

Spring 1985

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# FOCAL

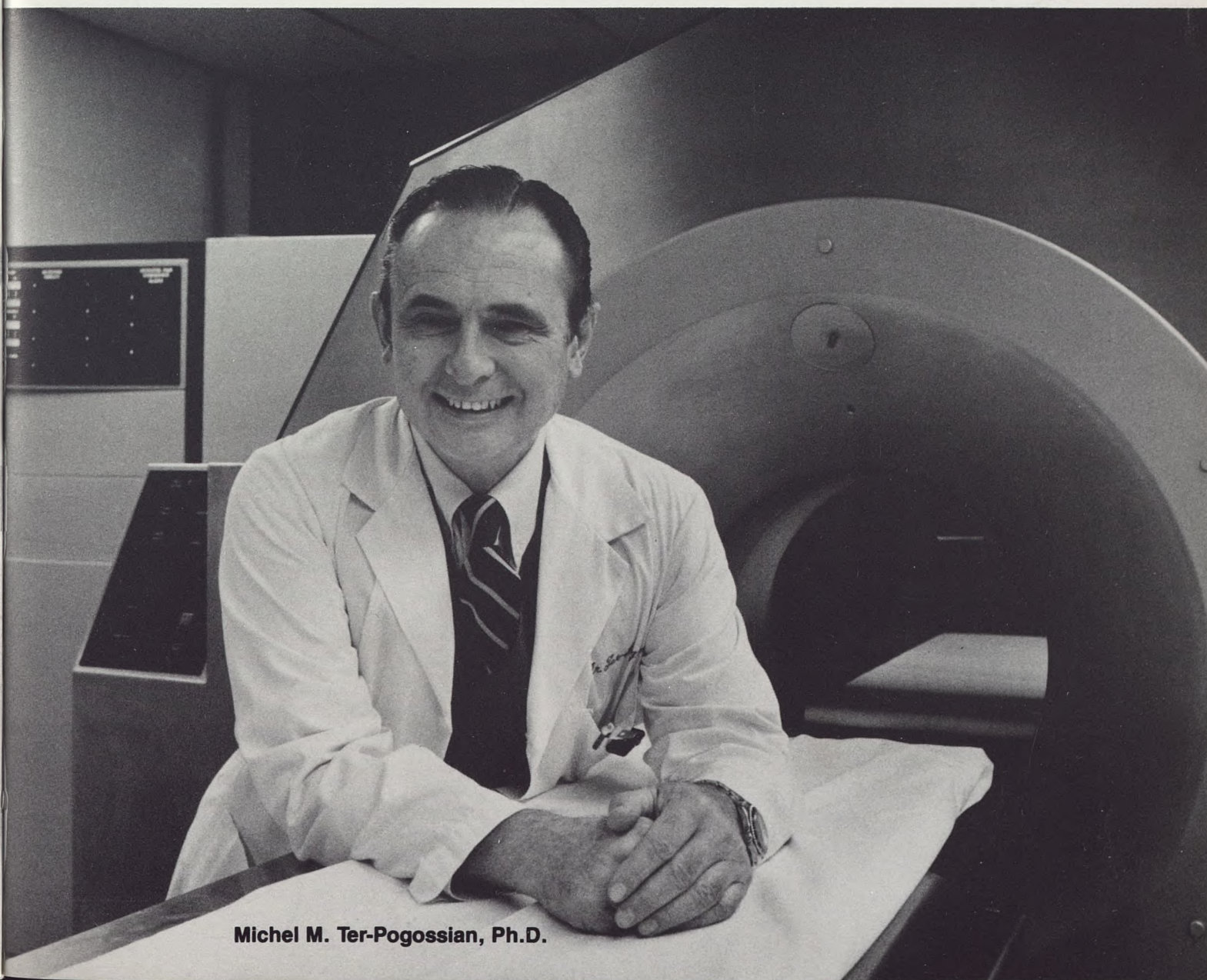
SPOT

M A G A Z I N E

Mallinckrodt Institute of Radiology

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1985



Michel M. Ter-Pogossian, Ph.D.



## A Distinguished Career is Honored

*A pioneer in the use of radionuclides for biomedical research*



### Michel M. Ter-Pogossian, Ph.D.

From an organization that has an international membership of 10,000 physicians, physicists, chemists, radiopharmacists, and nuclear medicine technologists, it cannot be easy to single out individuals who have been



"most innovative" and "most inventive." Nevertheless, for the past twenty-five years the Society of Nuclear Medicine has recognized its best, and the honored include Enrico Fermi, Fred-eric and Irene Curie, Lord Rutherford of Nelson, and Otto Hahn.

**Michel M. Ter-Pogossian, Ph.D.**, director of the division of radiation sciences at Mallinckrodt Institute, joined the list of distinguished honorees on June 2, 1985, when he received the Georg Charles de Hevesy Nuclear Medicine Pioneer Award. He was selected for this honor by Society president **Michael J. Welch, Ph.D.**

Dr. Ter-Pogossian was a student at the University of Paris in 1943, the

year that an Hungarian chemist named Georg Charles de Hevesy was awarded the Nobel Prize for showing how radioelements could be used as physiologic tracers. Hevesy's concept of radioactive indicators gave birth to nuclear medicine—and to endless possibilities for younger scientists.

Since his initial involvement in 1951 with the construction of one of the first scanning devices capable of detecting concentrations of radioactive material in living matter, Dr. Ter-Pogossian has progressively advanced radiotracer instrumentation and methodology. The history of his personal achievements in this field often mirrors the history of nuclear medicine itself.

*Reviewing the achievements of Dr. Ter-Pogossian's career in radiation sciences, Dr. Ronald G. Evens, left, director of MIR, presented the Georg Charles de Hevesy Nuclear Medicine Pioneer Award.*



# PET, SPECT, and NMR

## Competing or Complementary Disciplines?

During the 1950s, Dr. Ter-Pogossian promoted the use of stationary imaging devices. He designed one of the first radioisotope cameras, and was pivotal in the development of gamma cameras using image intensifier tubes.

No less influential was his work with tracer methodology. In the mid-1950s, Ter-Pogossian reported the first biomedical application of a sodium iodide detector for the diagnosis and localization of intracranial tumors. And in 1956, he was the first nuclear medicine scientist to use radioactive oxygen-15 in biologic studies.

The success of Dr. Ter-Pogossian's preliminary studies using radioactive oxygen led to the installation in 1963 of a small biomedical cyclotron at the Washington University Medical Center—the first cyclotron in the United States located in a medical center. Using the short-lived radioisotopes produced by the cyclotron, Ter-Pogossian and his colleagues at Mallinckrodt developed techniques for measuring blood flow, blood volume, oxygen metabolism, and glucose metabolism.

In 1974, they created practical positron emission tomography (PET), the instrumentation which plots the path of radioactive substances in "slices" of living tissue. Since then, several enhancements on the original device have been made, including PET V, the first system to use the wobbling approach; PET VI, which is six years old and now used extensively by neurologist **Dr. Marcus E. Raichle** and his collaborators in cerebral studies; and the first time-of-flight system which was developed about three years ago for use in coronary studies.

On staff at Mallinckrodt Institute of Radiology for 35 years, Dr. Ter-Pogossian has published over 200 papers and 50 book chapters. He is a fellow of the American Physics Society, an honorary fellow of the American College of Radiology, and an honorary member of the Société Belge de Médecine Nucléaire. In 1976, he was honored with the Paul C. Aebersold Award. ■

Dually honored this year by the Society of Nuclear Medicine, **Michel M. Ter-Pogossian, Ph.D.**, delivered the Second Annual Society of Nuclear Medicine Lectureship during the same meeting at which he received the Georg Charles de Hevesy award.

In his opening remarks to the Society, Dr. Ter-Pogossian noted that three emerging modalities—positron emission tomography (PET), single photon emission computed tomography (SPECT), and nuclear magnetic resonance (NMR)—occupy somewhat controversial places within the field of nuclear medicine. He chose a subjective approach to these issues and introduced his comments as "a personal opinion based upon scientific observation."

Dr. Ter-Pogossian began his comparison of the modalities by outlining the historical development of NMR. He discussed how NMR, from its inception in the '40s throughout its development in the '70s, has been akin to nuclear medicine and how NMR imaging currently fits and impinges upon nuclear medicine. Particular attention was given to the image forming variables of the modalities.

To illustrate how NMR imaging differs from nuclear medicine, Dr. Ter-Pogossian described several sets of NMR images.

"These images, although undoubtedly modulated by physiology, reflect morphology. They are much closer in the type of information that they convey to CT than to nuclear images," he explained.

One exception that he noted was NMR imaging which utilizes the frequency shift of protons to separate water and fat. Identifying this technique as the work of **Thomas Dixon, Ph.D.**, among others, Dr. Ter-Pogossian said, "This is definitely a physiological study, and it provides highly useful information."

He cautioned that NMR imaging in physiological studies works best with protons. Citing scientific calculations



*Dr. Michel M. Ter-Pogossian delivered the Second Annual Society of Nuclear Medicine Lectureship in Houston, Texas, on June 2.*

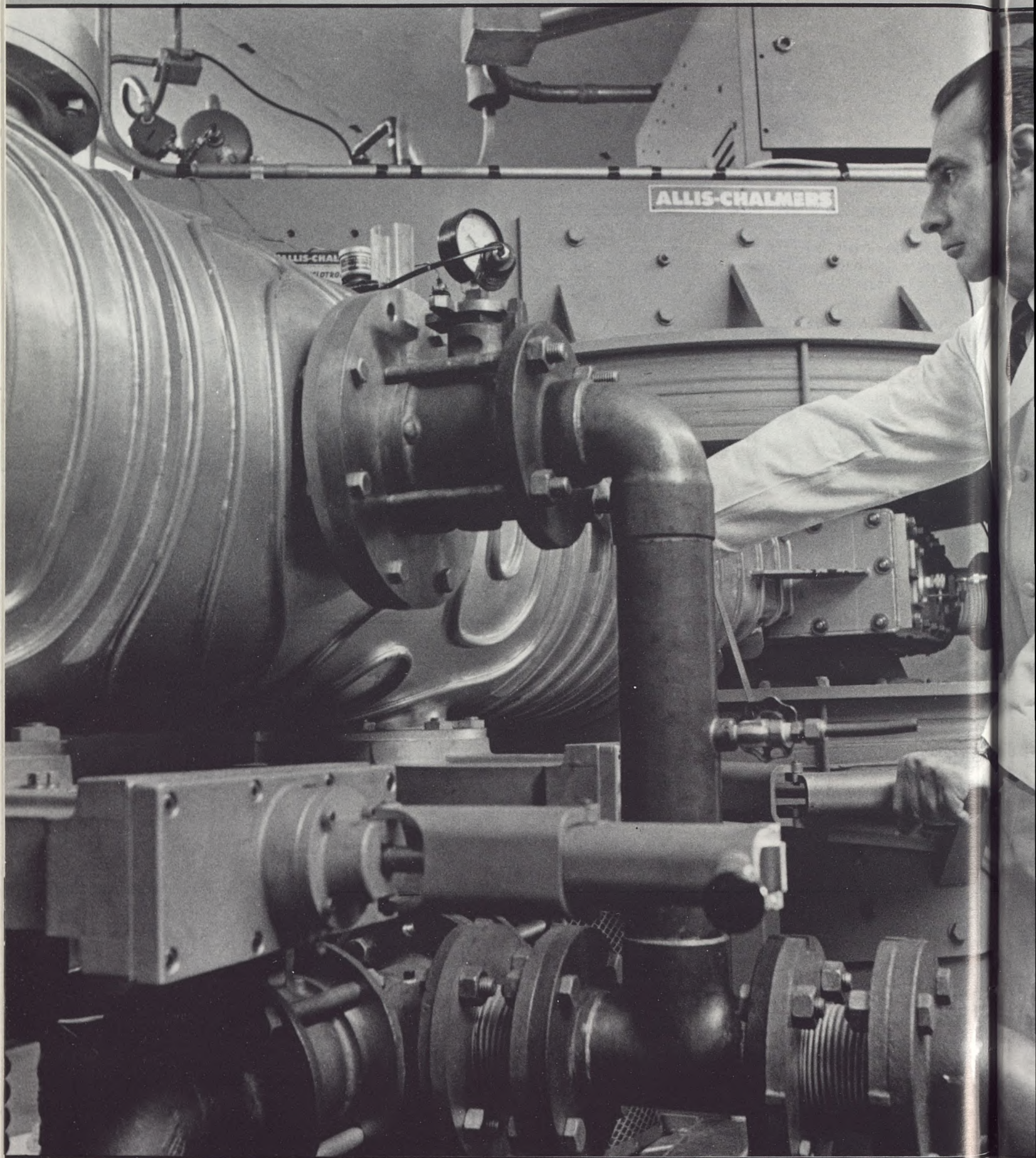
of spatial and timing resolution, he indicated that high resolution imaging of phosphorus and sodium with NMR would be difficult; and as far as carbon-13 in its natural state, practically impossible.

Dr. Ter-Pogossian also stated that tracer methodology, a cornerstone of nuclear medicine studies, is very difficult and in most cases, impossible, because of the large amounts of tracer material needed for imaging with NMR. "And our present knowledge of NMR does not allow us to hope that this situation will change in the foreseeable future," he added.

