RETHINKING THE APPROACH TO RADIATION TREATMENT
Perry Grigsby, MD, MBA, professor of radiology, (shown with Astrid Morrison, MD, radiation oncology chief resident, 1995-1996) is the 1995 recipient of the Radiation Oncology Teacher of the Year Award. Now in its seventh year, the award is presented annually to the MIR faculty member who made a significant contribution to resident education. Past award earners are Susan Shapiro, MD - 1989; Carlos Perez, MD - 1990; Perry Grigsby, MD - 1991; Jeff Michalski, MD - 1992; Russell Gerber, MS - 1993, and Mary Graham, MD - 1994.

An MIR faculty member since 1986, Grigsby is nationally recognized for his work in the clinical application of brachytherapy in the treatment of gynecologic cancers. He completed a radiation oncology residency at the Institute (chief resident, 1985-1986) and was twice named an American Cancer Society Clinical Fellow. In 1995, Grigsby was appointed as a fellow of the American College of Radiology.
CHERNOBYL—10 YEARS AFTER
Since many of the adverse health effects attributed to radiation exposure following the Chernobyl nuclear accident cannot be substantiated, researchers believe that the social ramifications of the accident may far outweigh the physical impact.

RETHINKING THE APPROACH TO RADIATION TREATMENT
A multi-institutional clinical trial that involves the transfer of patient records over the Internet and the delivery of high doses of radiation using 3-D conformal radiotherapy is charting a new course in the treatment of prostate cancer.

ER—EMERGENCY RADIOLOGY
With the addition of attending radiologists to the staffs of the Medical Center’s emergency rooms, Mallinckrodt Institute is helping to set a standard in the evolving role of emergency and trauma medicine.

ON THE COVER:
For the past 10 years, Mallinckrodt Institute of Radiology’s clinicians and physicists have played an important role in the development of three-dimensional radiation treatment planning and conformal therapy, perfecting methods for delivering high-energy radiation safely and more precisely to the tumor site while sparing surrounding healthy tissue.
Dr. William Peck, executive vice chancellor for medical affairs and dean of Washington University School of Medicine, and Dr. Emily Smith at the AOA ceremony.

**MIR on the move in NIH funding**

The “NIH FY 1995 Extramural Awards to Medical Schools” report had some good news for the Institute. In a field of 64 medical school radiology departments, MIR ranks number two in National Institutes of Health (NIH) research funding — following the perennial leader, University of Pennsylvania. Rounding out the top 10 list are Duke, University of California at San Francisco, Stanford, Johns Hopkins, University of Washington, University of Michigan, Yale, and Case Western Reserve.

“The listing of annual NIH Extramural Awards is an objective measurement of research productivity,” says MIR Director Ronald Evens. “In the past four years, the Institute has steadily progressed from a respectable tenth place nationwide to the number two spot this year. Congratulations to all the MIR clinicians and scientists who made this progress possible and whose expertise will someday move the Institute into the coveted first place.”

**Smith elected to AOA**

In recognition of her important contributions to medical care and medical academic programs, Emily Smith, MD, assistant professor of radiology, was elected as a member of the Washington University Chapter of Alpha Omega Alpha (AOA) Honorary Medical Society. As guest speaker at the initiation ceremony in March, Washington University Chancellor Mark Wrighton officially welcomed Smith and 25 other new members into the prestigious AOA.

An MIR faculty member since 1972, Smith received her undergraduate and medical degrees from Washington University and completed three years of radiology training at the Institute. She also completed a one-year rotating internship at Parkland Memorial Hospital in Dallas, Texas.

Smith, a diagnostic radiologist, has focused her MIR clinical efforts in the areas of musculoskeletal and gastrointestinal imaging. From 1972 to 1985, she was director of Queeny Tower radiological services. She now covers musculoskeletal radiology and breast imaging services at the Institute and general diagnostic imaging at Barnes-Jewish West County Hospital.

An active member of the Washington University Medical Center Alumni Association, Smith currently chairs the Annual Fund Committee. According to Dr. John Davidson, a member of the AOA nominating committee and a former Alumni Fund chairman, “The Alumni Association sponsors numerous academic programs with monies from the Annual Fund. The success of this effort has been due in a significant way to Doctor Smith’s enthusiasm for these programs and her business acumen.”

**Evens receives Justice Department commendation**

Each year healthcare fraud drains thousands of dollars from our national and state treasuries. In an era of healthcare reform, a renewed emphasis is being placed on the detection and prosecution of fraud cases. In recognition of his assistance in a successful prosecution case, Ronald Evens, MD, professor of radiology and director of The Mallinckrodt Institute of Radiology, received the United States Department of Justice’s Certificate of Commendation awarded by Attorney General Janet Reno. Evens is one of the few persons outside of the Justice Department to receive a Certificate of Commendation — an honor usually reserved for Department agents and attorneys. In a letter from the office of the U.S. Attorney, Southern District of Illinois, Evans was commended for his “absolutely outstanding job during the presentation of the government’s case.”
Abdominal Radiology earns top award

For the third time in four years, an MIR faculty member garnered the Hounsfield Award for outstanding computed tomography (CT) research. James Brink, MD, associate professor of radiology and chief of abdominal radiology; Harvey Glazer, MD, professor of radiology; and Ge Wang, PhD, assistant professor of radiology. The researchers found that pulmonary emboli were less obscured by dense contrast material, and thus more easily detected, by using helical (or spiral) CT with an optimal display window. The project was supported by grants from Siemens Medical Systems and Mallinckrodt Medical, Inc.

Ty Bae, MD, PhD, assistant in radiology, and Elizabeth McFarland, MD, assistant professor of radiology, received cum laude awards for "Computer simulation of CT contrast enhancement: prediction of aortic and hepatic enhancement during abdominal CT" and "Qualitative evaluation of cystic renal masses by CT," respectively.

