the largest society of university radiologists in the world and is dedicated to the promotion of excellence in laboratory and clinical investigation, teaching, and clinical practice.

Mentors and students benefit

MIR's Summer Research Program provides medical students or science undergraduates with research experiences in one of the many branches of radiological sciences: contrast agent development, digital imaging, diagnostic radiology, magnetic resonance imaging, molecular pharmacology, nuclear medicine, positron emission tomography, and radiopharmaceutical development. The program was begun in

1993, and, according to Program Coordinator Carolyn Anderson, PhD, assistant professor of radiology, "provides an excellent way to introduce students to radiological sciences research, a field that they would have very little exposure to in traditional science undergraduate or medical school programs."

As part of this year's program, six students were paired with mentors, who either served individually or as part of a team, from the divisions of Diagnostic Radiology, Nuclear Medicine, and Radiological Sciences: James Brink, MD; Thomas Conturo, MD, PhD;

Farrokh Dehdashti, MD; Jay Heiken, MD; Elizabeth McFarland, MD; Peter Shile, MD; Celette Skinner, PhD; Richard Slone, MD; and Ge Wang, PhD. All reported that the program was a rewarding experience for themselves as well as for the students.

Applications for the MIR Summer Research Program will be available in November, with an application deadline of February. Students will be notified of their acceptance in March. For further information, contact Anderson by e-mail (andersoncj@mirlink.wustl.edu) or call 314-362-8427.

SPOT NEWS

Anderson recognized by Alumni Association

Claire Anderson, MD, was one of seven award recipients honored by the Alumni Association at Washington University School of Medicine's (WUSM) Reunion '96 banquet. The award recognized outstanding contributions to the field of medicine and to WUSM. Anderson, a 1971 medical school alumna, joined the MIR faculty in 1974. A professor of radiology in the chest radiology section, Anderson focuses her work on clinical diagnostic radiology and is currently involved in chest radiology for a large group of patients in a lung transplantation program.

NIH consensus panel sets protocol

At the urging of Perry Grigsby, MD, professor of radiology in MIR's Radiation Oncology Center, the National Institutes of Health convened a consensus panel in April to study the cause, prevention, and treatment of cervical cancer, one of the most prevalent tumors in women. The 13-member panel found that wider use of the Pap test, a diagnostic procedure for detecting cervical cancer, could prevent nearly all of the 15,000 new cases of this disease that occur each year in the United States.

According to Grigsby, "One of the most significant findings of the panel is the importance of routine Pap tests. If every woman received the Pap test, it would dramatically reduce the prevalence of this disease." Further research is needed to establish methods for reaching women who are most at risk because they fail to have the annual test — the uninsured, women over 65, ethnic minorities, and rural and poor women.

Because of a clear link between human papillomavirus (HPV) infection and cervical cancer, the panel

stressed the importance of HPV vaccine research and of educating women about HPV prevention. Although most women infected with the sexually transmitted HPV never experience serious health problems, scientific research has shown that a small percentage of women with HPV eventually develop invasive cancer.

The consensus panel agreed on a protocol for treating cervical cancer: Hysterectomy or radiation therapy is recommended for early-stage cancers. In more advanced tumors, radiation therapy is the treatment of choice. Chemotherapy is also being evaluated as a treatment option.

RADIOLOGY
Diagnosis • Treatment • Research

1895-1995

**PRACTICAL ISSUES IN
LEADING-EDGE RADIOLOGY**

OCTOBER 11-13, 1996

*A Symposium Sponsored by
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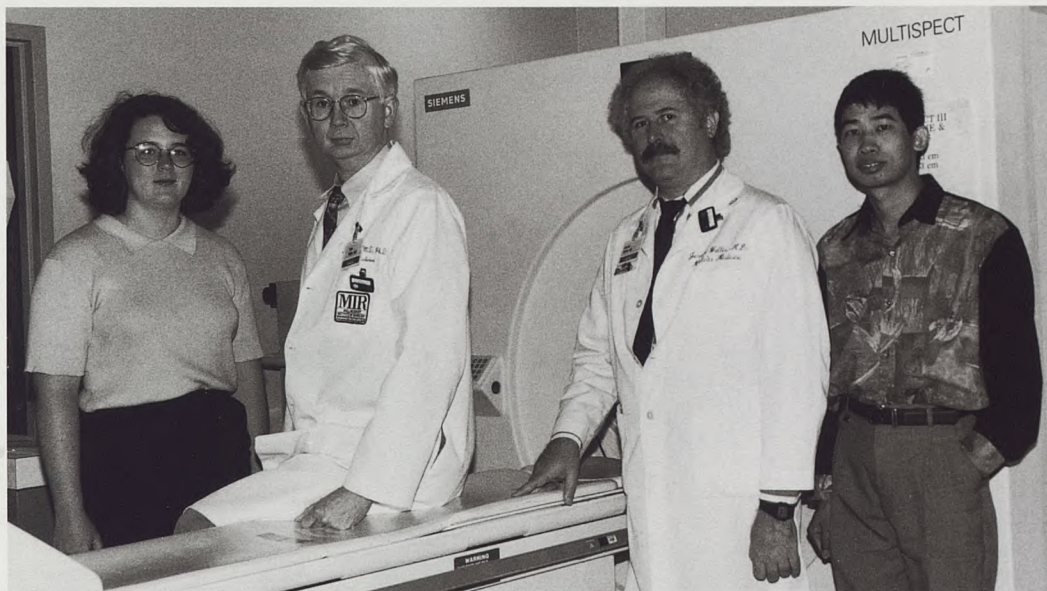
Call Linda Macker at 314-362-2916
for more information.

Wilson Award presented

Now in its 28th year, the Wilson Award honors annually a Washington University graduating medical student who makes meritorious contributions to the Department of Radiology. The award is a tribute to Doctor Hugh Wilson, the second director of the Institute, who advocated the advancement of education.

John Lim, the 1995-1996 recipient, worked in both research and clinical capacities in abdominal radiology under the mentorship of James Brink, MD, associate professor of radiology and codirector of computed body tomography (CT). Lim first began working in abdominal radiology during the summer between his first and second years of medical school as a participant in the research elective program. He developed image-processing techniques to assess the accuracy of spiral CT depiction of renal arterial stenoses and also worked closely with Ge Wang, PhD, assistant professor of radiology and the CT physicist, to implement novel signal-processing techniques.

"John is highly motivated, innovative, and meticulous in the execution of his research. His diligence resulted in the rapid publication of a manuscript in the journal *Radiology*," says Brink. "John has an excellent fund of medical knowledge as well as a keen interest in the problems faced by diagnostic radiologists."



The research team: Michelle Miller, Doctors Tom Miller, Jerold Wallis, and Guang-ming Dai.

New-generation algorithms developed

Mallinckrodt Institute has entered into a three-year collaboration with Siemens Nuclear Medicine Group to market a new generation of iterative reconstruction algorithms developed by researchers in MIR's Division of Nuclear Medicine. Although coprincipal investigators Jerold Wallis, MD, and Tom Miller, MD, PhD, are only a year into their collaboration with Siemens, the two have been researching the new-generation algorithms for more than 10 years. The research uses nuclear medicine images obtained as part of a single-photon emission computed tomography (SPECT) study

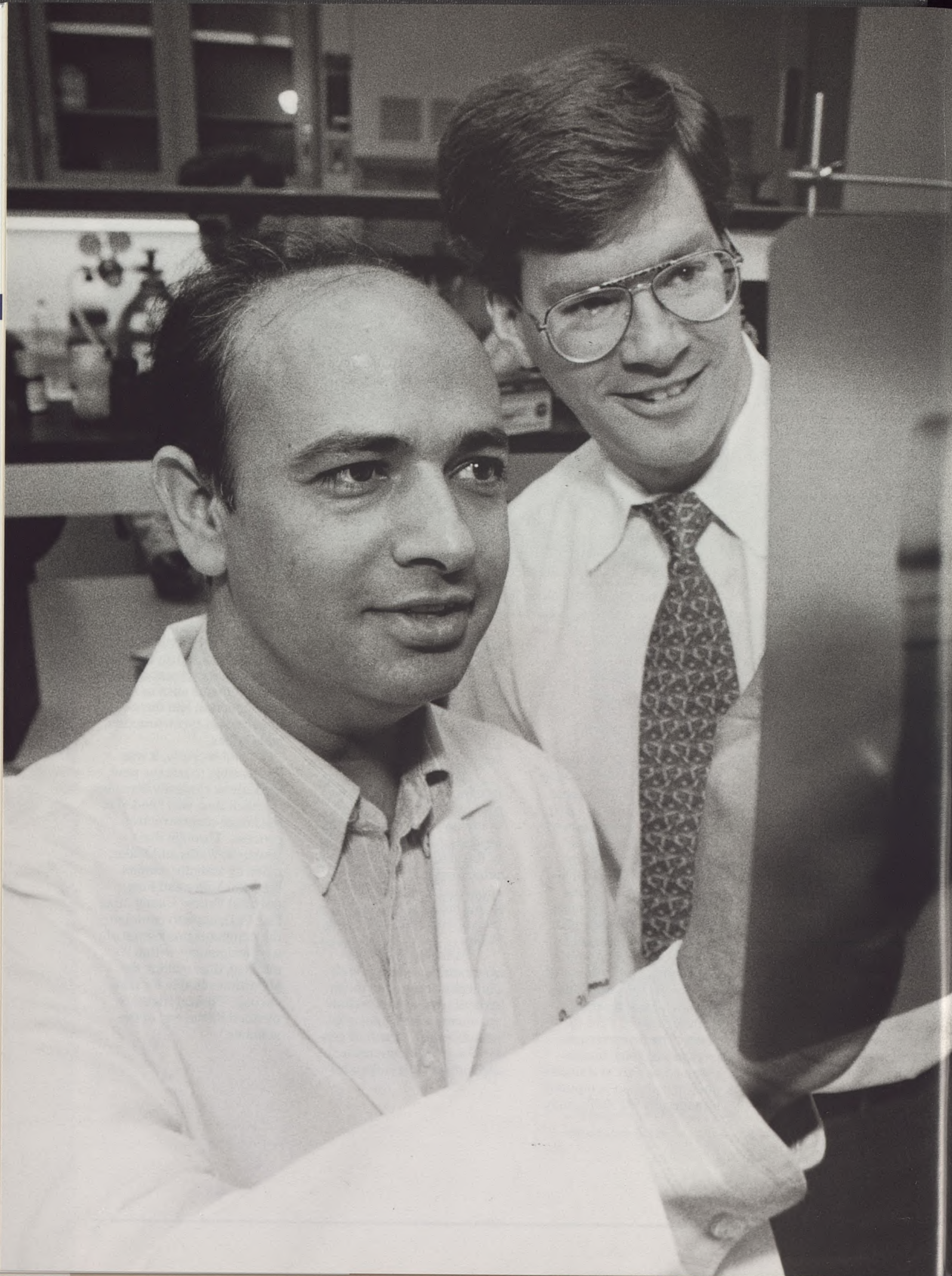
and processes the images with a computer program. This program utilizes the newly developed algorithms to reconstruct a more accurate image than that available from current clinical software.

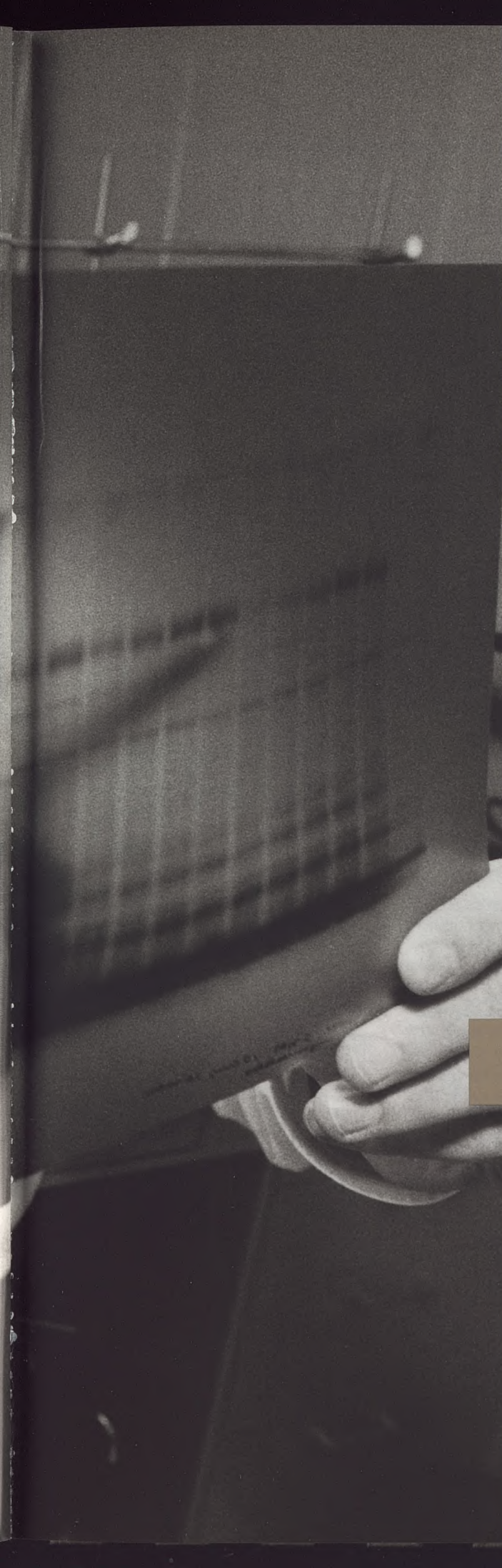
"The innovations we've developed at the Mallinckrodt Institute are designed to dramatically speed up the processor-intensive portions of the algorithm such as re-projection and resolution recovery. Faster convergence is a principal advantage of our algorithm," says Wallis.

"Bringing improved quantitative accuracy with clinically acceptable reconstruction times to the clinical environment is the goal of the project. The first generation of two-dimensional algorithms with collimator-

specific resolution recovery will be the platform for launching incremental improvements such as scatter correction and three-dimensional reconstruction," adds Miller.

