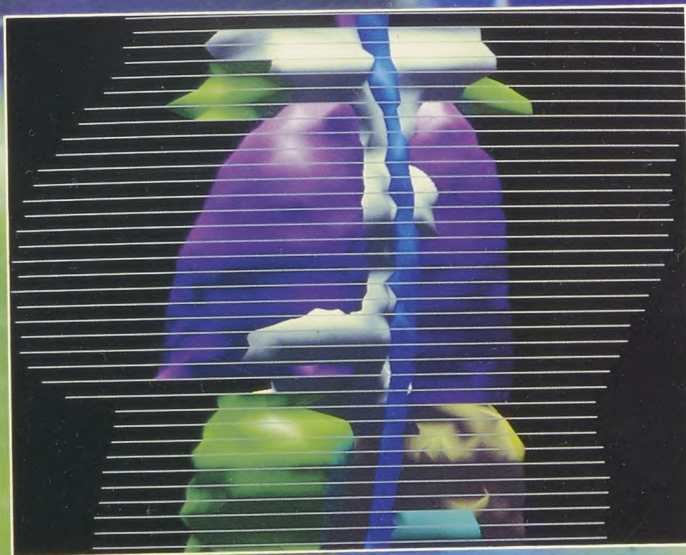


FALL/WINTER, 1988

VOLUME 19, NUMBER 3

FOCAL SPOT

MALLINCKRODT INSTITUTE OF RADIOLOGY



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**TREATING CANCER
IN THE NEXT CENTURY**



Steve Kohler

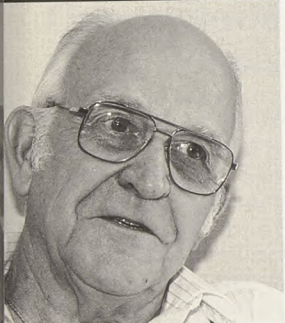
Juana Figueroa and her son, Rafael, share a quiet moment together at St. Louis' Ronald McDonald House. The Figuroas are in St. Louis from their home in Peru seeking treatment for Rafael.

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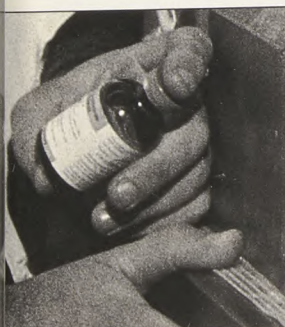
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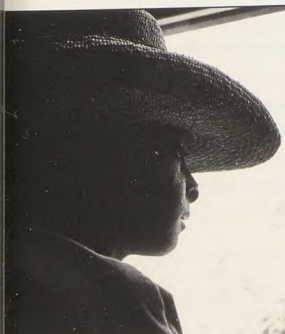
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ON THE COVER:

A manipulated image from the screen of a revolutionary treatment planning system suggests the speed with which radiation oncology is moving into the future. The patient's organs are displayed in individual colors, and the operator can manipulate the image for the clearest view. Photograph by Steve Kohler.

SPOT NEWS



Thomas Murry

Ex-Residents Return

When James W. Owen, M.D., finished his residency at Mallinckrodt Institute of Radiology five years ago, he left what had become a group of close friends to enter practice in Topeka, Kansas. St. Louis slipped into the past, but the memories created here remained important.

When the five-year milestone arrived, Owen began to imagine a reunion. Support among his colleagues from 1982, '83, and '84 proved strong, and the reunion was organized for the weekend of September 23 to 25, 1988, complete

Ex-residents returning for their reunion: (sitting) David DiSantis and Jill White Sullivan, and (standing, left to right) Floyd Scales, Dale Johnston, Bob Laakman, Jim McDonald, Jim Weinstein, Jerry VanDyke, and James Owen.

with a scientific session on Saturday and a trip to a Cardinals' baseball game.

Nine former residents were able to return to St. Louis for the refresher. Faculty members R. Gilbert Jost, M.D., and William A. Murphy, Jr., M.D., sat in on the continuing education session, and this year's co-chief resident Bruce Bower, M.D., led a tour of Mallinckrodt's newest facilities to bring the ex-residents up to date.

Lithotriptors Topic Of Symposium

The rapidly evolving science of biliary lithotripsy—the treatment of gallstones noninvasively with devices that fragment the stones via shock waves—was the subject of a three-day international symposium in mid-July. The first of its kind, the symposium was hosted by Harvard Medical School.

Second generation lithotriptors, potent gallstone solvents, and interventional procedures were the focus of discussion. Current knowledge was explored in detail by a 20-person guest faculty that included Mallinckrodt Institute's Bruce L. McClennan, M.D.

The presentation by McClennan, "Biliary Lithotripsy: Perspectives of a Uroradiologist," acquainted prospective users of the technology with the physical basis, clinical techniques, and initial results of the pioneering work with the Lithostar done at Mallinckrodt.

Murphy Called on as MRI Expert

The growing importance of magnetic resonance imaging (MRI) in the diagnosis and treatment of musculoskeletal conditions and Mallinckrodt's role as a leader in the field have been highlighted recently by a call for the expertise of William A. Murphy, Jr., M.D., professor of radiology.

On September 29, Murphy spoke at a conference of pharmaceutical firm scientists, academicians, and regulatory scientists from the Food and Drug Adminis-

tration (FDA) gathered for the first time to discuss the form and future of therapeutic drug trials in arthritis. He detailed the methods by which MRI might best be used to test the efficacy and safety of new arthritis drugs about to enter testing.

Two weeks later, Murphy addressed 40 experts gathered to develop an effective research strategy for diagnostic radiology for the next three to five years. Held to aid the National Institutes of Health and the National Cancer Institute with planning, the workshop presented Murphy with the opportunity to assist in setting a national agenda for the future of musculoskeletal MRI.

Murphy addressed both major MRI societies as an invited speaker at the 1988 annual meetings of the Society of Magnetic Resonance in Medicine (SMRM) and the Society of Magnetic Resonance Imaging (SMRI). Here, too, he discussed the state of the art and future of musculoskeletal MRI.

He also serves as an appointee to a three-year term on the Scientific Program Committee of the American Roentgen Ray Society.

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Grant Funds DNA Research

A five-year, \$350,000 grant from the National Cancer Institute will help Yvonne C. Taylor, Ph.D., assistant professor of cancer biology in radiology, better understand the precise conditions under which cells fail to recover from DNA damage produced by radiation.

Taylor studies potentially lethal damage (PLD), a class of cellular damage caused by radiation which is normally repaired. However, certain manipulations of post-irradiation conditions can cause cells to not recover from this damage. Although many agents are known that can alter PLD recovery, what makes this damage become lethal is not understood at the molecular level. Taylor's hypothesis is that the conformation of chromatin (DNA plus associated proteins)—which changes throughout the cell cycle and when cells go from a dividing to a non-dividing state—is a determining factor in recovery from PLD.

Says Taylor, "If we can manipulate the appropriate changes in DNA, then perhaps we can also manipulate the recovery ability of cells in tumors." By reducing tumor cell recovery, the effects of radiotherapy would be enhanced.

Rare Honor To Barry Siegel

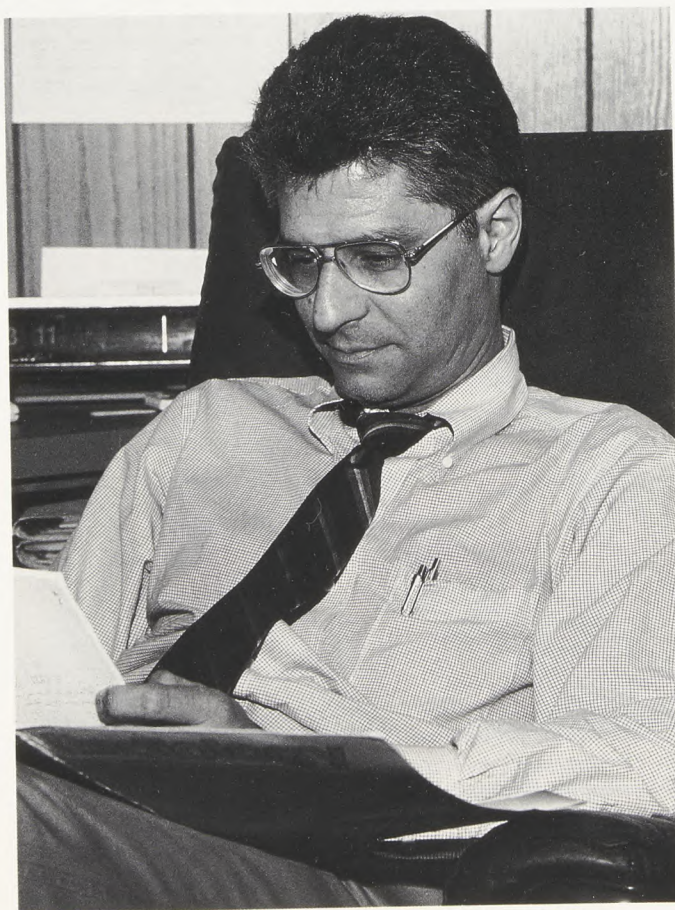
The special citation from the commissioner of the Food and Drug Administration (FDA) reads: "For exceptional leadership in influencing the scientific and regulatory environment of radiopharmaceutical drug development, reflecting unselfish and enthusiastic commitment to the FDA." The recipient: Barry A. Siegel, M.D., director of Mallinckrodt's Division of Nuclear Medicine.

Only a very few such awards are presented each year, granted at the commissioner's discretion to those whose contributions and accomplishments he chooses to honor. Siegel says his award was "totally unexpected," though his association with the FDA goes back to 1972 when, as a resident, he visited there for two weeks. At that time, the agency had just taken over responsibility for approving all radioactive drugs from the Atomic Energy Commission. Faced with a large influx of new drug applications, the administration brought in a few outside experts to help review those applications. Siegel was one of those called upon. Ever since, he has been a consultant to the FDA's Division of Oncology and Radiopharmaceutical Drug Products, traveling to Washington D.C. several times each year as an advisor and problem-solver.

During his years of service, Siegel says his two biggest contributions have been to oversee the development of guidelines for the clinical evaluation of radiopharmaceutical drugs and to promote a change in the method by which instructions and indications for a drug's use



The FDA Commissioner's medal



Barry A. Siegel, M.D.

are adopted. Because of his influence, the FDA first began to consider evidence from the academic literature as a basis for issuing guidelines regulating radiopharmaceutical use.

In his letter notifying Siegel of the award, FDA Commissioner Frank E. Young, M.D., Ph.D., wrote, "To be selected for special recognition should be most satisfying since accomplishments such as yours impact the well-being of the public."

Steve Kohler

SPOT NEWS



Residents, fellows, and trainees of Mallinckrodt Institute of Radiology for 1987-1988 were (front row) Doctors

Jonathan Wiener, Larry D. Schertz, David A. Thorne, R. Gilbert Jost, Bruce L. Bower, Lynn Barrett, Ronald G. Evens, Gary D. Shackelford, Scott N. Nadel, John T. Engels, Amy A. Mosher, V. Marie Tartar, Steven S. Eilenberg, Barbara A. Garner, (second row) Doctors R. Stephen Surratt, Paul D. Kountz, Jr., Charles F. Garvin, Johnson Liou, Steven L. Solomon, Ted J. Cardoso, David N. Rabin, M. Alan Burns, Scott D. Stevens, Michael R. Schiering, Jonathan D. Root, David L. Rifken, Andre S. Strzembosz, Threasa H. Reiman, (third row) Doctors P. Kim Nelson, John Clemett, Richard J. Pacini, Sonke Harms, Howard C. Hutt, William G. Way, Jr., Allan J. Romano, Michael B. Evert, Dale M. Fletcher, James S. Newman, Paul L. Molina, Thomas F. Hirsch, Thomas C. Winter III, Charles A. James, Kevin C. Funk, and Mark A. Perry.

Bagshaw Reports Study Results

When renowned radiation oncologist Malcolm A. Bagshaw, M.D., spoke at Mallinckrodt Institute of Radiology on June 24, the news he had to share was good. Reporting on his study of the world's largest group of prostate cancer patients, Bagshaw commented that in a particularly successful subgroup, eighty-six percent of those treated with radiotherapy had retained their sexual potency 15 months after treatment. Fifty percent still had erectile potency seven years later. Conventional surgery almost always results in impotency, and even controversial nerve-sparing surgery can't claim such success.

Delivering the annual Probstein Oncology lecture, Bagshaw detailed his use of controlled radiation to treat more than 900 men suffering prostate cancer in a 30-year study at Stanford University, where he heads the medical center's Department of Radiation Oncology.

Bagshaw recalled the anecdote of one of his patients, a man in his 80s with a large but localized carcinoma of the prostate,

who tolerated the treatment without difficulty and survived for more than 20 years with no further evidence of cancer.

A world authority in the use of linear accelerators for the treatment of cancer, Bagshaw was instrumental in developing radiotherapy as a curative treatment for early stage prostatic cancer. About 90,000 new cases of the disease are diagnosed annually, and it is the second leading cause of cancer deaths in men 55 and older.

The Probstein Oncology Lecture was established by Sally and Norman K. Probstein in honor of William Fair, M.D., former head of urology at Washington University School of Medicine, and Carlos Perez, M.D., director of the Radiation Oncology Center at Mallinckrodt.

Brink Named To Two Posts

One of Mallinckrodt's chief technologists, Gary S. Brink, R.T., B.S., FASRT, has been selected to serve simultaneously on two national committees for the American Society of Radiologic Technologists (ASRT), the largest organization representing technologists.

Brink has been named a member of the Resolutions

Committee, in which position he will help to consider and format suggestions submitted from the membership at large. Brink is one of 12 members of the committee from across the country.

His concurrent reappointment to the Commission on Professional Development means that Brink will also serve to review those resolutions that concern professional development and, as its vice-chairman, help to set the agenda for the national organization's policy on that topic.

Evens Named To ACR Board

Ronald G. Evens, M.D., professor and head of the Institute, has been appointed to the Board of Chancellors of the American College of Radiology (ACR), "one of the most senior positions in the profession and definitely an honor," according to the ACR's Paul Fullagar. "The position is filled only by recognized leaders."

The post is more than honorary, however, since the board is the governing body of the ACR, setting policy for that national organization on the advice of the elected council members. Traditionally, members of the board are reappointed twice, serving a total term of three years. A member may also succeed himself for a second three-year term.