Radiation Oncology reference published

The Radiation Oncology Center's James Purdy, PhD, and Bahman Emami, MD, are the editors of a comprehensive reference on innovative approaches to conformal therapy — the delivery of high-energy radiation safely and more precisely to the tumor site while sparing surrounding healthy tissue — and the use of 3-D radiation therapy planning. Published in January of this year, 3D Radiation Treatment Planning and Conformal Therapy is a compilation of the proceedings of an international symposium sponsored by Washington University School of Medicine and Mallinckrodt Institute in April of 1995.

The book's 38 chapters provide clinicians and physicists with a valuable tool in understanding the implications of 3-D radiation therapy in an era of image-based medicine. Published by Medical Physics Publishing, Madison, Wisconsin, the book presents the research and clinical findings of the more than 30 radiation oncology experts who served on the faculty of the 1995 symposium. Topics include computed tomography simulation, 3-D dose calculation algorithms and treatment aids, stereotactic and brachytherapy, and treatment delivery and verification.

Purdy, professor of radiology and chief of radiation oncology physics, is director of the Quality Assurance Center for a multi-institutional dose-escalation study funded by the National Cancer Institute and the Radiation Therapy Oncology Group (RTOG). Emami, professor of radiology and clinical director of the Radiation Oncology Center's 3-D program, chairs RTOG dose-escalation studies using conformal radiation therapy in lung cancer.
During a routine shutdown of one of the four reactors housed at the Chernobyl Nuclear Power Station, two rapid-succession explosions blew off the roof of Unit 4, exposing the reactor core. The accident resulted in the largest, short-term environmental release of a single source of radioactive material ever recorded.

The intense drama that followed was straight out of a Hollywood action movie: A self-sustained, uncontrolled nuclear reaction melted the reactor's fuel rod assemblies. Molten fuel disintegrated the concrete-and-steel floor of the reactor housing. The mix of intense heat and moisture caused steam explosions that hurled concrete, graphite, and other debris through the hole in the roof. Within seconds of the explosions, massive plumes of radioactive smoke rose into the atmosphere, spreading far beyond the facility.
explosion, smoke, fumes, and radionuclides (including radioiodine, caesium, strontium, and plutonium) shot up through the opening. The mile-high plume of contamination drifted through the atmosphere, eventually filtering into the western portions of the Soviet Union, eastern and western Europe, and, to some extent, throughout the Northern Hemisphere. Alarms blared as fires, steam, and dust filled Unit 4. Flames danced along the roof of an adjoining turbine building while regional fire units and rescue workers rushed to the scene. Radioactivity was released for ten days while helicopters pilots made hundreds of trips to the site, dropping tons of heat-absorbent and filtering materials onto the exposed reactor core.

By Vicki Kunkler
DURING THOSE TEN DAYS, AN UNEVEN PATTERN OF
radioactive fallout resulted from sporadic, and often heavy, rainfall and changing wind directions.

The explosion destroyed most of the plant’s radiation monitors, initially hampering any measurement of radiation levels. It is now believed that radiation levels in some areas of the plant exceeded 10,000 rads per hour; these radiation levels would result in lethal radiation exposure in less than six minutes. At the time of the explosion, 444 workers were on-site. Within hours of the accident, 203 workers and rescue personnel were suffering from immediate, acute effects of radiation exposure; 29 eventually died. Two individuals died immediately from blast and thermal injuries.

In the days following the explosion, 135,000 inhabitants of towns within 18 miles of the power plant were evacuated. Subsequent radiation exposure evaluations indicated these citizens received approximately 12,000 millirems of radiation — or 40 times more radiation exposure than the 300 millirems of naturally emitted radiation from cosmic rays, the earth, and the atmosphere.

At the request of the Soviet government in October of 1989, the International Atomic Energy Agency (IAEA) formed a multinational team of experts from 25 countries and seven organizations to conduct radiological assessments of the three areas affected by the nuclear accident — now known as the Ukrainian Soviet Socialist Republic, the Byelorussian Soviet Socialist Republic, and the Russian Soviet Federated Socialist Republic. Mallinckrodt Institute’s Dr. Henry Royal, an internationally renowned expert in radiation exposure, and Dr. Fred Mettler of the University of New Mexico School of Medicine were co-leaders of the IAEA’s medical effects team. For the IAEA mission, Royal travelled twice to Chernobyl to examine adults and children who were living in the most contaminated areas outside of the 18-mile contaminated zone.

ADVERSE HEALTH EFFECTS CANNOT BE SUBSTANTIATED

In the years following the explosion, there has been extensive interest in the health effects as well as the social and economic consequences of the accident. Estimates of the long-term consequences vary, but the general scientific consensus is that many of the adverse health effects attributed to radiation, which have been widely reported in the media, cannot be substantiated. Royal uses the cleanup workers as an example. There were more than 500,000 workers (called liquidators) who were brought in from all parts of the Soviet Union. Approximately 200,000 of these workers may have been exposed to as much as 25 rems of radiation. Scientists estimate that a small increase in the incidence of cancers may be measurable if these workers are carefully studied throughout their lifetimes. A definitive scientific study will be difficult, and costly, for several reasons: First, after the work was completed, the liquidators returned to their homes; consequently, there is no one village or town to use as a study base for the liquidators. Second, in order to determine the effect from the radiation dose, both the radiation dose and the effect must be carefully documented. Unfortunately, the dose to each cleanup worker was not reliably recorded. In addition, to measure the effect, the incidence of cancer must be accurately tracked over the lifetime of the workers; the infrastructure required for this task is not present in the former Soviet Union.

According to Royal, the diagnostic capabilities of the health care system in the former Soviet Union is vastly inferior to those of developed countries. Even if the accurate diagnosis of cancer were possible, a reliable system for tracking the diagnosis centrally would be needed; the methods used to track health statistics in the Soviet republics are primitive at best.

"WE FOUND THAT OVERALL THE PEOPLE, ESPECIALLY THE CHILDREN, WERE SURPRISINGLY HEALTHY."
—HENRY ROYAL, MD
of illnesses among the residents living in the most contaminated areas outside of the evacuation zone, Royal and medical teams went into these areas to examine approximately 2,000 patients. “We found that overall the people, especially the children, were surprisingly healthy,” says Royal. “Most of the children’s health problems could not be attributed directly to radiation exposure but rather to malnutrition or stress.”