Until recently, it was not feasible to use the new algorithms clinically because so much time was needed in the image-reconstruction process. Through their research, Wallis and Miller, aided by summer student Michelle Miller and Post-doctoral Fellow Guang-ming Dai, PhD, hope to complete the computer processing of a typical patient within 20 minutes, thus making the algorithm suitable for clinical use. Clinical trials are planned by the end of the summer.



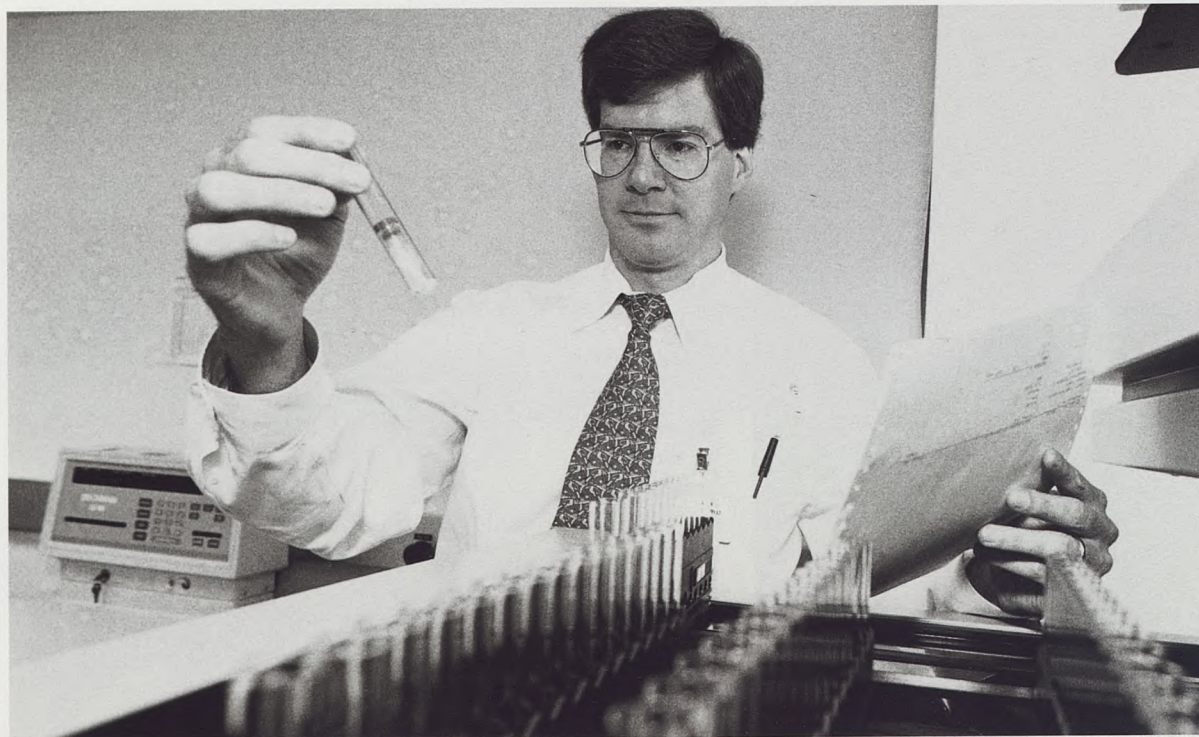


AN ATLAS OF DISCOVERY

David Piwnica-Worms, MD, PhD, and his team of scientists at Mallinckrodt Institute of Radiology (MIR) stand at a figurative *Arc de Triomphe*, with innumerable research avenues radiating in every direction. Some of these roads provide the team with unforeseen opportunities, others allow the export and growth of their own discoveries. One thing is true: The research itself is a virtual metropolis of application and innovation and holds great promise for improved patient care.

by Joanna B. Downer

Chemist Vijay Sharma, PhD, (left) and David Piwnica-Worms, MD, PhD, head of MIR's molecular radiopharmacology lab.



Piwnica-Worms daily cross-checks cell outtake samples.

Piwnica-Worms, an associate professor of radiology at MIR and an associate professor of molecular biology and pharmacology at Washington University, focuses his research on multidrug resistance (MDR) in cancer and, more recently, in infectious disease. MDR is characterized by a tumor cell that, after exposure to just a single chemotherapeutic agent, becomes nonresponsive to a whole host of other agents, which may only slightly resemble each other chemically. One manifestation of MDR tumors is the cell surface presence of a large molecule, P-glycoprotein (Pgp), which spans the cell membrane. Pgp is also present

in some normal tissues, such as the liver and kidneys. In MDR, once Pgp is activated by an MDR-inducing agent, the protein acts as a one-way highway, rapidly transporting the administered drug and any "member" drugs out of the cell, explains Piwnica-Worms.

Multidrug resistance has a serious effect on cancer treatment because many commonly used chemotherapeutic agents induce resistance in predisposed cells, resulting in failed therapy and fewer treatment options for the patient. Knowledge of a patient's MDR status prior to initialization of treatment could result in a more effective first line of therapy, and this is where Piwnica-Worms and his team are making their contributions.

Piwnica-Worms arrived at the study of MDR and Pgp almost by chance. While on staff at Harvard Medical School's Brigham and Women's Hospital, he began examining the cellular uptake mechanism of technetium-99m-SESTAMIBI (^{99m}Tc -SESTAMIBI), a compound used in cardiac perfusion imaging to measure and verify blood flow to the heart muscle using single photon emission computed tomography (SPECT). Radioactive ^{99m}Tc decays by emitting a packet of energy, called a photon, which is detected outside of the body by a SPECT scanner. A computer-generated image of the decay process permits visualization of the localization of the radiopharmaceutical within the body, without the physician ever having to pick up a scalpel. Such noninvasive imaging techniques are extremely beneficial in diagnosis and evaluation of cancer and other diseases.

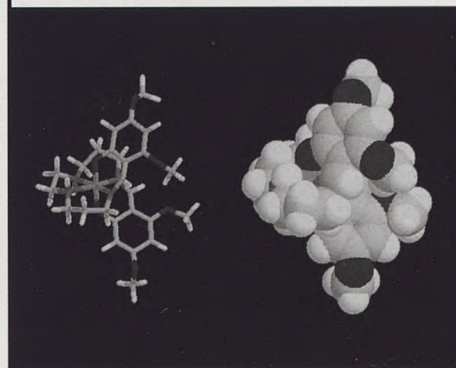
During this time, Piwnica-Worms found that ^{99m}Tc -SESTAMIBI is taken up by the cells, then concentrated and retained in tiny compartments within the cell called mitochondria. The chemical nature of Tc-SESTAMIBI is lipophilic and cationic. Its lipophilic, or fat loving, nature permits the compound to flow freely across the cellular membrane and into the cell. Tc-SESTAMIBI's cationic, or positive, charge then allows it to be transported into the negatively charged interior of the mitochondria. This process happens repeatedly, resulting in the accumulation of a high level of the radiopharmaceutical within the mitochondria, where the compound essentially becomes stuck.

In other tissues, such as the liver and kidneys, Piwnica-Worms found that the ^{99m}Tc -SESTAMIBI was not retained as it was in the heart. Instead it was extruded from the cells at a very high rate, faster than it could travel into the mitochondria. The reason for this exporting of the radiopharmaceutical led Piwnica-Worms down the road to multidrug-resistance imaging.

Aware of Pgp presence in the liver and kidneys, Piwnica-Worms hypothesized that Pgp was responsible for the rapid clearance of ^{99m}Tc -SESTAMIBI from these organs. Since this first discovery that ^{99m}Tc -SESTAMIBI retention is inversely related to the presence of Pgp, the research team has undertaken exhaustive biochemical studies to prove without a doubt that Pgp is responsible for the differences in tissue uptake.

Piwnica-Worms and his team came to MIR in August of 1994, continuing their in-depth study of the mechanism and behavior of Pgp and ^{99m}Tc -SESTAMIBI. Biochemist Carolyn Crankshaw, MS, examined the relationship between uptake of ^{99m}Tc -SESTAMIBI and tumor-cell lines with different levels of Pgp. Vallabhaneni Rao, PhD, a biochemist, has been instrumental in verifying the role of Pgp through the use of human DNA transferred into baculovirus, a DNA virus that is made to infect insect cells in the laboratory. It is then amplified for proof of the connection between the human gene, MDR1 (which codes for the production of Pgp), Pgp itself, and differences in ^{99m}Tc -SESTAMIBI uptake. As a result of their painstaking work, ^{99m}Tc -SESTAMIBI is moving beyond heart imaging.

Gary Luker, MD, a research fellow in Piwnica-Worms' laboratory, has collaborated with Doctors Nancy Bartlett and Paula Fracasso of the Division of Hematology-Oncology and with Doctors Barry Siegel and Henry Royal of the Division of Nuclear Medicine on a pilot clinical trial using ^{99m}Tc -SESTAMIBI. During the study, baseline images were obtained that showed the expected rapid clearance of ^{99m}Tc -SESTAMIBI from the liver and kidney. Administration of a high potency Pgp reversal agent (called PSC 833 and provided by Sandoz Pharmaceuticals) and subsequent reinjection of ^{99m}Tc -SESTAMIBI resulted in the accumulation and prolonged retention of the imaging agent in those tissues, as if Pgp were no longer functioning. This is the same result we hope to find in tumors, says Piwnica-Worms. A multicenter Phase Ib clinical trial using a different modulator is about to begin, he adds.



This pilot study verified that ^{99m}Tc -SESTAMIBI can distinguish between Pgp expressing (multidrug resistant) and non-Pgp expressing (drug sensitive) tissue. In addition, it aided Sandoz in validating PSC 833 as a useful modulator, a compound which blocks the Pgp route out of the cell and allows retention of the normally Pgp-affected drugs (^{99m}Tc -SESTAMIBI in this case) within their intracellular targets.

It is this kind of two-way street between clinical and scientific research that is typical of Piwnica-Worms' collaborations, as well as the nature of the project itself. Modulators come in from the clinical side and rendezvous with Piwnica-Worms' well-characterized Pgp imaging agent, resulting in the validation of both the modulator and the radiotracer used to create the image. Although many modulators are in clinical trials, no com-

pound is in standard practice. ^{99m}Tc -SESTAMIBI is an excellent way to noninvasively measure the efficacy of the modulators in clinical trials.

As a result of the promising work with ^{99m}Tc -SESTAMIBI, Piwnica-Worms has obtained a grant from Mallinckrodt Medical Inc. to evaluate a series of ^{99m}Tc compounds known as Q complexes, which were initially developed as cardiac agents. In this

Knowledge of a patient's MDR status prior to initialization of treatment could result in a more effective first line of therapy.

collaboration, Piwnica-Worms salutes the openness of his collaborators Doctors Dan Burleigh, Mary Marmion, and Karen Deutsch, and Mallinckrodt Medical as a whole. "This has been an excellent two-way academic and industrial relationship and is a testimonial to their willingness to share and build on important data and information," commends Piwnica-Worms.



Biochemist Vallabhaneni Rao evaluates a Western blot of the molecule P-glycoprotein in cancer cells.

With assistance by Research Technologist Julie Dahlheimer, approximately 40 of these Q complexes have been tested for Pgp activity by the techniques developed by Crankshaw, Rao, and Luker. Three or four of these compounds exceed ^{99m}Tc -SESTAMIBI's Pgp distinction characteristics in cell models. Additional studies are now underway to further evaluate the most promising candidates for MDR Pgp imaging. If the project continues to move forward, pilot evaluation in patients could begin within a year, says Piwnica-Worms.

Having migrated to the realm of discovery and development of new radiopharmaceutical imaging agents for Pgp, Piwnica-Worms and his coworkers began building a path to synthesize and to evaluate a series of new radiotracers. Chemist Vijay Sharma, PhD, is responsible for synthesizing this new generation of complexes, known as N_4O_2 compounds. Unlike SESTAMIBI, these compounds possess a broad flexibility to incorporate a variety of metals besides ^{99m}Tc , which opens roads to a number of other uses.

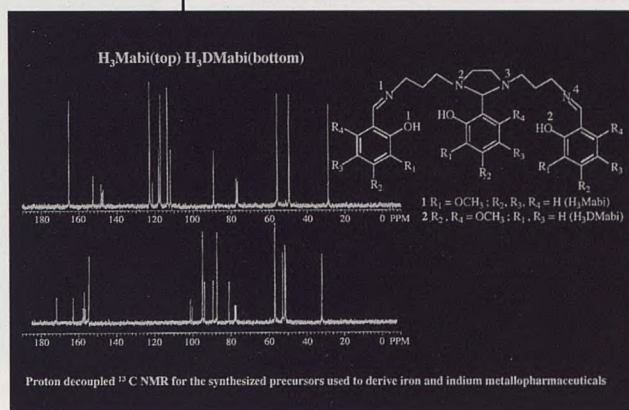
Incorporation of gallium-68, a positron-emitting metal, into these compounds will permit the use of positron emission tomography (PET) for visualization of the MDR tumors. PET offers the opportunity for quantitative functional imaging of biological processes, which would increase knowledge of the circumstances responsible for induction of MDR activity by

chemotherapeutics and subsequent reversal by modulators — an area little understood. This research is in collaboration with Doctors Michael Welch, Laura Bass, and David Reichert of MIR's Division of Radiological Sciences.

Beyond diagnostic imaging, use of iron (Fe) as the metal in these N_4O_2 complexes may lead to their use as therapeutic agents for MDR. It may be possible to modify the functional groups on the basic N_4O_2 structure in a way that would permit the $\text{Fe}-\text{N}_4\text{O}_2$ complex to block the Pgp exit route, resulting in a reversal of the MDR activity, says Piwnica-Worms.

In fact, Piwnica-Worms' ongoing collaboration with Doctor Daniel Goldberg of the Department of Molecular Microbiology resulted in a study of the therapeutic effect of these iron compounds in drug-resistant malaria, an infectious disease whose MDR activity may be due to a Pgp-related protein. One of the fortunate characteristics of all of these Pgp agents is that after proving their transport connection to Pgp, they can be used to study MDR itself, both in cancer and in infectious disease.