Regarding the comparative sensitivity and resolution of NMR and PET, Ter-Pogossian calculated that the present resolution of photons with NMR is about 3mm<sup>3</sup> per voxel, and with PET 8mm<sup>3</sup>, but said it is reasonable to extrapolate that in the near future, NMR will reach 1mm<sup>3</sup> and PET 3mm<sup>3</sup>. The

*continued*







## PET, SPECT, and NMR

approximate sensitivity in units per gram of tissue is 4 for NMR and 10-12 for PET. Several PET images were discussed to show how these figures qualify the type of work that is possible with each modality.

To begin his comparison of PET and SPECT (single photon emission computed tomography), Dr. Ter-Pogossian reviewed the history of the modalities. He argued that although PET and SPECT both utilize the image reconstruction process which was developed by David Kuhl in the '60s, they should be placed in separate categories.

"Fundamentally, the two modalities are very different in their concepts. The origin of PET is not so much the concept of the imaging process per se, but rather the interest in utilizing specific radionuclides, which are carbon-11, nitrogen-13, oxygen-15, and fluorine-18. The initial work to obtain autoradiograms of a tumor using oxygen-15, work that was carried out at Mallinckrodt Institute by **Dr. William Powers** and myself, was first presented at a 1957 United Nations Conference on peaceful utilization of radionuclides. As Frederic Curie commented, at that time, short-lived radionuclides such as oxygen-15 are highly attractive in physiological studies. Since then, oxygen-15 has become one of the major, if not the major, radionuclide in the study of cerebral function integrity."

According to Dr. Ter-Pogossian, the PET imaging process did not develop and become significant until later. "Probes were introduced to trace these short-lived radionuclides. As the number of probes increased, it was gradually recognized that chemistry and physiology were important factors in PET imaging, and at Mallinckrodt Institute, **Dr. Michael Welch** joined the PET investigations to 'straighten out' the chemistry, and **Dr. Marcus Raic-**

**hle** to interject thorough understanding of physiology."

"The realization that PET images could be obtained followed the development of a positron transverse section imaging device by a group of investigators at the Brookhaven National Laboratory," recalled Dr. Ter-Pogossian. "At Washington University, the probes that were utilized in the early systems were put together by a multidisciplinary team to construct a practical PET imaging device. Then, through the efforts of many individuals particularly **John Hood**, several more advanced PET devices were developed, and the progression of improvements has continued."

Reflecting upon the origin of SPECT, Dr. Ter-Pogossian noted that a different concept guided its development.

"The main drive, the main thrust in developing SPECT was to obtain better images with conventional nuclear medicine radionuclides. The modeling of what was happening to these compounds was secondary to the imaging process. Industry eventually realized that there was something important in SPECT. At this time, SPECT remains more an imaging modality, than a biochemical tool."

Dr. Ter-Pogossian concluded that, at the fundamental level, PET and SPECT are differentiated on the basis of modeling.

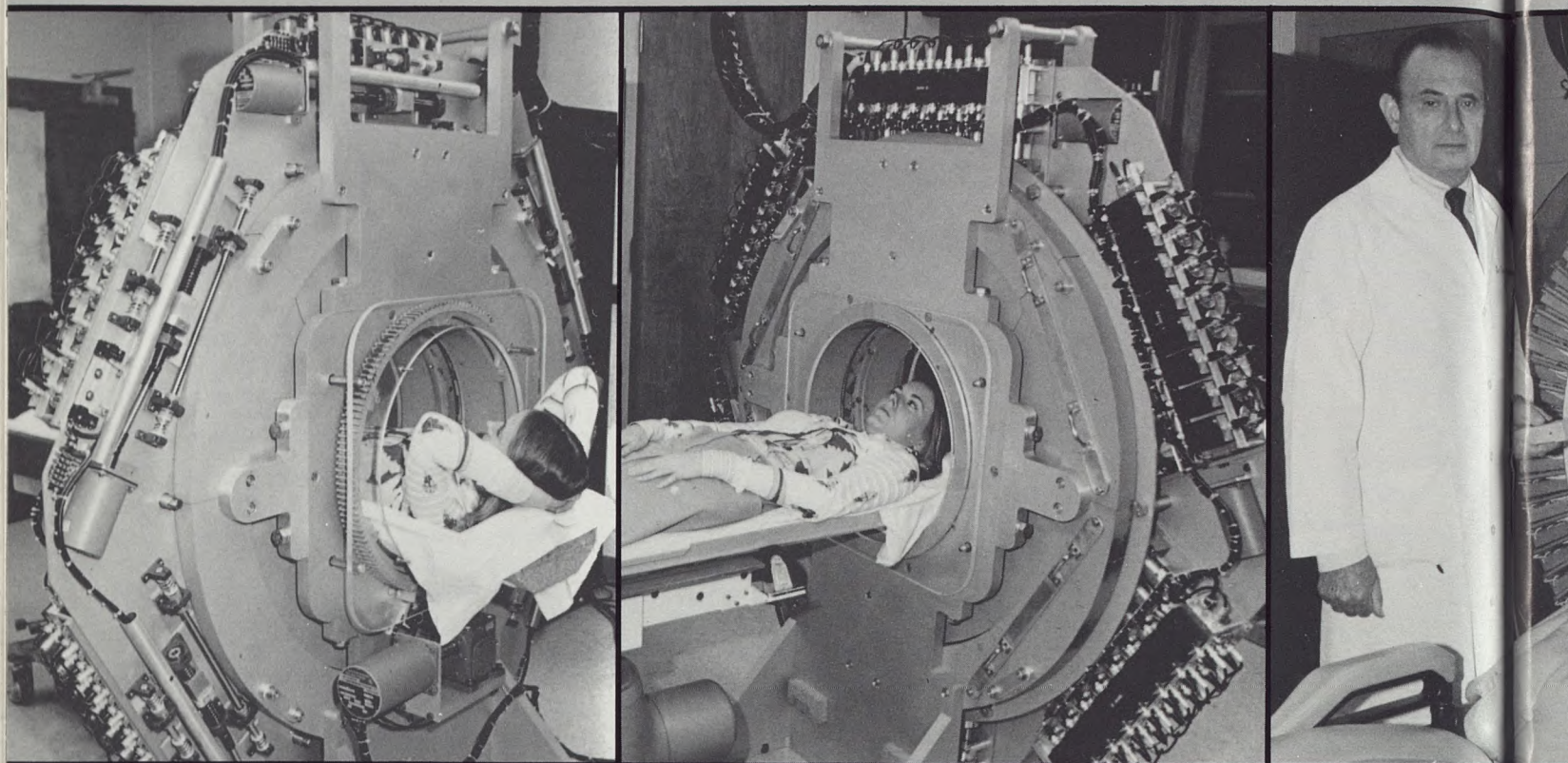


*Dr. Ter-Pogossian began using a cyclotron in the late 1950s to produce short-lived isotopes. The in-hospital cyclotron installed at Barnard Hospital in 1963 was the first of its kind in the United States.*

*Mallinckrodt colleagues, Dr. Michel M. Ter-Pogossian, left, and Dr. Michael J. Welch, at the 32nd annual meeting of the Society of Nuclear Medicine. Dr. Welch is president of the Society.*

*continued*





*PETT III, designed in 1975 to be a whole body positron emission transaxial tomograph, was the first PETT used in clinical studies.*

"PET is based on physiological modeling, such that all of the efforts that are being made in PET: in the selection of the radiochemical, in the method of administration, in the instrumentation, go back to a presumed physiological model. On the other hand, SPECT is still mostly directed towards morphological studies."

Comparing the two modalities at the practical level, Dr. Ter-Pogossian noted three difficulties with SPECT. First, the collimation of single photons with SPECT is inherently a less efficient process than the coincidence detection of annihilation radiation with PET. In general, for the same dose of radiation to the patient, more counts can be obtained with PET.

"The second difficulty with SPECT is in the instrumentation," he said. He explained that the imaging systems developed by industry have not done justice to the methodology and noted that SPECT will probably reach its best performance when devices are specifically designed and built for that purpose, rather than adapted secondhand from other systems. Industry is definitely

moving in this direction.

Radiopharmaceuticals were the third difficulty mentioned by Dr. Ter-Pogossian. He indicated that there is a need to develop substances which behave in a predictable way in various organs and measure whatever scientists choose to measure, and which are labeled with either technetium-99 or iodine-123, or another nuclide well-suited for imaging.

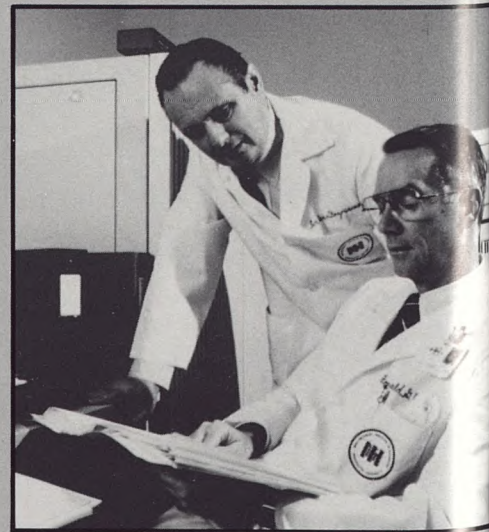
Dr. Ter-Pogossian's concluding remarks, his speculations about the future of the three modalities are reprinted below.

"It seems to me at this point in time, NMR imaging is generally a morphological imaging modality, very close to CT, with obvious advantages over the latter that the radiologists have well-recognized. The NMR images are probably closer in their readability to radiology than they are to nuclear medicine. If and when NMR imaging reaches the point of physiological studies, then I think that the nuclear medicine profession might become more involved.

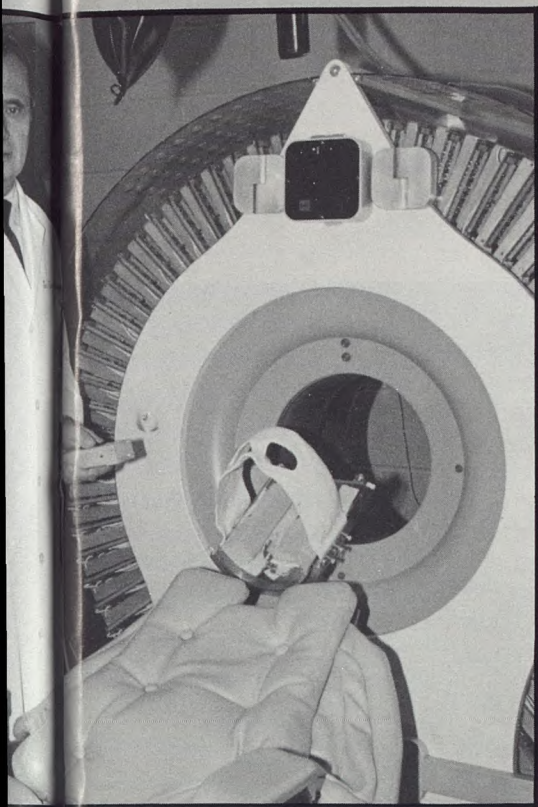
"It is easy to predict the future of PET. The use and recognition of the

usefulness of PET has been growing steadily in the past years. At this point in time, it is fair to say that a number of physiological variables which are totally unreachable by any means have been studied and documented by PET.