Subsequently, scientists did find a measurable increase in thyroid cancer in children who had been living in the evacuation zone; however, the incidence of cancer in the Soviet Union had been on the rise for a decade preceding the Chernobyl accident. Royal says that the statistics “were very confusing,” and the cases of thyroid cancer “occurred earlier than expected” and “with greater effect than expected.” This may have been the result of two factors: the method of data collection and the distribution of stable iodine to evacuation-zone residents. “The combination of radiation exposure and more iodine in the diet than was normal [a result of the stable iodine that was given to evacuees] may have resulted in the higher incidence,” Royal adds.

And there were other complications. Due in part to the Soviet governments’ desperate economic situation, there was no unified study. Medical teams from many organizations, all working independently, were encouraged to provide clinical assistance. Further compounding the problems, medical research negotiations had to be made with three different governments, and the terms of the negotiations were subject to constant change. Plus, the release of radioactivity occurred over a ten-day period and was deposited in uneven amounts in different areas, resulting in a number of variables that affected a person’s radiation exposure. For example: Was he indoors or outdoors at the time of the accident? Was it raining? Was she given potassium iodide to counter the effects of the radioiodine? What foods had been eaten? Were the foods produced locally or imported?

**Social impact versus physical impact**

However, as Royal points out, quantitative estimates of the expected increase in the incidence of disease due to radiation exposure for many of the populations are very small and unlikely to be detected. “With any type of nuclear accident, we must weigh the social impact against the physical impact,” says Royal. “Chernobyl makes us ask a lot of questions that are universally applicable. For example, what does the word ‘contaminated’ actually mean? Although none of us would choose to live in a contaminated area, the risk of living there might be very small. Living in a contaminated area might increase your risk of dying from this substance by one in ten thousand or one in a million. It’s a very, very small risk but has a large impact on how we think. We have to be careful as a society that we don’t let the words hamper us. When it comes to protecting the population’s health, we must understand where the big risks are and whether or not we can change those risks.”

In the United States as in the Soviet republics, perinatal care, drug abuse, and alcoholism are among the major causes of ill health. While governments are willing to spend millions of dollars on nuclear waste cleanup, Royal believes that it is more rational to spend one-tenth of the allocated monies on waste cleanup and the balance on problems that will have a much greater impact on the public’s health.

During Royal’s participation in 1990, the IAEA medical effects team examined patients from the settlements of Novozyblov, Surazh, Unecha, and Zlynka.
HE USES ST. LOUIS AS A GOOD EXAMPLE OF THE RISK

from radiation exposure versus acceptability of that risk. "Quantitative risk analysis shows that the health risk from nuclear waste in Weldon Springs, the airport, and other areas is extremely small, with the maximum possible dose around a very low ten millirems per year," he says. "Why, radiation workers — X-ray technologists are an easily identifiable reference — are allowed a maximum yearly exposure of five thousand millirems. We are all exposed to two hundred millirems from radon in our homes. If we wanted to decrease the public's exposure to radiation, radon abatement programs would be much more cost-effective than current waste cleanup programs."

“But even a small risk can be viewed as unacceptable based on whether it is a voluntary or involuntary risk, it is shared equitably, and the benefits are less than the risk. Individuals perceive as unacceptable a risk that is involuntarily imposed by a powerful outside factor, such as the government, or one from which the individual receives no benefit from accepting the risk,” Royal continues. “Unfortunately, the more time and money that is spent protecting the public here and abroad from small but unacceptable risks, the less resources that will be available to combat much larger but acceptable risks, like malnutrition and smoking. We all have a great deal to learn from the Chernobyl accident.”

All photos included in this article were taken during Dr. Royal's trips to Chernobyl.
RETHINKING THE APPROACH TO RADIATION TREATMENT
At Mallinckrodt Institute of Radiology (MIR), a team of radiation oncology specialists is leading a national study to determine whether or not significantly increasing the radiation dosage for patients diagnosed with prostate cancer improves tumor control — and ultimately, cancer survival — without causing harmful side effects. Funded by the National Cancer Institute (NCI), the dose escalation study is symbolic: It is the first time that high doses of radiation have been administered using three-dimensional conformal radiotherapy in a multi-institutional clinical trial, and the auditing process involves the transfer of patient records over the Internet.

Now in its second year, the study involves 170 patients and 11 healthcare facilities. All of the patients have been diagnosed with early-stage cancer — stages A, B, or C — that has not metastasized to tissues outside the prostate. Those patients in whom the cancer has spread (stage D) are not candidates for the study because local radiotherapy would not be effective.

Mallinckrodt Institute is the NCI-designated Quality Assurance Center. Images of each patient’s prostate, the surrounding tissues, and the tumor area targeted for radiation are sent over a computer network and reviewed by MIR’s physicians and physicists. Results are then stored in a Washington University-developed database that will serve as a national resource for the analysis of similar dose-escalation programs.

By Barbara Yount
Researchers can now increase the doses of radiation to the highest levels ever because of the state-of-the-art technology of three-dimensional radiation therapy. Precise doses of radiation are delivered to the tumor site (called target volume) without “spilling” over to the surrounding healthy tissues.

According to Carlos Perez, MD, professor of radiology and director of the Radiation Oncology Center, “In treating prostate cancers with high-dose conformal therapy, we know that there is improved tumor control and a higher survival rate for patients.”

Three-dimensional radiotherapy “allows us to rethink the approach to treatment,” says Jeff Michalski, MD, assistant professor of radiology. “In the past, radiation oncologists treated tumors at the expense of surrounding normal tissues. But with 3-D we are able to approach therapy in an anatomical sense with a more precise definition of the target volume and normal structures. We can deliver high doses of radiation therapy to the tumor, and ultimately the tumor is sacrificed — not the normal tissues.”

The focus of the study is to determine the toxicity and side effects from the increased levels of radiation and to gauge tumor control and patient survival. The research promises an effective treatment for the more than 100,000 men, typically in their mid-to late 60s, who are diagnosed each year with prostate cancer. It is the most commonly detected cancer in men, due in part to the improved screening techniques for prostate cancer.