Concomitantly, Evens was named to the chairmanship of the ACR's Commission on Technology Assessment and Efficacy Studies. The commission studies new treatments and technologies, then develops an official position for the ACR. In addition to guiding radiologists, the information is made available to other medical

SPOT NEWS

specialties to inform physicians about the efficacy and application of radiology's developing techniques. The commission, which Evens now leads, consists of at least one member from each of radiology's subspecialties.

Lithostar Approved

After testing at Mallinckrodt Institute of Radiology since December of 1986, the Siemens Lithostar received FDA pre-market approval as a treatment device for kidney stones on September 30. A second generation lithotripter that requires no water bath and greatly reduces the need for anesthesia, the Lithostar is now officially approved for sale in the U.S.

More than 500 patients participated in clinical trials here. According to co-chief investigator Bruce L. McClennan, M.D., professor of radiology, the Lithostar is destined to become an important machine for treating kidney stones.

An investigational device exemption (IDE) has also been granted by the FDA so that clinical trials can begin using Lithostar to treat biliary duct stones. Hepatic, cystic, and common duct stones all will be treated with the Lithostar, employing the same shock generators used in disintegrating kidney stones. Shortly after Christmas, Siemens is scheduled to deliver a new shock generator to be added to the Lithostar, making it applicable to gallstones as well.

Setting The Pace

Late in September, the installation of a new magnetic resonance (MR) scanner began when the lid was lifted off the fifth floor and the magnet was lowered into place with a large crane. The new 1.0 Tesla machine replaces the .5 Tesla machine that was the first Siemens unit in this country. With much improved image quality and able to produce images much more quickly, the new scanner is Siemens' latest model. According to Chuck Armstrong of Siemens, the 1.0 Tesla power level makes the unit capable of many kinds of studies, both neurological and musculoskeletal.

Joseph K.T. Lee, M.D., professor of radiology, who heads Mallinckrodt's MRI effort, says the new machine incorporates many changes in both hardware and software and employs a new, more efficient coil design. As this was written, he anticipated an eight-week installation and shakedown period, with the first patients expected to be seen shortly after Thanksgiving, or just about the time this edition of *Focal Spot* is distributed.

Also on the fifth floor, a new computed tomography (CT) scanner is now in operation. The Somatom Plus from Siemens is the first of its kind in this country and one of only two operational in the world.

A developmental machine for which new algorithms and software are still being created, the Plus first scanned patients in mid-September. According to Stuart S. Sagel, M.D., professor of radiology, the machine's design incorporates a continuously rotating scanning ring and detector



Norman Henne

array. That design greatly reduces the interscan time and, along with other improvements, produces an average scan time of one second per slice. Such speed reduces problems related to movement, particularly respiration by the patient. The scanner samples data almost simultaneously from two views, greatly reducing artifacts.

The magnet for the new Siemens magnetic resonance scanner is lowered through the roof of the fifth floor, guided by many hands.

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Carol McCarthy, Ph.D., J.D., (left); Mrs. Wendell G. Scott; and Ronald G. Evens, M.D.

AHA President Sees Policy Trends

In the opinion of the president of the American Hospital Association (AHA), physicians and other healthcare workers have a responsibility not only to provide quality treatment, but to serve as advocates of public policy that insures "appropriate, accessible care for all patients."

Delivering the 17th annual Wendell G. Scott Lecture on September 12,

Carol McCarthy, Ph.D., J.D., painted the big picture of the state of current health policy and its effect on clinical outcomes. Payment policies in both the private sector and through Medicare, the trend toward more outpatient care, the medically indigent without insurance coverage, and demands for the measurement of care quality all are areas in which McCarthy says public policy is very active.

Anticipating pressure for more unified payment systems, McCarthy noted that more than forty percent of all hospitals will lose money

treating Medicare patients this year, yet suggested that the government will assume a greater measure of long-term costs. The bedrock of the insurance system "is in the private sector and employer-based insurance. But that bedrock has eroded. Of the nation's thirty-seven million uninsured, fifty-three percent have a full-time, full-year link to the workplace," she said in detailing the problems she sees. "Perhaps it is time that all businesses accept the cost of health coverage, just as they do the cost of a minimum wage, as a societal obligation and a cost of business," McCarthy said. She urged her audience not to ignore health policy matters in the interest of the technical aspects of medicine.

President of the AHA since June of 1986, McCarthy previously served as president of the Massachusetts Hospital Association and in executive positions with other hospital organizations. She holds a law degree and a doctorate in healthcare economics. Well versed in healthcare administration, planning, and finance, she is also a contributing editor to the textbook, *Health Care in the United States*.

Thomas Murry

Article Calls For Modern Management

Michael J. Albertina, R.T., B.A., chief technologist of operations at Mallinckrodt, examines modern healthcare management techniques in a five-page article published in the June, 1988, edition of *Administrative*

Radiology. The article explores administrative concepts that have prevailed in healthcare and the ways in which they are changing as the study of personnel management evolves. Some of the problems that occur as technology advances and the pressures of efficiency are felt are also treated. "Effective management," Albertina writes, "focuses on taking into account the human needs and aspirations of employees."

Calling on the healthcare industry at large to accept more participative forms of management, Albertina says, "the administrator must begin to function as team leader. He must begin to rely more on the knowledge, attitudes, and skills of others than formal authority and control of information to move the hospital toward desired goals."

Oncology Program Teaches Basics

Basic immunological concepts, the effects of ionizing radiation, and cell population kinetics were the principal subjects of instruction during a full-time oncology clerkship program offered to first-year medical students by Mallinckrodt Institute of Radiology over the summer.

Students participated in clinical activities or assisted with laboratory investigations related to oncology. This year's group—D. Ross Dickson, Ahmed F. Ghouri, Evelyn C. Kase, and Robert C. Quackenbush—were all members of the first-year class at Washington University Medical School.

At season's end, each of the four gave a presenta-

SPOT NEWS

tion summing up the 10 weeks' work. An audience of technologists and physicians filled Scarpellino Auditorium for the talks. Joseph R. Simpson, M.D., Ph.D., associate professor of radiology in the Radiation Oncology Center, coordinated the program for the eighth year.

New Radiation Oncology residents and new fellows at Mallinckrodt are (front row, left to right) Doctors Farrokh Dehdashti, fellow in Nuclear Medicine; Carol Yates, fellow in abdominal radiology; Ronald G. Evens, professor and head of the Institute; Elvira Lang, fellow in interventional radiology; Cheryl Sisler, fellow in pediatric radiology. (Back row, left to right) Doctors Martin Keisch, resident in Radiation Oncology; Jeff Michalski, resident in Radiation Oncology; Jerold Saef, fellow in Nuclear Medicine; Kenneth Lee, fellow in Nuclear Medicine; Tsuneo Hirano, fellow in Nuclear Medicine.

Eleven physicians have been accepted into the Institute's residency program in Diagnostic Radiology. They are (front row, left to right) Doctors Andrew Landes; Edith Kang; Ronald G. Evens, professor and head of the Institute; Dixie J. Anderson, residency program coordinator; William Horstman; Clint Anderson, (back row, left to right) Doctors John Engels, chief resident; Jonathan White; Robert Smith; Ronald Robinson; Jeffrey Borders; Jamie Surratt; Clark West; Mark Mayhle; Bruce Bower, co-chief resident.



Thomas Murry



Thomas Murry



PROPERTY OF FARMERS GROUP ASSOCIATION

Bahman Emami, M.D., who has written the protocol for a national study using the Sigma 60/BSO 2000, hopes for sixty to seventy percent eradication, results already achieved with superficial tumors.

Getting Better

ALL THE TIME

By Candace O'Connor

Last Christmas, Forrest Becker, a 69-year-old retired jeweler, knew something was desperately wrong. He felt weak, he couldn't sleep, he had pains coursing through his legs. Then his doctor gave him the bad news. The colorectal cancer he had faced five years earlier was back, this time as an inoperable mass invading the sacrum, a triangular pelvic bone at the base of the spine.

With a full course of chemotherapy and radiation behind him, Becker came to Mallinckrodt Institute of Radiology seeking specialized help with treatment complications. He needed more radiation for the tumor that was pressing hard against the nerves running down into his legs. But this time, he was only eligible for 14 treatments—half his initial dose—since more might damage the very nerves that Becker needed to protect.

How to supplement that dose and strike a more effective blow at his cancerous mass? This summer, Becker became one of the first three patients treated on a promising new piece of equipment now helping to shrink abdominal and pelvic tumors that lie deep within the body. This machine, the Sigma 60/BSD-2000, uses the latest technology to administer an ancient, though still experimental, form of heat treatment called hyperthermia.

Mallinckrodt is currently one of six U.S. institutions embarking on a national study to track the results of BSD-2000 therapy. Buoyed by hyperthermia's success in fighting lesions less than four centimeters deep, doctors are hoping this new machine can produce similar results on deep-seated tumors, as

much as six to 10 centimeters below the skin.

"Our experience with recurrent superficial tumors shows we have a tremendous advantage when we mix hyperthermia with radiation or chemotherapy," says Bahman Emami, M.D., professor of radiology and chief of the hyperthermia section, who has

written the protocol for this national study.

"In our institution, we have achieved sixty to seventy percent complete eradication," adds Emami. "So if we heat these tumors just as well as we heated the superficial ones, what's wrong with hoping we'll achieve the same results?"

Only seven weeks after the last of his three hyperthermia sessions, Forrest Becker is sold on the procedure. He's walking better and gaining weight. People stop him to remark how good he looks. Even the 50-minute drive from Breeze, Illinois, is well worth it. "I'd drive him three hours for this treatment," adds his son, A.G. Becker.

"I haven't felt this well in a year," says Becker. "I tell everyone at Mallinckrodt that I'm the best ad they've got."

Another hyperthermia unit, the BSD-1000 Annular Phased Array System, was previously used at Mallinckrodt in cases of inoperable pelvic and abdominal malignancy. In national and institutional studies of cancer patients treated with this machine, the results were encouraging when the tumor was heated to 42 or 43 degrees Celsius for at least 30 minutes. Unfortunately, equipment limitations made this kind of heating difficult to achieve.

Patient tolerance to the old equipment was also a problem. "In sixty percent of the patients we had local discomfort and pain. In twenty percent, we had problems with apprehension," says Emami. "They were anxious and wanted

GETTING BETTER

to get out. They felt exhausted.”

At fault was the design of the machine, which resembled a large, opaque box. Patients lay prone on a stretcher, the heating unit centered over the area of their tumor. Unable to see in or out, they felt claustrophobic.

New Technology Design

The BSD Corporation, manufacturer of the old unit, answered these criticisms in creating the BSD-2000 successor unit. This time, they housed heating antennae in a much smaller, transparent unit which slides easily over the pelvic region and allows patient and doctor to see what is going on. Coupled to the antennae is a

Forrest Becker: Walking better and gaining weight.

water bag which also adds to the patient's comfort. At the start of the treatment, the bag fills with warm water, which cools as the heating progresses.

But the major advance comes in the machine's vastly improved technology. First, it allows doctors to steer the heat directly to the tumor, not simply to a cross section of the body. Second, through its computer link, it gives doctors a chance to preplan the power needed in each of the machine's eight antennae to get the necessary heat to the tumor.

These antennae work by radiating electromagnetic waves into the patient's body. This low-frequency radiation—even lower than that of a microwave oven—generates an electrical field which, in turn, creates conductive current that heats the tissue.

“But you need more than that,” says Robert Myerson, M.D., Ph.D., assistant professor of radiology, who has been performing phantom research and treating patients using this new equipment. You can't simply dump power into the body; you need to deposit it in an organized way where it is needed.”

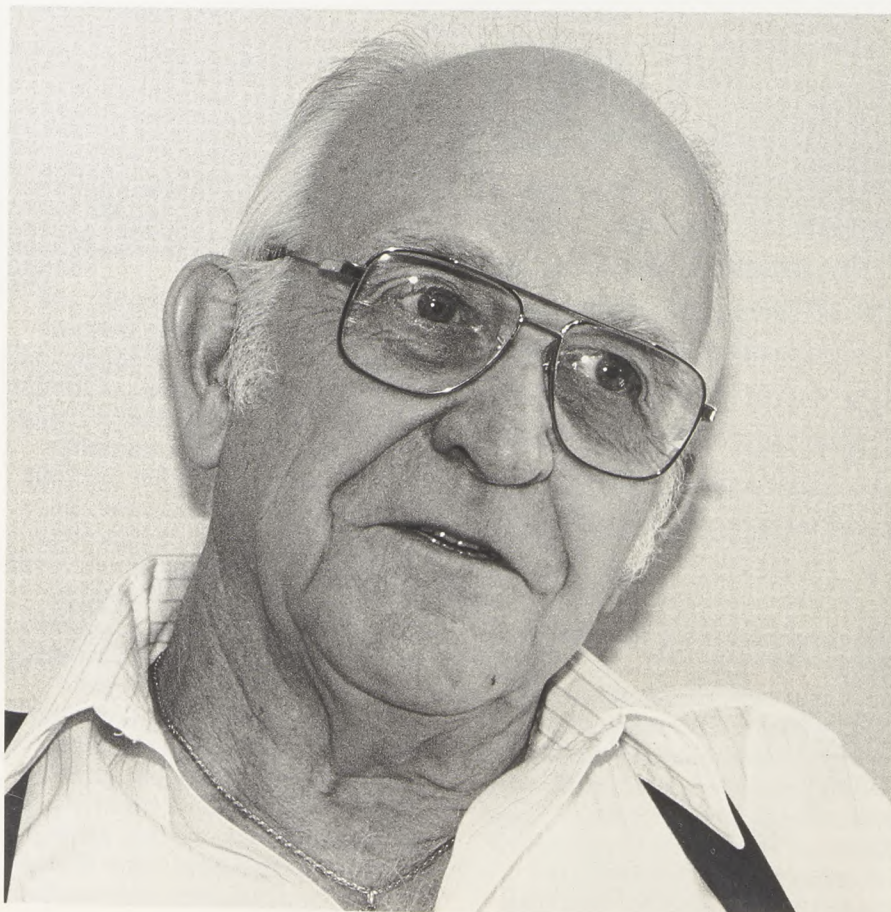
We have a tremendous advantage when we mix hyperthermia with radiation or chemotherapy.

That's where the steering comes in. Unlike the earlier unit, this one allows doctors to adjust the phase and amplitude of each pair of antennae. “Ideally, we would like to satisfy two requirements: to cover the tumor with the maximum possible electric field and to spare normal tissue as much as possible,” says Myerson.