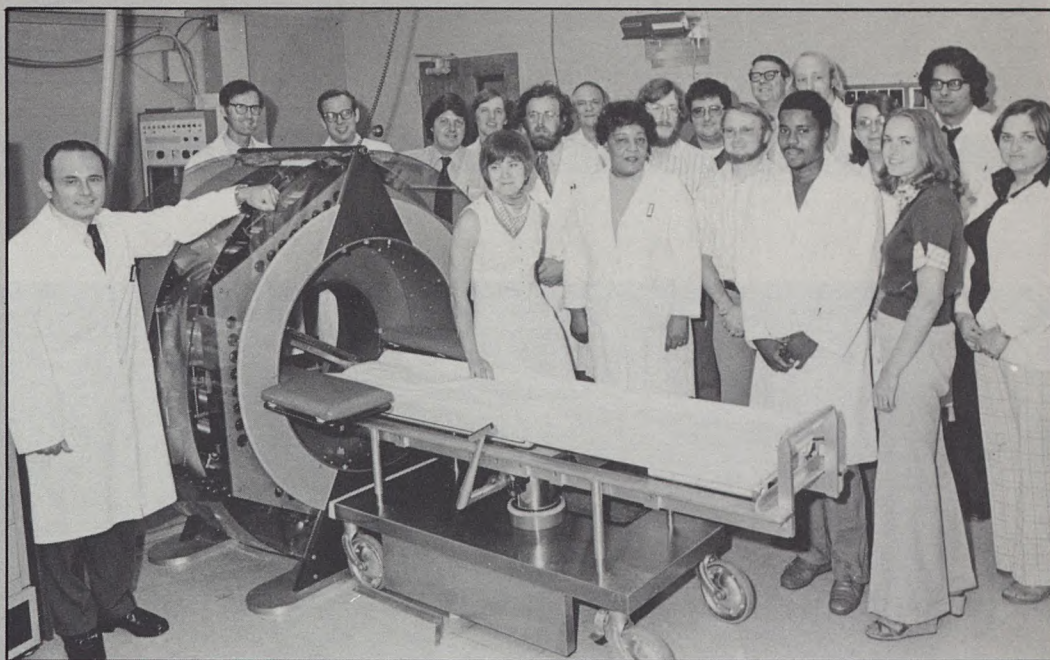
"A few years ago, I heard statements to the effect that PET is great but it is a purely physiological modality. I think that by and large this is still true







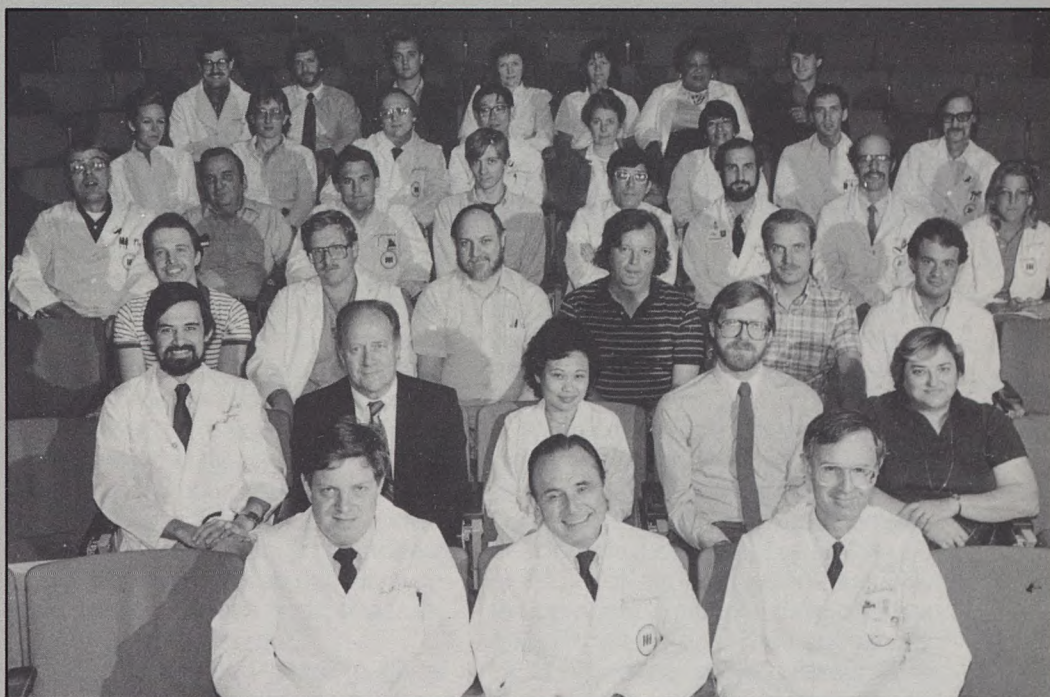
As with earlier PET systems, the PETT VI has studied and documented a number of physiological variables that are unreachable by other imaging modalities.



**PETT Team 1977** Left, Michel M. Ter-Pogossian, Ph.D., director of the division of radiation sciences; Marcus E. Raichle, M.D.; Robert Grubb, M.D.; Michael J. Welch, Ph.D.; John Hood, Jr.; Susan Hortner; Timothy Tewson, M.D.; Gene Barbier; Ruby Hicks; Steven Wittmer; John Martin; John Eichling; Bob Feldhaus; Bill Margenau; Larry Johnson; Christa Cooper; Carol Higgins; Nizar Mullani; Diane Zaltsman.

today. So far, PET has been mostly a modality used for the understanding of normal and abnormal physiology. But this situation is changing rapidly. In a number of centers throughout the country where PET is well in hand, this modality is shifting from the research area into the clinical application. At Mallinckrodt, **Dr. Barry Siegel**, who has been very supportive of PET throughout its development, has made the decision of installing a PET unit in his department of nuclear medicine. It is being completed now and will be used for clinical studies.

"The future of SPECT is more difficult to predict. There is no question that better instrumentation and better pharmaceuticals will become available. Whether these will be sufficient to overcome some of the weaknesses of SPECT is a question which remains open. The future of SPECT hinges strongly on whether or not this modality is proven to be clinically useful."



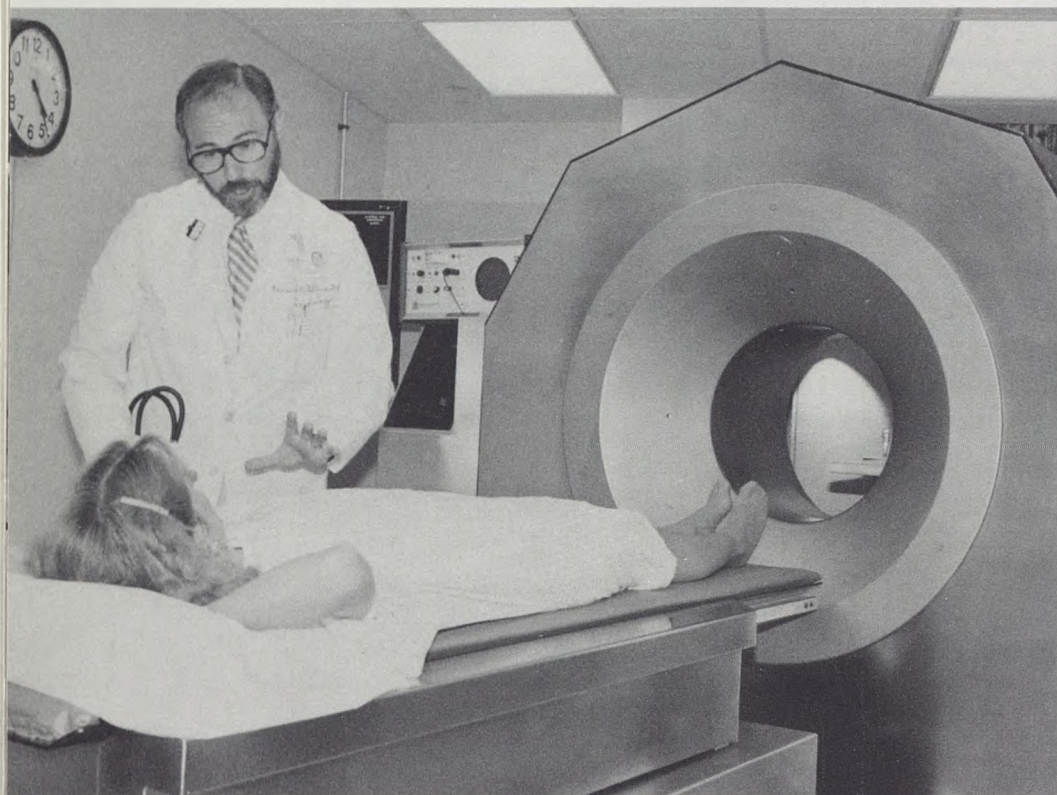
**PETT Team 1985** Front, left, M. Welch, M. Ter-Pogossian, M. Raichle. 2nd row, K. Fox, J. Hood, Sr., T. Nha Vu, M. Mintun, D. Zaltsman. 3rd row, J. Hood, Jr., L. Lich, G. Hoffman, D. Fiehe, T. Holmes, M. Albertina. 4th row, D. Marshall, J. Robison, P. Jerabek, D. Ballinger, W. Powers, J. Perlmutter, M. Kilbourn, L. Hoerr. 5th row, G. Markland, T. Baird, J. Brodack, D. Hwang, C. Mathias, C. Dence, M. Green, K. Lechner. 6th row, J. Dickens, D. Shuster, T. Hurley, M. Rowley, S. Parker, R. Hicks, M. Raichle, Jr.

On staff at Mallinckrodt Institute of Radiology for 35 years, Dr. Michel M. Ter-Pogossian, left, works closely with Dr. Ronald G. Evens.



# Super PETT

## Venturing Deeper into the Heart



*Dr. Edward M. Geltman prepares a patient for a PET scan in the Super PETT scanner at the cardiac care unit in Barnes Hospital.*

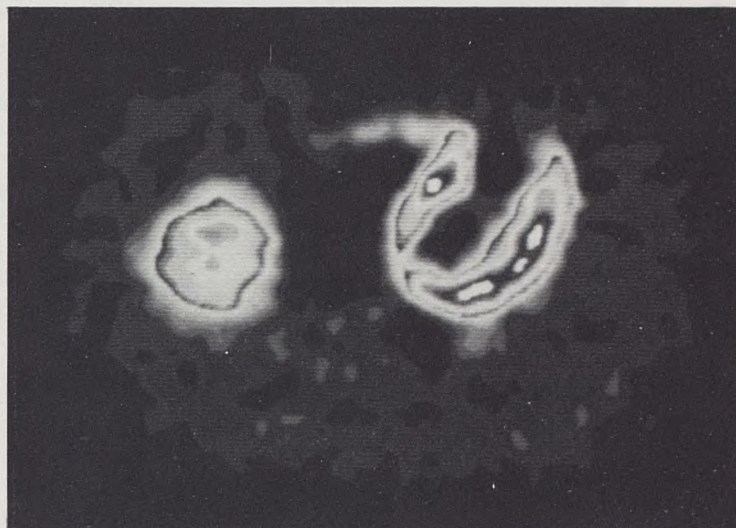
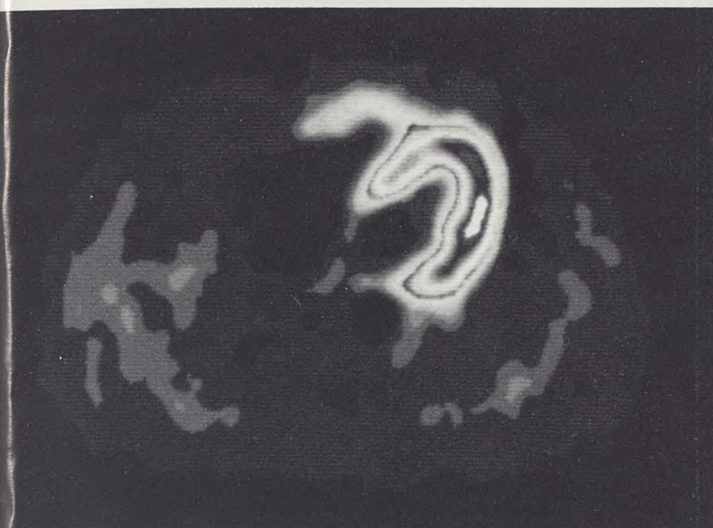
Glucose, palmitate, and acetate are some of the body's basic building blocks. Called metabolic substrates, they are also important to the functioning of the heart. Increased understanding of the ways in which these substrates act in the heart, says the medical director of the Cardiac Diagnostic Laboratory at Barnes Hospital and assistant radiologist at Mallinckrodt Institute of Radiology, **Edward M. Geltman, M.D.**, could lead towards early identification of heart diseases such as coronary artery disease, cardiomyopathy, or angina.

Now equipped with Super PETT, the latest in a series of PETT scanners designed to study the heart, Dr. Geltman and other investigators will be able to build an index, or a measure, of normal metabolic activity in the organ. "If the heart were a power plant, we can say the blood can be thought of as a chain of trucks delivering palmitate, and other metabolic substrates, which are the equivalent of various kinds of fuels. The questions we want to ask are how much blood is going in and coming out, how much fuel is being delivered, and what are the stops the trucks (blood) will be making in the delivery process," says Dr. Geltman.

Cardiologists already know that the normal heart is a homogenous organ which usually uses a single metabolic substrate at any given time at nearly the same rate in all of its regions. In studies of heart disease, investigators will search for regional differences in metabolism in the heart muscle (the region of the heart which does the majority of the heart's work). The capability to see localized areas is made possible by Super PETT's increased clarity, resolution, and speed in data acquisition and image processing.

"What is particularly exciting," says Dr. Geltman, "is that we will be able to better understand the physiology of a heart attack. We can use the more sophisticated device to examine how blood flow and metabolism actually change over the course of time by studying how they do or don't return to





*The Super PETT image on the left shows the varied distribution of palmitate, a metabolic substrate, in the heart of a normal patient. The white horse-shoe shaped spot on the right is the heart muscle. The image on the right, taken at a slightly lower level of the heart, reveals the damage to the heart muscle and the lack of palmitate in that region in a patient who has experienced a heart attack. (The large white spot on the left shows the distribution of palmitate in the dome of the liver, another organ which avidly stores and uses the substrate).*

normal function after a heart attack."

Describing investigations of palmitate use by the heart in heart attack patients, Dr. Geltman says, "With the PETT IV, we could see areas in our images which were hot (very active) and cold (inactive). With Super PETT, we have a more powerful spectacle to see through. We can determine whether a cold area is cold because its extracting too little substrate or burning it up at so fast a pace that the dynamic process could not be recorded. We can also learn whether a hot area is hot because it is extracting and burning the palmitate normally, extracting and retaining an abnormally large amount (of substrate), or burning too little."

"The new device does not give us the capability to say how many millimoles of palmitate—a fat which the heart uses the majority of the time—

are being burned up per gram of tissue per minute. There are several simultaneous processes going on. Some of the palmitate is burned into carbon dioxide, stored as fat or complex lipids, or diffuses out of the heart."