Eventually, the study will benefit referring physicians in managing the disease after treatment since their patients will have fewer complications and side effects. “We know that for prostate cancer, the higher doses of radiation are more likely to result in a cure, but we want to be sure that the tissue can tolerate the doses without the risk of complications,” says Michalski.
Common side effects of radiation treatment include irritation of the rectum, with diarrhea and bleeding occurring in five to 10 percent of cases. About two percent of patients develop rectal ulcers, which usually heal and are not long-term. Located below the bladder and surrounding the first section of the urethra, the prostate is the male sex gland that produces semen. Nerves along the prostate area are often unaffected in radiation treatment, but when they are, impotency results. As many as one-third of patients become impotent.

While the traditional or standard level of radiation dosage is from 6,400 to 6,800 rads, the study is designed to escalate dosage in three phases: increasing the standard dosage to 6,840 rads; next, raising that dosage to 7,380 rads; and finally, taking the dosage to 7,920 rads.

Ultimately, a database rich in clinical information will provide physicians with information about the expected complications, cures, and side effects of 3-D conformal radiotherapy in treating prostate cancer. In two years, the study will determine the effect of radiation on normal tissue. The cure rate will take longer to determine because it will entail a randomized study to compare standard doses with the higher levels, says Michalski.

The research promises an effective treatment for the more than 100,000 men who are diagnosed each year with prostate cancer.

The Radiation Therapy Oncology Group established a 3-D Quality Assurance Center at MIR, providing a $250,000 NCI grant to monitor multi-institutional clinical trials. James Purdy, PhD, a professor of radiology and chief of radiation oncology physics, serves as director of the Quality Assurance Center. “We had to develop the QA criteria for the studies, establish a mechanism for the planning and verification, and establish the quality assurance review process,” says Purdy.

In addition to Drs. Michalski and Purdy, a team of physicists and computer scientists comprises the 3-D Quality Assurance Center. MIR’s William Harms, BS; Walter Bosch, PhD; and Thomas Lakanen, MME; and Michael Kahn, MD, assistant professor of medicine at Washington University School of Medicine, are key members of this important staff.
Using the 3-D treatment planning tools, therapy was specifically planned for this prostate cancer patient. Shown is a front-to-back image of the tumor and the surrounding organs.

The use of the Internet for data exchange is a unique development. While the protocols for most clinical trials are reviewed on paper, this study involves the capturing of a patient’s computed tomography (CT) scan over a computer network. The image allows researchers to make quantitative assessments and verification of patient treatment based on the contours of the region to be treated and the structures as defined by the institution transmitting the data. In addition, researchers can study the dose distribution and determine whether or not it conforms to the protocol.

As Michalski pores over Internet-transmitted CT scans, with red-dashed lines etching the outline of the area receiving treatment, he explains that the audit entails looking for irregularities, both in the treatment and in the prostate itself. The virtuosity of the study is “only as strong as the weakest link,” he says. Michalski has found errors, largely minor flaws, in about 10 percent of the 150 cases he has reviewed. “It’s definitely helpful to have someone looking over your shoulder,” he says. “It provides a little assurance — a good feeling that you’re doing the right thing.”
After Michalski reviews the clinical image information, a physicist correlates that data with the allotted radiation dosage. The physicist also checks that the calculations allow a protected margin of five to 10 millimeters around the prostate. Then he checks the integrity of the data and prepares files for entry into the database.

A unique development — the capturing of a patient's CT scan over a computer network.

“The QA Center is now developing a clinical/image query-able database,” says Purdy. “Once it is developed, we will be able to correlate clinical results with planning and verification data. This will enable researchers to quantitate tumor control probability and normal tissue complication probability to a degree that was just not achievable before.”
Two years ago, when Francis Davis learned he had prostate cancer, he was determined to have a positive attitude despite the unknown prognosis of a disease that robs many men of their virility.

Davis, now 78, had gone for a routine physical in the spring of 1994 at his wife’s request. He had been tiring easily. His last physical had been during World War II, in December of 1941, by a Navy physician.

A high level of prostate antigen showed up on Davis’ prostate cancer screening test, and that led him to Gerald Andriole, MD, a Washington University School of Medicine assistant professor of urologic surgery who is on staff at Barnes-Jewish Hospital. A biopsy in May of ‘94 confirmed that Francis Davis had prostate cancer.

Meanwhile, Davis engrossed himself in learning about prostate cancer. He joined a cancer support group. He learned that he could have his prostate removed surgically, called a radical prostatectomy that is used in nearly 75 percent of the prostate cancer cases in St. Louis. He also could opt for radiation therapy. Or, he could do nothing about the cancer and hope that its progression into the bone and surrounding tissues would be slow.

“I was firmly convinced that if I had my prostate removed, it would affect the quality of my life so drastically that I would dread it,” says Davis.

Instead, Davis chose radiation therapy. In September, a pelvic lymph node biopsy assured that Davis’ cancer was confined in the right side of the prostate and insured his eligibility for 3-D conformal radiotherapy. He met with Mallinckrodt Institute’s Dr. Jeff Michalski, who explained the advanced technology and precision of three-dimensional radiation therapy.

“I knew if I didn’t take this treatment, my chances of survival would go right out the window,” says Davis.

Davis is one of 70 prostate cancer patients treated so far at the Institute who are part of the NCI study monitoring the effects of increased radiation levels in reducing tumors. He was among the first group of patients who received 38 radiation treatments of 6,840 rads over eight weeks.

Davis is now cancer-free; his prostate antigen count is well within the normal range. But Davis is still an important part of the study, says Michalski. He returns to the clinic quarterly for follow-up appointments to determine if there are any ill effects from the radiation treatments.

Davis, a retired McDonnell Douglas systems engineer, now has time to enjoy his nine grandchildren and the sunroom where he and his wife tend colorful orchids and Easter lilies. And he has plenty of time to give to the Boy Scouts of America. A member since 1929, Davis has accrued many awards, including the Scouts Key, the District Award of Merit, the Arrowhead Honor, and the Silver Beaver Award.