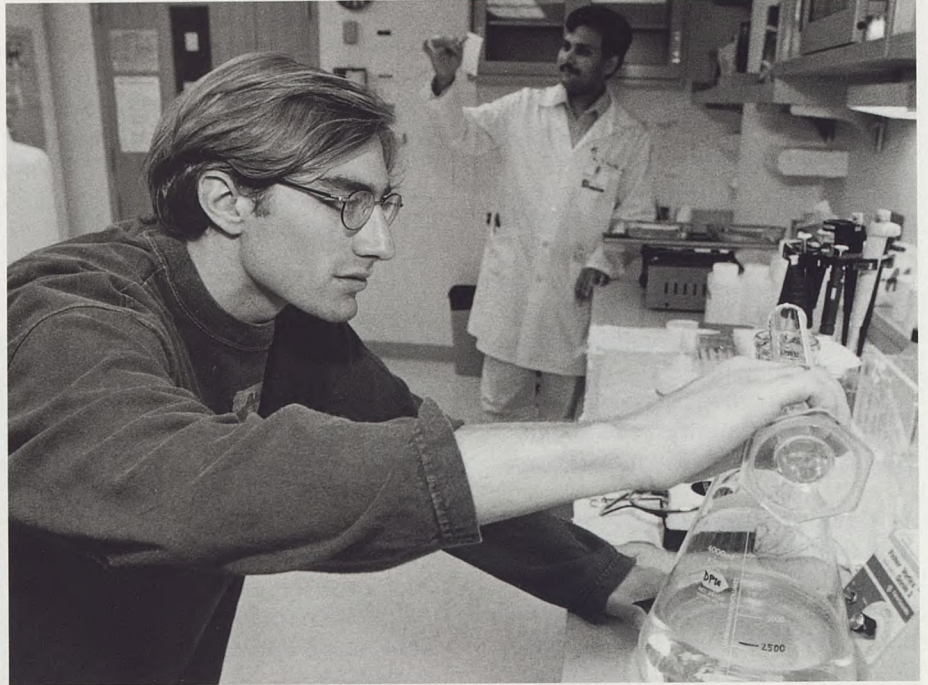
"We have the pleasure of working on both sides of the interface between chemistry and cell biology. We can develop and validate novel agents and then turn them around to probe biological transport function," explains Piwnica-Worms.



These MDR Pgp imaging agents will be of great use to both nuclear medicine physicians and their patients. Groups around the world have begun to realize the advantages of identifying MDR status early using the available ^{99m}Tc -SES-TAMIBI. One of the major benefits of MDR Pgp imaging agents may be improved estimation of prognosis and risk at initial presentation or recurrence of disease, says Piwnica-Worms.

“Several studies indicate that if the patient’s tissues contain Pgp, there is a high correlation with poor outcome and early treatment failure. Conversely, when Pgp is not present in the tissue, the patients have better outcomes and longer remissions. This has been shown for a wide variety of cancer types,” explains Piwnica-Worms.

Knowledge of MDR status would affect choice of therapy as well. If MDR were present, selection of chemotherapeutic agents known to be affected by Pgp would be curtailed, since failure of such drugs would be imminent without a modulator. If no modulator was available, alternative agents that are not transported by Pgp would be used from the beginning of therapy. “It would be quite desirable if we can increase the probability that the chemotherapy chosen for the patient will be successful,” Piwnica-Worms emphasizes.



One of the major benefits of MDR Pgp imaging agents may be improved estimation of prognosis and risk at initial presentation or recurrence of disease.

Ron Dolin, an undergraduate student at Washington University, assists Rao in verifying the presence of Pgp tumor cells.

In addition, any of these imaging agents — ^{99m}Tc -SESTAMIBI, the Q complexes, or the N_4O_2 complexes — could be used to monitor the effectiveness of modulators administered in an attempt to reverse the MDR activity of the tumor. During chemotherapy treatment the modulators close the Pgp export path, allowing the chemotherapy drug to reach its cellular destination. The imaging agent essentially tracks the chemotherapeutic drug, so that retention of radioactivity in the tumor verifies the efficacy of the modulator, explains Piwnica-Worms.

The broad distribution of MDR in tumors of various types, as well as in infectious disease, provides a significant population of patients who would benefit from development of both Pgp imaging

agents and modulators. Among its many applications, Piwnica-Worms' work in developing and testing imaging agents improves the ability to evaluate modulators in patients.

The diverse nature of Piwnica-Worms' research is supported by his presence here at MIR and Washington University. "The facilities, the equipment, the collaborative relationships we've been able to develop at Washington University have really been a major step forward for the breadth and quality of our research program. A lot of the things we've been able to do have been a product of the multifaceted environment here," says Piwnica-Worms.

In Piwnica-Worms' research, the roads of biology, chemistry, and clinical and molecular medicine intersect. Because of Piwnica-Worms' philosophy of rigorous and extensive characterization and veri-

fication at each step along the way, from drug development and synthesis to screening in cells to evaluation in patients, the road to MDR Pgp imaging will be well-traveled by the time he is through. **MIR**

Editor's note: Joanna Downer is a chemistry graduate student conducting research in MIR's Division of Radiological Sciences.

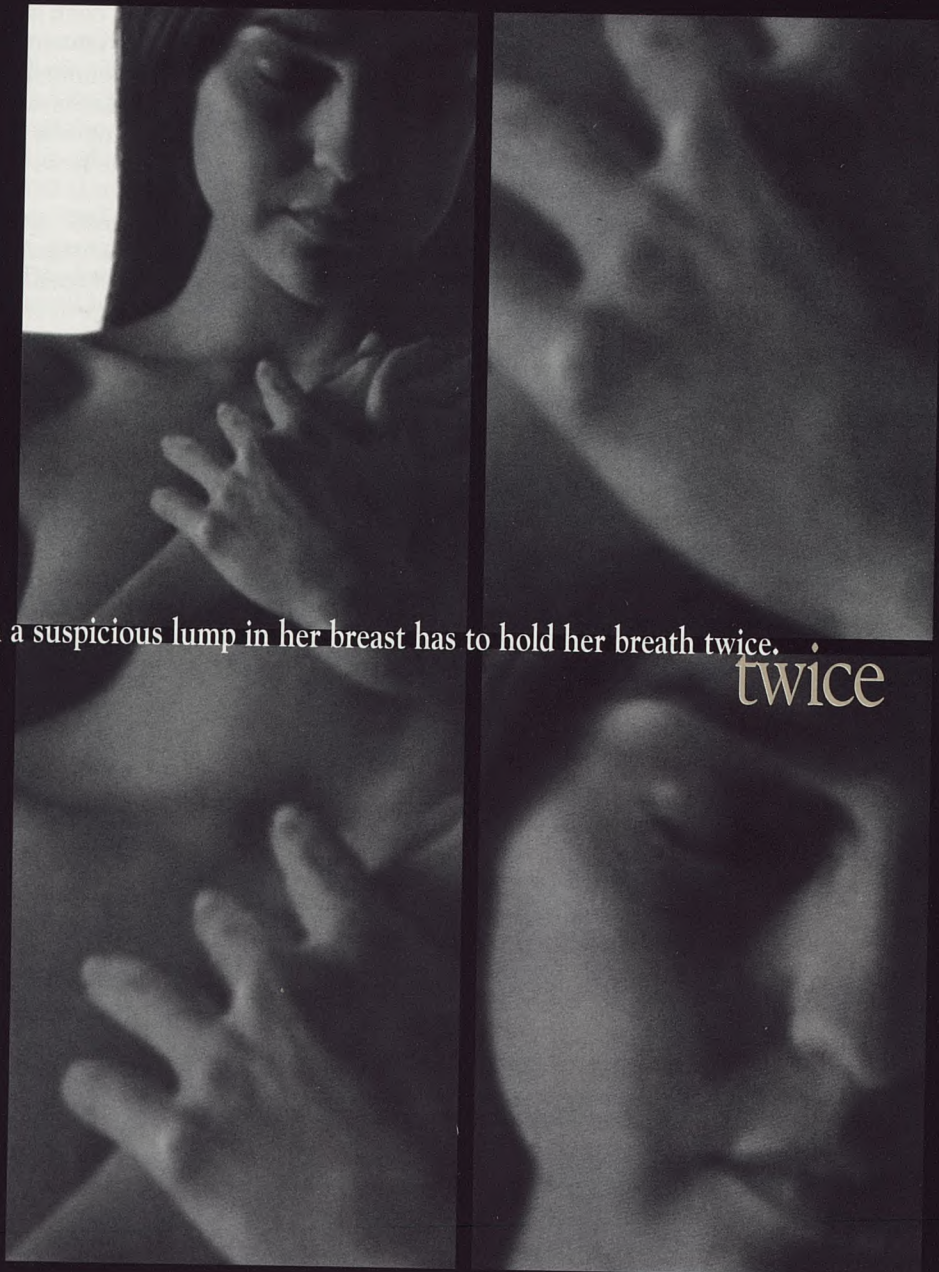
Research Technologist Julie Dahlheimer checks tissue cultures of cancer cells that contain different levels of the multidrug resistance molecule Pgp.



Woman

A woman with a suspicious lump in her breast has to hold her breath twice.

twice



A WOMAN WITH A SUSPICIOUS LUMP IN HER BREAST HAS TO HOLD HER BREATH TWICE. FIRST, SHE MUST UNDERGO A SURGICAL BIOPSY TO SEE WHETHER THE LUMP IS MALIGNANT. AND AFTER THE CANCER IS DIAGNOSED, SHE AGONIZES WHILE SHE AWAITS THE RESULTS OF A SECOND SURGICAL PROCEDURE: A LYMPH-NODE DISSECTION THAT WILL SHOW WHETHER OR NOT THE CANCER HAS SPREAD AND HOW MANY NODES ARE AFFECTED.

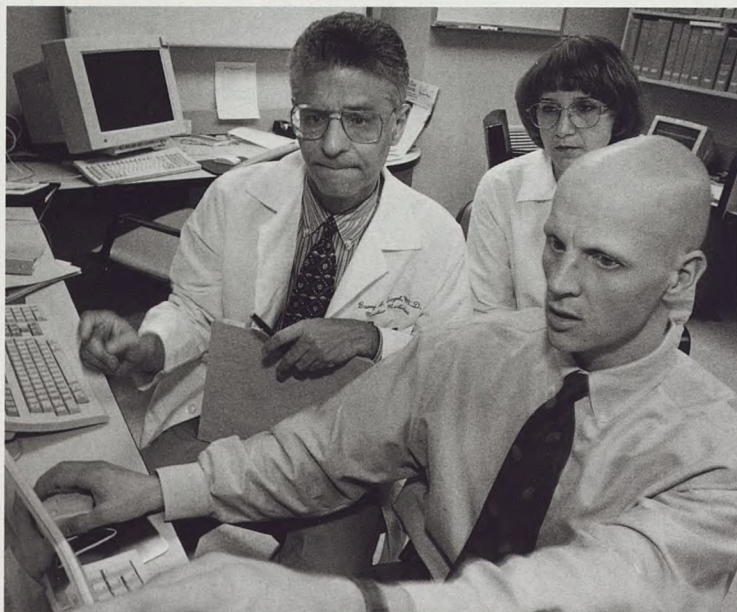
PET

THESE FINDINGS ARE CRITICALLY IMPORTANT TO HER FUTURE. IF HER AXILLARY LYMPH NODES ARE FREE OF CANCER, SHE CAN EXPECT A 10-YEAR SURVIVAL RATE OF ABOUT 70 PERCENT; IF CANCER IS PRESENT, THE SURVIVAL RATE DROPS TO 30 PERCENT. THE NUMBER OF CANCEROUS NODES IS ALSO CRUCIAL, SINCE PATIENTS WITH FOUR OR MORE POSITIVE NODES HAVE A MUCH POORER PROGNOSIS THAN PATIENTS WITH FEWER AFFECTED NODES.

A NEW STUDY AT MALLINCKRODT INSTITUTE OF RADIOLOGY AND TWO OTHER CLINICAL SITES WILL SOON BE TESTING WHETHER OR NOT THERE IS AN ACCURATE, ECONOMICAL, AND NONINVASIVE WAY TO EVALUATE LYMPH-NODE METASTASIS USING POSITRON EMISSION TOMOGRAPHY (PET). THE MULTICENTER STUDY, SUPPORTED BY A \$2.8 MILLION GRANT, IS THE FIRST OF ITS KIND FUNDED BY THE NATIONAL CANCER INSTITUTE (NCI) FOR THE EVALUATION OF THE EFFECTIVENESS OF PET SCANS IN CANCER DIAGNOSIS. by Candace O'Connor

PET: A Logical Tool in the Fight Against Breast Cancer

women will benefit



Doctors Siegel and Dehdashti examine PET images of breast cancer with Duffy Cutler, PhD, a nuclear medicine physicist.

Barry Siegel, MD, director of the Division of Nuclear Medicine and principal investigator for the St. Louis site, says the outcome of this study could have great significance for women with breast cancer. Right now, surgery is the only option for evaluating lymph-node involvement. But surgery is expensive and uncomfortable, and it also entails some risks, such as infections and long-term swelling.

“Avoiding the expense and discomfort of axillary dissection is an important goal, and PET seems a logical tool for achieving that goal,” he says. “We’re very glad we have the opportunity to evaluate PET’s effectiveness in this study.”

Along with the lymph-node study, a second breast-cancer initiative — also funded by the NCI — is underway in the Division of Nuclear Medicine, with Farrokh Dehdashti, MD, assistant professor of radiology, as the principal investigator. This study, which focuses on patients with advanced breast cancer with estrogen-receptor-positive tumors, will try to predict more accurately which women will benefit from hormonal therapy.

Both studies rely on PET, a noninvasive, imaging technique developed in the early 1970s by a team of Mallinckrodt Institute researchers led by the late Dr. Michel Ter-Pogossian. PET provides vivid functional images of various organ systems. In earlier studies, it has proven to be a sensitive tool for distinguishing benign tissue from malignant tissue and for detecting the spread of cancerous tumors.

MIR researchers began planning the lymph-node study nearly five years ago, when the U.S. Army announced a new funding program for breast-cancer research. But their first application for funding was not successful. When a second Army initiative was announced, Siegel joined forces with MIR alumni Edward Coleman, MD, of the Duke University Medical Center and Richard Wahl, MD, of the University of Michigan Medical Center, and resubmitted the proposal. Although the study received a highly favorable review, it was once again not funded.