The index of metabolism developed by Dr. Geltman and his colleagues will help them understand how the heart responds metabolically to an abnormal condition such as an obstruction of the arteries in studies of patients with coronary artery disease. Investigators will eventually be able to study the indexes of metabolic activity in patients with other heart disorders. These indexes, based upon information gained from PETT images, should allow physicians to target regions of abnormal activity and detect those patients who could be at risk for a heart attack or another cardiac disorder.

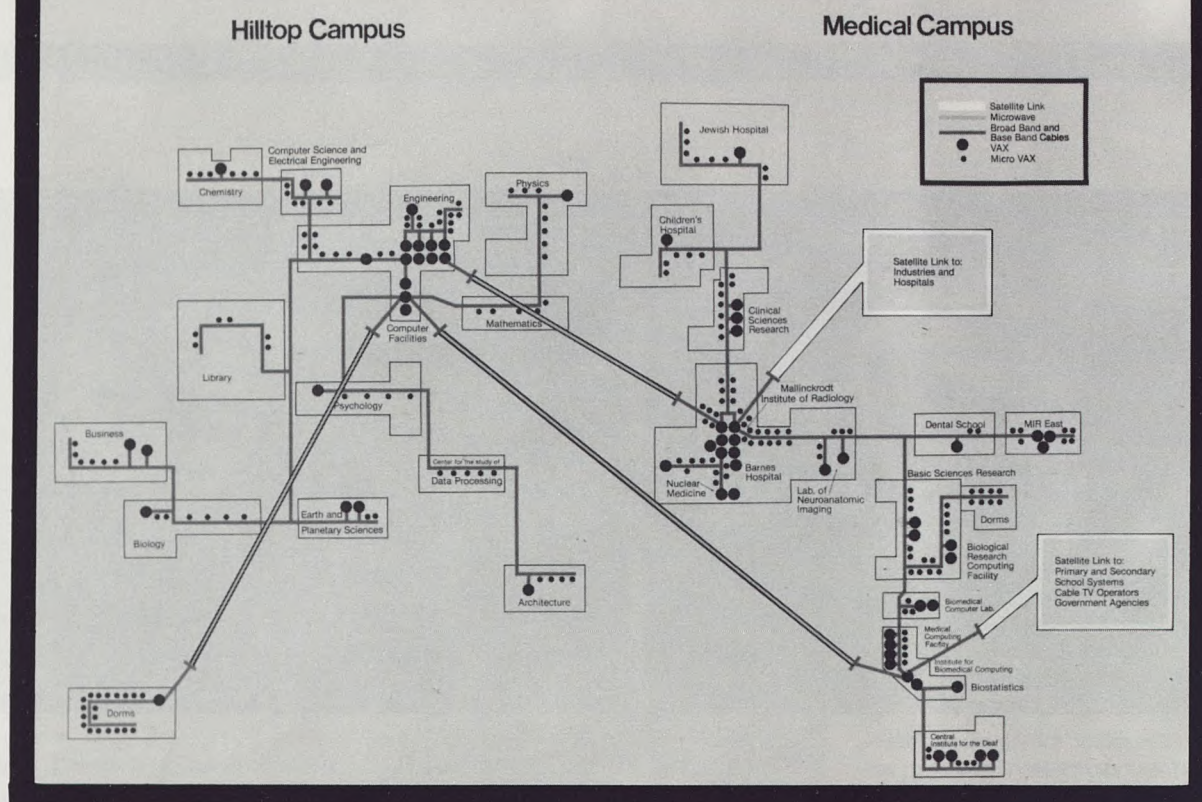
In studies of heart attack patients given t-PA, the amazing drug which can dissolve life-threatening blood clots during a heart attack, physicians may be able to determine which patients may require surgical intervention after t-PA. Sixty to seventy percent of the heart attack patients administered t-PA may have their blood clots dissolved says Dr. Geltman. When t-PA does dissolve a patient's blood clot, the heart muscle of that patient goes through a

natural repairing process. Some of this muscle may be salvaged with some restoration of function. For some patients, both t-PA and surgical intervention will be necessary because t-PA is not able to dissolve the underlying cholesterol deposit which caused blood to clot initially. Studies with Super PETT should help identify patients in which metabolism has been restored, but a limitation of blood flow remains, indicating that surgery or balloon angioplasty may be important additional therapy.

This research, the focus of the work being accomplished by Dr. Geltman and other academic cardiologists, radiologists, radiochemists, and computer scientists, has incorporated the use of PETT (positron emission transaxial tomography) scanners developed at Mallinckrodt Institute. The Laboratory's PETT IV scanner allowed researchers to study the way in which the heart uses fats such as palmitate in its metabolic processes. Their widely-publicized studies have shown that PETT images can reveal areas of damaged muscle in heart attack victims and patients with cardiomyopathy. ■



## Prospective Computing Network 1985-1988



## MIR and Washington University A New World of Computers

by Ria Munoz

A radiologist punches a few buttons on a computer terminal keyboard and within seconds, a digitized image of a patient's chest arrives on the screen of another terminal in a cardiologist's office.

A geologist, who is miles away from the medical center, at another professional workstation, devises a program which will convert information from NASA images, retrieved from missions in space, into geophysical models of the icy satellites which orbit Saturn.

Somewhere else, a business student watches paper wind through a printer, clicking and buzzing, then wind back up with a freshly printed set of graphs describing fluctuations in market prices for ten different companies in the same industry.

This is not a glimpse into a futuristic world. It is a possible picture of events to come from sophisticated worksta-

tions at Washington University in St. Louis. These workstations are a major feature of a new campus-wide network of computing and information resources which will be functioning in the next three years.

The new network is a larger and more advanced system building upon the existing network between Washington University's computing facilities division and the Medical and Hilltop campuses as well as the local networks within Mallinckrodt Institute of Radiology, the School of Engineering, and the Department of Computer Science.

Mallinckrodt's expertise in computer and information networking helped lay the groundwork for the campus-wide network. The world's leading radiology computer facility, the institute has a network which includes 8 cen-

tral computers and 175 terminals linked by direct communication lines, Ethernet coaxial cable, and in some regions, broadband coaxial cable (as used for cable television). Three new central computers and about 125 new terminals will be added over the next year.

The institute's desire to be on the cutting edge of networking technology is reflected by its emphasis on workstations. "Currently, the general concept about networks is that you take computer terminals and link them to a central computer facility," says **Dr. Gilbert Jost**, professor of radiology at Mallinckrodt. "Our concept is that computer technology is moving quickly enough that ordinary computer terminals will not be sophisticated enough for the physician of the future. What will be required will be a more sophisticated workstation with a computer in it."



"We have purchased central computer systems in the past that cost several hundred thousand dollars, but those same computers are now available on a single board. And in another year, the same functions will be available on a few computer chips. So it will be economical to take that kind of computer and put it in a local workstation," says Dr. Jost.

While several academic centers have computer networks, Washington University will be one of a handful of universities in the country with a network offering the capability to process and transmit visual images. These images, which include pictures, X-ray images, maps, symbols, and graphs, can be sent from a workstation at one end of campus to another. They can also be transmitted from a university research office, or lab, to other industries and educational institutions including secondary schools.

At Mallinckrodt, advanced workstations will offer new capabilities which could dramatically improve patient care in a hospital environment. According to Dr. Jost, "If Mrs. Jones is critically ill and needs surgery, the radiologist needs to interpret the film in his department, the surgeon needs the film in the operating room, and Mrs. Jones' internist needs the film in his office. So what physicians would really like to do is to call up the actual image in their offices or where they work."

Workstations capable of displaying digital images will be initially installed

in the Institute with the potential for workstations throughout the hospital and in physicians' offices in the metropolitan St. Louis area. Digital images include computed tomography (CT) scans, magnetic resonance (MR) images, positron emission tomography (PET) images, as well as digital ultrasound and vascular images. In future research, radiologists hope to be able to collaborate with scientists enhancing satellite images on the Hilltop campus.

The system could spark advances in medical research on other parts of the campus, such as the creation of new drugs. Richard Dammkoehler, a computer scientist, and Garland Marshall, a biochemist, are currently able to design three-dimensional images, or models, of molecules on the video screen of their computer workstation. Their color images show the positions of atoms and chemical bonds as well as the shapes of the electron clouds that surround the atomic nuclei. These features, when cross-compared with other models of molecular function and activity through the multi-campus computing network, will help these and other researchers gain important data for the development of new or improved pharmaceuticals.

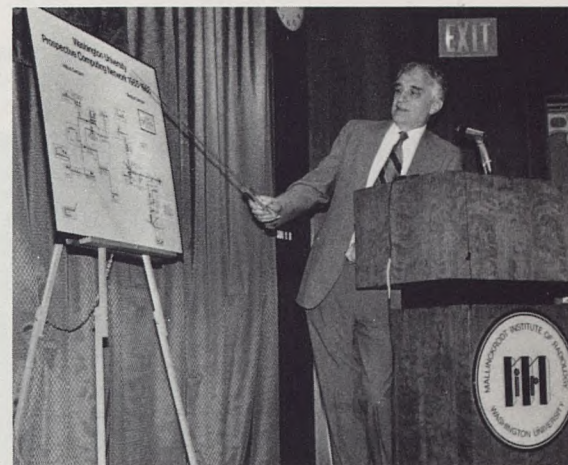
In the year 1988, the network is expected to bring computing to other divisions of Washington University such as the School of Dental Medicine, the Central Institute for the Deaf, the School of Architecture, and many departments of the College of Arts and Science. ■

## News Conference Announces Campus-wide Network

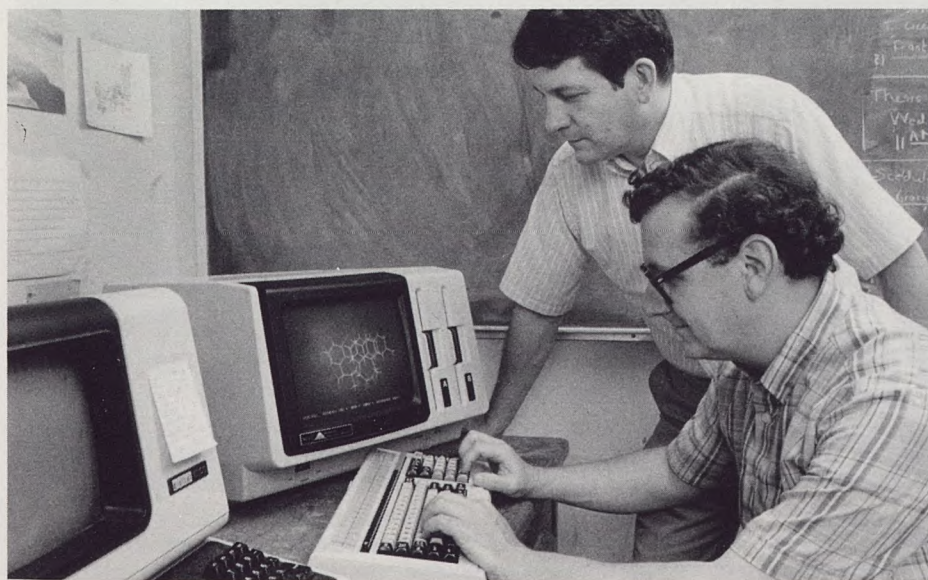
In a news conference held at MIR's Scarpellino Auditorium on May 8, details of a new partnership agreement between Washington University and Digital Equip-

*continued*

*Professor Jerome R. Cox, Jr., the chairman of computer science at Washington University, describes the many links and varied communication lines making up the unique network.*



Chancellor Danforth receives a bronze plaque from Joel Schwartz, vice president of educational marketing for Digital. The plaque commemorates the partnership agreement made between Digital and Washington University which provides for the sophisticated technology and equipment supporting the network.



At the Washington University Medical Center, pharmacologist Douglas Covey, seated, and biochemist Garland Marshall electronically manipulate a model of a chemical compound at an advanced workstation.



## News Conference

ment Corporation were announced. The agreement develops a \$15 million computing network for both the Hilltop and Medical campuses to support advanced picture communications as well as high-speed text transmission. The University acquires the resources at a reduced cost over the next three years. In exchange, the University will provide Digital with technical expertise in the use of computers for research and higher education in a networked environment. The University will also act as a demonstration site for Digital products.

Washington University **chancellor William H. Danforth** and Richard Corley, Medical Systems Group manager

for Digital, outlined the details of the agreement.

"Washington University is a national leader in computing," said chancellor Danforth. "This agreement enables us to maintain that leadership in the important area of networking and advanced workstation development. We are grateful to Digital for the opportunity to acquire this excellent equipment."

Corley, a Digital executive, said, "Through this partnership, we hope to achieve a new level of computer integration—one that will have many applications throughout higher education. Students of many disciplines may access the latest computer technology. The faculty can simultaneously

engage in academic research using fully-integrated equipment, and administrators can use one of the most advanced office automation systems available."

**Jerome R. Cox, Jr.**, principal investigator and professor of computer science at Washington University described the project and **R. Gilbert Jost, M.D.**, professor of radiology, discussed implications of the new system for the medical center and demonstrated a prototype professional workstation.