He no longer tires as easily, but Davis concedes that he sneaks in a 45-minute nap each afternoon. After all, he says, “It helps me get through the day.”
It’s 7 a.m., and in a small, darkened room behind the Barnes-Jewish Hospital’s South Campus Emergency Room, it is time for the daily read-out session. Huddled in front of the 50-panel light box, Clark West, MD, assistant professor of radiology and director of emergency and trauma radiology, reviews the night’s radiology cases with the residents who handled them. He scrolls through the films, double-checking diagnoses: a woman with right upper lobe pneumonia; a young man on the drug PCP who walked into the side of a bus and escaped with cuts and bruises.

by Candace O’Connor
The instant he sees one film, West recognizes the patient, a man with hypertrophic cardiomyopathy. "Why, he has been coming in ever since I was a medical student," says West, a 1986 Washington University School of Medicine graduate, who was also a diagnostic radiology resident and musculoskeletal fellow at Mallinckrodt Institute of Radiology (MIR). The man needed treatment for abdominal pain but on the whole, says West nostalgically, "He's doing all right, looking pretty good."

These crisp, black-and-white radiographs keep few secrets. Dreadlocks appear as shadowy strings. Hearing aids, zippers, and gold tooth-ornaments stand out in high relief. A woman complaining of back pain, grumbles West, would probably feel a lot better if she discarded her tight corset, whose snaps are vivid on the screen.

Most important, these films chart the interior landscape of the body, revealing abnormalities. During this night, the residents have spent a good deal of time on one case: a woman who stepped out of her car and into the path of an oncoming vehicle, sustaining multiple bone fractures. The Emergency Room's trauma team resuscitated her, and she was rushed to the computed tomography (CT) scanner for the first of many tests that would disclose the extent of her injuries.

As usual, the residents on duty have done a fine job with all these cases. David Kim, MD, a second-year diagnostic radiology resident, and William James, MD, a third-year diagnostic radiology resident, made up the night’s call team, arriving at 5 p.m. and snatching a few hours’ sleep after 1 a.m. when the heavy evening workload tapered off. John Leahy, MD, a second-year diagnostic radiology resident, was the designated "night stalker" (a bit of hospital humor identifying the psychiatrist).
radiologist working the late shift), who came on duty at 6 p.m. and split his time between Barnes-Jewish and Children’s hospitals.

“They were handling some complex issues last night and that’s typical,” says West. “But the residents here don’t miss much. We have excellent residents—no place has better—and we watch their work closely, more than anywhere else in the country.”

For these residents and the attending radiologists who supervise them, the Emergency Room is an increasingly busy place. The total number of patients treated grows each year. The number of Emergency Room scans has also gone up — from 30,000 exams 10 years ago to more than 40,000 today.

The traditional practice model of these radiologists is changing, too. Except in special cases, they no longer sit in an isolated room reading stacks of film. “In the emergency department,” says West, “we like to see ourselves as diagnostic imaging consultants. We’re interpreting films, but we’re also helping to decide which examination is most appropriate, to advise people on the approach to a problem, to visit a patient if the findings are uncertain. We’re really in the middle of the whole process.”

That’s the exciting part for him, West says. “I’m not nearly as interested in the traditional idea of ‘read the films, doctor, and send out the report.’ I like the interactive aspect. It’s fun — and it’s also where, every now and then, I make a big difference in somebody’s care.”

As a field, West adds, radiology has been slow to get deeply involved in emergency room imaging. But as an institution, MIR has been at the forefront of this trend. Beginning in 1990, West’s two predecessors as director of emergency radiology — Fred Mann, MD, and Anthony Wilson, MB ChB — began working toward placing attending staff in the ER. Since West returned to the Institute in 1993 after a six-month fellowship in trauma radiology at the Maryland Shock Trauma Center, he has continued to move in the same direction.

During the daytime, a first-year resident and an attending radiology staff member are typically on duty in the Emergency Room. Twice a day, an attending neuroradiologist also stops by to review neuro CT films. “It’s a good system,” says West. “The radiologists in the ER are able to render timely interpretations. We have the benefit of additional experience whenever we need it. Similar consultation is available from our colleagues in chest and abdominal imaging.”
West has also pressed for other changes. Just completed this spring, a large reading room, close to the Emergency Room, is equipped with the latest in workstations and light boxes for convenient, high-quality film viewing.

All of these improvements mean better patient care in the Emergency Room, a place that has become increasingly effective during the tenure of Tim Buchman, MD, PhD, professor of surgery and director of the trauma service, and Lawrence Lewis, MD, associate professor of medicine and director of emergency medicine. It is, however, seldom as glamorous or exciting as the popular television program ER. “Some ninety percent of the work is routine,” says West. “Then every once in a while you have an absolute crisis for which you have little or no warning.”

The Barnes-Jewish Hospital ER treats several categories of patients, he says. Most urgent of all are the victims of a bad fall or a high-speed auto accident who arrive by ambulance or helicopter. These cases take the expertise of the trauma team: 12 specially trained people from around the hospital who drop everything and rush to the Emergency Room to await the patient’s arrival. An emergency radiology resident or attending radiologist will stand just behind the frontline team members, ready to provide advice on imaging care.

The traditional role of emergency room radiologists is changing.

A second kind of case is a medical emergency, such as a patient in cardiac arrest. The situation is still urgent but less time-intensive than a major trauma case. In this situation, chest films will be taken by the radiology technologists; a radiologist will view the films and hurry to the patient’s side to discuss the interpretation of the study.

Last are the routine cases, such as broken arms. “There is always a competition in the Emergency Room between the critically ill patient and the routine patient,” says West. “The person who comes in with a broken arm will be taken care of on a first-come, first-served basis, unless there is some medical reason to move that patient ahead.”

The kinds of cases also vary by season. On icy winter days, Emergency Room staff see a large number of ankle and wrist fractures; pneumonia and hypothermia are also common. Summer is the time for firecracker injuries, bike accidents, and increased numbers of gunshot wounds and high-speed motor vehicle accidents. Friday and Saturday nights are the heaviest. Resident call-teams are on staff those evenings, and attending emergency radiologists stop by every 12 hours to review the films and double-check the diagnoses.