The three institutions rewrote the grant and submitted it to the NCI with Wahl as the overall principal investigator. Two institutions were added to the study: the American College of Radiology Clinical Trials Division for data management and the Brown University Medical School for help with statistical analysis. Last September, the grant was funded; the MIR group’s portion of the funding is a total of \$620,000. Since then, says Siegel, the investigators have spent several months finalizing the protocol, preparing forms for data gathering, and working out electronic data submission issues. Patient recruitment began in July.

PET: A Logical Tool

"We're looking for women with primary breast cancer, who have not yet had an axillary dissection but are scheduled for one," says Siegel. "They should not have had any therapy — chemotherapy, hormonal therapy, or radiation — prior to the axillary dissection."

A designated surgeon at each study site will refer patients to the researchers and serve as a contact for other surgeons who might also be a source of patients. Diane Radford, MD, is the surgical contact for the MIR group; other members of the team include Doctors Dehdashti and Peter Humphrey of the Department of Pathology, a research coordinator, a physicist, and several technologists. The three sites hope to scan 414 women (138 women at each center) over a 30-month period.

Women recruited for the study will be imaged with PET after receiving an injection of F-18 fluorodeoxyglucose (FDG), a radioactive form of sugar that is taken up more avidly, and retained longer, by malignant tissues than by normal tissues. Earlier studies have reported preliminary success using PET and FDG to detect cancer in the axillary nodes of small numbers of patients with newly diagnosed breast cancer.

This new, larger-scale study will compare PET results with the outcome of the surgical biopsies, which the women will undergo soon afterwards. "Our first goal is to determine the sensitivity and specificity of PET in detecting axillary nodal metastasis," says Siegel. "The second goal is to see whether or not PET-derived estimates of the extent of metastatic disease in the axillary nodes and also in the internal mammary nodes provide prognostic information that we couldn't obtain with standard, invasive staging methods."

In a study variation, some 45 patients with large tumors, who will receive chemotherapy before their axillary dissections, will also have PET scans prior to their treatment and biopsies. "We decided that although we wouldn't be able to use these patients to assess how reliable PET is in detecting the disease, because the pathology will be changed by the intervening chemotherapy, we do need to find out if PET is providing reliable prognostic information in these patients with more advanced tumors," says Siegel.

To gather prognostic information, researchers plan to follow up with all patients over the five-year life of the study to look for any signs of recurrence. The referring surgeons will not know any of the results, unless PET turns up a life-threatening condition such as a metastasis that has progressed beyond the lymph nodes but is unsuspected clinically.

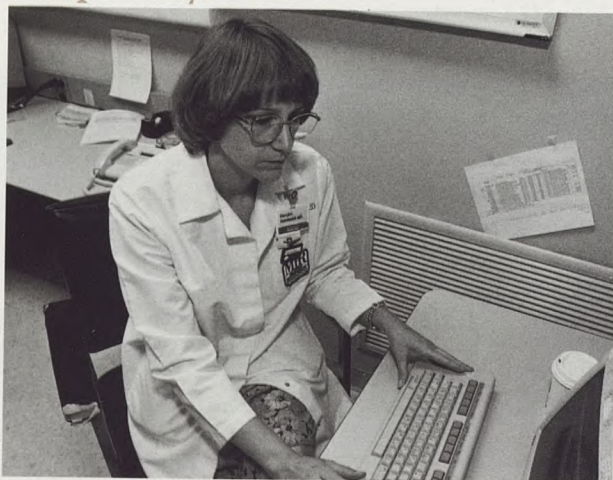
If this study proves successful, the researchers may next apply for funds to evaluate the use of gamma cameras, which are more widely available than PET scanners, in assessing nodal metastasis. Meanwhile, says Siegel, "for an investigator-initiated grant, this was an unusually large funding. We're proud of that. Now we've got to make it the best possible study to prove that the confidence placed in us was justified."

"AVOIDING THE EXPENSE AND DISCOMFORT OF AXILLARY DISSECTION IS AN IMPORTANT GOAL, AND PET SEEMS A LOGICAL TOOL FOR ACHIEVING THAT GOAL."

— BARRY SIEGEL, MD

the sensitivity of PET

better quality of life



"TWO-THIRDS OF PATIENTS WITH BREAST CANCER HAVE ER-POSITIVE TUMORS, BUT ONLY FIFTY OR SIXTY PERCENT WILL RESPOND TO HORMONAL THERAPY."

— FARROKH DEHDASHTI, MD

As the lymph-node project gets underway, the study directed by Dehdashti, in collaboration with Siegel; Joanne Mortimer, MD, of the Division of Hematology/Oncology; and a group of referring clinicians, is also just beginning. This research, supported by a four-year, \$1.7 million NIH grant, will involve 60 women, all of whom have locally advanced tumors that have proven through *in vitro* analysis to be estrogen-receptor (ER) positive. Estrogen, a naturally occurring hormone, is strongly suspected of being a cause for the growth of cancerous cells in the breast.

"Two-thirds of breast-cancer patients have ER-positive tumors," says Dehdashti. "But only fifty or sixty percent will respond to hormonal therapy. Nobody knows why. So we are trying to find out if our imaging compound, which shows the functional status of these receptors, can better identify those patients who would respond to hormonal therapy."

In the study, patients will be injected with both FDG (the radioactive form of sugar used in Siegel's study) and F-18 fluoroestradiol (FES), a radioactive form of a natural estrogen. Then the patients will be imaged with PET before and after the start of tamoxifen therapy, an anti-estrogen drug. The hypothesis is that the tamoxifen will initially have an agonistic effect, causing an increase in the FDG uptake in the tumor and making it appear that the tumor is getting worse. But if the FES uptake goes down at the same time, the tamoxifen

may be blocking the uptake in the tumor — when in actuality the tumor is getting better. If the FDG uptake increases and the FES uptake either does not change or decreases only minimally, the tamoxifen may not be working and the disease may be progressing.

Being able to tell early on whether or not hormonal therapy is working will also benefit a small percentage of patients who experience a clinical problem called the "flare reaction." Typically, a week or two after the start of treatment, the patient with flare reaction has an increase in pain or swelling of the tumor. Clinically, it may be difficult to distinguish a flare reaction from disease progression. Therefore, the physician may decide the tamoxifen is not working and then starts the patient on chemotherapy. But, in fact, the agonistic effect is transiently causing the tumor to grow **until** the antagonistic effect kicks in, and the patient begins to improve.

"If we prove our hypothesis, we will be providing unique information about therapy," says Dehdashti. "Hormonal therapy is less toxic than chemotherapy, which can make patients very ill. If the clinician prematurely stops the hormonal therapy, this action actually takes away the patient's opportunity for a better quality of life." ■

PET: A Logical Tool

THE DIRECTOR'S OFFICE REPORT

All Mallinckrodt Institute faculty and staff names in this section are highlighted in boldface type.

PROMOTIONS

Carlos Aquino-Aponte, MD, instructor in radiology, was promoted to assistant professor of radiology, Division of Diagnostic Radiology.

William Dawson, MD, assistant professor of radiology, was promoted to associate professor of radiology, Division of Diagnostic Radiology.

Thomas Herman, MD, assistant professor of radiology, was promoted to associate professor of radiology, Division of Diagnostic Radiology.

Assen Kirov, PhD, research associate, was promoted to instructor in radiology, Radiation Oncology Center.

William Mehard, MD, instructor in radiology, was promoted to assistant professor of radiology, Division of Diagnostic Radiology.

Linda Proctor, MD, instructor in radiology, was promoted to assistant professor of radiology, Division of Diagnostic Radiology.

David Reichert, PhD, research associate, was promoted to research instructor in radiology, Division of Radiological Sciences.

Dmitriy Yablonskiy, PhD, research associate, was promoted to research instructor in radiology, Division of Radiological Sciences.

JOINT APPOINTMENTS

Thomas Conturo, MD, PhD, assistant professor of radiology, received a joint appointment as an adjunct assistant professor of physics.

NEW STAFF

FIRST-YEAR FELLOWS

Mary Alderman, MD, instructor in radiology, is a fellow in vascular and interventional radiology. She completed four years of training in diagnostic radiology at Mallinckrodt Institute of Radiology and is a member of Alpha Omega Alpha.

Robert Buse, MD, instructor in radiology, is a fellow in neuroradiology. He received an undergraduate degree from Xavier University, Cincinnati, Ohio, and a medical degree from the University of Cincinnati. Buse completed a four-year residency in diagnostic radiology at Vanderbilt University, Nashville, Tennessee, and is a member of Alpha Omega Alpha.

Serge Djukic, MD, instructor in radiology, is a fellow in neuroradiology. He received an undergraduate degree from Peta Beogradska Gimnazija and a medical degree from the University of Belgrade, Yugoslavia. Djukic completed four years of training in diagnostic radiology at the University of California, San Diego.

James Duncan, MD, PhD, assistant professor of radiology and of cell biology and physiology, is a fellow in vascular and interventional radiology. He was a radiology resident (cochief resident, 1993-1994) and research instructor at Mallinckrodt Institute of Radiology. Duncan is a member of Alpha Omega Alpha.

Richard Edelstein, MD, is a fellow in vascular and interventional radiology. He completed a four-year diagnostic radiology residency at Mallinckrodt Institute of Radiology and is a member of Alpha Omega Alpha.

Matthew Fleishman, MD, instructor in radiology, is a fellow in chest radiology. He completed a four-year diagnostic radiology residency at Mallinckrodt Institute of Radiology. Fleishman is a member of Alpha Omega Alpha.

Jeffrey Friedland, MD, instructor in radiology, is a fellow in pediatric radiology. He completed a four-year diagnostic radiology residency at Mallinckrodt Institute of Radiology. He is a member of Alpha Omega Alpha.

David Gius, MD, PhD, instructor in radiology, is the 1996-1997 American Society for Therapeutic Radiology and Oncology (ASTRO) fellow in radiation oncology. He completed two years of residency in radiation oncology at Mallinckrodt Institute of Radiology.

Annette Johnson, MD, instructor in radiology, is a fellow in neuroradiology. She received an undergraduate degree from The College of William and Mary, Williamsburg, Virginia, and a medical degree from The Medical College of Virginia. Johnson completed four years of training in diagnostic radiology at Glessinger Medical Center, Danville, Pennsylvania.

David Linkhous, MD, instructor in radiology, is a fellow in musculoskeletal radiology. He received an undergraduate and a medical degree from the University of Virginia, Charlottesville. Linkhous completed an internship at Letterman Army Medical Center, San Francisco, California, and a diagnostic radiology residency at the University of California, San Francisco.

Lee Madeline, MD, instructor in radiology, is a fellow in neuroradiology. He received an undergraduate degree from the University of Michigan, Ann Arbor, and a medical degree from Vanderbilt University, Nashville, Tennessee. Madeline completed a four-year diagnostic radiology residency at Bowman Gray Medical College, Winston-Salem, North Carolina. He is a member of Alpha Omega Alpha.

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Eric Malden, MD, instructor in radiology, is a fellow in vascular and interventional radiology. He completed four years of training in diagnostic radiology at Mallinckrodt Institute of Radiology.

Randolph Pawluk, MD, instructor in radiology, is a fellow in magnetic resonance imaging. He received undergraduate and medical degrees from the University of Alberta, Edmonton. Pawluk completed an internship at the Royal Alexandra Hospital, Alberta, Edmonton, Canada, and a residency at the University of Alberta Hospital. He is a member of Alpha Omega Alpha.

Rory Satterfield, MD, instructor in radiology, is a fellow in abdominal radiology. He completed a four-year diagnostic radiology residency at Mallinckrodt Institute of Radiology.

Michele Semin, MD, instructor in radiology, is a fellow in abdominal radiology. She completed four years of training in diagnostic radiology at Mallinckrodt Institute of Radiology.

Farid Shafaie, MD, instructor in radiology, is a fellow in neuroradiology. He received undergraduate degrees from the University of Texas, San Antonio, and from the University of Delaware, Newark, and a medical degree from Eastern Virginia Medical

School, Norfolk. Shafaie completed a four-year diagnostic radiology residency at Eastern Virginia Medical School Hospital, Norfolk. He is a member of Alpha Omega Alpha.

Mel Sharafuddin, MD, instructor in radiology, is a fellow in vascular and interventional radiology. He received undergraduate and medical degrees from the University of Beirut, Lebanon. Sharafuddin completed an internship at the University of Iowa Hospital and Clinics, Iowa City, and a residency at St. Louis University Health Sciences Center, St. Louis, Missouri. He is a member of Alpha Omega Alpha.

Leland Tsao, MD, instructor in radiology, is a fellow in magnetic resonance imaging. He received an undergraduate degree from the University of Virginia, Charlottesville, and a medical degree from the Medical College of Virginia, Richmond. Tsao completed an internship at the Mayo Clinic, Rochester, Minnesota, and a four-year diagnostic radiology residency at Vanderbilt University, Nashville, Tennessee. He is a member of Alpha Omega Alpha.

Farrel VanWagenen, MD, instructor in radiology, is a fellow in vascular and interventional radiology. He completed four years of training in diagnostic radiology and was cochief resident, 1995-1996, at Mallinckrodt Institute of Radiology. VanWagenen is a member of Alpha Omega Alpha.

Steven Winn, MD, instructor in radiology, is a fellow in abdominal radiology. He completed three years of training in diagnostic radiology at Mallinckrodt Institute of Radiology. Winn is a member of Alpha Omega Alpha.

Robert Wissman, MD, instructor in radiology, is a fellow in musculoskeletal radiology. He received an undergraduate degree from the University of Cincinnati and a medical degree from Ohio State University, Columbus. Wissman completed a four-year diagnostic radiology residency at Ohio State University, Columbus.

FIRST-YEAR POSTGRADUATES
Mark Fister, MD, assistant in radiology, received an undergraduate degree from the University of Illinois, Urbana, and a medical degree from the University of Kentucky, Lexington. He is a member of Alpha Omega Alpha.

Jon Fromke, MD, assistant in radiology, received an undergraduate degree from Wheaton College, Illinois, and a medical degree from University of Minnesota, Minneapolis. He is a member of Alpha Omega Alpha.