Activities benefitting from the agreement include Mallinckrodt Institute of Radiology, the School of Medicine, the School of Engineering and Department of Computer Science, and the School of Business. ■

*Washington University chancellor William H. Danforth opens the news conference announcing the development of the campus-wide computing and information network.*



*Gilbert Jost, M.D., demonstrates how physicians, administrators, and staff can obtain patient information from one of Mallinckrodt Institute's current workstations. The three video screens feature the institute's computing capabilities in retrieving patient records, X-ray examination reports, and digitized X-ray images.*



*Lyn D. Pankoff, associate dean of computing at Washington University, Richard Corley, Medical Systems Group manager of Digital, and Robert L. Virgil, dean of the School of Business at Washington University also admire the gift plaque.*



*Weeks before the news conference, Professor Jerome Cox, left, Dr. Jost, chancellor Danforth, and Joel Schwartz, Digital representative, meet to discuss details of the proposed network.*



# Putting Technology to Work in Health Care

## MIR Begins a Three-year Project with NASA

Those who lament our society's ability "to put a man on the moon before solving problems closer to home" must be encouraged by the work of **Michael W. Vannier, M.D.**, associate professor of radiology at Mallinckrodt Institute. In his computer laboratory within the new Clinical Sciences Research Building, Dr. Vannier is joining forces with the aerospace industry to apply advanced engineering technology toward the solution of medical problems.

One of the technology-exchange programs began in 1982, when Dr. Vannier, MIR collaborators, and NASA specialists from the Kennedy Space Center established a voluntary work group to study the application of multispectral satellite-image analysis to magnetic resonance (MR) imaging. Access to NASA's Remote Sensing and Image Processing Laboratory, located at the University of Florida, was provided by Robert Butterfield, a technology manager at the Kennedy Space Center.

Coordinating their efforts, the collaborators processed MR imaging test data on the computers which NASA uses to analyze data collected by LANDSAT satellites. At the 69th Scientific Assembly of the Radiological Society of North America (RSNA) in November 1983, they reported that the LANDSAT computers could assimilate multispectral MR images; identify body tissues including cerebrospinal fluid, white and gray brain matter, muscle, bone, and subcutaneous fat; and create color composite pictures of the body interior.

As a result of successful preliminary investigations and recognition of MR imaging's potential diagnostic capabilities, NASA recently proposed to expand the collaboration with Mallinckrodt Institute into a three-year "cooperative project." According to NASA's project plan, MIR and NASA will work together "to develop the application of multispectral image processing technology for the purpose of analyzing medical data obtained through MR imaging."



*Robert Butterfield, left, a technology manager at the Kennedy Space Center, and Dr. Michael W. Vannier, Mallinckrodt radiologist, have worked together since 1980 to apply advanced engineering technology toward the solution of medical problems.*

The proposal is unique in that it is the first to commit NASA technology utilization resources to the improvement of medical imaging. For the first year of the project, fiscal year 1985, NASA has contributed funding of \$110,000.

Additional manpower and computer resources are also included in the three-year project plan. Under its terms, the NASA image-processing technology needed for the project is to be provided principally by the Earth Resources Laboratory (ERL) located at the National Space Technology Laboratories in Mississippi. (The ERL is the largest center of remote sensing in the United States). Other NASA work teams and consultants may become involved as the project unfolds.

The major emphasis during the first year of investigation is to establish at Mallinckrodt Institute the hardware and software capability for multispectral analysis of MR imaging scans. Dr. Vannier and his colleagues are working to adapt existing NASA software for application to MR images—a task made difficult by the complexity of the programs.

Collaborators at the ERL are finding ways to reduce the radiometric and geometric distortions introduced by the MR imaging scanner, and thereby to optimize MR image acquisition and

display. Using NASA's well-established methods for computer processing of multispectral images, they are also defining tissue characteristic "signatures" or unique MR imaging features that are specific, sensitive, and consistent in multiple data sets.

In the years to come, the computer programs which are jointly developed by NASA and MIR will be statistically validated in a large-scale clinical trial. Using a data base of MR images assembled from clinical studies at Mallinckrodt, the project team will define the advantages and limitations of multispectral analysis for MR imaging.

Project benefits, including MR imaging knowledge, technology, and operator training, will be extended to the worldwide medical community as the investigation progresses. Ultimately the project will produce a set of validated software programs for multispectral image processing that are directly usable at any facility with an MR imaging scanner. ■

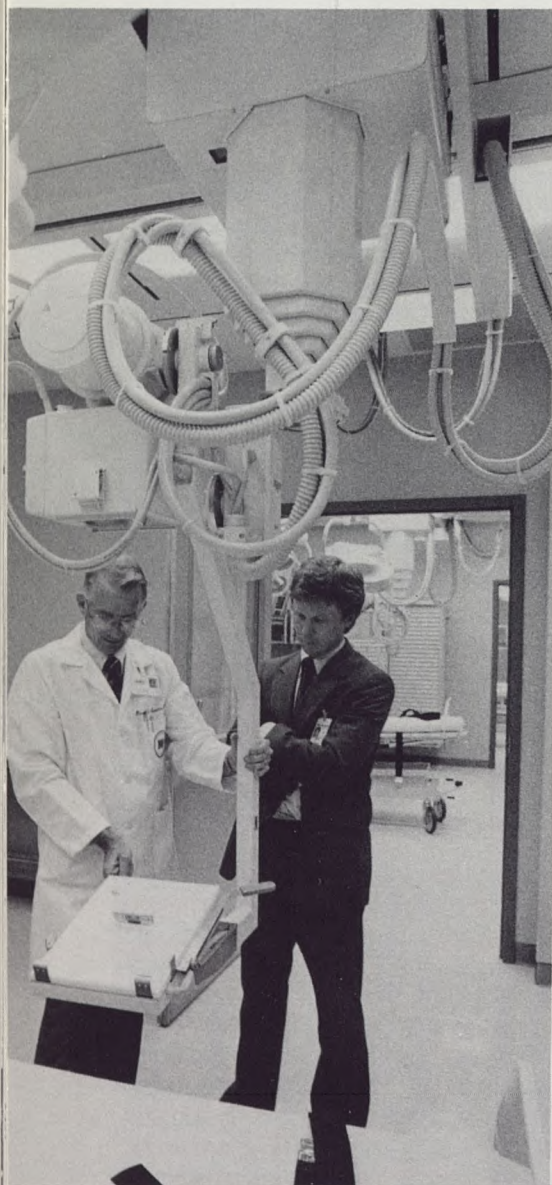
In an interesting spinoff of the MR multispectral imaging project, NASA has placed a CT (computed tomography) scanner in a non-destructive testing laboratory next to the launch pad at the Kennedy Space Center. Similar scanners are on order for other NASA centers.

According to NASA specialist Robert Butterfield, "The scanners have been acquired because Dr. Vannier successfully demonstrated to us the advantages of having a CT scanner for industrial use. For example, we can use CT to locate problems and defects in the fuel pump and protection system tiles of the space shuttle, and in solid rocket propellents."

Butterfield added, "The technology exchange with the Mallinckrodt Institute has definitely not been one-sided. NASA has learned a lot from Dr. Vannier, and has expanded its technology base through collaboration with MIR."



## New Barnes Emergency Department Dedicated



Inside a major trauma room, Mallinckrodt's director Dr. Ronald G. Evens demonstrates the operation of state-of-the-art X-ray equipment to Mark F. Weber, vice president of Barnes.



During opening ceremonies at Barnes Hospital's new Emergency Department, Gov. John Ashcroft presided over the dedication.

The new Barnes Hospital Emergency Department was dedicated June 25 with remarks and ribbon-cutting by Governor John Ashcroft and other dignitaries. The 21,000-square-foot facility is a \$9.9 million joint venture of Barnes and the Washington University School of Medicine.

In praise of the medical center's commitment to excellence and service, Gov. Ashcroft cited a personal experience. In 1978, his son, Jay, was brought to St. Louis from Columbia, Missouri, for diagnosis of seizures. Mallinckrodt's latest technology, a CT scanner, was used to diagnose the problem and subsequent treatment began. Now 12, his son has outgrown the symptoms and discontinued medication.

Within the new department, Mallinckrodt has provided state-of-the-art X-ray equipment able to save critical time when diagnosing accident victims. In the two major trauma rooms, two sophisticated X-ray cameras, equipped with rotating U-arm systems, enable radiologists to gain different views without having to move the patient. Additional bucky mat units, X-ray equipment that enables speedy diagnosis and processing of films, are installed in the department's two radiographic rooms. Film development and reading facilities are also available. ■

## Conferences/Symposia/ Meetings/Seminars/Courses

**Klaus Sartor, M.D.**, presented a paper entitled, "Spinal Intramedullary Lesions: Evaluation of MR Imaging," at the Annual Meeting of the American Society of Neuroradiology in New Orleans, Louisiana, on Feb. 23.

**Harvey S. Glazer, M.D.**, presented the following lectures: "Role of MRI in Staging Bronchogenic Carcinoma," at the Annual Meeting of the Society of Thoracic Surgery, Phoenix, Arizona, on Jan. 20; and "MR Imaging of the Lung, Mediastinum, and Pleura," at the Magnetic Resonance Imaging in Medical Practice Conference, Miami Beach, Florida, on Mar. 12.

**G. Leland Melson, M.D.**, presented "Sonography of the Biliary System" and "Unusual Lesions of Superficial Parts" at the Sixth Annual Spring Sonic Symposium which was sponsored by the Mississippi Ultrasound Society and the University of Mississippi Medical Center and held in Jackson, Mississippi, on Mar. 23.

**Stuart S. Sagel, M.D.**, presented "CT of the Mediastinum: Anatomy, Technique, Pathology and Comparison with MRI," "CT of Asbestos-Related Renal Disease," and "CT of the Larynx" for the 8th Annual Refresher Course of the Society of Computed Body Tomography, San Diego, California, Mar. 25-29.

**William A. Murphy, Jr., M.D.**, presented the following talks: "Musculoskeletal, Soft Tissue and Breast" for the Magnetic Resonance Imaging in Medical Practice Conference held in Miami Beach, Florida, on Mar. 12; "Ischemic Necrosis," "Future Orthopedic Applications," "Soft Tissue Masses," and "Metabolic Analysis of Muscle Disorders" for the International Magnetic Resonance Winter Conference held in Schlading, Austria, on Mar. 17; "Paget Disease," "MRI of Bone and Joint Disorders," "Trauma to the Temporomandibular Joint," and "Forensic Radiology: Current Concepts" for the Skeletal Radiology at the Pointe Conference at Phoenix, Arizona, on Mar. 25; "MRI of the Musculoskeletal System" and "MRI of the Breast" for Magnetic Resonance Imaging: A National Conference on Clinical Applications and Issues at San Diego, Apr. 1.



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**Joseph K.T. Lee, M.D.**, gave the following talks: "MRI of the Liver," "CT of Pelvic Neoplasms," "CT/MRI of Lymphadenopathy," and "CT of Biliary Tree" for the Contemporary Imaging Symposium held at the University of California at San Francisco, Jan. 7-12; "MRI of the Pelvis," "CT/MRI of the Mediastinum," "CT/MRI of Lymphadenopathy" for the Diagnostic Imaging Seminar, sponsored by the University of Texas, which was held at Montego Bay, Jamaica, on Feb. 4-9; "MRI of Renal Neoplasm and Infection" for the Society of Uroradiology Postgraduate Course, St. Thomas, U.S. Virgin Islands, Mar. 1-8; "MRI of Pelvic Neoplasms," "MRI of the Liver," "CT/MRI of the Pancreas," "CT of the Biliary Tree," "CT/MRI of Lymphadenopathy," and "MRI of the Kidney" for the Sixth Midwinter Diagnostic Radiologic Conference, sponsored by the Loyola University School of Medicine, held in Maui, Hawaii, Mar. 18-22; "MRI of the Liver" and "MRI of the Pelvis" for the Computed Body Tomography Postgraduate Course, San Diego, California, Mar. 25-29; and "Radiologic Evaluation of Jaundiced Patients" and "CT of the Pancreas" for the Diagnostic Imaging Seminar, sponsored by the Buffalo Radiology Society, held in Buffalo, New York, Apr. 13.

**Jay P. Heiken, M.D.**, served as a guest faculty member at the Nuclear Magnetic Resonance in Medicine Symposium which was sponsored by the Central Chapter of the Society of Nuclear Medicine and held in Chicago, Illinois, on Mar. 21-23. He also presented a talk entitled, "Magnetic Resonance Imaging in Cancer Diagnosis," at the Marilyn Fixman Cancer Conference at Jewish Hospital, Apr. 17.

**Bruce L. McClennan, M.D.**, gave the following talks: "CT of the Pelvis," at the meeting of the Society of Uroradiology held on St. Thomas, in the Virgin Islands, on Mar. 1; and "CT-MRI Correlation of Renal Tumors" and "Oncologic Imaging of the Prostate" for the Washington Imaging Conference held in Washington, D.C., on Apr. 25-26.

**Patrick R.M. Thomas, M.D.**, presented lectures on "The National Wilms' Tumor Study" at Tufts University, Boston, Apr. 11, and "Radiation and Chemotherapy for Locally Unresectable Adenocarcinoma of the Pancreas: Results of a Multi-Institutional

Randomized Trial" for the American Radium Society Meeting, Acapulco, Mexico, on Apr. 28.