While planning their treatment strategy, doctors glean information from the patient's CT scan to determine the target point. They also take measurements of the patient and enter data in the computer, together with initial amplitude and phase estimates.

Using this data, the computer then prints out a colorful graph which predicts power distribution over a cross section of the body. Red is the area of the most intense heat; blue, the least. Based on these predictions, doctors may revise their phase and amplitude estimates.

Several factors complicate these estimates, Myerson says. The computer's predictions



Steve Kohler

assume that the antennae operate independently of each other. In fact they interact, loaning power and borrowing it to and from each other. Doctors need to correct for this interaction to achieve the power they need.

Accuracy may also be affected by such hard-to-predict factors as patient bloodflow. If power is deposited in an area with heavy bloodflow, the patient's body may dissipate some of this power, and a lower temperature may result.

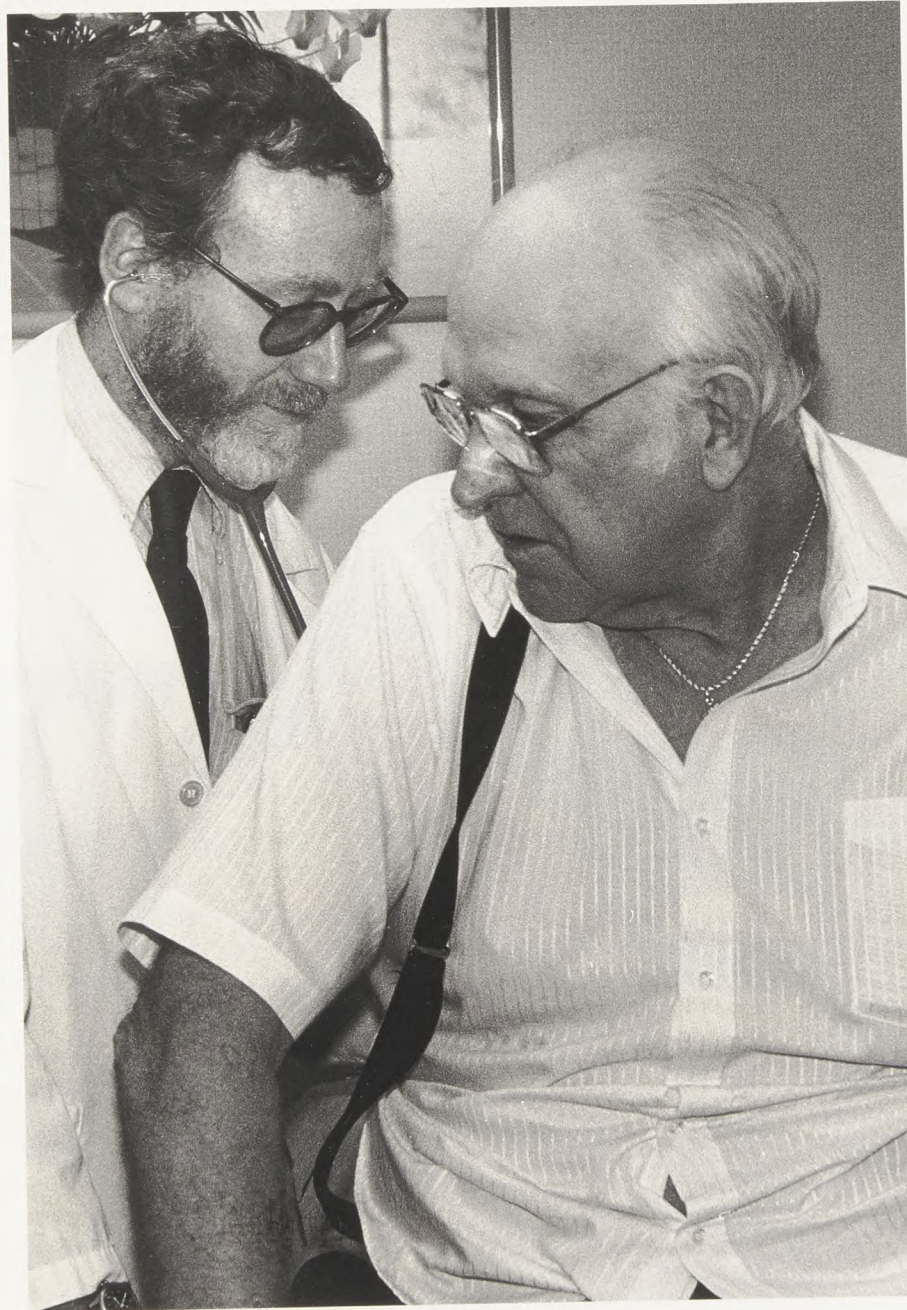
On the whole, though, "this machine does the physics about as well as any deep hyperthermia unit can do it," says Myerson. "We have more control over power deposition than we ever had in the past, and we have as much control over patient comfort as we can get."

The Treatment Session

Taped to the patient during treatment are four probes which use the surface electric field to measure power distribution to the tumor area. Three or four other probes—inserted in such natural openings as bladder, rectum, and vagina—monitor tissue temperature. Another one measures systemic temperature, while a last one is placed in the soft tissue near the tumor.

In less than half an hour, patients reach the 42 or 43 degree temperature and, ideally, should sustain it for half an hour or more. They are not anesthetized or medicated; in case they experience discomfort, they can quickly say so. Altogether, several weekly hyperthermia treatments are usually scheduled for each patient. "But I'm satisfied if we can get in one successful session," says Myerson. "That may be enough to do the job."

Not all cancer patients are eligible for hyperthermia, he cautions. A healthy heart is necessary,



Steve Kohler

since this treatment can heat large blood vessels and accelerate the pulse rate. Currently limited to deep-seated pelvic and abdominal cancer, it is not yet available for tumors of the thorax.

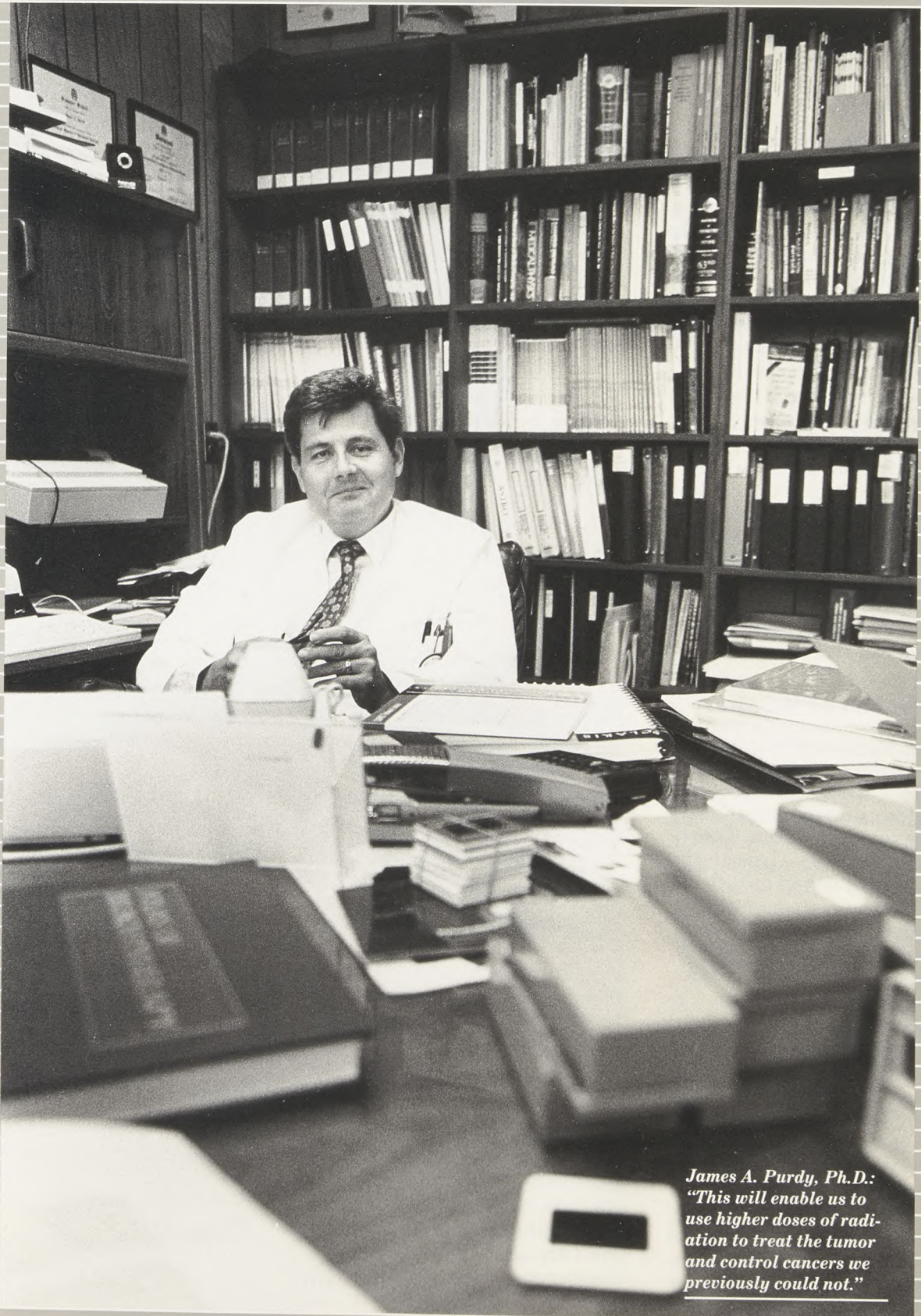
"In our feasibility study, if we can show that we are able to deliver the necessary temperature in fifty or sixty percent of the patients, we will look at other tumors—ones that have a low cure rate with conventional treatment modalities," says Emami. "Locally advanced prostate, cervix, and bladder are potentially all here."

Forrest Becker is awaiting the results of his follow-up CT scan to

Robert J. Myerson, M.D., assistant professor of radiology in the Radiation Oncology Center, examines hyperthermia patient Forrest Becker.

see how his tumor looks now. At the same time, Mallinckrodt doctors are studying the unit that treated him to determine how effective it is in arresting tumor growth.

The bottom line is this: "We now have a better means of treating tumors in the depths of the body," says Emami. "If this machine performs in the way we expect it to, it should be a significant advance." □



*James A. Purdy, Ph.D.:
"This will enable us to
use higher doses of radi-
ation to treat the tumor
and control cancers we
previously could not."*

TREATING CANCER IN THE 21st CENTURY

By Suzanne Hagan

Picture this. It's the year 2000, and you're looking across the desk at your doctor. Concern is in his eyes. He explains that you have lung cancer. Within the hour you are whisked to a CT simulator where a series of 60 to 80 images is made. Your doctor studies the films, analyzing every inch of you on the computer screen. The images are then fed into a computer programmed with your doctor's plan of therapy. In minutes, the computer reconstructs your torso, sculpting a colorful picture of your body in three dimensions. As the picture is completed, the entire volume and area of your tumor are revealed, as is the volume of the normal tissue surrounding it. Every detail of the tumor can be seen as your image moves around on the screen.

As a result of this complex image processing, your doctor and the medical physicist assigned to your case can tailor a cancer treatment to the special contours and configurations of your anatomy. The highest possible dose of radiation can be delivered to the tumor in your lung without injury to your heart, spinal cord, and healthy lung tissue. The chances of controlling your tumor are good, and the probability of side effects from treatment is minimal. In 1988, such a precise three-dimensional treatment planning system for cancer is being developed at Mallinckrodt Institute.

TREATING CANCER

“Many cancers are very sensitive to radiation,” says Bahman Emami, M.D., who specializes in the radiation treatment of cancer at Mallinckrodt’s Radiation Oncology Center. “Yet there are important problems we encounter. One problem is to find the best way to aim the radiation so as not to miss the tumor and still spare healthy organs.”

Emami, a member of the team working on the treatment planning research, describes its advantages: “One of my patients had a tumor in the chest region that could not be treated with a dose as large as I would have liked because the heart was in the field. We were forced to treat with a lower dose to preserve the heart. If the computer-driven three-dimensional system had been available, I could have used more scans to work out a treatment plan that would have taken that patient to the dose I wanted, still sparing the heart. It just bothers me.”

Currently cancer specialists plan radiation treatment by

Radiation oncologists continue to encounter the problem of finding the best way to aim the radiation beam without missing the tumor and still sparing healthy tissue.

hand, drawing the target volume on the CT scans and delineating the tumor area on the simulator-generated X-ray films. Lack of

time and technology limit the number of CT scans that the doctor can realistically use. These limitations often compromise cancer treatment.

“We want radiation therapy delivered safely and effectively,” explains Robert Morton, director of the Radiation Research

“We’re designing our systems for cancer specialists to use, not for computer scientists.”

Program at the National Cancer Institute (NCI). “As part of that effort, we want to know what dosage is delivered not only to the tumor, but also to normal tissue nearby.” What is needed is a system that quickly combines the patient’s 60 to 80 CT scans into a three-dimensional image and the software for planning and delivering radiation therapy.

Morton’s program has funded six institutions in two separate contracts—Memorial Sloan-Kettering, Massachusetts General Hospital, M.D. Anderson Hospital, University of Michigan, University of Pennsylvania, and Mallinckrodt Institute—to evaluate the potential of three-dimensional radiation treatment planning for several hard-to-treat cancers.

James A. Purdy, Ph.D., a radiation physicist, is the principal investigator of the two NCI contracts at Mallinckrodt Institute. His group used an image processor developed at Washington University’s Biomedical Computer Laboratory for molecular biology. It was adapted to accept multiple images from CT scans, displaying

these images on a video screen. The treatment planning software combines these “slices,” sculpting them into a lifelike three-dimensional image. The video screen also displays a simulation of the radiation beam impinging on the treatment area. When the viewer uses the workstation’s joystick, the images can be turned so that any aspect is visible. Thus, a physician can accurately simulate the effects of a planned pathway of radiation. Such precision has never before been used in planning radiation therapy.

“One thing I particularly liked about the St. Louis group’s approach,” says Morton, “is the ability to visualize the enhancement of the field of treatment. Their system enables a viewer to see the field edges encompassing the tumor and plan a beam trajectory that avoids as much of the normal tissue as possible. I think that of all the contracts, theirs was the best approach.”

“We are developing new tools for radiation treatment,” explains Purdy. “These new tools will better represent the three-dimensionality of the tumor. The X-ray and radiation beam therapy used for treatment will better conform to the tumor’s volume. This will enable us to use higher doses of radiation to treat the tumor and control cancers that we previously could not.”