Mark Oswood, MD, assistant in radiology, received an undergraduate degree from St. Olaf College, Northfield, Minnesota, and a medical degree from Yale University, New Haven, Connecticut.

Bartosz Rydzewski, MD, assistant in radiology, received an undergraduate degree from K. Marcinkowski Memorial, Poznan, Poland, and a medical degree from Vanderbilt University, Nashville, Tennessee. He is a member of Alpha Omega Alpha.

FIRST-YEAR DIAGNOSTIC RADIOLOGY RESIDENTS

Donald Blair, MD, assistant in radiology, received an undergraduate degree from the University of Chicago and a medical degree from Columbia College of Physicians and Surgeons, New York City. He completed a one-year transitional internship at the University of Hawaii, Honolulu.

Mary Board, MD, assistant in radiology, received an undergraduate degree from Miami University, Oxford, Ohio, and a medical degree from Washington University, St. Louis, Missouri. She completed a one-year internship at Barnes-Jewish Hospital, St. Louis, Missouri.

Hank Chen, MD, assistant in radiology, received an undergraduate degree from the University of California, Berkeley, and a medical degree from University of California, Los Angeles. He completed a one-year internship at St. Vincent's Hospital, New York City. Chen is a member of Alpha Omega Alpha.

Timothy Davis, MD, assistant in radiology, received an undergraduate degree from Indiana University, Bloomington; a masters degree and a doctorate from Massachusetts Institute of Technology, Cambridge; and a medical degree from Harvard University, Cambridge, Massachusetts.

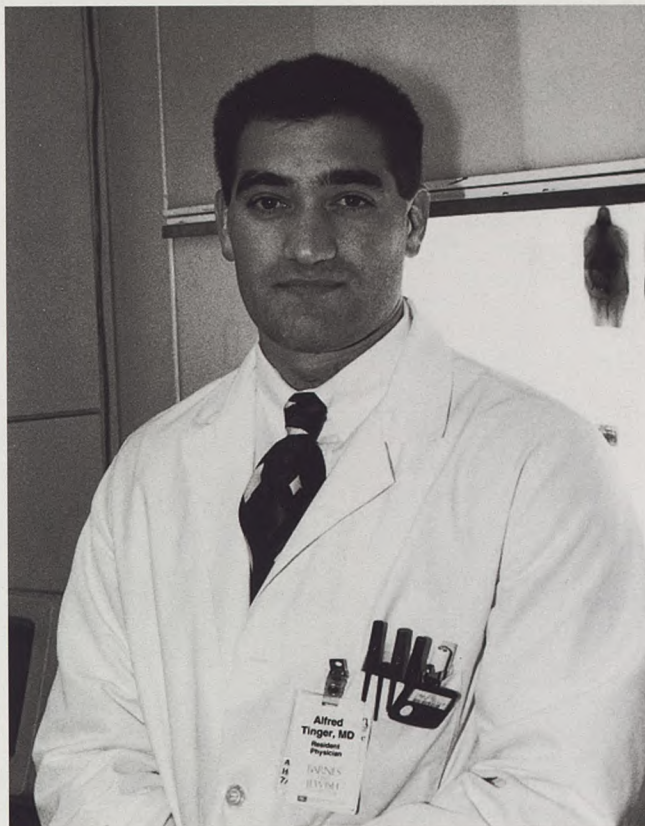
Terry Falk, MD, assistant in radiology, received an undergraduate degree from University of North Dakota, Grand Forks, and a medical degree from University of Minnesota, Minneapolis. He completed a one-year transitional internship at Hennepin County Medical Center, Minneapolis, Minnesota. Falk is a member of Alpha Omega Alpha.

Anthony Hein, MD, assistant in radiology, received an undergraduate degree from Stanford University, California, and a medical degree from University of California, Los Angeles. He completed an internship at Cedars-Sinai Medical Center, Los Angeles, California. Hein is a member of Alpha Omega Alpha.

David Jeck, MD, assistant in radiology, received an undergraduate degree from University of Pennsylvania, Philadelphia, and a medical degree from the University of Arizona, Tucson. He completed an internship at Good Samaritan Regional Center, Tucson. Jeck is a member of Alpha Omega Alpha.

Radiation Oncology Center

Alfred Tinger, MD, is the 1996-1997 radiation oncology chief resident. He received an undergraduate degree in physics from the State University of New York at Binghamton and a medical degree from the State University of New York Health Center at Brooklyn.



Leo Lawler, MD, assistant in radiology, received an undergraduate and a medical degree from the University of Dublin, Ireland. He completed an internship at St. Vincent's University Hospital, Dublin, Ireland, and at Mayo Clinic, Rochester, Minnesota.

Jason Levy, MD, assistant in radiology, received an undergraduate degree from Washington University, St. Louis, Missouri, and a medical degree from New York University, New York. He completed an internship at Lenox Hill Hospital, New York City.

Pratik Mukherjee, MD, assistant in radiology, received an undergraduate degree from Yale University, New Haven, Connecticut, and a medical degree from Cornell University, Ithaca, New York. He completed an internship at New York Hospital.

Harold Prow, MD, assistant in radiology, received an undergraduate degree from Vanderbilt University, Nashville, Tennessee, and a medical degree from Baylor University, Waco, Texas. He completed an internship at the University of Hawaii, Honolulu. Prow is a member of Alpha Omega Alpha.

Agnes Santosa, MD, assistant in radiology, received an undergraduate degree from Massachusetts Institute of Technology, Cambridge, and a medical degree from Stanford University, California. She completed an internship at Kaiser Permanente, Santa Clara, California.

Stephen Schmitter, MD, assistant in radiology, received an undergraduate degree from University of Michigan, Ann Arbor, and a medical degree from Stanford University, California. He completed an internship at Mercy Hospital and Medical Center, San Diego, California.

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FIRST-YEAR NUCLEAR MEDICINE TRAINEES

Edward Grishaw, MD, assistant in radiology, received an undergraduate degree from the University of Texas, San Antonio, and a medical degree from the University of Texas Health Science Center, San Antonio. He completed a four-year diagnostic radiology residency at Bowman Gray School of Medicine, Winston-Salem, North Carolina. Grishaw is a member of Alpha Omega Alpha.

Anton Johnson, MD, assistant in radiology, received an undergraduate degree and a medical degree from University of Minnesota, Minneapolis. He completed a four-year diagnostic radiology residency at University of Minnesota, Minneapolis. Johnson is a member of Alpha Omega Alpha.

Brigid Gordon, MD, assistant in radiology, received an undergraduate degree from Chestnut Hill College, Philadelphia, Pennsylvania, and a medical degree from Georgetown University, Washington, DC. She completed a four-year diagnostic radiology residency at Duke University Medical Center, Durham, North Carolina. Gordon is a member of Alpha Omega Alpha.

Louis Winner, MD, assistant in radiology, received an undergraduate degree from Emory University, Atlanta, Georgia, and a medical degree from University of Texas, Dallas. He completed an internship and a residency at Baylor University Medical Center, Waco, Texas.

FIRST-YEAR RADIATION ONCOLOGY RESIDENTS

Samuel Au, MD, PhD, assistant in radiology, received an undergraduate degree from Massachusetts Institute of Technology, Cambridge; a masters degree from University of Southern California, Los Angeles; a masters degree and a doctorate degree from University of Illinois, Urbana; and a medical degree from University of California, Davis. He completed an internship at San Bernadino County Medical Center, California.

Heather Curry, MD, assistant in radiology, received an undergraduate degree from Bryn Mawr College, Bryn Mawr, Pennsylvania, and a medical degree from Temple University, Philadelphia, Pennsylvania. She completed an internship at Abington Hospital, Abington, Pennsylvania.

Noushin Izadifar, MD, assistant in radiology, received a medical degree from Shiraz University, Shiraz, Iran. She completed a transitional internship at Ghasm Hospital, Mashad, Iran, and six months of residency in radiation oncology at Jorjani Hospital, Tehran, Iran.

Dotun Oyedijo, MD, assistant in radiology, received an undergraduate and a medical degree from University of Michigan, Ann Arbor. He completed an internship at Oakwood Hospital and Medical Center, Dearborn, Michigan.

OFF STAFF

Kim Baker, MD, instructor in radiology, completed a two-year fellowship in neuroradiology and has accepted a position with Hahnemann University Hospital, Philadelphia, Pennsylvania.

Robert Brown, PhD, visiting professor of radiology, Division of Radiological Sciences.

Gregory Cizek, MD, instructor in radiology, completed a two-year fellowship in neuroradiology and has entered private practice in St. Louis, Missouri.

Glenn Coates, MD, instructor in radiology, completed a one-year fellowship in magnetic resonance imaging and has accepted a position with Wake Radiology, Raleigh, North Carolina.

Wayne Drevets, MD, assistant professor of radiology, Division of Radiological Sciences.

John Felker, MD, assistant in radiology, completed four years of training in diagnostic radiology and has accepted a position with Greenview Regional Hospital Radiology Consultants, Bowling Green, Kentucky.

Andrew Fisher, MD, assistant in radiology, completed four years of training in diagnostic radiology and has received a body imaging fellowship at Duke University School of Medicine, Durham, North Carolina.

Kenneth Ford, MD, instructor in radiology, completed a one-year fellowship in abdominal radiology and has accepted positions as a staff radiologist at Baylor University Medical Center, Waco, Texas, and as medical director at Texas Diagnostic Imaging Center, Mesquite.

Anthony Foti, MD, assistant in radiology, completed four years of training in diagnostic radiology and has received an abdominal/body imaging fellowship at Duke University School of Medicine, Durham, North Carolina.

Donald Frei, MD, instructor in radiology, completed a two-year fellowship in neuroradiology and has accepted a position with Texas Neuroradiology PA, Dallas.

Arjun Godhwani, PhD, adjunct research associate, Division of Radiological Sciences.

Phillip Gunther, MD, instructor in radiology, completed a one-year fellowship in magnetic resonance imaging and has accepted a position with Diagnostic Imaging Northwest, Tacoma, Washington.

Robert Kanterman, MD, instructor in radiology, completed a one-year fellowship in vascular and interventional radiology and has accepted a position with St. Luke's Hospital, Chesterfield, Missouri.

Todd Knapp, MD, assistant in radiology, completed one year of training in diagnostic radiology.

Keith Kronemer, MD, instructor in radiology, completed a one-year fellowship in pediatric radiology and has accepted a position with Christ Hospital Medical Center, Oak Lawn, Illinois.

Kenneth Larson, PhD, research associate, Division of Radiological Sciences.

Henry Lee, MD, instructor in radiology, has accepted a position with The Radiation Oncology Center of Las Vegas, Sunrise Hospital, Las Vegas, Nevada.

Stephen Loehr, MD, assistant in radiology, completed one year of training in diagnostic radiology.

Gary Luker, MD, instructor in radiology, completed four years of training in diagnostic radiology and a one-year fellowship in pediatric radiology. He has accepted a position with Mallinckrodt Institute of Radiology, St. Louis, Missouri.

Kevin McEnery, MD, Assistant professor of radiology, Division of Diagnostic Radiology, has accepted a position with M.D. Anderson Cancer Center, Houston, Texas.

Mitchell Miller, MD, instructor in radiology, completed a four-year diagnostic radiology residency and a one-year fellowship in abdominal radiology. He has accepted a position with Atlantic Radiologists, Domona, New Jersey.

Astrid Morrison, MD, assistant in radiology and chief resident, Radiation Oncology Center, 1995-1996, completed three years of residency and a one-year fellowship in radiation oncology. She has entered private practice in Oklahoma City, Oklahoma.

John Moyers, MD, assistant in radiology, completed one year of training in nuclear medicine and has entered private practice in Nashville, Tennessee.

Sean Muldowney, MD, instructor in radiology and cochief resident, Division of Diagnostic Radiology, 1994-1995, completed four years of training in diagnostic radiology and a one-year fellowship in vascular and interventional radiology. He has accepted a position with Mori, Bean & Brooks, PA, Jacksonville, Florida.

Theodore Passe, MD, assistant in radiology, completed one year of training in diagnostic radiology.

Charles Pringle, MD, assistant in radiology, completed one year of training in nuclear medicine and has accepted a position with Radiological Group, PA, Jackson, Mississippi.

Valerie Reichert, MD, instructor in radiology, completed a four-year diagnostic radiology residency and a one-year fellowship in abdominal radiology. She has accepted a position with St. Luke's Hospital, Chesterfield, Missouri.

Michael Roarke, MD, assistant in radiology, completed a four-year diagnostic radiology residency and one year of training in nuclear medicine. He has accepted a position with Lyndon B. Johnson General Hospital, University of Texas, Houston.

Francis Schlueter, MD, instructor in radiology, completed a four-year diagnostic radiology residency and a one-year fellowship in vascular and interventional radiology. He has accepted a position with Good Samaritan Hospital, Cincinnati, Ohio.

Ken Schreiber, MD, PhD, instructor in radiology, completed a one-year fellowship in musculoskeletal radiology and has accepted a position with the University of Mississippi Medical Center, Jackson.

Gregg Schubach, MD, assistant in radiology, completed one year of training in nuclear medicine and has accepted a position with Progressive Physician Associates, Easton, Pennsylvania.

Sharon Schubach, MD, instructor in radiology, completed a one-year fellowship in breast imaging.

Kurt Simpson, MD, instructor in radiology, completed four years of training in diagnostic radiology and a one-year fellowship in vascular and interventional radiology. He has accepted a position with the University of Wisconsin, Clinical Science Center, Madison.

Isabel Soroeta, MD, instructor in radiology, completed a one-year fellowship in breast imaging and has accepted a position with Barnes-Jewish West County Hospital, Creve Coeur, Missouri.

Jeffrey Spaeder, MD, assistant in radiology, completed one year of training in diagnostic radiology and has entered the internal medicine residency program at Johns Hopkins Hospital, Baltimore, Maryland.

Glenn Strome, MD, instructor in radiology, completed a one-year fellowship in musculoskeletal radiology and has accepted a position with Erlanger Memorial Medical Center, Chattanooga, Tennessee.

Avinash Sud, MD, instructor in radiology, completed a two-year fellowship in neuroradiology and accepted a position with St. Jude Radiology medical Group, Inc., Fullerton, California.