**Delia Garcia, M.D.**, presented a paper entitled, "Radiation Therapy for Primary Spinal Cord Tumors: A Dose-Response," at the American Radium Society meeting, Acapulco, Mexico, Apr. 27-May 1.

**Carlos A. Perez, M.D.**, moderated a panel on "Carcinoma of Head and Neck" at the Second Annual Endocurietherapy Symposium held in St. Louis on Apr. 19-20. He also made the following presentations: "Radiation Therapy for Small Cell and Non-Small Cell Lung Cancer" and "Radiation Therapy for Bladder Cancer" for the Current Concepts in the Diagnosis and Management of Lung Cancer and Genitourinary Tumors meeting held in South Bend, Indiana, on Apr. 10; "Carcinoma of the Prostate" and "Clinical Hyperthermia" at the Circulo de Radioterapeutas Ibero-Latinoamericanos, Miami, Apr. 11; "Hyperthermia: A Potentially Effective New Modality for Cancer Therapy" at Cancer Update 1985: Innovations in Cancer Management, Merrillville, Indiana, Apr. 13; "Randomized Study of Prospective Irradiation and Surgery or Irradiation Alone in the Treatment of Stage IB and IIA Carcinoma of the Uterine Cervix" at the American Radium Society Meeting, Acapulco, Mexico, Apr. 27-May 1; and "A Review of Current Clinical Experience with Irradiation and Hyperthermia" and "Intracavitary Applications in the Management of Carcinoma of the Cervix, Endometrium and Vagina" at the Fourth Annual Endocurietherapy Workshop and Symposium, Long Beach, California, Apr. 30-May 2.

**Todd H. Wasserman, M.D.**, lectured on "New Approaches to Radiation Therapy of Lung Cancers," at the Isaac Levin Memorial Symposium, Baystate Medical Center, Springfield, Massachusetts, Mar. 15; "Gastric Lymphomas" at the Boca Raton Community Hospital Oncology Conference, Florida, Mar. 28; and "Curable Therapy for Early Stage Hodgkin's Disease" and "Abdominal and Gastric Lymphomas," at Hahnemann Medical College, Philadelphia, Apr. 15-16. He also gave a talk entitled, "Radiation and You," at the First Annual Cancer Awareness Resource Expo, sponsored by the St. Louis Chapter of the Leukemia Society, the American Cancer Society, and General American Life Insurance Company, which was held in St. Louis, Jun. 1-2.

**Mokhtar Gado, M.D.**, gave the following talks: "Functional CT Anatomy," "Spinal Stenosis: Perspectives and Classification," "Imaging of Spinal Cord," and "MRI of Cerebral Infarction" for the Neuroimaging Update 1985 meeting, Puerto Vallarta, Mexico, Feb. 1-6; "Comparison of CT and Magnetic Resonance in Neuroradiology" for the Greater Kansas City Radiological Society, Kansas City, Missouri, Feb. 13; "Multispectral Analysis of MRI Images in Brain Lesions" for the Annual American Society of Neuroradiology Meeting, New Orleans, Feb. 18-23; "Functional Anatomy of the Brain: CT and MRI," "Suprasellar Mass Lesions," "Cervical Cord Myelography and Metrizamide CT," and "CT Evaluation of the Herniated Lumbar Disc and of Spinal Stenosis" for the Postgraduate Course on Neuroradiology: CT & MRI of the Brain, Neck, and Spine, New York, Apr. 9-13; "The Evaluation of Parasellar Lesions," "CT and MRI of Posterior Fossa Tumors," "CT and MRI of Post-Operative Tumors," and "The Examination of the Cervical Cord" for the Fifth Annual Washington Imaging Conference, Washington, D.C., Apr. 21-26; "Radiology of Sella & Suprasellar Lesions," "Radiology of Hydrocephalus," and "Radiology of Stroke" for the Neuroradiology Review Course, Oakbrook, Illinois, May 4-5; "Anatomic Correlations with MRI," "The Significance of Proton Density Image," and "Post-Operative MRI Appearance in case of Tumor" for the Radiological Symposium in Brussels, Belgium, Jun. 13-15.

**Michael W. Vannier, M.D.**, made the following presentations: "3D Reconstructions from CT Scan Data" and "Practical Applications of 3D Reconstructions in Plastic Surgery, Orthopedics, and Neurosurgery" for the continuing medical education course, Computer Graphics in Medicine and Surgery, held at the Virginia Mason Medical Center, Seattle, Washington, May 10; "3D X-ray Reconstruction in Head and Neck Surgery" for the 1985 Combined Annual Scientific Program, sponsored by the B.C. Society of Otolaryngology - Head and Neck Surgery, the Oregon Academy of Otolaryngology and Head and Neck Surgery, and the Northwest Academy of Otolaryngology and Head and Neck Surgery, held in Vancouver, British Columbia, on May 16-18; and "Computer Graphics" and "Three Dimensional CT Scan Reconstruction at the Mallinckrodt Institute of Radiology" for Computer Assisted Radiol-



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ogy '85, an international symposium and exhibition, held in Berlin, West Germany, Jun. 26-29.

## Grand Rounds

**Joseph K.T. Lee, M.D.**, spoke on "MRI of the Body" at the St. Luke's West Hospital Surgical Grand Rounds, Apr. 15.

**Harvey S. Glazer, M.D.**, presented talks on: "Magnetic Resonance Imaging of the Body" at the Barnes Hospital Grand Rounds, Mar. 27; "Magnetic Resonance Imaging of the Chest" at the Jewish Hospital Oncology Grand Rounds, Apr. 17; and "Computed Tomography and Magnetic Resonance Imaging of the Mediastinum" at the St. Luke's Hospital Grand Rounds, Apr. 23.

## Workshops

**Harvey S. Glazer, M.D.**, made a presentation entitled, "Magnetic Resonance Imaging of the Body," for the Postgraduate Workshop in Clinical NMR at the Baylor College of Medicine, Houston, on Mar. 1.

**Jay P. Heiken, M.D.**, gave a talk on "MRI of the Chest, Abdomen, and Pelvis" at the Postgraduate Workshop in Magnetic Resonance Imaging and Spectroscopy at the Baylor College of Medicine, Houston, on Mar. 29 and Apr. 26.

**Carlos A. Perez, M.D.**, presented "Carcinoma of the Prostate" at a Meet the Professor Workshop at the American Radiology Society meeting, Acapulco, Apr. 27-May 1.

## Visiting Professors/ Guest Lecturers

**Bruce L. McClennan, M.D.**, serving as a visiting professor, spoke on: "CT and MRI of Renal Masses," "MRI in Chest Diseases," and "Oncologic Imaging of the Pelvis" for a postgraduate course in the U.S. and British Virgin Islands, sponsored by George Washington University and Alexandria Hospital, on Jan. 27-Feb. 1; "CT Renal Inflammatory Disease," "Oncologic Imaging of the Pelvis," "CT of the Pelvis," and "Percutaneous Nephrolithotomy" for the Intermountain Imaging Course, sponsored by the Medical College of Wisconsin, at Steamboat Springs, Colorado, Feb. 10-16.

**Stuart S. Sagel, M.D.**, spoke on "CT of the Pericardium" and "CT in the Evaluation of Bronchogenic Carcinoma" as a guest lecturer for the New York Roentgen Society and visiting professor at the Hospital for Joint Diseases Orthopaedic Institute and Beth Israel Medical Center, New York, Feb. 25.

**Jay P. Heiken, M.D.**, presented conferences on "Magnetic Resonance Imaging of the Abdomen and Pelvis" and "Magnetic Resonance Imaging of the Liver" while serving as a visiting professor at Columbia University in New York on Mar. 13-14.

**Carlos A. Perez, M.D.**, gave the following presentations as visiting professor: "Carcinoma of the Rectosigmoid," "Conservative Treatment of Carcinoma of the Breast," "Carcinoma of the Prostate," "Carcinoma of the Bladder," and "Cervical Lymph Nodes, Unknown Primary" at the Surgical Society of Venezuela meeting, Caracas, Mar. 15-22; and "Radiotherapy for Cancer of Cervix," "Treatment of Carcinoma of the Prostate," and "Clinical Hyperthermia" at the Instituto Nacional de Cancerologia, Bogota, Colombia, Mar. 24-27.

**William A. Murphy, Jr., M.D.**, as a visiting professor, presented talks on "Temporomandibular Joint Imaging" and "Breast Microcalcifications" at Harrisburg Hospital and as the 16th Annual Ritzman Memorial Lecturer, spoke on "Perspectives in Magnetic Resonance Imaging," at the South Central Pennsylvania Area Radiological Conference, Harrisburg, Pennsylvania, on Apr. 10.

**V. Rao Devineni, M.D.**, was as an invited lecturer at the Second Annual Endocrine-therapy Society meeting, St. Louis, on Apr. 19-20, where he spoke on "Cobalt-60 Eye Plaque for Choroidal Melanoma" and "Interstitial Therapy for Brain Tumors."

**Louis A. Gilula, M.D.**, as a visiting professor at the Hospital for Joint Diseases Orthopaedic Institute in New York on May 20-22, spoke on "Radiology of Trauma to the Hand" and "CT: Foot and Ankle."

## International Visitors



**Michael J. Welch, Ph.D.**, professor of radiology and chemistry, describes the institute's PET facilities to visiting physicians and scientists from Mallinckrodt, Inc., St. Louis, and Chiba University and the Daiichi Radioisotope Laboratories in Japan.

## Elected

**Carlos A. Perez, M.D.**, was elected as a trustee of the American Board of Radiology (ABR) for a six-year term to begin July 1, 1985. Dr. Perez was chosen by the trustees of the ABR from among several distinguished colleagues nominated by the American Society of Therapeutic Radiologists and Oncologists. ASTRO is one of the national radiologic societies represented in the ABR. The primary objective of the ABR is to assure that the highest standards of training and practice are maintained in diagnostic and therapeutic radiology in the United States. Trustees are chosen because of their outstanding commitment to their objective. Perez has been keenly interested in training programs in radiology, and has been instrumental in the evolution of the residency training program in therapeutic radiology within the division.

**Marilyn J. Siegel, M.D.**, has been elected a member of the Society of Computed Body Tomography. Chosen for her leading contributions to pediatric computed tomography, Dr. Siegel is the only pediatric radiologist in the Society. She joins forty-



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five other physicians and scientists, including MIR staff members, **Drs. Ronald G. Evens, Stuart S. Sagel, and Joseph K.T. Lee**, who are considered authorities in the field of computerized radiology. A nonprofit organization, the Society was formed ten years ago as a forum for the exchange of ideas and information in the areas of computed body tomography, cross-sectional, and computer based imaging.

Three Mallinckrodt physicians hold top positions in the Greater St. Louis Society of Radiologists. A recent election named **Bruce L. McClennan, M.D.**, vice president; **G. Leland Melson, M.D.**, secretary-treasurer; and **V. Rao Devineni, M.D.**, president of the Radiation Oncology chapter. The physicians will each serve a one-year term from 1985-1986.

**Todd H. Wasserman, M.D.**, has been elected a member of the American Radiology Society (ARS) and the Gilbert Fletcher Society. Founded in 1916, the ARS is the oldest continuing professional organization devoted to cancer in the United States. ARS is devoted to the academic pursuit of work in cancer among radiation therapists and other medical specialists. The Gilbert Fletcher Society is a society of individuals who have been associated with training by Dr. Gilbert Fletcher, an authority in the field of radiation oncology. The members of the Gilbert Fletcher Society are physicians involved in scientific pursuits in radiation oncology.

**Bruce Walz, M.D.**, has been reelected a member of the board of directors of the Missouri Radiological Society. Dr. Walz will serve a three-year term, from 1985-1988. He was also elected co-chairman of the 1985 scientific program committee.

## Appointments

**Michael W. Vannier, M.D.**, has been appointed as an associate editor for "Computerized Radiology," an international journal reporting on radiological diagnosis using CT, MR, PET, and computer imaging and digital fluoroscopy.

**Todd H. Wasserman, M.D.**, has been appointed a member of the National Cancer Institute's Radiosensitizer/Radioprotector (RS/RP) Working Group. An eleven-member body, the RS/RP Working Group is an advisory committee to the Radiation Research Program of the Division of Cancer Treatment in NCI.



**Bruce L. McClennan, M.D.**, professor of radiology and chief of the abdominal imaging section at Mallinckrodt Institute, has been appointed to the board of directors of the Missouri State Radiological Society. Serving as the state chapter of the American College of Radiology, the Society represents over 300 radiologists and is responsible for upholding legal, medical, and ethical standards of radiological practice.

Additionally, Dr. McClennan has been elected to the vice presidency of the Greater St. Louis Radiological Society, after serving a one-year term as secretary-treasurer. Founded in 1923 as the St. Louis Roentgen Ray Society, the Greater St. Louis Radiological Society is the largest local radiological society in Missouri.

A fellow of the American College of Radiology, Dr. McClennan is the author or co-author of more than 80 journal articles and 14 book chapters. His recent activities in-

clude preparing the section on "Inflammatory Disease" for the fifth edition of **Clinical Urography: An Atlas and Textbook of Urological Imaging**, and participation in studies of Hexabrix, a new contrast agent developed by Mallinckrodt, Inc.