Purdy and his co-workers, who presented their 3-D work at the American Society for Therapeutic Radiology and Oncology (ASTRO) meeting in October, emphasize that without the data provided by CT scans, such an approach to radiation treatment planning and delivery would not be possible. However, since the software is only now becoming available for combining the images into a graphic representation of the patient’s anatomy and for provid-

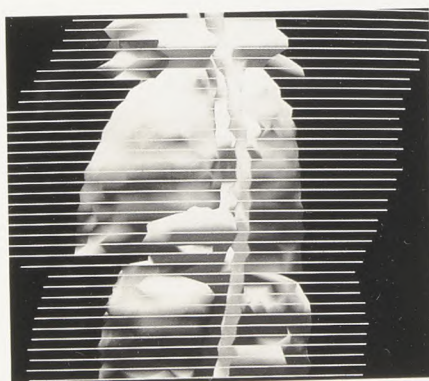
ing real time interactivity, a cancer specialist like Emami must do his treatment planning by hand. That is, he uses at most two or three CT scans, MR images, or standard X-ray images to hand draw the desired treatment area where the beam is to be directed. Then he uses a conventional treatment planning system to compute the overall dosage theoretically delivered, typically ignoring tissue density effects. This estimated dosage doesn't take into account the radiation scattering effects from inhomogeneities within the treatment area. Nor is there extensive data to determine the tolerance of normal tissue to radiation. Radiation oncologists have to use their experience to decide where and how much to irradiate a patient to kill as much of the tumor as possible.

The system that Purdy's group is developing will get around these difficulties. All the diagnostic images, not just two or three, can be used by the computer to construct an electronic sculpture of the patient's anatomy, allowing the doctor a timely way of delineating the tumor. The computer can calculate the amount of radiation striking any point within the tumor volume, taking into account the scattering effects from inhomogeneities. Thus, the total dosage being delivered can be figured accurately.

Radiation oncologists realize that their efforts to plan doses, even with three-dimensional planning, will need new technology to verify the treatment if the potential is to be realized. Currently, a weekly X-ray image made during the course of a patient's radiotherapy is compared with one made prior to treatment to decide if the radiation beam needs to be adjusted. Ideally, verification should take place as radiation is

being delivered, not afterward.

John Wong, Ph.D., a member of Purdy's group, has taken on this problem. He has developed a system of plastic fiber optics to measure radiation passing through the patient to a fluorescent screen below. The fiberoptic cables pick



The images produced by the new system show the body's features in realistic detail, revealing for study the volume of the tumor to be treated.

up the image from the fluorescent screen and transmit it to a TV camera interfaced with a computer workstation. The transmitted image shows whether the radiation is reaching the desired area and displays any fluctuations in the beam due to setup variations and patient motion.

Purdy and his research team also hope to develop computer programs to control the radiation beam's direction and shape, customizing it to allow for a patient's individual contours and irregularities. "Rather than treating only rectangular or square fields," says Purdy, "we will be able to shape the field. We will also be able, under computer control, to move the patient and the beams simultaneously, allowing us to deliver a much higher dose to the patient."

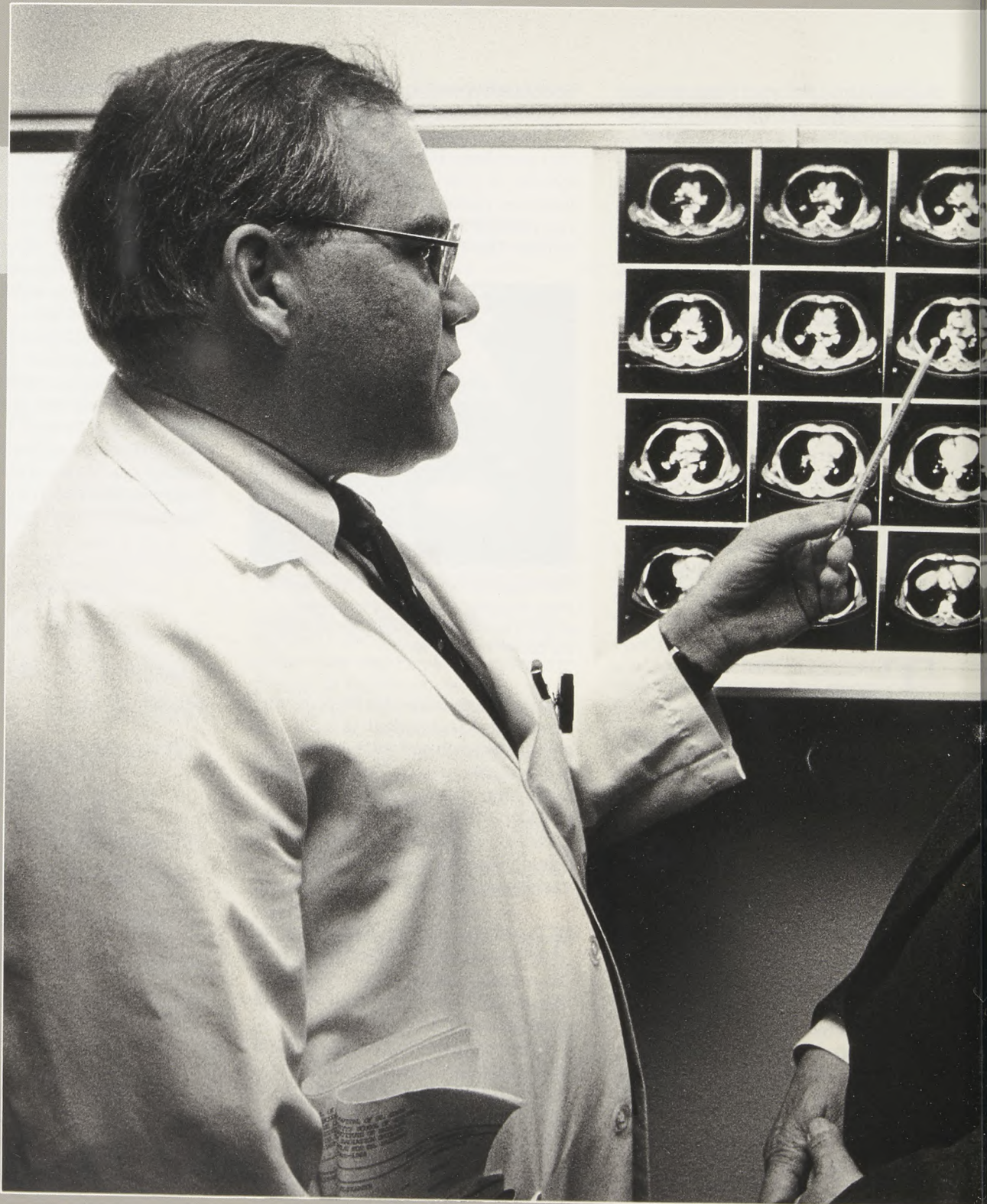
Purdy's goal is to develop all the necessary software to make these computer innovations a

reality, and to do it in such a way that dedicated workstations are networked together into a 3-D radiation therapy system. Eventually, supercomputers will be available for such applications, but Purdy's system will definitely be user friendly: "We're designing our systems for cancer specialists to use, not computer scientists," he says.

Emami is enthusiastic about the potential of this new system, which should be available for limited clinical use in about three years: "Right now, if I give a certain patient a particular dose, I might expect a cure rate of thirty-five percent. But if I can increase this dose to twice as much—an

"One of my patients had a tumor in the chest region that could not be treated with as high a dose as I would have liked because the heart was in the field. We were forced to treat with a lower dose to preserve the heart."

option I don't have now because of the limits of the normal tissue to radiation exposure—then I can expect a much improved cure rate." By the year 2000, doctors hope to be able to offer their cancer patients a cure rate of fifty percent. □



PHOTOGRAPH BY THE ASSOCIATION OF THE PRESS



STAYING the COURSE

The Prolonged Search
for an Effective Radiosensitizer

by Steve Kohler

Scientific research doesn't often proceed as smoothly as its practitioners would like. The big breakthrough announced in the headlines is the rare exception; more often, tiny advances are preceded by years of diligence. As an endeavor, research requires not just insight and precision, but optimism and hope.

When Todd Wasserman, M.D., needs inspiration to stay the course in his own work, he thinks back to a childhood experience. At the age of six, he participated in the clinical trials of the Salk polio vaccine, receiving three doses of either placebo or active vaccine—at the time he didn't know which. After many failed attempts to control polio, the eventual success of those trials resulted in what Wasserman calls “one of the most important changes in medicine to occur during my pre-professional lifetime.” Then, in an uncharacteristically personal note, he adds, “It inspired me.”

Todd H. Wasserman, M.D., and his patient, Thomas Consiglio, in consultation. Consiglio was a part of the phase I clinical trials of SR-2508 and is a vocal advocate of the drug's promise.

Steve Kohler

STAYING THE COURSE

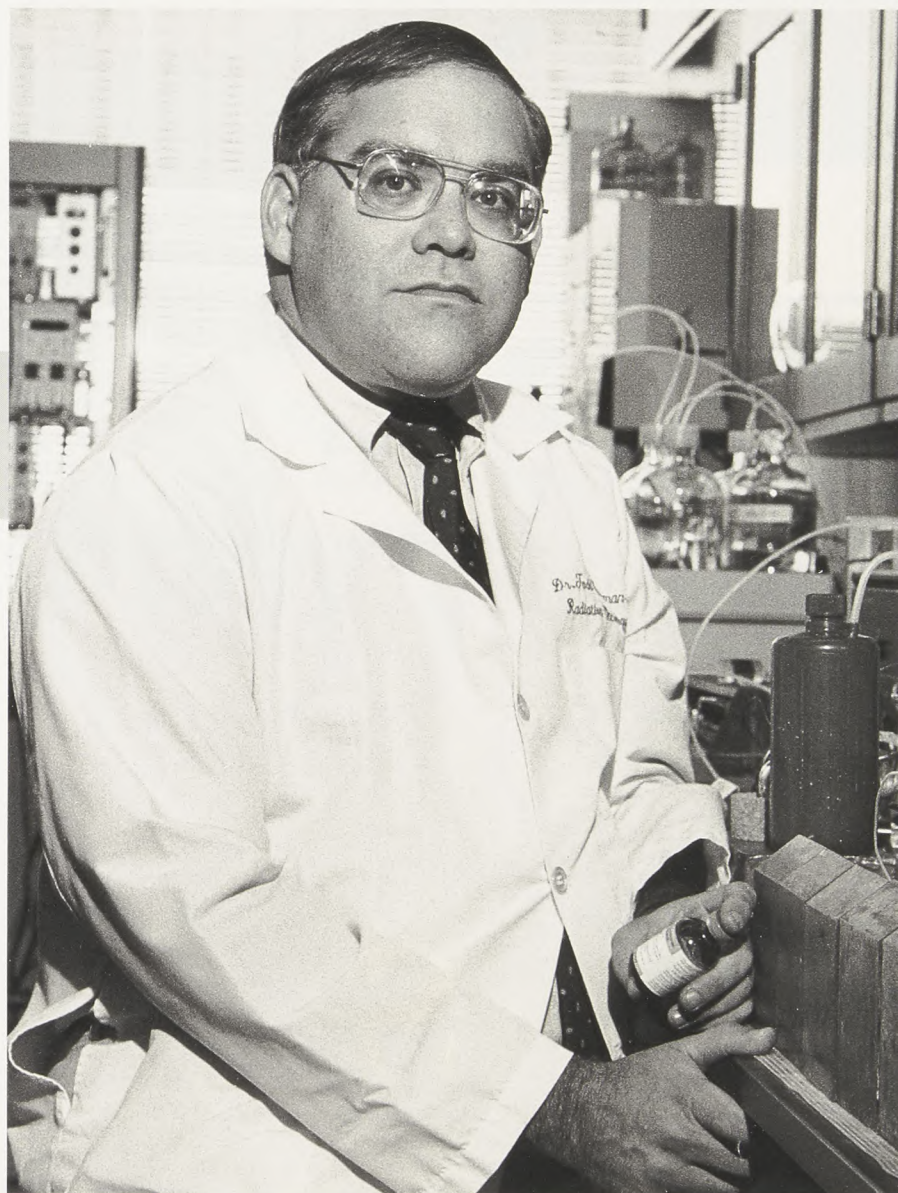
These days, Wasserman, professor of radiation oncology in Mallinckrodt's Radiation Oncology Center and chief of the Department of Radiation Oncology at Jewish Hospital, is on the convoluted trail of improved treatments for cancer—a more complicated disease than polio. Actually, Wasserman points out, cancer is a whole family of diseases that will always require a variety of cures and treatments.

Specifically, his work entails the testing of drugs that will make cancer cells more vulnerable to the effects of radiation. Radiation destroys cells by inducing certain chemical changes from which they cannot recover. If those changes can be enhanced via chemical manipulation, then radiation's effects can be magnified.

For 30 years it's been known that many tumors are organized

The potential for good is at least as great as it was in the case of polio and the Salk vaccine.

as concentric rings of cells, each layer identifiable according to its oxygen content. At the core is often a dead region, isolated from both blood supply and oxygen. At the surface lie active, highly oxygenated cells that radiation kills without difficulty. Between those two is a zone of oxygen-poor, or hypoxic, cells that radiation has difficulty affecting. In a state akin to dormancy, these cells can quickly become revitalized and dangerous again should the overlying cells be stripped away, as they are during a course of radiation therapy.



Steve Kohler

Research in the lab has shown that oxygenating the hypoxic region of tumors makes those cells more susceptible to treatment with radiation. Effectively treating hypoxic cells may require three times the radiation dosage necessary for treatment in an oxygen-rich setting. That dose of radiation can be too much for surrounding normal tissue to bear. Early attempts to increase the efficiency of radiation therapy by increasing oxygen levels included placing patients in hyperbaric chambers to force oxygen deep into their systems. Cumbersome and impractical, that approach was abandoned.

But Wasserman and his colleagues recognized that chemical agents might be able to sensitize hypoxic cells to radiation, reach

In the laboratory where SR-2508 is assayed, Todd H. Wasserman, M.D., holds a vial of the radiosensitizer he's worked with for more than five years.

into the dormant zones of tumors, and yet not sensitize normal tissue. In 1977, clinical trials began to test the drug misonidazole, commonly called miso, as a tumor-cell sensitizer.