As resources permit, West wants to move toward increased attending coverage in the Emergency Room. Ideally, he would like to see two shifts of attending radiologists, covering 18 hours each day. Whenever they were not on-site, the radiologists would be available at home via a teleradiology transmission system.
In fact, West is taking a close look at the whole field of electronic radiology, which would allow high-speed communication links with affiliated hospitals. He has also been planning for the future by examining new equipment. A comprehensive, 200-patient study, just begun this spring, is evaluating the diagnostic performance of a new Kodak computed radiography system in detecting musculoskeletal fractures.

4,000 such patients each year, “our major contribution may be setting a practice pattern that can work for the long term and thoroughly investigating how electronic radiology fits into that model.”

Overall, the Institute is trying to build a nationally prominent emergency radiology program, and we have already gone a long way in that regard,” he says. While the Barnes-Jewish Hospital ER, which admits more than 1,000 major trauma patients annually, is not the size of the largest trauma centers in the country that serve

**The Institute is building a nationally prominent emergency radiology program.**

— in the retroperitoneum (behind the peritoneum or membrane lining the abdominal and pelvic walls and the undersurface of the diaphragm). The staff will follow the patient closely to see whether this suspicious area poses a problem.

“We have a very strong commitment,” says West, “to doing the best possible imaging on all of our patients.”

During the 7 a.m. readout, Daniel Kida, MD, chief of MIK’s neuroradiology, reviewed neuro CT films.
THE DIRECTOR’S OFFICE REPORT

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

PROMOTIONS
Timothy McCarthy, PhD, instructor in radiology, was promoted to assistant professor of radiology, Division of Radiological Sciences.

Ming Xu, MS, research associate was promoted to research instructor, Division of Nuclear Medicine.

NEW STAFF
Georgi Daskalov, PhD, research associate, Radiation Oncology Center.

OFF STAFF
Enrique Cubillo, MD, assistant professor of clinical radiology, Division of Diagnostic Radiology, and chief of the Department of Radiology, St. Louis Regional Medical Center, has accepted a position in the Department of Radiology, Mercy Hospital, Wilkes-Barre, Pennsylvania.

Nilesh Gohel, MD, research assistant in radiology, Division of Radiological Sciences.

Song Lai, graduate research assistant, Division of Radiological Sciences.

Zhao Hai Li, PhD, assistant professor of radiology, Division of Radiological Sciences.

Higinia Cardenes Perera, MD, assistant in radiology, Radiation Oncology Center.

Milorad Rogic, PhD, adjunct professor in radiology, Division of Radiological Sciences.

Helmut Stark, research assistant in radiology, Division of Radiological Sciences, has accepted a position with Siemens Medical Systems in Erlangen, Germany.

Christopher Ullrich, MD, adjunct professor in radiology, Division of Radiological Sciences.

Mary Vest, MD, assistant in radiology, Radiation Oncology Center.

APPOINTMENTS/ELECTIONS
James Brink, MD, associate professor of radiology, was appointed as the Institute’s codirector of computed body tomography.

Jay Heiken, MD, professor of radiology and chief of abdominal radiology, was appointed by the American College of Radiology to the Task Force on Continuing Competence and to the Committee on Drugs and Contrast Media of the Commission on General Radiology & Pediatric Radiology.

Eric Klein, MS, assistant professor of radiology, was appointed to a three-year term as a member of the American Association of Physicists in Medicine (AAPM) Radiation Therapy Committee.

FELLOWSHIPS/GRANTS
Ge Wang, PhD, assistant professor of radiology, as principal investigator, received a two-year grant of $50,000 from the National Institutes of Health to investigate “Spiral CT deblurring for in situ cochlear implant study.”

Michael Vannier, MD, professor of radiology, is coinvestigator; consultants are Margaret Skinner, PhD, associate professor of otolaryngology (audiology); Barbara Bohne, PhD, professor of otolaryngology (neurobiology); Gary Harding, MSE, research scientist of otolaryngology; and Zhao Hai Li, PhD, assistant professor of biostatistics and of radiology.

Michael Welch, PhD, professor of radiology and of chemistry, and codirector of the Division of Radiological Sciences, as principal investigator, received two renewal grants from the U.S. Department of Energy: a three-year grant in the amount of $711,000 for “Preparation of radiopharmaceuticals labeled with metal radionuclides” (Carolyn Anderson, PhD, assistant professor of radiology, is coinvestigator), and a three-year grant in the amount of $590,999 for “Labeling of receptor ligands with radionuclides.”
Pamela Woodard, MD, instructor in radiology, received a one-year Society of Thoracic Radiology Seed Grant for approximately $6,000 to investigate “Detection of pulmonary nodules and interstitial lung disease: comparison of ThoraVision digital hard-copy images with conventional wide-latitude asymmetric screen-film radiographs.”

**Honors/Awards**

By invitation of *NMR in Biomedicine*, a review article by Thomas Conturo, MD, PhD, assistant professor of radiology, and coauthors Robert McKinstry, MD, PhD, assistant in radiology; Joseph Aronovitz, PhD, medical student; and Jeff Neil, MD, PhD, assistant professor of neurology, is scheduled for an upcoming journal issue dedicated to diffusion imaging with MRI. The article, “Diffusion MRI: Precision, Accuracy, and Flow Effects,” is one of 10 invited review articles.

Elizabeth McFarland, MD, assistant professor of radiology, was selected by the United States Olympic Committee to serve on the Task Force on Women in Sports. As one of 50 members who were chosen from more than 200 nominees nationwide, McFarland will participate in the Women Olympic Leadership Development Program that is designed to increase the numbers of professional women involved in U.S. Olympic leadership roles.

**Senturia Lecture**

As part of the City-Wide Radiology Conferences, Jack Thornbury, MD, presented the Second Annual Hyman R. Senturia Lecture on March 11, 1996, in the Institute’s Scarpellino Auditorium. Thornbury, professor emeritus of radiology, University of Wisconsin School of Medicine, spoke on “Technology assessment, outcomes research, and decision making in diagnostic imaging.”