Robert Swanson, MD, assistant in radiology, completed four years of residency in radiation oncology, and has accepted a position with United States Air Force Medical Center, Biloxi, Mississippi.

Alexander Tsiaras, visiting research associate, Division of Radiological Sciences.

Michael Wallace, MD, instructor in radiology, completed a one-year fellowship in vascular and interventional radiology and has accepted a position with the University of Texas Southwestern Medical School, Dallas.

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Continued from page 23

Eric Weidman, MD, assistant in radiology and chief resident, Division of Diagnostic Radiology, 1995-1996, completed a four-year diagnostic radiology residency and has accepted a position with the David Grant Medical Center at Travis Air Force Base, Fairfield, California.

Pamela Woodard, MD, instructor in radiology, completed a one-year fellowship in chest radiology and has accepted a position with Mallinckrodt Institute of Radiology.

Neda Yagan, MD, assistant in radiology, completed a four-year diagnostic radiology residency and has accepted a position with the University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania.

Tongzeng Yang, PhD, instructor in radiology, Division of Radiological Sciences.

Terry Yeager, MD, instructor in radiology, completed a one-year fellowship in vascular and interventional radiology and has accepted a position with Tripler Army Medical Center, Honolulu, Hawaii.

Anthony Zelazny, MD, assistant in radiology, completed four years of training in diagnostic radiology and has received a musculoskeletal fellowship at the University of Wisconsin Hospital and Clinics, Madison.

Tinko Zlatev, MD, assistant in radiology, completed four years of training in diagnostic radiology and has accepted a position with Haywood County Hospital, Clyde, North Carolina.

APPOINTMENTS/ELECTIONS

Jeffrey Brown, MD, associate professor of radiology, was appointed to the Roster of Distinguished Scientific Advisors for the Radiological Society of North America's Research and Education Fund.

Louis Gilula, MD, professor of radiology and director of musculoskeletal radiology, was elected as membership chairman for the American Society for Musculoskeletal Radiology. He was appointed as examiner for the Musculoskeletal Section of the Diagnostic Radiology Oral Boards, Louisville, Kentucky, June 9 - 12.

Lawrence Kotner, MD, associate professor of radiology, was appointed to a one-year term as a medical staff representative to the Medical Executive Committee of Barnes-Jewish Hospital.

Daniel Low, PhD, assistant professor of radiology, was appointed to a two-year term on the Board of Representatives for the Missouri River Valley Chapter of the American Association of Physicists in Medicine.

Jeff Michalski, MD, assistant professor of radiology, and **Barry Siegel, MD**, professor of radiology and director of the Division of Nuclear Medicine, were appointed cochairmen of the Protocol Review and Monitoring Committee of the Washington University Cancer Center.

Tom Miller, MD, PhD, was elected as a member of the House of Delegates of the Society of Nuclear Medicine.

Scott Mirowitz, MD, associate professor of radiology, co director of body MRI, and chief of radiology at Barnes-Jewish Hospital - North Campus, was appointed editor of *Magnetic Resonance Imaging Clinics of North America*.

Douglas Robertson, MD, PhD, assistant professor of radiology and of orthopedic surgery, was appointed to the Public Affairs Committee of the St. Louis Regional Commerce and Growth Association.

Joseph Roti Roti, PhD, professor of radiology, associate director of the Radiation Oncology Center, and chief of cancer biology, was appointed to the State of Nebraska Department of Health's Technical Review Panel for the Cancer and Smoking Disease Research Program. He also was appointed as a reviewer for the IEEE Standards Coordinating Committee 28, Subcommittee 4, *In vitro* Literature Review Working Group.

Peter Shile, MD, PhD, assistant professor of radiology, was appointed as a clinical reviewer for the American College of Radiology Stereotactic Breast Biopsy Accreditation Program. He also was appointed to a three-year term on the American Roentgen Ray Society Scientific Program Committee for Breast Imaging.

Barry Siegel, MD, professor of radiology and director of the Division of Nuclear Medicine, was appointed by the United States Pharmacopeia Division of Information Development to a five-year term on the Radiopharmaceuticals Expert Advisory Panel. The multidisciplinary panel will develop and approve drug and therapeutics information and contribute to any decisions relating to radiopharmaceuticals.

Marilyn Siegel, MD, professor of radiology, was appointed to a three-year term as a member of the Convention Program Committee of the American Institute of Ultrasound Medicine.

Celette Skinner, PhD, assistant professor of radiology, was appointed as a member of the Prevention and Control and Human Cancer Genetics Research Programs, Washington University Cancer Center.

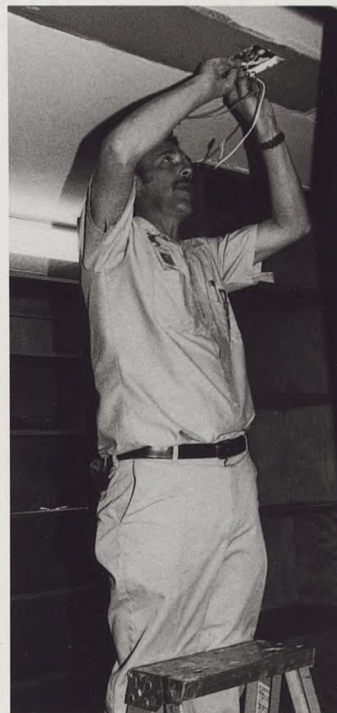
Clark West, MD, assistant professor of radiology and director of emergency and trauma radiology, was appointed to a one-year term as chairman of the Membership Committee for the American Society of Emergency Radiology.

Jeffrey Williamson, PhD, professor of radiology and chief of brachytherapy physics, was elected as a fellow of the American Association of Physicists in Medicine. He was appointed to the U.S. Nuclear Regulatory Commission Advisory Committee on Medical Use of Isotopes.

Franz Wippold, MD, associate professor of radiology, was appointed as guest investigator for the Armed Forces Institute of Pathology's study on spinal cord tumors.

MIR Education Center

Joe Quennoz, Dave Smugala, and David Piper of the MIR plant facilities team are renovating space on the fourth floor of the Old Children's Annex in preparation for the Education Center's move from the Institute's 10th floor.



FELLOWSHIPS/ GRANTS

Thomas Conturo, MD, PhD, assistant professor of radiology, as principal investigator, received a \$300,000 grant from the McDonnell Center for Higher Brain Function Major Grants Program for his research on "Functional neuronal imaging with magnetic resonance in humans and primates." Coinvestigators on the three-year grant are **Marcus Raichle, MD**, codirector of the Division of Radiological Sciences; **Avi Snyder, PhD, MD**, Department of Neurology; **Robert McKinstry, MD, PhD**, assistant in radiol-

ogy; **Harold Burton, PhD**, Department of Anatomy and Neurobiology; **Tongzeng Yang, PhD**, instructor in radiology; and **Erbil Akbudak, PhD**, graduate research assistant in radiology.

Duffy Cutler, PhD, assistant professor of radiology, received a three-year grant in the amount of \$524,998 for research on "Radiation dosimetry of Cu-64-labeled radiotherapy agents using positron emission tomography."

Mokhtar Gado, MD, professor of radiology, received a five-year grant from the National Institutes of Health for research on magnetic resonance imaging of the structural brain changes associated with cognitive changes due to cerebrovascular disease.

Marshall Hicks, MD, associate professor of radiology, received a Seed Grant Award from the Radiological Society of North America's Research and Education Fund. The one-year grant will support research in "Interventional and vascular techniques for hepatic gene therapy."

FYI

FELLOWSHIPS/ GRANTS

Continued from page 25

Weili Lin, PhD, assistant professor of radiology, received a four-year grant in the amount of \$791,233 from the National Institute of Neurological Disorders and Stroke for research on "Tissue water measurements of brain edema with MRI."

Daniel Low, PhD, assistant professor of radiology, received the 1996 American Association of Physicists in Medicine Travel Award, presented at the AAPM's annual meeting in July in Philadelphia. The award will support Low's travels to Great Britain, where he will present invited lectures at several universities.

Gary Luker, MD, instructor in radiology, received a one-year RSNA Fellowship supported by Mallinckrodt Medical Inc. from the Radiological Society of North America's Research and Education Fund. The \$30,000 grant was awarded for Luker's research in "Characterization of Tc99m-N₂O₂P₂ complexes for functional imaging of multidrug resistance in cancer." For this same research, Luker also received a one-year, \$30,000 grant from the Society of Nuclear Medicine.

Douglas Robertson, MD, PhD, assistant professor of radiology and of orthopedic surgery, received a three-year Whitaker Foundation Biomedical Research Grant in the amount of \$210,000 for research on "Modeling and analysis of acetabular defects caused by failed hip prostheses."

Celette Skinner, PhD, assistant professor of radiology, as principal investigator, received a \$20,000 one-year grant from the Barnard Hospital Board for research on "Beliefs about breast cancer, risk factors and personal risk, and preferences regarding risk counseling among low-income African-American women in urban St. Louis."

Ge Wang, PhD, assistant professor of radiology, received a \$543,628 five-year grant from the National Institute of Diabetes and Digestive and Kidney Diseases for the research project "Unraveling the GI Tract by Spiral CT." **Michael Vannier, MD**, professor of radiology and chief of the image processing lab, is coinvestigator.

Michael Vannier, MD, professor of radiology and chief of the image processing lab, received a \$1,251,152 grant from the National Institute of Neurological Disorders and Stroke. The five-year grant will fund the research project "Normal MR neuro-morphometry by global pattern matching."

Jeffrey Williamson, PhD, professor of radiology and chief of brachytherapy physics, received a three-year grant from the National Cancer Institute for "Brachytherapy dosimetry using plastic scintillator." Coinvestigators for the \$752,000 grant are Robert Binns, PhD, Washington University Department of Physics; **Assen Kirov, MS**; John Wong, PhD, William Beaumont Hospital, Royal Oaks, Michigan; and Charles Hurlbut, Epikon, Inc., Bedford Heights, Ohio.

Pamela Woodard, MD, instructor in radiology, received the 1996 Siemens Medical Systems/RSNA Fellowship from the Radiological Society of North America's Research and Education Fund. The one-year \$30,000 fellowship will support her research project "Identification of proximal coronary artery stenosis with 3D MR retrospective respiratory gating." Woodard also received an American Heart Association Fellows Grant for her research in coronary magnetic resonance angiography.

HONORS/ AWARDS

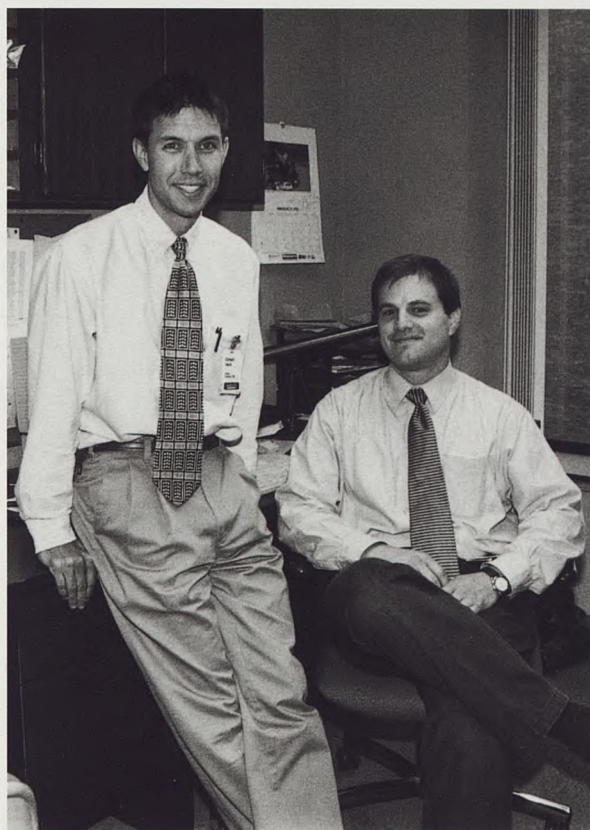
Carolyn Anderson, PhD, assistant professor of radiology, was an invited instructor at the Summer School in Nuclear Chemistry, a Department of Energy-sponsored program for undergraduates in chemistry, at San Jose State University, San Jose, California, July 8-12.

Ty Bae, MD, PhD, assistant in radiology, received a \$25,000 Research Resident Award from the Radiological Society of North America's Research and Education Fund. The one-year award will support Bae's research project "Optimization of contrast enhancement during spiral CT: effect of alterations in cardiovascular physiology."

Evren Senol, graduate research assistant, received first prize in the Washington University Research Fair, sponsored by the Association of Graduate Engineering Students.

Diagnostic Radiology

Donald Heck, MD, and Thomas Vaughan, MD, (seated) are the diagnostic radiology chief residents for 1996-1997. Heck received a medical degree from Duke University; Vaughan is an alumnus of Washington University School of Medicine.



LECTURES/ PRESENTATIONS

Carolyn Anderson, PhD, assistant professor of radiology, presented "Preclinical internal emitter therapy studies with Cu-64 and Cu-67 labeled antibodies and peptides" at the Los Alamos National Laboratory, Los Alamos, New Mexico, June 7.

Harold Bennett, MD, PhD, assistant professor of radiology, presented "Role of radiology in detection and staging of colorectal cancer" at the 8th Annual American Cancer Society Program on Breast and Colorectal Can-

cer, Memorial Hospital of Carbondale, Illinois, April 27.

James Blaine, DSc, professor of radiology and chief of the electronic radiology lab, presented a tutorial, "Selecting networks for health data and images," at the American Medical Informatics Association's 1996 Spring Congress, Kansas City, Missouri, June 5 - 8.

Walter Bosch, DSc, instructor in radiology, spoke on "Data management for 3D CRT" at the 38th Annual Meeting of the American Association of Physicists in

Medicine, Philadelphia, Pennsylvania, July 23.

James Brink, MD, associate professor of radiology and codirector of computed body tomography, presented "Spiral CT angiography" and "Contrast media physiology: emphasis on hepatic imaging" at the Siemens CT Users' Meeting, Scottsdale, Arizona, June 7 and 8.