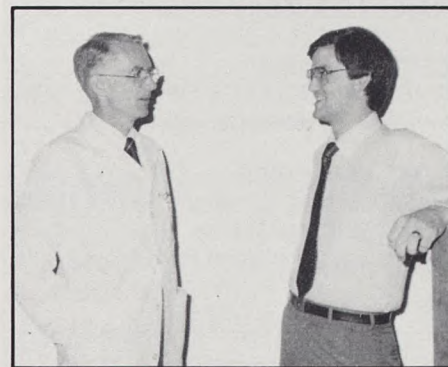
## Honors/Awards

Mallinckrodt physicians, **Drs. Dixie Aronberg and Michael W. Vannier**, were named leaders in the field of science and medicine in "The New St. Louisans," a special report published by **St. Louis Magazine**, July 1985. The report covered the career achievements and interests of "extraordinary men and women under 40 who are shaping St. Louis."



**Virginia Trent**, director of public relations at Mallinckrodt, was named the 1985 Advertising Person of the Year by the Advertising Federation of St. Louis (AFSL). She was also chosen Business Person of the Week by KEZK-FM radio station. Paul Johnson, of KEZK-FM, presented the station's award to Mrs. Trent.

## Alumni News



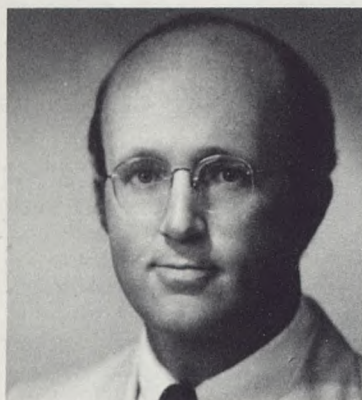
*Dr. James W. Owen, III, with Dr. Ronald G. Evens*

**James W. Owen, III, M.D.**, chief resident (82-83), visited the institute on March 18. A lecturer during the noon conference, Dr. Owen reviewed cases from his private practice group in Topeka, Kansas.



# NEWS

## Dr. Robert Stanley, Sante Lecturer



*Dr. Robert Stanley was chief of abdominal radiology at Mallinckrodt Institute from 1971 to 1982.*

Mallinckrodt alumnus **Robert J. Stanley, M.D.**, delivered the seventh annual Leroy Sante Memorial Lecture at St. Louis University on April 15. His talk was entitled "Turf: The Changing Battle Lines."

Stanley began his discussion of the interdisciplinary role conflicts which confront radiologists by quoting from an editorial on the problem of "commercial laboratories" and "individuals other than radiologists doing X-ray procedures." The telling point of this comment, which reflects current issues in radiology, is that it was written by Dr. Leroy Sante in 1925.

According to Stanley, in the 1960s, the battle lines of professional domain were

drawn over intravenous urography, angiography, and neuroradiology.

He noted that the issues confronting radiologists in the 1970s were more intramural than interdisciplinary. Within the radiology department, competition arose between the studies involving new imaging modalities such as CT and ultrasound. Moving on to the 1980s, Stanley described the emerging field of interventional radiology.

Of the concerns facing radiologists in the 1980s, Stanley underscored two: controlling patient referral and choosing between the role of image interpreter and consultant therapist radiologist. He cited the results of a study conducted by Dr. Hillier Baker, which showed that when a consultant in radiology supervised patient workups throughout the hospital, the number of radiological tests ordered per patient decreased. His argument was that radiology consultation can help to lower the costs of medical care.

Concluding his remarks with a discussion of cost containment in radiology, Stanley noted specifically the competition which radiologists face from technique intensive internists, outpatient imaging centers, and alternate health care providers.

Stanley was director of the abdominal imaging section at Mallinckrodt Institute for eleven years. Since 1982, he has served as professor and chairman of the department of radiology at the University of Alabama Medical Center in Birmingham. ■

### MIR Calendar of Events

**SEPT. 7-12, 1985**

AMERICAN COLLEGE OF RADIOLOGY  
Montreal, Quebec, Canada

**SEPT. 12-14, 1985**

FIRST ANNUAL CLINICAL HYPERTHERMIA SYMPOSIUM  
Mallinckrodt Institute of Radiology

**SEPT. 29-OCT. 4, 1985**

AMERICAN SOCIETY FOR THERAPEUTIC RADIOLOGY AND ONCOLOGY  
Miami Beach, Florida

**NOVEMBER 17-22, 1985**

RADIOLOGICAL SOCIETY OF NORTH AMERICA  
Chicago, Illinois

## ARRS

### Papers

**Oblique Magnetic Resonance Imaging of the Cardiovascular System: Normal and Pathologic Anatomy.** Kenneth S. Rholl, M.D., Robert G. Levitt, M.D., Fernando Gutierrez, M.D., Harvey S. Glazer, M.D., Joseph K.T. Lee, M.D., William A. Murphy, Jr., M.D., Roy R. Peterson, Ph.D.

**MRI of the Hematoma: In Vitro Correlation of Clinical Observations.** Evan Unger, M.D., Joseph K.T. Lee, M.D., Harvey S. Glazer, M.D., David Ling, M.D., Tom Dixon, Ph.D.

**The Significance of the CT Detection of Diaphragmatic Lymph Nodes.** Dixie Aronberg, M.D., Harvey S. Glazer, M.D., Stuart S. Sagel, M.D.

**CT of the Small Bowel.** Susan James, M.D., Daniel Picus, M.D., Dennis M. Balfe, M.D., Joseph K.T. Lee, M.D.

**Ytterbium-DTPA, A Potential Intravenous Contrast Agent.** Evan C. Unger, M.D., Fernando Gutierrez, M.D.

**High Resolution Ultrasonography for Evaluating Suspected Primary Testicular Neoplasms.** David Ling, M.D., G. Leland Melson, M.D., Russell Tackett, M.D., William J. Catalona, M.D.

**MR of Normal and Pathological Skeletal Muscle.** William A. Murphy, Jr., M.D., William G. Totty, M.D., James Carroll, M.D.

**Percutaneous Balloon Catheter Dilatation of Biliary Strictures: Multi-Center Experience with 63 Cases.** Peter R. Mueller, M.D., Joseph T. Ferrucci, M.D., Eric vanSonnenberg, M.D., Philip Weyman, M.D., Nicholas Papanicolaou, M.D., Alan S. Brown, M.D.

**Three-Dimensional Computed Tomography of the Foot.** Steven Adler, M.D., Michael Vannier, M.D., Louis A. Gilula, M.D., Robert Knapp, B.S., Lawrence Oloff, D.P.M., Allan Jacobs, D.P.M.

### Exhibits

**Oblique Magnetic Resonance Imaging of the Cardiovascular System: Normal and Pathologic Anatomy.** Kenneth S. Rholl, M.D., Robert G. Levitt, M.D., Fernando Gutierrez, M.D., Harvey S. Glazer, M.D., Joseph K.T. Lee, M.D., William A. Murphy, Jr., M.D., Roy R. Peterson, Ph.D.

**Ultrasonography of the Shoulder.** William D. Middleton, M.D., William R. Reinus, M.D., William G. Totty, M.D., G. Leland Melson, M.D., William A. Murphy, Jr., M.D.

### Re-elected

**Ronald G. Evens, M.D.**, the director of Mallinckrodt, was re-elected treasurer of the American Roentgen Ray Society during the society's annual meeting. He has served as treasurer of the ARRS since 1983 and a member of the ARRS executive council since 1980.



# UPDATE

## SNM



*President of the Society of Nuclear Medicine Michael J. Welch, Ph.D., professor of radiology and chemistry at MIR, opens the Society's annual meeting held in Houston, Texas.*

The 32nd Annual Meeting of the Society of Nuclear Medicine, held on June 2-5, in Houston, Texas, offered the year's largest and most varied collection of nuclear medicine papers, seminars, posters, and exhibits. Several thousand participants gained the opportunity to hear national experts in nuclear medicine discuss chemistry, physics, quality assurance, cardiovascular nuclear medicine, PET, SPECT, and magnetic resonance imaging at the annual meeting. More than 600 scientific presentations covering thirty different subjects of importance were made. Society president, **Michael J. Welch, Ph.D.**, and other Mallinckrodt staff members made the following contributions.

### PAPERS

**The Use of C-11 Glucose and Positron Emission Tomography to Measure Brain Glucose Metabolism.** Mark A. Mintun, M.D., Marcus E. Raichle, M.D., Michael J. Welch, Ph.D., and Michael R. Kilbourn, Ph.D.

**Comparison of Methods Used to Radiolabel Monoclonal Antibodies.** Fyllis L. Otsuka, Ph.D., and Michael J. Welch, Ph.D.

**Use of O-15 Water and C-11 Butanol to Measure Cerebral Blood Flow (CBF) and Water Permeability with Positron Emission Tomography (PET).** Peter Herscovitch, M.D., Marcus E. Raichle, M.D., Michael R. Kilbourn, Ph.D., and Michael J. Welch, Ph.D.

**Evaluation of the Maximum-Likelihood Method for Reconstruction Images in Positron Emission Tomography.** Mark A. Mintun, M.D., J. Gorman, A.G. Swift, and D.L. Snyder.

**Halofluorination: A Rapid and Efficient Method for the Incorporation of Radiofluorine into Organic Molecules.** D.Y. Chi, J.A. Katzenellenbogen, M.R. Kilbourn, Ph.D., and Michael J. Welch, Ph.D.

**Multispectral Dual Isotope and NMR Image Analysis.** Michael W. Vannier, M.D., R.M. Beihn, R.L. Butterfield, B.S., and F.H. Deland

**The Measurement of Regional Pulmonary Blood Flow Using Positron Emission Tomography and O-15 Water.** Mark A. Mintun, M.D., G.F. Marklin, Mark A. Green, Ph.D., and D.P. Schuster

**Nonstationary Temporal Wiener Filtering of Gated Blood Pool Studies.** M.A. King, Tom R. Miller, M.D., Ph.D., P.W. Doherty, and J.A. Bianco

**Effect of Tissue Heterogeneity on the Measurement of Regional Cerebral Oxygen Extraction (E) and Metabolic Rate (CMRO<sub>2</sub>) with Positron Emission Tomography.** Peter Herscovitch, M.D. and Marcus E. Raichle, M.D.

**Brain Oxygen Utilization Measured with O-15 Radiotracers and Positron Emission Tomography: Generation of Metabolic Images.** Peter Herscovitch, M.D., Mark A. Mintun, M.D., and Marcus E. Raichle, M.D.

**Compartmental Models: Limitation for Measurement of CBF with PET.** Kenneth B. Larson and Marcus E. Raichle, M.D.

### POSTERS

**Myelin Imaging with C-11 Labeled Diphenylmethanol and Positron Emission Tomography.** Peter Herscovitch, M.D., D.D. Dischino, Michael R. Kilbourn, Ph.D., Michael J. Welch, Ph.D., and Marcus E. Raichle, M.D.

**Evaluation of PLED as a Chelating Ligand for the Preparation of Gallium and Indium Radiopharmaceuticals.** Mark A. Green, Ph.D., Carla J. Mathias, B.S., Michael J. Welch, Ph.D., P. Taylor, and A.E. Martell

**NCA (18F)-16 $\beta$ -Fluorestradiol-17B: Optimization of Yield and Quality Control by HPLC.** James W. Brodack, Ph.D., Michael R. Kilbourn, Ph.D., Michael J. Welch, Ph.D., and J.A. Katzenellenbogen

**Synthesis and Uptake of No-Carrier Added C-11 Labeled Putrescine in Male Rat Prostate.** Paul A. Jerabek, Ph.D., Carmen S. Dence, M.S., Michael R. Kilbourn, Ph.D., Michael J. Welch, Ph.D., and Dov Kadmon

**Biodistribution and Metabolism of 16 $\beta$ -(18F)-(Fluoro) - 17B-Estradiol.** Carla J. Mathias, B.S., James W. Brodack, Ph.D., Michael R. Kilbourn, Ph.D., K.A. Carlson, J.A. Katzenellenbogen, and Michael J. Welch, Ph.D.

### SEMINARS

**Comparison of Monoclonal Antibodies by Iodination with Those Labeled with 111 In Using Bifunctional Chelates.** Michael J. Welch, Ph.D., and Fyllis L. Otsuka, Ph.D.

### CONTINUING EDUCATION

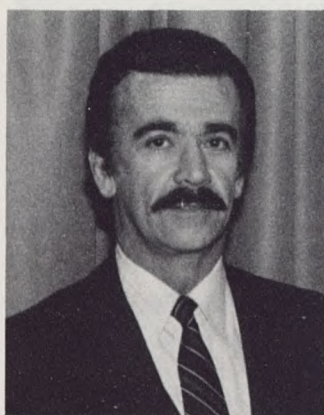
**Clinical Utility of New Computer Techniques and Tomography in Cardiac Studies.** Edward Geltman, M.D., faculty member



## Perez Honored With Probstain Lecture

**Carlos Perez, M.D.**, director of Mallinckrodt's division of radiation oncology, has been honored with the establishment of a new lectureship at the Washington University Medical Center.