A sort of "fool's gold" in Wasserman's explanation, miso does not actually increase the oxygen level of hypoxic cells, but it "induces chemical events after radiation similar to those of oxygen." And it shows a preference for hypoxic tissues, collecting there via a mechanism that remains not totally understood. Apparently, the drug makes it impossible for damage done to the cells'

DNA by radiation to be repaired. The effected cell dies.

The problem with miso came during the translation from the laboratory to the practical world of treating patients. The drug could not be tolerated in doses

*Wasserman explains:
"Good science doesn't
always end in
positive results."*

large enough for its effectiveness to be measured or relied upon. Therapeutic gain was never demonstrated; research had not run smoothly at all.

But the theory continued to make sense and offer promise. A derivative of miso—known as etanidazole or SR-2508—works in much the same way. Except that it can be administered in total doses three times as large as miso thanks to its lower toxicity. Still present is the predictable side effect of a cumulative neuropathy, a tingling sensation particularly in the extremities that builds after several doses have been administered. But the serious mental confusion that limited the effectiveness of miso is gone. Thankfully, the neuropathy disappears after the regimen is completed.

According to Norman Coleman, M.D., chairman of the Radiation Therapy Department at Harvard Medical School, SR-2508 is the first drug good enough to really test the hypothesis that cell sensitizers can increase the efficiency of radiation therapy in cancer. He says, "It's true that we have not succeeded. But we have a much better drug now."

Wasserman, eager for success after 14 years of leading the

research, agrees. He says, "We would not have developed SR-2508 if miso had been an immediate success. And this is probably not the last drug we will have to develop. But it may let us know that we have the right approach."

Not that the work to date has no value. As Wasserman explains, "Good science doesn't always end in positive results. Understandable, repeatable results, yes. But not always and every time positive. If you know more when you're done, if you answer a question, then it can be considered successful."

Testing in phase III clinical trials, in which large numbers of patients are treated with radiation and with or without SR-2508,

*The serious mental
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began in July, 1987, at 25 North American institutions, all members of the Radiation Therapy Oncology Group (RTOG). Twenty-five European cancer centers are testing SR-2508 simultaneously in a parallel study. Head and neck tumors, readily quantifiable, are under study and results are expected in 1990, just in time for the Seventh International Conference on Chemical Modifiers which Wasserman will chair. He was co-chairman for the sixth conference held earlier this year in Paris.

Organizing the research and bringing investigators together from around the world to share their insight has required extraordinary perseverance. Many negative and null

trials have had to be reported. Fully half of Wasserman's academic life has been devoted to the struggle to bring cell sensitizers like SR-2508 to their potential. The results of the trials now being conducted will be the watershed.

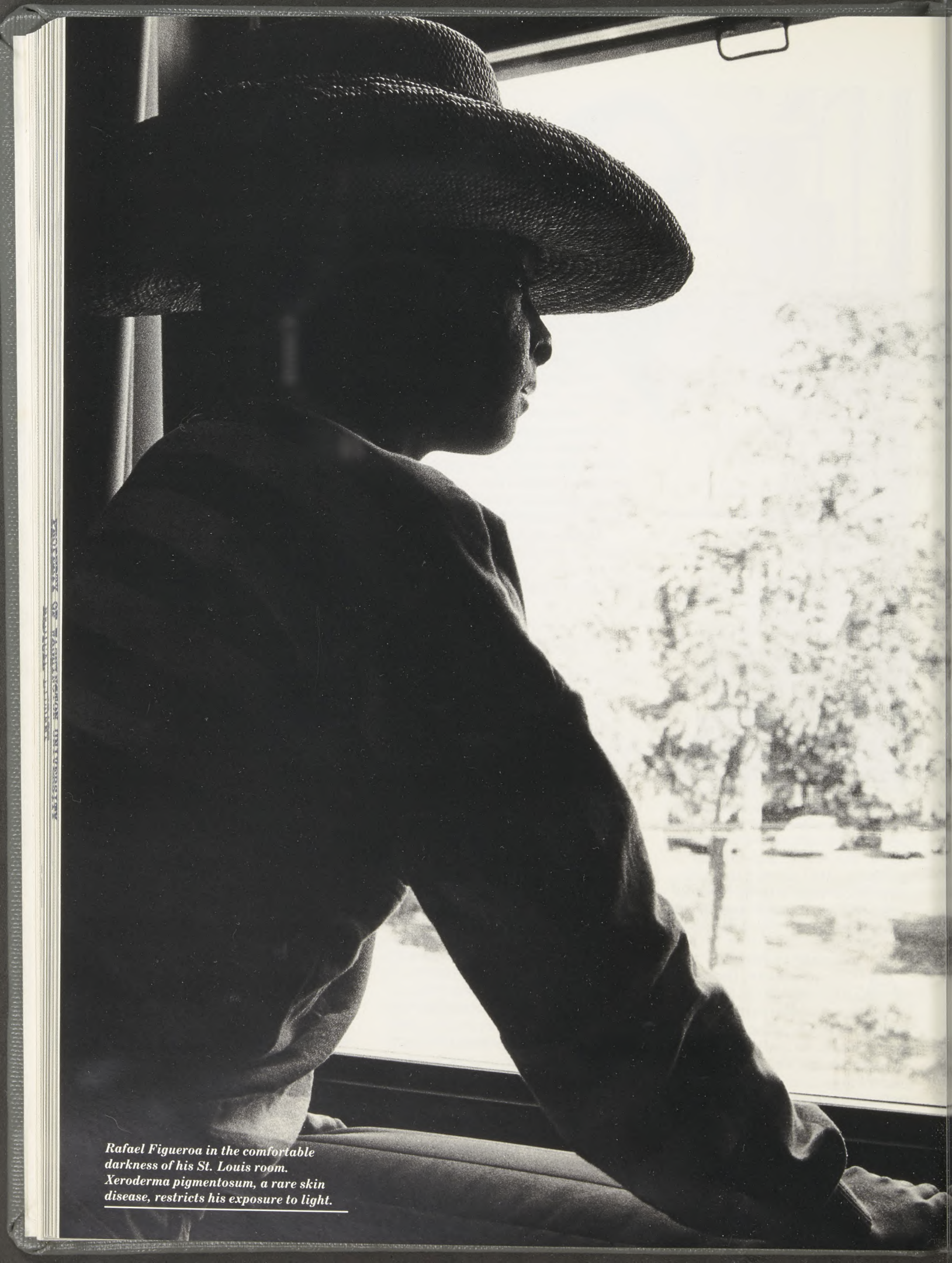
But no matter what those results are, this research could hardly have had a more dedicated captain. From his office at Harvard, Coleman says Wasserman has been "the engine that has run it. The research might have died several times if it hadn't been for Todd Wasserman. He gets people together; he's skilled in dealing with the National Institutes of Health, a source of grant money, and a tremendous facilitator."

Carlos Perez, M.D., director of the Division of Radiation Oncology at Mallinckrodt, joins in registering his hope for the work. "The biological basis is very sound. It works well in the lab. Even if we don't hit a home run here, we will still win the game with small, incremental gains."

The potential for good is at least as great as it was in the case

*Cancer is a whole
family of diseases
that will always
require a variety of
cures and treatments*

of polio and the Salk vaccine. So Todd Wasserman moves along at the rate that good science will allow, suffering the frustration of small victories. He develops and tests new compounds in blind trials much like the one he was involved in 36 years ago when he received the Salk vaccine that later erased the menace of polio for so many. □



PHOTOGRAPH BY HARRY KROGER FOR THE MUSEUM OF MODERN ART

Rafael Figueroa in the comfortable darkness of his St. Louis room. Xeroderma pigmentosum, a rare skin disease, restricts his exposure to light.

OUT OF THE DARK

by Steve Kohler

Wherever she goes in St. Louis, Juana Figueroa takes along two companions. One is her son, Rafael, whose rare disease has brought the pair here from their home in Lima, Peru. The other is a small, stout notebook, its pages listing the names of all those people who have helped the mother and son on their quest to find treatment for Rafael.

The entries in the book are in chronological order—the most recent contacts last. At the top of page one is the name of Carlos A. Perez, M.D. When Mrs. Figueroa and her son got off the plane from Lima, the only English they knew was the name of Perez and that of Mallinckrodt Institute of Radiology.

They'd flown for almost 10 hours, courtesy of Eastern Airlines, in the hope that Perez, who directs the Radiation Oncology Center at Mallinckrodt, could provide the extraordinary care that Rafael requires. Diagnosed at age four as suffering from xeroderma pigmentosum (a rare pigmentary disease of the skin that leaves its victims extra-sensitive to the damage wrought by ultraviolet light), Rafael had seen his condition worsen; eight years later Lima's specialists could be of little help. More advanced therapy was required.

Mayer Zaharia, M.D., chief of the Department of Radiation Therapy at Lima's Institute of Neoplastic Diseases, a huge cancer hospital, suggested Mallinckrodt Institute. Zaharia had been a visiting professor here and had seen the successes of Perez and his colleagues.

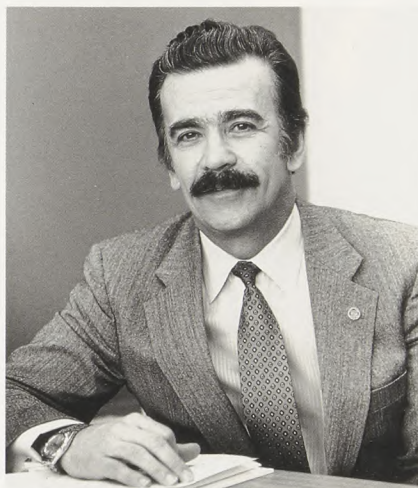
OUT OF THE DARK

Deplaning on July 7, the Figueroas—mother and son—found their way to South Kingshighway and eventually to Pat Norton, whose name is entered second in the little notebook. A clinical research assistant in Radiation Oncology with a degree in Spanish, Norton immediately assumed the role of mentor to the visitors. She arranged lodging and acted as a translator while Juana's English came back from her days as a high-school student of the language.

Specialists were called in. The name of Ann Martin, M.D., was inscribed indelibly when she took over management of the dermatological aspects of Rafael's case. Otolaryngologists Gershon Spector, M.D., and Donald Sessions, M.D., joined the team when biopsies revealed that the underlying xeroderma pigmentosum had led to a melanoma on Rafael's ear that required surgery.

Written large in the book is the name of Karen Forsman, M.D., a resident in dermatology who has acted to coordinate the therapy and all the contributing specialists. Among those whose expertise she has called upon is Fred Chu, M.D., a Medical School ophthalmologist managing Rafael's eye problems. George Hruza, M.D., a cutaneous surgeon, treated skin cancer on Rafael's face.

Anyone granted a look into Juana's book would also find the name of Rafael's roommate and friend, a youngster who shared 25 days with Rafael in Barnard Free Skin and Cancer Hospital. Despite a language barrier, the two delighted together in the humor of the drawings in the "Calvin and Hobbes" comic strip. As Rafael's condition began to respond to the collaborative efforts of Washington University's best, he was again able to laugh at the escapades of the boy and his imaginary pet tiger.



Carlos A. Perez, M.D., director of the Radiation Oncology Center and lead physician in Rafael's treatment that includes many Washington University Medical School experts.

Diagnosed at age four, Rafael had seen his condition worsen; eight years later Lima's specialists could be of little help.

Strictly a night person as a result of his aversion to light, Rafael occasionally awakened his mother with his laughing. But she was delighted to have her sleep disturbed by a sound she had heard too little of lately.

Juana's list continued to grow: Mike, a nurse on Barnard's fourth floor; the good people of a church who welcomed the Figueroas into their congregation; a local Peruvian family whose members helped with understanding North American customs. And always the doctors who assessed and treated and explained.

"The doors opened," Juana says in a tone that conveys both gratitude and awe. "Good things just keep happening; we keep going." She is certain that she and her son were destined to find Mallinckrodt.

Despite the poor long-term prognosis for Rafael, she says they feel encouraged by his recent progress. For her, it's a miracle that Rafael sometimes beams out a smile from beneath the brim of his traditional Peruvian farmer's sombrero.

Perez is pleased, but not particularly surprised, at the success he and his colleagues are having. "We have a top national center here, with the very best people in many fields. Our reputation is spreading beyond the Midwest." In addition to Rafael, Perez recently has treated four other patients from outside the country, including a cabinet member from Uruguay. Referrals come from the many physicians who visit here as fellows or guest lecturers and from the contacts made by the Mallinckrodt staff members on their own travels. "They find out that we do first-rate work," Perez says.

On Rafael's twelfth birthday, he was honored at three separate birthday parties. He spoke to his father, his sisters, aunts, and cousins in Peru, and the family shared a few happy moments together.

On that day, too, the family began to lay plans to relocate to St. Louis where they have found so much help. Difficulties in immigrating don't worry Juana; she has encountered greater hurdles.

She takes life in small pieces and says, "That was a good day. There are good days and bad days, but living this way we are nearer to God. Every day is thanks to Him. And we learn this lesson: Have faith. God will do the rest for you."

That said, it's clear that Juana Figueroa's constant companions number three, not just two. In addition to the tangible—her son and the book of names—there is also an abiding faith that generates bright hope. □

FYI

THE DIRECTOR'S OFFICE REPORT

NEW STAFF

Jeffrey J. Brown, M.D., assistant professor of radiology, Division of Diagnostic Radiology

Donald E. Gayou, Ph.D., research associate in three-dimensional imaging, Division of Diagnostic Radiology

Landis K. Griffeth, M.D., Ph.D., assistant professor of radiology, Division of Nuclear Medicine (completed a 4-year residency in Diagnostic Radiology and Nuclear Medicine at Mallinckrodt Institute of Radiology)

Marshall E. Hicks, M.D., assistant professor of radiology, Division of Diagnostic Radiology

Peter P. Lai, M.D., Ph.D., assistant professor of radiology, Division of Radiation Oncology

Francisco Li-Aravena, M.S., research assistant in radiation physics, Division of Radiation Oncology

Frederick A. Mann, M.D., assistant professor of radiology, musculoskeletal section, Division of Diagnostic Radiology

Victor A. Marcial-Vega, M.D., instructor in radiology, Division of Radiation Oncology

Paul L. Molina, M.D., instructor in radiology, Division of Diagnostic Radiology (completed a 1-year fellowship in chest radiology at Mallinckrodt Institute of Radiology)

William H. Perman, Ph.D., assistant professor of radiation sciences in radiology, Division of Radiation Sciences

Thomas K. Pilgram, Ph.D., research associate in three-dimensional imaging, Division of Diagnostic Radiology

Ying Su, B.S., research assistant in radiation physics, Division of Radiation Oncology

OFF STAFF

Lynn Barrett, M.D., co-chief resident 1987-1988, completed a 4-year residency in Diagnostic Radiology and has accepted a fellowship at Rush Presbyterian, St. Luke's Medical Center, Chicago.