Farrokh Dehdashti, MD, assistant professor of radiology, presented "Breast imaging with PET" and "Epilepsy imaging with PET" at the Feasibility of PET Imaging

Symposium, Institute of Radiological Science, Mater Hospital, Dublin, Ireland, April 15.

Bahman Emami, MD, professor of radiology, spoke on "RTOG protocol 93-11/three-dimensional conformal radiotherapy of lung cancer: rationale for new dose escalation study schema" at the IASLC Workshop - Controversies in Staging and Combined Treatment Modalities in Lung Cancer, Bruges, Belgium, June 23 - 27. He presented "Squamous cell carcinoma of the floor of mouth: evaluation of long-term results and prognostic factors" and "Squamous cell carcinoma of the oral tongue: evaluation of long-term results and prognostic factors" at the 4th International Conference on head and Neck Cancer, Toronto, Ontario, Canada.

Keith Fischer, MD, associate professor of radiology, spoke on "Scintigraphic markers of outcome after lung volume reduction surgery as assessed with preoperative lung scans" at the American Roentgen Ray Society 96th Annual Meeting, San Diego, California, May 5 - 10.

David Gierada, MD, instructor in radiology, presented "Dynamic MR imaging to analyze respiratory mechanics in patients having lung volume reduction surgery," which received a Certificate of Merit Award; "Atelectatic pseudomass in severe bullous emphysema," and "Dynamic MR imaging of respiratory coordination before and after lung volume reduction surgery" to the American Roentgen Ray Society 96th Annual Meeting, San Diego, California, May 5 - 10.

LECTURES/ PRESENTATIONS

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Louis Gilula, MD, professor of radiology and chief of musculoskeletal radiology, lectured on "Imaging approach to wrist pain" at The 86th Congress of the Central Japan Association of Orthopaedic Surgery and Traumatology, Nara, Japan, May 30 and 31. As visiting professor, he spoke on "Plain film approach to musculoskeletal tumors" and "Radiographic interpretation of ligament instabilities of the wrist" at the Fukuoka University School of Medicine, Fukuoka, Japan, June 3. Gilula lectured on "Arthrography and CT arthrography," "Roentgenographic approach to hand and wrist pain," "Percutaneous bone biopsy," and "MRI of wrist and hand" at the Advance Course in Musculoskeletal Radiology, Margherita di Savoia, Italy, June 21 - 23.

Harvey Glazer, MD, professor of radiology, presented the instructional course "Pitfalls in the radiological diagnosis of bronchogenic carcinoma" at the American Roentgen Ray Society 96th Annual Meeting, San Diego, California, May 5 - 10.

Mary Graham, MD, assistant professor of radiology, spoke on "Multimodality treatment of esophagus cancer," "Radiation therapy for lung cancer," and "New technology in radiation therapy - maximize the potential" at the Southern California ACS Traveling Oncologist Lecture Series, Los Angeles, California, June 3 - 7.

Jay Heiken, MD, professor of radiology and chief of abdominal radiology, presented "Colorectal carcinoma: detection, staging, and follow-up," "CT and MRI evaluation of gynecologic neoplasms," and "Testicular germ cell neoplasms: detection, staging, and follow-up" to the Annual Meeting of the Oklahoma State Radiological Society, Oklahoma City, Oklahoma, April 12 and 13. He presented "Diffuse Diseases of the Liver" at the Categorical Course on Radiology of the Liver, Biliary Tract, and Pancreas, at the American Roentgen Ray Society 96th Annual Meeting, San Diego, California, May 5 - 10.

Eric Klein, MS, assistant professor of radiology, spoke on "Clinical uses of multileaf collimation and enhanced dynamic wedge" at the Varian Applications meeting, Williamsburg, Virginia, June 21.

Weili Lin, PhD, assistant professor of radiology, lectured on "Contrast-enhanced magnetic resonance angiography of carotid artery wall in pigs" and "Simultaneous and quantitative separation of R1 and R2 change *in vivo* fMRI using single-shot Gp2" at the ISMRM meeting, New York City, New York, April 29 and May 1.

Daniel Low, PhD, assistant professor of radiology, presented "Use of physical modulators for intensity

modulated radiation therapy" at the American Association of Physicists in Medicine Annual Meeting, Philadelphia, Pennsylvania, July 21-25.

Elizabeth McFarland, MD, assistant professor of radiology, presented "Imaging of focal liver lesions" at the Barnes-Jewish Hospital Medical Grand Rounds, St. Louis, Missouri, May 19.

Robert McKinstry, MD, PhD, assistant in radiology, presented "Echo planar human diffusion tensor imaging with tetrahedral encoding" and a poster exhibit, "Quantitative measurements of brain water apparent diffusion coefficient in healthy full-term neonates," to the 4th Annual Meeting of the International Society for Magnetic Resonance in Medicine, New York City, April 28 - May 3.

Eduardo Moros, PhD, assistant professor of radiology, spoke on "Lateral conformability and penetration depth controllability using ultrasound arrays and reflectors" at the 1996 Surgical Application of Energy Sources Conference, Estes Park, Colorado, May 17 - 19. He presented "Power deposition conformability of the SURLAS: a system for external simultaneous thermoradiotherapy" to the 7th International Congress on Hyperthermic Oncology Meeting, Rome, Italy, April 9 - 13. Moros presented "The radial transmission line as a broad-band shielded exposure system for microwave irradiation of large numbers of culture flasks" to the 18th Annual Meeting of the Bioelectromagnetics Society (BEMS), Victoria, British Columbia, Canada, June 9 - 14.

Douglas Robertson, MD, PhD, assistant professor of radiology and of orthopedic surgery, spoke on "Advanced technologies applied to orthopedic joint replacement" at the St. Louis Regional Commerce and Growth Association, St. Louis, Missouri, May 17.

Joseph Roti Roti, PhD, professor of radiology, associate director of the Radiation Oncology Center, and chief of cancer biology, presented "Consideration of the use of the alkaline comet assay for routine screen of DNA damage," "Further evidence that S-phase progression is required for hyperthermia-induced cell death in HeLa cells," "Chronic thermotolerance with continued cell proliferation," "Enhanced turnover rate of topoisomerase II α mRNA by agents known to induce G₂-delay," and "Differential radioprotection of oncogene transfected rat embryo cells by WR1065 correlates with DNA supercoiling changes" to the 44th Annual Meeting of the Radiation Research Society, Chicago, Illinois, April 14 - 17. As invited speaker, he lectured on "Nuclear matrix mediated DNA organization and the radioresistance/sensitivity of transformed cells" at the 21st Annual Meeting of the Gilbert H. Fletcher Society, Williamsburg, Virginia, April 18 - 20. Roti Roti spoke on "Measurement of DNA damage by the alkaline comet assay after *in vitro* exposure to 835 Mhz electromagnetic radiation," "Lack of any significant effects of 835 Mhz FM or CDMA microwave exposure upon macromolecular synthesis rates, cell growth, or cell cycle phase distribution,"

"Comparison of stereotactic and template injection of methods to implant 9L glioma cells in the rat brain," and "Further characterization and modification of a chemically induced rat brain tumor model for tumor promotion studies" at the 18th Annual Meeting of the Bioelectromagnetics Society, Victoria, British Columbia, Canada, June 9 - 14.

Henry Royal, MD, professor of radiology and associate director of the Division of Nuclear Medicine, presented "SNM procedure guidelines" to the Mid-eastern Society of Nuclear Medicine Chapter, Rockville, Maryland, April 13. He presented the keynote address, "Technology assessment: the good, the bad, and the horrific," as well as "Measuring value: David Jones or target" and "Pulmonary embolism: Technology assessment gone mad!" to the Australian and New Zealand Society of Nuclear Medicine, Ayer's Rock, Australia, June 28 - 30.

Stuart Sagel, MD, professor of radiology and chief of chest radiology, spoke on "CT of the pleura" and "Role of CT and MRI in staging bronchogenic carcinoma" at the Annual Conference on Chest Disease of the Fleischner Society, Vancouver, British Columbia, Canada, June 13 - 15.

Barry Siegel, MD, professor of radiology and director of the Division of Nuclear Medicine, presented "Somatostatin-receptor imaging of neuroendocrine tumors" to the Catholic University Graduate School, Seoul, Korea, May 13.

Marilyn Siegel, MD, professor of radiology, spoke on "Problems and pitfalls in pediatric MRI" and "Pediatric musculoskeletal MRI" at the 19th Annual Course of the Society of Computed Body Tomography and Magnetic Resonance, Scottsdale, Arizona, May 18 - 20. As invited lecturer, she presented "Recent advances in pediatric ultrasound" to the Korean Society of Medical Ultrasound, Seoul, Korea, May 11. As visiting professor, Siegel spoke on "Applications of duplex and colored Doppler sonography in the pediatric abdomen" and "Duplex and color Doppler Sonography of the neonatal brain" at the Seoul National University Children's Hospital, Seoul, Korea, May 13 and 14. She chaired a special focus session on ultrasonography and spoke on "Doppler ultrasonography in the acute pediatric abdomen" and "Breast sonography in children" at the International Pediatric Radiology Meeting, Boston, Massachusetts, May 25 - 29.

Celette Skinner, PhD, assistant professor of radiology, as a panel member, presented "What we know about the effectiveness of tailoring" at the initial meeting of the National Cancer Institute's panel on "Tailored Messages in Cancer Communications", Bethesda, Maryland, July 17.

Richard Slone, MD, assistant professor of radiology, presented "Radiologic assessment of structural features in emphysema" and "Comparison of radiologic features with clinical data and outcome following lung volume reduction surgery" at the Multidisciplinary Volume Reduction Research Meeting, St. Louis, Missouri, April

23. He presented "Preoperative radiologic evaluation and patient selection criterion for lung volume reduction surgery," "Common pitfalls leading to rejection of major papers submitted to AJR," and "Preoperative radiologic findings in patients with an unfavorable outcome after lung volume reduction surgery" at the American Roentgen Ray Society 96th Annual Meeting, San Diego, California, May 5 - 10.

Douglas Spitz, PhD, assistant professor of radiology, as guest lecturer, spoke on "Mechanisms of resistance to oxidative stress" at the St. Louis University Health Sciences Center, St. Louis, Missouri, April 12. He presented "The cytotoxicity of anticancer agents in H₂O₂-resistant hamster fibroblasts," "Mechanisms of heat resistance in oxidative stress resistant cells," and "Nitric oxide induced resistance to oxidative stress" to the 44th Annual Meeting of the Radiation Research Society, Chicago, Illinois, April 14 - 17. Spitz presented "Does 835 MHz FMCW irradiation alter nitric oxide production by the J774.16 mouse macrophage of cell line?", "Comparison of stereotactic and template injection methods to implant 9L glioma cells in the rat brain," and "Further characterization and modification of a chemically induced rat brain tumor model for tumor promotion studies" to the 18th Annual Meeting of the Bioelectromagnetics Society, Victoria, British Columbia, Canada, June 9 - 14.

Alfred Tinger, MD, assistant in radiology and chief resident, Radiation Oncology Center, spoke on "Patient motion within an immobilization device" at the 4th International Conference on Electronic Portal Imaging, Amsterdam, The Netherlands, June 10.

Jeffrey Williamson, PhD, professor of radiology and chief of brachytherapy physics, as invited speaker, presented the refresher course "Brachytherapy source strength, quantities, and calibrations" at the 38th Annual American Association of Physicists in Medicine, Philadelphia, Pennsylvania, July 21 - 25.

Franz Wippold, MD, associate professor of radiology, as visiting professor, spoke on "Head and neck imaging update" at the National Naval Medical Center, Bethesda, Maryland; Walter Reed Army Medical Center, Washington, DC; and Uniformed Services University of the Health Services, Bethesda, Maryland, April 29 - May 10.

Pamela Woodard, MD, instructor in radiology, as invited lecturer, spoke on "Cardiac and thoracic vascular imaging: recent developments in MR and spiral CT" at the St. Louis University Health Sciences Center, St. Louis, Missouri, April 10. She presented "Identification of coronary artery stenoses with 3D MR retrospective respiratory gating" to the American Roentgen Ray Society 96th Annual Meeting, San Diego, California, May 5 - 10.

SYMPOSIA

SOCIETY OF NUCLEAR MEDICINE

*The 43rd Annual Meeting
Denver, Colorado
June 3 - 5, 1996*

Farrokh Dehdashti, MD, as first author, received the 1996 Outstanding Manuscript Award for one of the five best papers published in the *Journal of Nuclear Medicine*. The paper, "Positron tomographic assessment of estrogen receptors in breast cancer: comparison with FDG-PET and in vitro receptor assays," was coauthored with **Barry Siegel, MD; Duffy Cutler, PhD; Michael Welch, PhD; Thomas Bonasera, MA; Maureen Fusselman, MS, BSN; and Diane Detert, CNMT**, of Mallinckrodt Institute; **Joanne Mortimer, MD**, of Washington University's Division of Medical Oncology; **Landis Griffith, MD, PhD**, of Baylor University Medical Center, Waco, Texas; and **John Katzenellenbogen, PhD**, of the University of Illinois, Urbana.

SCIENTIFIC PAPERS

Carolyn Anderson, PhD, moderator, "Radiopharmaceutical chemistry: therapeutic and other nuclides I."

Duffy Cutler, PhD, comoderator, "Instrumentation and data analysis: three-dimensional PET."

Farrokh Dehdashti, MD, moderator, "Oncology diagnosis (nonantibody): breast cancer newer tracers."

Robert Gropler, MD, comoderator, "Cardiovascular - PET: myocardial perfusion."

David Piwnica-Worms, MD, PhD, comoderator, "Radiopharmaceutical chemistry: preclinical studies II."

Barry Siegel, MD, moderator, "Radiobiology I - dosimetry."

Carolyn Anderson, PhD; Judith Connett, PhD; Carl Germain, MS; Li Guo, MS; Buck Rogers, PhD; Sally Schwarz, RPh, MS; Alan Fritzberg, PhD; Michael Welch, PhD, "Cu-64-Labeled BAT-21T-NR-LU-10 Fab: an agent for PET imaging and radioimmunotherapy."

*Washington University, St. Louis, Missouri. **University of Alabama, Birmingham. ***NeoRx Corporation, Seattle, Washington.