**Clark West, MD**

Clark West, MD, assistant professor of radiology and director of emergency and trauma radiology, successfully completed the Missouri ATLS™ Student Course. Sponsored by the American College of Surgeons, the Advanced Trauma Life Support curriculum tests the participant’s knowledge of state-of-the-art trauma care. Based on his outstanding performance during the skills assessment portion, West was recommended as an ATLS instructor.

**Lectures/Presentations**

Ty Bae, MD, PhD, assistant in radiology, spoke on “Computer simulation of CT contrast enhancement: prediction of aortic and hepatic enhancement during abdominal CT” at the Annual Meeting of the Society of Computed Body Tomography and Magnetic Resonance, Scottsdale, Arizona, March 17 - 22.

James Brink, MD, associate professor of radiology and codirector of computed body tomography, presented “Depiction of pulmonary emboli with helical CT: optimization of window width and level in a porcine model” and “Clinical strategies for maximizing longitudinal resolution with helical body CT,” and spoke at workshops on “Spiral CT of the chest” and “Spiral CT angiography” at the Annual Meeting of the Society of Computed Body Tomography and Magnetic Resonance, Scottsdale, Arizona, March 17 - 22.
Lectures/Presentations
continued from page 23

Jeffrey Brown, MD, associate professor of radiology, presented "MRI of the liver," "MRI of the kidneys and adrenals," "MRI of the heart and great vessels," and "MRI of the breast" at the Los Angeles Radiological Society Annual Meeting, January 19 - 22.


Elizabeth McFarland, MD, assistant professor of radiology, presented "3D virtual CT imaging" at a meeting of the Greater St. Louis Society of Radiologists, St. Louis, Missouri, February 20. She spoke on "Unraveling the G1 tract for virtual colonoscopic spiral CT" and "Qualitative evaluation of cystic renal masses by CT" at the Annual Meeting of the Society of Computed Body Tomography and Magnetic Resonance, Scottsdale, Arizona, March 17 - 22.

Jeff Michalski, MD, assistant professor of radiology, presented "The use of CT in virtual simulation" to the Greater St. Louis Society of Radiologists, St. Louis, Missouri, February 20. He spoke on "Practical issues in virtual simulation for radiation oncology treatment planning" at the State University of New York at Stony Brook, March 7. Michalski spoke on "Radiotherapy of prostate cancer" at the Cancer Research Center, St. Louis, Missouri, March 16.

James Purdy, PhD, professor of radiology and associate director of the Radiation Oncology Center, as a member of the symposium faculty, spoke on "Dynamic conformal radiotherapy - A new era" at the American Radium Society Annual Meeting, San Francisco, California, March 30 - April 3.

Marcus Raichle, MD, professor of radiology, of neurology, and of anatomy and neurobiology, and codirector of the Division of Radiological Sciences, as invited lecturer, presented "Brain imaging in the 21st century" as part of a new lecture series, the "21st Century Lectures," at Washington University, St. Louis, Missouri, February 29. As the Eighth Annual C. R. Stephen Lecturer, he spoke on "An expanded view of human memory systems" at Washington University, Department of Anesthesiology, St. Louis, Missouri, March 21.
Sixth-Floor Renovation

After Dr. Raichle’s lab vacated the Institute’s sixth floor for new space in the Imaging Center on Scott Avenue, the MIR plant facilities renovation team moved in. Dave Smugala (left) and Joe Quennoz added the finishing touches in time for the mid-April grand opening of the vascular and interventional radiology administrative offices.

Robert Swanson, MD, assistant in radiology, spoke on “Differential radioprotection of oncogene-transformed rat embryo cells by WR 1065 correlates with DNA supercoiling changes” at the meeting of the American College of Physicians, San Antonio, Texas, March 2 - 6.

Ge Wang, PhD, assistant professor of radiology, presented “Helical CT and cone-beam CT” at General Electric Medical Systems, Milwaukee, Wisconsin, January 30.

Eric Weidman, MD, assistant in radiology and 1995-1996 diagnostic radiology chief resident, spoke on “Gunshot wounds in the urban setting” at the David Grant Medical Center, Travis Air Force Base, Fairfield, California, December 11.

Michael Welch, PhD, professor of radiology and codirector of the Division of Radiological Sciences, as invited speaker, presented “Value of PET imaging for clinical cancer research” at the American Cancer Society’s 38th Annual Science Writers Seminar, San Francisco, California, March 24 - 27.


Darryl Zuckerman, MD, assistant professor of radiology, presented “Thrombolysis” and “Vascular interventions” workshops at the 21st Annual Meeting of the Society of Cardiovascular & Interventional Radiology (SCVIR), Seattle, Washington, March 5 and 6.
SYMPOSIA

MEDICAL IMAGING 1996
Newport Beach, California, February 10 - 15. Sponsored by The Society of Photo-Optical Instrumentation Engineers,
PACS DESIGN AND EVALUATION: ENGINEERING AND CLINICAL ISSUES
Gilbert Jost, MD, conference chairman.
Session 1: Storage Systems and Databases
Peter Shile, MD; Jennifer Freirnuth, *“Bibliographic database of PACS-related articles from the SPIE literature.” *Normandy Senior High School, St. Louis, Missouri.
Session 3: Imaging Standards
Stephen M. Moore, MS, “Observations on DICOM demonstrations at the RSNA annual meetings.”

Poster Session
Received an Honorable Mention Award
David Melson, BS, BA; Karen Gauvain, BA; Brian Beardslee, director of OEM business development***; Larry Burton, industrial engineer***.
James Blaine, DSc; Gary Brink, RT, BS****, “Methodology for cost-analysis of film-based and filmless portable chest systems,” *medical student, Saint Louis University, St. Louis, Missouri. **Kodak Health Imaging Systems, Dallas, Texas. ***Eastman Kodak Company, Rochester, New York. ****director, Department of Radiology, BJc Health System, St. Louis, Missouri.