Inta S. Berzins, M.D., completed a 4-year residency in Diagnostic Radiology, and one year of training in Nuclear Medicine and has accepted a position as staff radiologist at Parkland Hospital-Southwestern Medical Center, University of Texas, Dallas.

Scott J. J. Evans, M.D., completed a 4-year residency in Diagnostic Radiology and has received an imaging fellowship at San Francisco General Hospital.

Joseph N. Fields III, M.D., assistant professor of radiology, Division of Radiation Oncology, has joined the staff of the Department of Radiation Oncology, Memorial Medical Center, Springfield, Illinois.

Kevin C. Funk, M.D., completed a 4-year residency in Diagnostic Radiology and has entered private practice at Eastern Idaho Regional Medical Center, Idaho Falls.

Charles F. Garvin, M.D., instructor in radiology, completed a 2-year fellowship in neuroradiology and

has entered private practice at St. Luke's Hospital, St. Louis.

James R. Geurin, M.D., completed a 4-year residency in Radiation Oncology which included one year as an American Cancer Society Clinical Fellow and has entered private practice with Radiation Oncologists, Inc., Kansas City, Kansas.

David C. Hardy, M.D., assistant professor of radiology, Division of Diagnostic Radiology, has entered private practice in mammography and abdominal and skeletal imaging at LDS Hospital, Salt Lake City.

Howard C. Hutt, M.D., instructor in radiology, completed a 1-year fellowship in neuroradiology.

Scott N. Nadel, M.D., chief resident in radiology 1987-88, completed a 4-year residency in Diagnostic Radiology and has entered private practice in Bradenton, Florida.

David N. Rabin, M.D., instructor in radiology, completed a 1-year fellowship in abdominal radiology and has accepted a position as attending radiologist in imaging at Rush Presbyterian, St. Luke's Medical Center, Chicago.

Theresa A.H. Reiman, M.D., instructor in radiology, completed a 4-year residency in Diagnostic Radiology and a 1-year abdominal radiology fellowship, and has entered private practice with Valley Radiologists Ltd., Phoenix.

David L. Rifkin, M.D., assistant in radiology, has completed seventeen months of training in the Division of Nuclear Medicine and

has entered private practice in Northhampton, Massachusetts.

Debra D. Rosenthal, M.D., completed a 4-year residency in Diagnostic Radiology, and one year of training in Nuclear Medicine and pediatrics, and has entered private practice at St. John's Mercy Medical Center, St. Louis.

Thomas E. St. Amour, M.D., completed a 4-year residency in Diagnostic Radiology and has entered private practice with Radiology Associates, Little Rock, Arkansas.

Vythialingam Sathiaseelan, Ph.D., assistant professor of radiation physics in radiology, Division of Radiation Oncology, has entered private practice at Northwestern Memorial Hospital, Chicago.

David H. Schmidt, M.D., completed a 4-year residency in Diagnostic Radiology and has received an imaging fellowship at the University of California, San Diego.

Clement C. Wen, M.D., instructor in radiology, completed a 2-year fellowship in neuroradiology and has entered private practice in Baton Rouge.

Xingren Ying, Ph.D., research associate in radiation physics, Division of Radiation Oncology, has accepted a position at the Institute of Automation, Chinese Academy Sciences, Beijing, People's Republic of China.

Frederick R. Zivnuska, M.D., instructor in clinical radiology, has entered private practice in radiation oncology at St. Luke's Hospital, Milwaukee.

FYI

THE DIRECTOR'S OFFICE REPORT

FIRST YEAR POSTGRADUATES

Jeffrey L. Borders, M.D., Ph.D., graduated from Cal Tech with a Bachelor of Science degree in biology. Borders received his Ph.D. in bioengineering and his medical degree from the University of California, San Diego.

Edith H. Kang, M.D., graduated from Brown University with a Bachelor of Arts degree in human biology and received her medical degree from the University of Pennsylvania. She is a member of AOA.

Andrew B. Landes, M.D., graduated from Wesleyan University with a Bachelor of Arts degree in chemistry and completed his medical education at Washington University School of Medicine.

Mark Mayhle, M.D., graduated from Seattle Pacific University with a Bachelor of Science degree in engineering science. Mayhle received his Master of Science degree in chemical engineering and his medical degree from the University of Washington. He is a member of AOA.

Ronald O. Robison, M.D., received a Bachelor of Science degree in biology and general science from Oregon State University and completed his medical education at the Oregon Health Sciences University. Robison is a member of AOA.

Robert M. Smith II, M.D., Ph.D., graduated from Florida State University with a Bachelor of Science degree in physics and a Ph.D. in molecular biophysics. He received his medical degree from Emory University.

Jonathan C. White, M.D., Ph.D., received a Bachelor of Science degree in physics and math from MIT. White received his Master of Science degree and Ph.D. in physics as well as his medical degree from Stanford University.

NEW FELLOWS

Karen S. Baker, M.D., instructor in radiology, is a fellow in musculoskeletal radiology. She received a Bachelor of Science degree in biology and her medical degree from the University of Kentucky. Baker completed her diagnostic radiology residency at the Medical College of Virginia, Richmond.

Elvira V. Lang, M.D., instructor in radiology, is a fellow in interventional radiology. Lang received her medical degree, completed her residency in radiology, and was a faculty radiologist at the School of Medicine, University of Heidelberg, West Germany. In the United States, Lang completed a radiology internship and a fellowship in angiography as well as a residency at the University of California, San Diego.

Cheryl L. Sisler, M.D., instructor in radiology, is a fellow in pediatric radiology. She received a Bachelor of Science degree in pharmacology at the University of Wisconsin-Madison and completed her medical education at St. Louis University. Sisler completed her residency in diagnostic radiology at Jewish Hospital. She is a member of AOA.

Carol K. Yates, M.D., instructor in radiology, is a fellow in abdominal radiology. She received her medical education at University of Oklahoma Health Sciences Center and completed her residency in diagnostic radiology at Baptist Medical Center, Oklahoma City. She is a member of AOA.

FIRST YEAR RESIDENTS

Clinton M. Anderson, M.D., received his Bachelor of Arts degree in biology from the University of Tennessee. He completed his medical education and internship at Vanderbilt University, Nashville. Anderson is a member of AOA.

William G. Horstman, M.D., received his Bachelor of Science degree in chemistry from the University of South Dakota. A 1983 graduate of Washington University School of Medicine, Horstman completed his internship and two years of residency in urology at the Naval Hospital in San Diego.

Jamie T. Surratt, M.D., received a Bachelor of Science degree in physical therapy from the University of Kentucky. She completed her medical education at the University of Louisville, Kentucky, and completed her internship and a 1-year residency in internal medicine at Barnes Hospital. Surratt is a member of AOA.

O. Clark West, M.D., completed his premedical training at Drake University. A 1986 graduate of Washington University School of Medicine, West completed his internship and a 1-year residency in internal medicine at Barnes Hospital. He is a member of AOA.

Kris J. Van Lom, M.D., graduated from the University of Oregon with a Bachelor of Arts in biology and received his medical degree from the Oregon Health Sciences University School of Medicine. He completed his internship at Mercy Hospital, San Diego, and a 3-year diagnostic radiology residency at University of California, San Diego. He is a member of AOA.

FYI

VISITING PROFESSORS & INVITED LECTURERS

RADIATION ONCOLOGY RESIDENTS

Avraham Eisbruch, M.D., received his medical degree and completed his internal medicine residency at Tel-Aviv University, Israel. He completed a fellowship in medical oncology at University of Texas and in oncology and radiation therapy at Tel-Aviv University.

Martin Keisch, M.D., received his Bachelor of Science degree in biology from State University of New York at Stony Brook and his medical degree from Tufts University, Boston, Massachusetts. Keisch completed his internship at the Boston VA Medical Center and is a member of AOA.

Jeff M. Michalski, M.D., received his premedical training at the University of Wisconsin and completed his medical education at the Medical College of Wisconsin. He completed his internship and one year of residency in radiation oncology at Columbia-Presbyterian Medical Center, New York.

NUCLEAR MEDICINE TRAINEES

Farrokh Dehdashti-Shahrokh, M.D., received her medical degree from Pahlavi Medical School, Shiraz, Iran, had an internship and three years of radiology residency in Iran, and completed a 2-year residency in nuclear medicine at the Medical College of Wisconsin Hospitals.

Tsuneo Hirano, M.D., received his medical training at the Gunma University School of Medicine, Japan, and completed his radiology residency at Tulane University Medical Center Hospital, New Orleans.

Kenneth J. Lee, M.D., received his B.S. and M.B. degrees in medicine and surgery from the University of Melbourne, Australia. He received the Fellow degree in internal medicine and cardiology from the Royal Australasian College of Physicians.

Jerold L. Saef, M.D., received his Bachelor of Arts degree in chemistry from Florida Atlantic University and his medical degree from the University of South Florida College of Medicine. He completed a 2-year residency in cardiology and a 3-year residency in internal medicine at St. Elizabeth's Hospital of Boston, an affiliate of Tufts University School of Medicine. Saef has received U.S. Board certification in internal medicine.

James P. Crane, M.D., professor of radiology, presented Meet-the-Professor Session on "The Fetus with a Problem" at the AM Institute of Ultrasound in Medicine—World Federation for Ultrasound in Medicine Annual Meeting, Washington, D.C., October 17-21. Crane was visiting professor at Harvard Medical School, September 30—October 2, where he spoke on "Prenatal Diagnosis and Management of Genitourinary Malformations" and "Sonographic Diagnosis of Neural Tube Defects."

Bahman Emami, M.D., professor of radiology, presented "Clinical Experience with Interstitial Hyperthermia and Radiation Therapy" at the Role of Hyperthermia in Radiation Oncology—Cooperative Meeting between the United States and the People's Republic of China, Beijing, China, September 8-10.

Mokhtar Gado, M.D., professor of radiology, presented "MR—Anatomy of the Spine and Cord at the Craniocervical Junction" at the XVth Congress of the European Society of Neuroradiology in Wurzburg, Germany, September 13-17. Gado presented "Overall Approach to Low Back Pain," "Principles of Interpretation of MR Images of the Brain," and "Lesions of the Sellar Region" at the 1988 Harvard Postgraduate Course, "Current Concepts in Neuroradiology, Head and Neck Radiology, and Neuro-MRI," in Boston, October 3-7.

Louis A. Gilula, M.D., professor of radiology, attended the National Podiatric Association, Anaheim, August 19. Gilula lectured on "Musculoskeletal Neoplasia" and "Arthrography/Tenography of Foot and Ankle." He attended the American Society for Surgery of the Hand, Baltimore, September 15. He participated in a panel discussion on "Imaging Techniques." Gilula attended the International Skeletal Society, Sydney, Australia, September 25—October 10, where he spoke on "Wrist Arthrography—Update." He spoke on "CT and 3-D CT of the Wrist," "Analytic Approach to Carpal Injuries," "CT of the Foot and Ankle" at Diagnostic Radiology Update, University of Texas, Southwestern Medical Center, Dallas, October 28-30. Gilula was co-organizer of an international "Wrist Investigator Workshop," and lectured on "The Wrist-1988," "Radiographic Anatomy and Exam," "Inflammation X-Ray Exam," and he attended a panel on "Clinical Evaluation of the Wrist," Tampa, November 3-5.

Jay P. Heiken, M.D., associate professor of radiology, presented "MRI of the Pelvis" at seminars in Magnetic Resonance Imaging in Door County, Egg Harbor, Wisconsin, July 29-31.

FYI

VISITING PROFESSORS & INVITED LECTURERS

Andrei Laszlo, Ph.D., assistant professor of cancer biology in radiology, lectured on "Mechanisms of Thermotolerance: Less Damage or Better Repair" at Stanford University, Department of Radiology, June 29; Laboratory of Cell Biology, Lawrence Berkeley Laboratory, July 5; Radiation Oncology Research Laboratory, Department of Radiology, University of California, San Francisco, July 8. Laszlo was visiting staff scientist at the Radiation Biology Section of the Radiation Oncology Branch of the National Cancer Institute, July 24–August 2. He visited Beaumont Hospital and Wayne State University in Detroit and the University of Michigan at Ann Arbor, November 8–10, where he presented a series of lectures "On the Molecular Mechanisms of Thermotolerance."

Joseph K.T. Lee, M.D., professor of radiology, chaired a scientific session at the 7th annual scientific meeting of the Society of Magnetic Resonance in Medicine, San Francisco, August 20-26. Lee spoke at a seminar on "Magnetic Resonance Imaging of the Liver and Male and Female Pelvis" in Los Angeles, September 16-18.

Bruce L. McClelland, M.D., professor of radiology, attended the Uroradiology '88 conference at the University of Minnesota PGC, Minneapolis, where he presented "Low Osmolar Contrast Media" and "Oncologic Imaging." McClelland was an invited speaker at the Royal Australian College of Radiology (RACR), Auckland, New Zealand, October 2-7. He also attended uroradiology meetings in Melbourne, Australia, October 14-16, where he was a guest lecturer. McClelland presented "Low Osmolar Media—U.S. Experience," "CT of the Indeterminate or Problem Mass," "Prostatic Ultrasound," and "Lithotripsy—Beyond the Stone Age."

Tom R. Miller, M.D., Ph.D., associate professor of radiology, presented a paper "Three-Dimensional Display of SPECT Images" at the annual meeting of the Missouri Valley Chapter, Society of Nuclear Medicine, Des Moines, September 17.

Stephen Moerlein, Ph.D., assistant professor of radiation chemistry in radiology, presented "Recent Developments in Radiopharmaceuticals for PET and SPECT" at the Nuclear Research Center, Juelich, Federal Republic of Germany, on July 12.