Carolyn Anderson, PhD; Elizabeth Sherman, BA; Deborah McCarthy, PhD; Laura Bass, PhD; Lynne Jones, BA; Michael Cristel, MA; Margaret Lanahan, MS; Ruth Shefer, PhD; Robert Klinkowstein, PhD; Michael Welch, PhD, "Radiotherapy studies of Cu-64-labeled tetra-octreotide in Tumor-bearing rats." *Newton Scientific Inc., Winchester, Massachusetts.

Judith Connett, PhD; **Carolyn Anderson, PhD; Li Guo, MS; Sally Schwarz, RPh, MS; Carl Germain, MS; Gordon Philpott, MD; Michael Welch, PhD**, "Long-term radioimmunotherapy studies of Cu-64 anti-colon carcinoma monoclonal antibody (Mab)-1A3, intact and F(ab')₂ singly and in combination in the GW39-hamster model."

*Washington University School of Medicine, St. Louis, Missouri.

Duffy Cutler, PhD; Farrokh Dehdashti, MD; Barry Siegel, MD; Joanna Downer, MS; Michael Welch, PhD, "Investigation of a prostate ligand 16β-[F-18]Fluoro-5α-Dihydro-testosterone for staging of prostate carcinoma."

Fidelma Flanagan, MD; Farrokh Dehdashti, MD; Joanne Mortimer, MD; Barry Siegel, MD; Stephanie Jonson, MS; Michael Welch, PhD, "PET assessment of response to tamoxifen therapy in patients with metastatic breast cancer." *Washington University, St. Louis, Missouri.

Fidelma Flanagan, MD; Farrokh Dehdashti, MD; Barry Siegel, MD; Diana Trask, RN; Sudhir Sundaresan, MD; Alexander Patterson, MD; Joel Cooper, MD, "Staging of esophageal cancer with FDG-PET." *Washington University, St. Louis, Missouri.

Fidelma Flanagan, MD; Farrokh Dehdashti, MD; Olagunji Ogunbiyi, MD; Barry Siegel, MD; Diana Trask, RN; Elisa Birnbaum, MD; James Fleshman, MD; Ira Kodner, MD, "The role of FDG-PET in advanced primary and recurrent colorectal cancer." *Washington University, St. Louis, Missouri.

Robert Hancock, PhD; **Michael Welch, PhD; David Reichert, PhD**, "Molecular mechanics investigation of Tc(V) complexes." *IBC Advanced Technologies, American Fork, Utah.

Pilar Herrero, MD; **Judy Hartman**, research patient coordinator; **Robert Gropler, MD**; **Steven Bergmann, MD**, "Quantification of myocardial perfusion with PET using carbon-11 acetate and a compartmental model in human subjects." *Washington University, St. Louis, Missouri.

Teresa Jones-Wilson, PhD; Kim Deal, PhD; Deborah McCarthy, PhD; David Reichert, PhD; Carolyn Anderson, PhD; Michael Welch, PhD, "The effect of charge on the retention of Copper-64 radiopharmaceuticals in the clearance organs."

Hans Lee, MD; **Hiie Gussak**, ultrasound technician; **Victor Davila-Roman, MD; Deborah Delano, RN; Patricia Rubin, MD; Robert Gropler, MD**, "Contractile reserve is not dependent solely upon changes in myocardial blood flow." *Washington University, St. Louis, Missouri.

Deborah McCarthy, PhD; Ruth Shefer, PhD; Robert Klinkowstein, PhD; Laura Bass, PhD; William Margeau, cyclotron supervisor; **Carolyn Anderson, PhD; Michael Welch, PhD**, "The efficient production of high specific activity Copper-64 using a biomedical cyclotron." *Newton Scientific Inc., Winchester, Massachusetts.

Eyal Mishani, PhD; Michael Cristel, MS; Timothy McCarthy, PhD; Michael Welch, PhD, "Radiosynthesis binding affinity and biodistribution of 3-[F-18]fluoro-N-(2,2,2-trifluoro-m-tolyl)piperazine (FTFMPP), a Radioligand for the Serotonin System."



Vijay Sharma, PhD; S. Wey, PhD*; **Laura Bass, PhD**; **Carolyn Crankshaw, MS**; Mark Green, PhD*; **Michael Welch, PhD**; **David Piwnica-Worms, MD, PhD**; "Monocationic N402 Schiff-base phenolate complexes of Ga(III): novel PET imaging agents of the human multidrug resistance (MDR1) P-glycoprotein." *Purdue University, West Lafayette, Indiana.

Vijay Sharma, PhD; **Vallabhaneni Rao, PhD**; **David Reichert, PhD**; **Carolyn Crankshaw, MS**; **Michael Welch, PhD**; **David Piwnica-Worms, MD, PhD**; "Effects of the central coordination metal on recognition of ethylenediamine-N-N'-Bis[Propyl (R-Benzylimino)] metal (III) cations by the multidrug resistance (MDR1) P-glycoprotein."

Jerold Wallis, MD; **Tom Miller, MD, PhD**; Mihelle Miller,* James Hamill, PhD**;

"Rapid 3-D projection in iterative reconstruction using gaussian diffusion." *summer student **Siemens Medical Systems, Hoffman Estates, Illinois.

Samuel Wang, MD; **Keith Fischer, MD**; **Richard Slone, MD**; **David Gierada, MD**; Roger Yusen, MD*; Joel Cooper, MD*; "Ventilation perfusion scintigraphy in the evaluation of patients for lung volume reduction surgery." *Washington University School of Medicine, St. Louis, Missouri.

Jian Zhang, MS; **Ming Xu, MS**; **Elizabeth Sherman, BA**; **Carmen Dence, MS**; **Timothy McCarthy, PhD**; **Michael Welch, PhD**, "In vivo evaluation and PET study of a C-11 labeled neuronal nitric oxide synthase (nNOS) inhibitor S-Methyl-L-Thiocitrulline ([C-11] MTICU)."

POSTER SESSIONS

Tom Miller, MD, PhD, moderator, "Instrumentation and data analysis: image generation and analysis."

Laura Bass, PhD; **James Duncan, MD, PhD**; **Mary Stephenson, medical research technician**; **Michael Cristel, MS**; **Carolyn Anderson, PhD**, "In vivo metabolism of IN-111-DTPA-Octreotide."

Carolyn Crankshaw, MS; **David Piwnica-Worms, MD, PhD**, "TC-99m-SES-TAMIBI may be a transport substrate of the human multidrug resistance-associated protein (MRP)."

James Duncan, MD, PhD; **Mary Stephenson, medical research technician**; **Carolyn Anderson, PhD**; **Herman Wu, medical student***, "IN-111-DTPA octreotide and other polypeptides are delivered to lysosomes in the liver, kidneys, and target tissues." *Washington University, St. Louis, Missouri.

Pilar Herrero, MD*; **Robert Gropler, MD**; Mark Shelton, MD*; Steven Bergmann, MD, PhD*, "Use of compartmental models of Carbon-11 acetate to measure myocardial oxygen consumption: validation in human subjects." *Washington University, St. Louis, Missouri.

John Ollinger, DSc*; **William Powers, MD**; **Lennis Lich, technical supervisor**, "Shielding to reject scatter from outside the field-of-view in infant PET scans." *Washington University, St. Louis, Missouri.

Patricia Rubin, MD*; **Deborah Delano, RN**; Jason Rogers, MD*; **Robert Gropler, MD**, "Cardiac PET with C-11 acetate identifies patients referred for cardiac transplant who benefit from high-risk coronary bypass surgery." *Washington University, St. Louis, Missouri.

Jerold Wallis, MD; **Tom Miller, MD, PhD**, "Use of iterative methods in reconstruction of 180° data."



Residents, trainees, and fellows for 1995-1996 were (front row, left to right) Doctors Pamela Woodard; Rachel Gordon; Christine Menias; Myeong Yoon; Michele Semin; Neda Yagan; Gilbert Jost, chief, Division of Diagnostic Radiology; Donald Heck; Eric Weidman; Ronald Evens, director of the Institute; Dennis Balfe, director of the Diagnostic Radiology Program; Farrel VanWagenen; Thomas Vaughan; Mary Alderman; Isabel Soroeta; Sharon Schubach; Debra Lau; (second row) Michael Roarke; Samuel Wang; Lawrence Kaskowitz; John Felker; Sanjeev Bhalla; Joshua Shimony; Peter Salazar; Dallas Peck; Mitchell Miller; Gavin Slethaug; Perry Pickhardt; Michael Boerner; James Milburn; Gregg Schubach; Sean Pierce; John Carico; Sean Muldowney; (third row) Felix Song; David Hillier; Jonathon Gurney; David Kim; Scott Kaltman; Kim Baker; Stephanie Hiskes; Kevin Berger; David Youmans; Sandy Ruhs; Kraig Kirkpatrick; Gregory Cizek; Anthony Zelazny; Donald Frei; (back row) George Brown; Kurt Simpson; Anthony Foti; John Butman; Richard Edelstein; Eric Malden; Jeffrey Friedland; Steven Winn; Matthew Fleishman; Andrew Fisher; Rory Satterfield; Robert McKinstry; Daniel Hassell; John Healy; Paul Guillerman; Robert Vogler; Glenn Hammer; Kenneth Ford; Michael Naylor; Ty Bae; Ken Schreiberman.

IN MEMORIAM



Michel M. Ter-Pogossian, PhD, an internationally known pioneer in the use of cyclotron-produced radionuclides in biomedical research, died suddenly of a heart attack on June 19, 1996, while visiting in Paris. He was emeritus professor of radiology at Washington University's Mallinckrodt Institute of Radiology. While the scientific world has lost an innovative researcher who fostered collaboration among scientists and clinicians from various disciplines in order to achieve improved medical imaging, we at Mallinckrodt Institute have lost a dear friend and colleague.

Born on April 21, 1925, in Berlin, Michel Ter-Pogossian was the only child of Armenian parents who had settled in Germany after escaping ethnic persecution in their homeland following World War I. The family moved to France when Michel was a young child. His fascination with science began as a youngster and was fueled by experiments involving his toy physics and chemistry kits. He later earned

degrees in science from the University of Paris and from the Institute of Radium in 1943 and 1946, respectively. It was in 1946 that Ter-Pogossian came to the United States to further his education, an outgrowth of his father's concern about young Michel's involvement with the war resistance efforts in France.

Ter-Pogossian was drawn to Washington University in large part by the reputation of Arthur Holly

Compton, a physicist and a Nobel laureate, who was the university's chancellor. In 1946, while studying for his degree, Ter-Pogossian worked in the Department of Physics as a research assistant. He received a master's degree in 1948 and a doctoral degree in nuclear physics in 1950. He joined the faculty of Mallinckrodt Institute in 1950 and was appointed as professor of radiation sciences in 1961. He also held a joint appointment as professor of biophysics in physiology. In 1973, he was named head of Mallinckrodt Institute's Division of Radiation Sciences, but the self-professed "research junkie" missed devoting his full time to laboratory work. In 1990, he stepped down from his administrative duties to return to his first love: research.

Among his many accomplishments, Michel Ter-Pogossian will foremost be remembered as the "father of PET." In the early 1970s, he led a collaborative research team of physical scientists, chemists, and physicians who developed the concept of positron emission tomography (PET). A major medical contribution, PET displays actual metabolic activity within different regions of organs and tissues, thereby extending scientists' and physicians' understanding of basic biological processes and providing a basis for the improved diagnosis of diseases. He played a major role in developing the concept of short-lived isotopes

and in designing and constructing the first PET scanner as well as the first multislice and the first time-of-flight PET scanners.

During a career that spanned more than four decades, he earned numerous accolades for his achievements in nuclear science, including France's Gold Medal Award of the Société Française de Médecine Nucléaire et de Biophysique, Canada's prestigious Gairdner Award, St. Louis' Peter H. Raven Lifetime Award of the Academy of Sciences, as well as the Society of Nuclear Medicine's Georg Charles de Hevesy Nuclear Medicine Pioneer Award and the Paul C. Aebersold Award. Ter-Pogossian was a member of many professional societies. He was elected in 1987 to the Institute of Medicine and served on the editorial boards of major scientific journals, including the *American Journal of Roentgenology*, the *Journal of Nuclear Medicine*, and the *Journal de Biophysique & Médecine Nucléaire*.

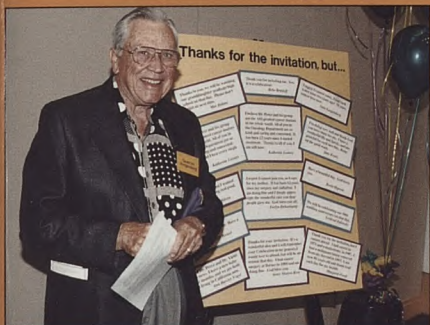
Dr. Ter-Pogossian was a prolific author, with more than 250 papers and book chapters to his credit, and was a charter member of the American Nuclear Society and a fellow of the American Physical Society. In addition, he was a past trustee of the Academy of Sciences of St. Louis and served as an advisor for several Department of Energy and National Institutes of Health committees.



JUNE 1, 1996



1 Chancellor Mark Wrighton, Dr. Todd Wasserman, and Christine Bowman, a former patient of Dr. Wasserman's.



2 Quentin Ringenberg travelled from Naples, Florida, to attend the celebration.



3 Mr. and Mrs. Harold Gilling

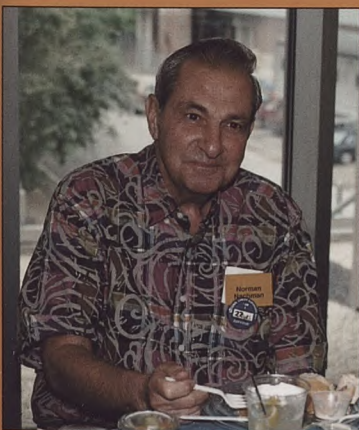


4 Norman Nachman, cancer-free for 22 years.



5 The Cancer Information Center was one of the stops on the guided tours.

6 Anne and Sam Flora, both cancer survivors, with daughter Elizabeth.



7 Bernadette Randle (center, shown with family members) spoke about her successful fight against lymphoma.



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FOCAL SPOT

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