SECOND INTERNATIONAL SYMPOSIUM 3-D RADIATION TREATMENT PLANNING AND CONFORMAL THERAPY
St. Louis, Missouri, April 11 - 13. Sponsored by the Radiation Oncology Center, Mallinckrodt Institute of Radiology, Washington University School of Medicine, and the Department of Radiation Oncology at the University of North Carolina.
Session 1: Measurements and Quantifications
Paul Commean, BEE; Kirk Smith, AAS; Michael Vannier, MD; Charles Hildebolt, DDS, PhD; Thomas Pilgram, PhD; James Cheverud, PhD; Gulab Bhatia, MS, “Precision and accuracy of 3D lower extremity residua measurement systems,” Washington University School of Medicine, St. Louis, Missouri.

SESSION I: 3-D TREATMENT PLANNING
Bahman Emami, MD, moderator.
James Purdy, PhD, “The evolution of 3-D treatment planning and conformal therapy.”
Jeff Michalski, MD, “The CT/simulation/3-D treatment planning.”

SESSION II: UNCERTAINTIES, TCP, AND NTCP
Jeff Michalski, MD, “Accounting for localization and organ motion uncertainty in treatment planning - A review.”
Bahman Emami, MD, “Impact of 3-D CRT in estimating NTCPs.”

SESSION III: TREATMENT PLAN OPTIMIZATION
James Purdy, PhD, moderator.
John Matthews, DSc, “Optimization using real-time 3-D planning.”

SESSION IV: PROSTATE CANCER: CLINICAL EXPERIENCE WITH 3-D CRT
Carlos Perez, MD, moderator.
Jeff Michalski, MD, “Update of the prostate 3-D CRT dose escalation study 94-06.”

SESSION V: MULTILEAF COLLIMATION/DYNAMIC WEDGE
Eric Klein, MS, “Implementation and clinical use of MLC.”

SESSION VI: LUNG CANCER: CLINICAL EXPERIENCE WITH 3-D CRT
Mary Graham, MD, “Washington University experience.”
Eric Klein, MS, “Clinical implications of heterogeneity corrections for lung cancer treatment.”
Bahman Emami, MD, “Update of the RTOG lung 3-D CRT dose escalation study 93-11.”

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SESSION VII: BEAM INTENSITY MODULATION
Daniel Low, PhD, "Beam intensity modulation using physical modulators (computer-controlled milling machine)."

SESSION VIII: CLINICAL EXPERIENCE WITH 3-D CRT
Mary Graham, MD, moderator.
Bahan Emami, MD, "Clinical experience with 3-D CRT treating head and neck cancer."

SESSION IX: RTP SYSTEMS/QUALITY ASSURANCE
Daniel Low, PhD, moderator.
William Harms, BS, "Comparisons of commercially available 3-D RTP systems."
James Purdy, PhD, "Quality assurance for 3-D CRT."
Walter Bosch, DSc, "Data exchange requirements for 3-D CRT multi-instrument clinical trials."

SESSION X: ECONOMICS/FUTURE DIRECTIONS
James Purdy, PhD, moderator.
Carlos Perez, MD, "Economics of 3-D CRT."

On February 29, 1996, the former Radiation Oncology conference room on the Institute's first floor was officially reopened by Carlos Perez, MD, director of the Radiation Oncology Center, and (right) Todd Wasserman, MD. Now known as the 1 MIR Conference/Workroom, the updated room is equipped with a computerized version of an opaque/transparency projector that can also be connected to the radiation treatment planning system. The room is used by faculty and staff for lectures, conferences, and patient-related work.

CALENDAR

American Roentgen Ray Society Annual Meeting
San Diego, California
May 5 - 10

City-Wide Radiology Conference
MIR's Scarpellino Auditorium
St. Louis, Missouri
May 13

Society for Pediatric Radiology Annual Meeting
Boston, Massachusetts
May 25 - 30

Society of Nuclear Medicine
Annual Meeting
Denver, Colorado
June 3 - 6

American Society of Neuroradiology
Seattle, Washington
June 21 - 27

American Medical Association
Chicago, Illinois
June 23 - 27
1895-1995

PRACTICAL ISSUES IN LEADING-EDGE RADIOLOGY

OCTOBER 11-13, 1996

A Symposium Sponsored by
The Mallinckrodt Institute of Radiology
and the Washington University
Office of Continuing Medical Education

Held at The Frontenac Hilton
Saint Louis, Missouri

Approved for 22.5 Hours of Category 1 CME Credit

For practicing radiologists, this three-day symposium offers seminars on leading-edge topics in radiology, including helical CT, MR angiography, CT angiography, and current neurointerventional techniques. William Reinus, MD, associate professor of radiology, is the symposium course director. Call Linda Macker at 314-362-2916 for registration information.
High-resolution radiographic image display produced by a new Super High Definition (SHD) digital imaging system is the focus of a Mallinckrodt Institute-based feasibility study. Developed by NTT Optical Network Systems Laboratories of Kanagawa, Japan, SHD image resolution of 2k x 2k pixels is presented from a multi-gigabyte display buffer at 60 frames per second. Under a one-year contractual agreement, MIR's James Blaine, DSc, director of the electronic radiology lab, and NTT's Tetsuya Fujii, PhD, senior research engineer, will explore the application of the SHD system in diagnostic radiography. SHD images are already being tested in other areas such as advertising and art restoration.

Top: Project researchers are (left to right) Blaine, Fujii, and Vivin Ramamurthy, graduate research assistant, Department of Electrical Engineering. Other coinvestigators from Washington University's Department of Computer Science are Jonathan Turner, PhD; Kamal Bhatia, graduate student; and Jerome Cox, ScD, who are studying the feasibility of using the SHD system to serve multiple, low-cost client display units via high-speed ATM networks.

Left: This photo was taken of an advertisement produced by the SHD system and displayed on the system's monitor. As a point of comparison, SHD monitor resolution is 2000 x 2000; high definition television (available commercially later this year), 1920 x 1125; standard broadcast quality TV, 640 x 480.