William A. Murphy, M.D., professor of radiology, spoke as the invited education session lecturer on "MRI of Bone Marrow" at the mid-February meeting in Boston of the Society for Magnetic Resonance Imaging. Murphy also was invited plenary session speaker at the Meeting of the Society of Magnetic Resonance in Medicine in San Francisco, August 20-26. The topic was "MRI of the Bone Marrow and Musculoskeletal Tumors." He was an invited speaker at a conference titled "Early Decisions in DMARD Development" jointly planned and co-sponsored by the Arthritis Foundation, the American Rheumatism Association, the National Institutes of Health and the Federal Drug Administration in Washington, D.C., September 29. The topic was "Newer Imaging Techniques in Proving Efficacy of Candidate Compounds." Murphy was an invited participant at a workshop on "Directions in Research in Diagnostic Imaging" held by the National Cancer Institute, Winston-Salem, North Carolina, October 12-14. He was an invited lecturer at continuing education meetings on Practical Magnetic Resonance Imaging 1988, Las Vegas, October 21-22, where he spoke on "MRI of Musculoskeletal Tumors," "MRI of the Bone Marrow: Basic Concepts," "MRI of the Bone Marrow: Clinical Aspects." He also spoke at the 17th Annual Seminar Musculoskeletal Disorders, Phoenix, November 11-13, on "MRI of Bone Marrow," "MRI of Musculoskeletal Tumors," and "Forensic Radiology."

Henry D. Royal, M.D., associate professor of radiology, attended Management of Radiation Accidents, Albuquerque, October 6-8, where he presented "Carcinogenesis and Radiation," "Bone Marrow Transplantation" and "Combined Injury."

Stuart S. Sagel, M.D., professor of radiology, was a visiting professor at St. Luke's/Presbyterian Hospital, Rush Medical School, Chicago, July 15.

Barry A. Siegel, M.D., professor of radiology, served on the faculty of the eleventh annual postgraduate course on Practical Radiology, University of Virginia School of Medicine, Charlottesville, Virginia, October 10-13, where he presented lectures on "Ventilation-Perfusion Scintigraphy and Pulmonary Embolism" and "Gastrointestinal Bleeding Scintigraphy."

Joseph R. Simpson, M.D., Ph.D., associate professor of radiology, spoke on "Techniques and Results of Interstitial Implants in Malignant High Grade Gliomas" at Tufts University, New England Medical Center Hospitals, May 20.

Jerrold Wallis, M.D., assistant professor of radiology, attended Clinical Nuclear Medicine Update, sponsored by the Missouri Valley Chapter of the Society of Nuclear Medicine, Des Moines, September 17, where he presented "Selection of Optimal SPECT Reconstruction Filters."

Todd H. Wasserman, M.D., professor of radiology, attended the semiannual Cancer and Acute Leukemia Group B Meeting in Atlanta, October 26, where he participated in the lymphoma, radiation, and lung subcommittee.

FYI

SYMPOSIA

Bahman Emami, M.D., professor of radiology, attended the 5th Symposium on Hyperthermic Oncology, Kyoto, Japan, September 4-15. Emami presented "Interstitial Hyperthermia and Brachytherapy in the Treatment of Head and Neck Cancer;" "Thermoradiotherapy of Malignant Melanoma," and "Regional Hyperthermia in the Treatment of Recurrent Deep-Seated Tumors: Analysis of Phase I Trial." He attended the first annual Oncology Symposium: Non-Small Cell Lung Cancer, Kansas City, November 18, where he presented "Radiotherapeutic Management of Non-Small Cell Lung Cancer."

Andrei Laszlo, Ph.D., assistant professor of cancer biology in radiology, attended the 5th International Symposium on Hyperthermic Oncology, Kyoto, Japan, August 29—September 3. He presented a poster titled "Mechanisms of Thermotolerance: Less Damage or Better Repair?" and a paper on "Modifications of Various States of Thermotolerance" in the workshop on "Modification of Thermotolerance" and a paper on "Mammalian Heat Shock Proteins: The Search for Functions." Laszlo was also invited to speak at a satellite meeting on "Heat Shock Proteins" at Kyoto University, September 5, where he presented a talk entitled "Mammalian Heat Shock Proteins."

Stuart S. Sagel, M.D., professor of radiology, presented "CT of the Mediastinum" and "CT of the Pleura" at the Ninth Annual Brown University Symposium on Diagnostic Imaging, Newport, Rhode Island, August 8-11.

Gilbert H. Nussbaum, Ph.D., associate professor of radiation physics in radiology, attended the 5th International Symposium on Hyperthermic Oncology in Kyoto, Japan, August 29—September 3. At this meeting he organized and co-chaired a symposium session, "Techniques for Electromagnetic Heating," and presented a paper titled "Targeted Deep Heating through Manipulation of SAR Distributions." He also attended the U.S./China Cooperative Meeting on "The Role of Hyperthermia in Radiation Oncology," Beijing, People's Republic of China, September 8-10, where he co-chaired the opening session on "Hyperthermia Physics, Engineering, and Thermometry," and presented a paper titled "Directed Deep Heating."

Joseph L. Roti Roti, Ph.D., professor of cancer biology in radiology, chaired two sessions at the 5th International Symposium on Hyperthermic Oncology, Kyoto, Japan, August 27—September 3. The subject of the first session was "Heat Induced Changes in Nuclear and Nuclear-Matrix Protein" co-authored with Andrei Laszlo, Ph.D., and the second session was "The Effects of Hyperthermia on DNA Damage and Its Repair." Roti Roti presented a paper entitled "Heat-Induced Changes in the Protein Content of Nuclei and Nucleoids as Modified in Thermotolerant Cells by Procaine, Ethanol or Glycerol" co-authored with Nazan Turkel.

Jeffrey J. Brown, M.D., assistant professor of radiology, presented "History of MRI" at a symposium titled "Application of High Technology to Medical Care" at the University of California School of Medicine, San Diego, September 13.

Judy M. Destouet, M.D., associate professor of radiology, presented "Mammography and the Augmented Breast" at the Third Annual Plastic Surgery of the Breast Symposium, Santa Fe, September 7.

Carlos A. Perez, M.D., professor of radiology and director of the Division of Radiation Oncology, spoke on "Controversies in the Role of Radiation Therapy in the Management of Cervical Metastatic Lymph Nodes in Tumor of the Oral Cavity, Oropharynx and Larynx" at the Second International Conference on Head and Neck Cancer, July 31—August 5, Boston. Perez attended the 5th International Symposium on Hyperthermic Oncology, Kyoto, Japan, August 29—September 3, where he spoke on "Prognostic Factors in the Combined Treatment of Tumors Radiation Dose and Fractionation," "Irradiation and Hyperthermia in the Treatment of Recurrent Carcinoma of the Breast in the Chest Wall," "MIR and RTOG Experience," and "Irradiation and External Hyperthermia in Treatment of Head and Neck Cancer." He also spoke on "Hyperthermia in the Treatment of Cancer," "Cancer of the Lung," "New Techniques of Irradiation," and "Radiation Therapy in Head and Neck Cancer," Medellin, Colombia, at the 10th Anniversary Instituto de Ciencias de la Salud, September 14-16.

AMERICAN SOCIETY FOR THERAPEUTIC RADIOLOGY AND ONCOLOGY

The following Mallinckrodt Institute staff members participated in the 30th Annual Scientific Meeting of the American Society for Therapeutic Radiology and Oncology, New Orleans, October 9-14.

SCIENTIFIC SESSIONS

Bahman Emami, M.D., organized and moderated "Photon Three-Dimensional Treatment Planning." He also presented "Three Dimensional Treatment Planning for Lung Cancer" and "3-D Planning in Thoracic Oncology."

James A. Purdy, Ph.D., organized and moderated "Electron Beam Dosimetry." He also presented "The Use of Dose Surfaces for Three-Dimensional Treatment Planning."

John W. Wong, Ph.D., presented "On-Line Radiotherapy Imaging with an Array of Fiber-Optic Image Reducers" and "Patient Dose Estimation Using Entrance and Portal Dose Distributions."

Joseph R. Simpson, M.D., Ph.D., moderated "Radiation Therapy Oncology Group (RTOG) Survival Data on Anaplastic Astrocytomas of the Brain: Does a More Aggressive Form of Treatment Adversely Impact Survival?" He also presented "Three-Dimensional Treatment Planning Considerations for Prostate Cancer."

Todd H. Wasserman, M.D., moderated "Biology of Sensitizers."

FYI

SYMPOSIA

Martin S. Weinhaus, Ph.D., presented "On a More Efficacious Presentation of the Images Used in Radiation Oncology"

SCIENTIFIC EXHIBITS

James A. Purdy, Ph.D., "Three Dimensional Radiation Therapy"

REFRESHER COURSES

Bahman Emami, M.D., "Applied Techniques and Clinical Practice of Interstitial Hyperthermia" and "Three-Dimensional Treatment Planning for Lung Cancer"

HONORS/ AWARDS

James P. Crane, M.D., professor of radiology, was named recipient of the Virginia Lang Chair in Obstetrics and Gynecology, August 8.

Andrei Laszlo, Ph.D., assistant professor of radiology in cancer biology, attended the 5th International Symposium on Hyperthermia Oncology in Kyoto, Japan, as one of seven recipients of the Outstanding Young Investigators in Hyperthermia award sponsored by the Yamamoto Vinyter Company of Japan.

Barry A. Siegel, M.D., professor of radiology, received a grant from the Edward Mallinckrodt, Jr. Foundation to research coronary artery disease using Positron Emission Tomography. Coinvestigators are Mark A. Mintun, M.D., assistant professor of radiology, and Robert J. Gropler, M.D., instructor in radiology.

APPOINTMENTS/ ELECTIONS

Andrei Laszlo, Ph.D., assistant professor of cancer biology in radiology, was appointed a representative for the program committee of the 1989 national meeting of the North American Hyperthermia Group in Seattle.

Bruce McClennan, M.D., professor of radiology, was invited to join the ACR Inter-society Committee on Systematized Refresher Courses as co-chairman of the Subcommittee on Genitourinary Radiology. The subcommittee will develop plans for a genitourinary radiology course for the 1989 meeting in New Orleans of the American Roentgen Ray Society and future refresher courses in genitourinary radiology.

Tom R. Miller, M.D., Ph.D., associate professor of radiology, was elected president-elect of the Computer and Instrumentation Council, Society of Nuclear Medicine.

William A. Murphy, Jr., M.D., professor of radiology, was appointed to a three-year term on the Scientific Program Committee of the American Roentgen Ray Society. Murphy is also currently serving on the Scientific Program Committee of the Radiological Society of North America as chairman of the Skeletal Committee.

Gilbert H. Nussbaum, Ph.D., associate professor of radiation physics in radiology, was a member of the thesis examination committee for S.G. Kim of the Department of Chemistry, for his dissertation on "A deuterium nuclear magnetic resonance spectroscopic investigation of tumor blood flow *in-vivo*," August 18.

ALUMNI NEWS

Norbert J. Liebsch, M.D., Ph.D., has accepted a staff position in Therapeutic Radiology working on the Proton Beam Project at Massachusetts General Hospital. After completion of his residency in Diagnostic Radiology at the Institute, Liebsch finished his training in Therapeutic Radiology at the Mayo Clinic. He received certifications in Diagnostic Radiology and Therapeutic Radiology by the American Board of Radiology and is currently applying for his Massachusetts medical license.

TECHNOLOGIST NEWS

Norman L. Hente, R.T., B.S., FASRT, was conference coordinator and Murray Lecturer for the 56th Annual Conference of the Missouri Society of Radiologic Technologists.

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CIC NEWS

The Cancer Information Center (CIC) is cosponsored by the Mallinckrodt Institute of Radiology and the Barnard Free Skin and Cancer Hospital at the Washington University Medical Center.

CONTRIBUTIONS

Mr. and Mrs. Herbert R. Bilgram in memory of Alma Arnold

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Social Services NW & Adolescent Psych Unit in memory of Noel Miller

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Kutis Bowling League, Red Bird Lanes in memory of James Illert

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Mrs. Dora D. Thompson in memory of Bene B. Hinsman

Staff of 5400, Barnes Hospital Plaza in memory of brother of Carmeletta Calhoun

"Tucker's Place", Kathy, Cindy, Rhonda, Gloria and Jerry in memory of Dr. Joseph Jaudon

Marie Brettschneider

Judy C. Hunt in memory of Lester Whited

Mr. & Mrs. Sidney J. Bronzin in memory of Lenore S. Rosen

Sandy Wood in appreciation of the thoughtfulness of Susie Yawitz

Mr. & Mrs. William J. Kristen, Jr. in memory of Preston Harrison and Patricia Parker

Sylvia Schacter in honor of wedding anniversary of Mr. & Mrs. George Lamb

Daniel Miller-for the family and friends of Susan Miller Gennari in memory of Susan Miller Gennari

Judy C. Hunt in memory of Lester Whited

Lloyd Jacobs

Mrs. Dorothy Showman in memory of Jarold E. McFarland

Mr. & Mrs. Everett Siegel in memory of Kenneth Lever

The Lab of 5509 Wohl Hospital in memory of Fannie Barker

Mrs. J.E. Kellogg in memory of Connie Foley

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KSDK donation in tribute of Dr. Judy Destouet

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Debbie Schachter and family in memory of Ann Roy

Erma Jean Bullerdick in memory of Mr. Aylward

Sylvia Schacter in memory of Mary Jones

Mr. & Mrs. R.F. Collins in memory of Beau Peters

FYI

CALENDAR

December 12, 1988

City-Wide Radiology
Conference
MRI in the Clinical Manage-
ment of Lymphoma
Elias A. Zerhouni, M.D.,
professor of radiology
Johns Hopkins Medical
Center, Baltimore
Scarpellino Auditorium

January 9, 1989

City-Wide Radiology
Conference
St. Louis University
To Be Announced

February 13, 1989

City-Wide Radiology
Conference
"MRI of the Pelvis: Staging
and Monitoring Response
Time in Therapy"
Herbert H. Kressel, M.D.,
professor of radiology
Hospital of the University
of Pennsylvania,
Philadelphia
Scarpellino Auditorium

March 13, 1989

City-Wide Radiology
Conference
3rd Annual Daniel R. Biello
Memorial Lecture
"Issues Facing the Diffusion
of Medical Technology"
Barbara J. McNeil, M.D.,
professor, radiology &
clinical epidemiology
Harvard Medical School,
Boston
Scarpellino Auditorium

April 10, 1989

City-Wide Radiology
Conference
Leroy Sante Lecture
St. Louis University
To Be Announced

May 8, 1989

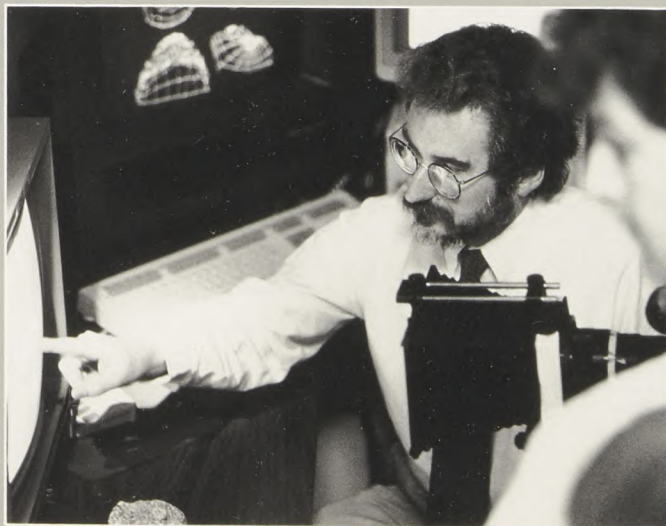
City-Wide Radiology
Conference
"Stereotactic Breast Biopsy"
Judy M. Destouet, M.D.,
associate professor of
radiology
Mallinckrodt Institute of
Radiology
Scarpellino Auditorium



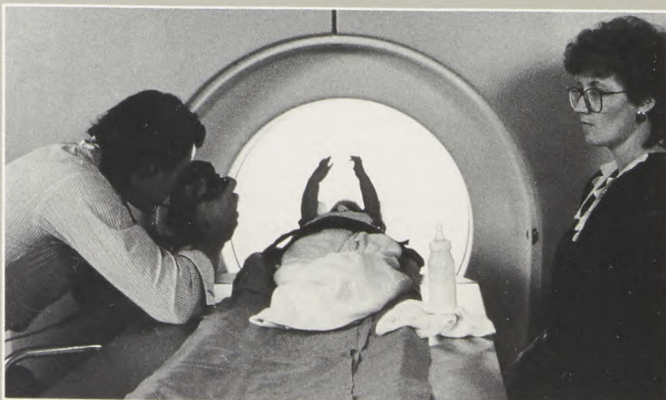
Steve Kohler

The BBC's Sir David Attenborough recently traveled to Mallinckrodt Institute with a full crew to film a program concerning the modern study of fossils. Here, Sir David confers with Michael W. Vannier, M.D., associate professor of radiology and director of the image processing laboratory.

Washington University Medical School's Glenn Conroy, Ph.D., points out a detail on the CRT for the camera.



Steve Kohler



Steve Kohler

Also visiting Mallinckrodt this fall was world-famous still photographer Alexander Tsiaras. Working for LIFE Magazine and a consortium of foreign publications, Tsiaras trained his eye on the manner in which radiology is aiding craniofacial reconstructions and pediatric heart surgery. Here, he focuses on an infant in a CT scanner's bore.

SPOTLIGHT

PROFILES OF THE CHIEFS



JOHN ENGELS

John Engels, M.D., has come to know precisely what he wants. His technique has been to experiment and then rule out that which he does not like. Now chief resident in Diagnostic Radiology at Mallinckrodt Institute of Radiology and liking it, Engels describes the process he's been through as "constantly redefining what is personally and professionally satisfying."

Reassessing his directions hasn't always been easy, but Engels has been decisive and unwilling to settle for less than the best. The son of a Chicago psychiatrist, he earned an undergraduate degree in science education at the University of Illinois, Champaign-Urbana, after the "hubhub" of medical school put him off initially. And he taught science on the north side of Chicago for a year before he realized that the unstable work environment for teachers in the late '70s, with enrollments down, meant an employment insecurity

he could not tolerate.

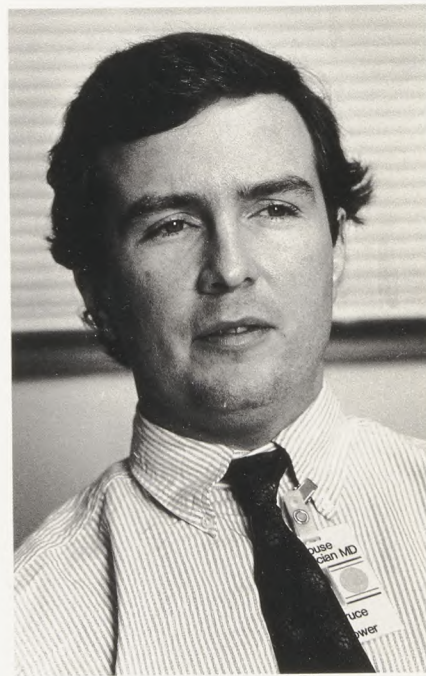
So Engels worked for a year as a research technician in cellular immunology, then moved on to graduate school in the same field. Eventually, his testing of the prevailing circumstances led to the realization that complete professional satisfaction lay only in a career as a physician.

Chicago's Rush Medical College proved fulfilling, and Engels followed with an internship in internal medicine at Washington University, coming here first in 1984. From that experience, he learned that the peculiar demands of 24-hour-a-day patient care were not for him. "The abstract is more my style," Engels says, though he still gets plenty of patient interaction.

For a time, he thought about following his father into psychiatry, but radiology kept beckoning. Although he says he's not "particularly oriented toward the technology," he's still confident of his choice of a career in radiology. The greatest reward has been to "know the diseases, what causes them, and how to recognize them." The challenge of correlating what the films show with a patient's history and symptoms clearly pleases Engels.

He'll continue to explore that challenge when he completes his residency in 1989, then enters private practice with a group of Mallinckrodt alumni at St. Louis' Missouri Baptist Hospital. "It's a general practice; we'll see it all," he says with anticipation.

John Engels has known for a long time that he was headed into private practice. That decision, along with those that came before it and those being pondered today, was made only after he tested the waters. When he didn't like something, he looked for another answer. Imagining a more appropriate mindset for a diagnostic radiologist is difficult. □



BRUCE BOWER

The conventional path to the practice of radiology—through college, medical school, internship, and residency—may have become more the exception than the rule. Witness Bruce Bower, M.D., new co-chief resident in Diagnostic Radiology. His medical education began with an early commitment to a six-year program through which he earned both B.S. and M.D. degrees. Bower is not sure what the B.S. is in. "It was the M.D. I was after," he says with characteristic pragmatism.

Bower's education has also continued longer than most, including a three-year residency in internal medicine and four years as a resident in radiology. His plans call for an additional year to be devoted to a fellowship in interventional radiology with Daniel Picus, M.D., here at Mallinckrodt before he calls his formal education complete.

Though Bower knew early that his professional life would be

SPOTLIGHT

PROFILES OF THE CHIEFS

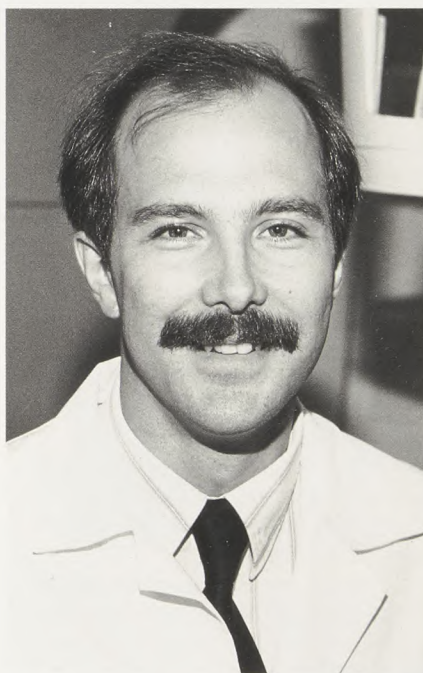
spent in some type of service to others, it was an event late in high school that set his course into medicine. Over the summer months, Bower and some friends worked at painting houses, and a member of the crew was involved in a serious motorcycle accident on his way home from work one day. Bower visited that friend during his convalescence and recognized in the medical profession the opportunity to combine many of his interests. As an aside, he notes that the accident victim is also a physician today, just back in this country after three years of service as a missionary in Africa.

During medical training at Hahnemann University in Philadelphia and his internal medicine residency at Case Western Reserve, Bower discovered that he was "always interested in the new things going on in the basement." New CT technology, the emergence of MRI, and the development of interventional techniques lured him away from internal medicine. Interventional radiology suits him especially well because, "I get restless reading films all day. I like to work with my hands, do procedures, and interact directly with patients."

Away from the many hours he gives to the work each week, a high level of activity remains characteristic of Bower, who is single. He works out and plays racquetball, tennis, and touch football. He also contributes to Mallinckrodt's softball team, for which he often pitches. "Unless Ron (Evens) shows up. Then he's the pitcher. Unless he says I'm the pitcher."

When his residency and the fellowship to follow end, Bower foresees private practice, "probably in Colorado, but maybe back in Pittsburgh." His mildly unconventional path to his goal has not cost him any of his pragmatism.

"I'll try to get the best job in the nicest area I can," he says. □



RICHARD LOVETT

Richard Lovett, M.D., paid his way through the University of Vermont by working in the fire department of his hometown, answering the fire alarm. Now that Lovett is the new assistant chief resident in Radiation Oncology at Mallinckrodt, he has traded the fire bell for a beeper, but he's still on call.

Lovett doesn't mind. He answers the beeper's signal many times during the course of a day that usually runs to 15 hours, sometimes more now that he's studying for boards. For Lovett, it's all satisfying; "everything I hoped for," he says.

Life as a physician always appealed to him, but "the road looked very long" when he first entered college. Anxious to get out on his own, Lovett undertook a two-year course of study that earned an Associate's Degree as a nuclear medicine technologist. He

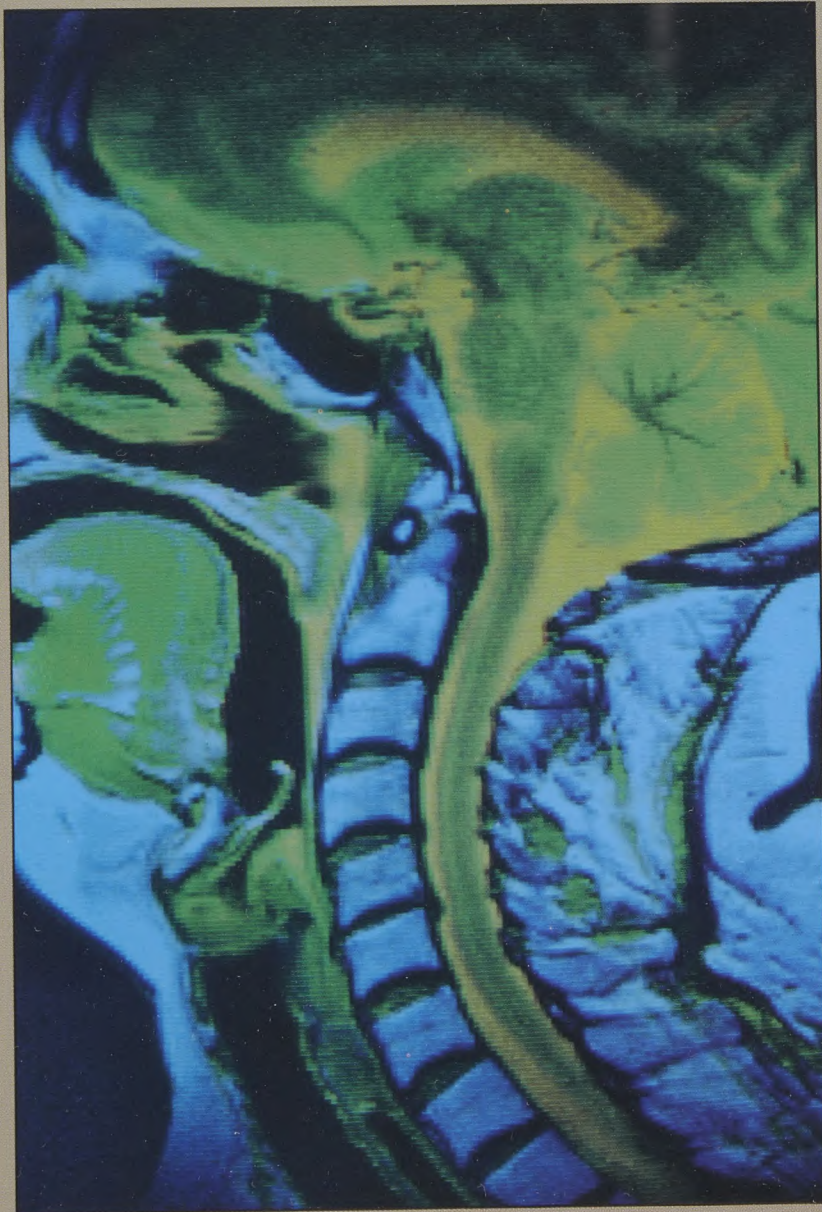
spent the next three years pursuing that career at New England Deaconess Hospital in Boston.

"But there are only so many career paths open to a technologist," Lovett says. He knew he wanted to continue working with patients, so he went to medical school. The same interest in technology that had drawn him to nuclear medicine made radiology a natural choice as a specialty. And a rotation in oncology in Vermont demonstrated just how he could blend his love for physics and the scientific with his desire to care for patients.

Many of Lovett's patients are very ill, some of them terminally so. "That's sometimes difficult," he admits. "When you treat someone for weeks on end, you develop an attachment. But no matter what the outcome, you're doing your best to either cure them or at least make them more comfortable." Lovett reduces the issue to its basics and explains, "They need something from me. I help."

He is the first in his family to leave Vermont in the pursuit of his profession. Two sisters remain within 20 miles of the family home, and a brother followed a family tradition and became a firefighter with the Rutland department. The move to Missouri has been a step into a more conservative realm—politically and socially—but not an unpleasant experience for Lovett who says he has "found a niche."

All of his work has been in academic departments, and Lovett anticipates that when he leaves Mallinckrodt after next year as chief resident, he will continue to mix research, writing, and clinical work. Exactly where, though, he's not sure. "I have no idea where I'll go," he says. Wherever it is, he'll remain on call in the service of his patients. □



When magnetic resonance imaging (MRI) focuses on one "slice" of the anatomy, it actually makes three images. Diagnosticians study all three, comparing them to what they know to be normal. Lately, in Mallinckrodt's image processing laboratory, each of the three has been assigned a color, and then they've been combined. According to neuroradiologist Mokhtar Gado, M.D., the colorization makes the components distinct and suggests ways in which tissues are either similar or different. "This is just the beginning, though," Gado says. "We still have many questions." Here, the process has been applied to MRI images of a patient's spinal cord, brain stem, and cerebellum. Note that subcutaneous fat and bone appear similar in color. Gado says that result is due to the presence of high fat content marrow within the bone.

FOCAL SPOT

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