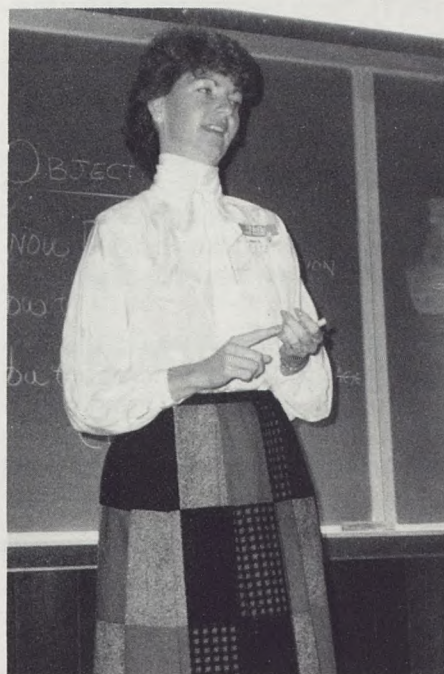
Honoring both Dr. Perez and William Fair, M.D., former head of urology in the department of surgery, the Probstain Oncology Lectureship was founded by Mr. and Mrs. Norman Probstain in appreciation of the physicians' professional services and of the staff at Barnes, Mallinckrodt Institute, and the Washington University Medical Center. The annual lectures, coordinated by Dr. Perez, will serve as a means of offering state-of-the-art information on concepts in cancer prevention, diagnosis, and treatment with an emphasis on genitourinary diseases.



Dr. Perez

On July 13, the first Probstain Oncology Lecture was delivered by Willet F. Whitmore, M.D., a pioneer in urologic oncology. Whitmore, who retired two years ago, was chief of the urologic service for 33 years at Memorial Sloan-Kettering Hospital in New York City. He is internationally renowned for developing techniques that have improved the management of patient with urologic cancers, and established the first fellowship in the United States for training young physicians in urologic oncology. Whitmore spoke on "Urologic Cancer: Impact of Local Control on Cure and Quality of Life."

## Radiation Oncology Communication Seminar

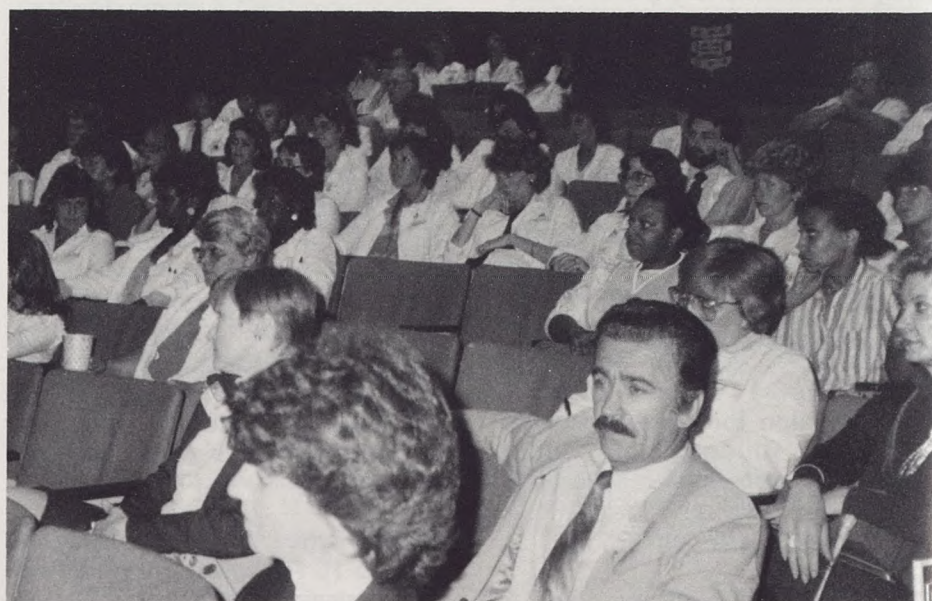


Linda Wynne, vice president of The Creative Thinking Center, Inc., discusses effective communications in patient care.

**Dr. Carlos Perez**, director of the division of radiation oncology, held a special conference to enhance effective communication in the division on June 14. The seminar was conducted by Ms. Linda Wynne, vice president of The Creative Thinking Center, Inc., with opening remarks by Mark Russell, administrator of fiscal affairs at Irene Walter Johnson Institute of Rehabilitation. It was attended by division staff members from all areas related to patient care—physicians, radiation therapy technologists, nurses, physicists, researchers, and administrators.

Wynne's presentation focused on the theory of brain predominance and its implications for communication. She illustrated ways in which people with different patterns of thinking can effectively communicate and demonstrated what happens to a person's mode of thought in a time of crisis—a state most cancer patients and their families are in.

"The purpose of the seminar is to improve our ability to communicate so that our operation will be smoother and to enhance our ability to take the best possible care of our patients," said Dr. Perez.



At Scarpellino Auditorium, staff members in the division of radiation oncology assemble for a conference directed at improving patient care.



# UPDATE

## MIR Sponsors Hyperthermia Symposium



**Bahman Emami, M.D.**

The division of radiation oncology at Mallinckrodt Institute of Radiology (MIR) will sponsor a three-day symposium on the use of hyperthermia in cancer treatment Thursday, Friday, and Saturday, September 12-14.

The morning sessions, to be held in the institute's Scarpellino Auditorium, will feature lectures by staff of the division of radiation oncology and distinguished guest speakers who have worked extensively with hyperthermia. Topics will cover the basic biology and physics of hyperthermia, thermal dose and thermometry principles, and techniques for patient treatment. Current information on clinical results with local, regional, and whole body techniques will also be provided.

Afternoon workshops will be held in the MIR Hyperthermia Treatment area on the third floor of Barnard Free Skin and Cancer Hospital, where participants will have the opportunity to observe actual hyperthermia treatments and discuss treatment methods and techniques with physicians, physicists, technicians, and nurses who are experts in the field.

Symposium committee members are: **Carlos A. Perez, M.D., Bahman Emami, M.D., Gilbert H. Nussbaum, Ph.D., and Ronald Johnston, Ph.D.**

## Prognosis for Colorectal Cancer

With the announcement on July 16 that President Ronald Reagan has colorectal cancer, national attention focused on the disease. "Increasing public understanding of this common and exceedingly important disease might, in the long run, promote early detection and improve the cure rate," says **Miljenko V. Pilepich, M.D.**, associate professor of clinical radiology in Mallinckrodt's division of radiation oncology.

According to Dr. Pilepich, "More than 150,000 new cases involving carcinomas of the large bowel are diagnosed each year in the United States, and nearly 60,000 deaths from the disease are recorded. The incidence of the tumor seems to be on the increase, particularly in the older adult population, and is apparently related to dietary habits."

Dr. Pilepich noted that certain benign lesions in the large bowel may be a source of malignancy. These include polyps, which are small, pendulous formations on the lining of the bowel. They are most commonly found in the distal part of the large bowel (rectum and sigmoid) but can arise in other places.

"A definite association between the presence of these lesions and subsequent malignancy has not been established beyond doubt," says Dr. Pilepich, "although there are indications that people with polyps have a higher risk of developing a malignant lesion. The polyps commonly produce bleeding and are usually removed through a proctoscope or colonoscope."

"Another lesion that seems to be associated with an increased incidence of malignancy is the villous adenoma, which is a spongy-looking lesion with many villous (hair-like) projections on its surface. The likelihood of developing an invasive cancer in these lesions is considerably higher than in adenomatous polyps," says Dr. Pilepich.

Fortunately, half of all cancers of the large bowel can be detected by a simple digital examination. "And," says Dr. Pilepich, "carcinoma of the large bowel is treatable and highly curable, if detected early."

The American Cancer Society recommends the following routine procedures aimed at early detection.

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*Routine annual digital examination for all persons aged 40 and over.*

*Annual Test for occult blood in the stool for all persons aged 50 and over.*

*Examination of the bowel using a sigmoidoscope and/or colonoscope should be performed every 3 to 5 years—after two initial negative examinations within one year.*

*Positive stool test is an indication for further evaluation. In addition to endoscopy, this should include radiographic studies such as a barium enema.*

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According to **Dennis M. Balfe, M.D.**, assistant professor of radiology and director of gastrointestinal radiology at MIR, "An air contrast enema can complement colonoscopic evaluation by providing a reliable picture of areas of the colon that are difficult to reach with the colonoscope and by detecting polyps that are hidden in the folds and angulated areas of the colon."

Barium enemas are often recommended when patients have unexplained abdominal symptoms, iron deficiency anemia, or polyps in the distal part of the bowel. "The radiographic examination can detect polyps in the colon that are as small as 5mm., a size at which most are nonmalignant and can be safely removed to prevent the development of invasive cancer," says Dr. Balfe.



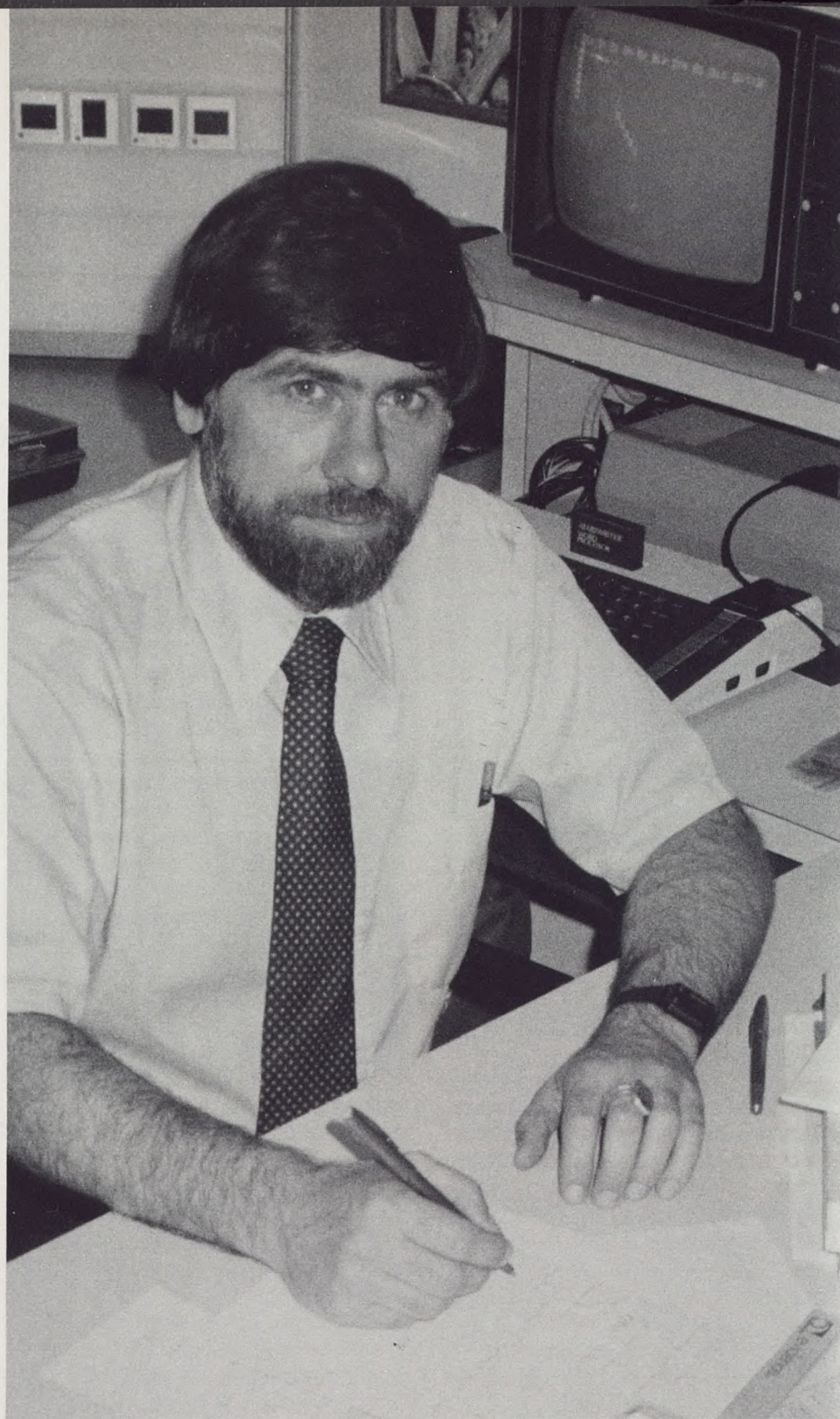
# The Ray and the Spectrum

by Ria Munoz

The human cell is not too small an object for **Joseph L. Roti Roti, Ph.D.** He's spent more than twenty years and made more than one career change to come closer to understanding it. The new chief of cancer biology in the division of radiation oncology at Mallinckrodt Institute, Dr. Roti Roti first wondered about the developmental patterns of cells as an undergraduate majoring in physics at Michigan Technological University.

"I remember comparing my biology and physics courses. In physics, the approach emphasized learning old ideas; in biology, scientists asked new questions. Questions like, 'Why does a cell go from one stage of its life cycle to another? What are the dynamics of growth in certain populations of cells?' were very basic questions in biology and yet, they were far more interesting to me. Those questions sound naive, but they really aren't so naive. All cancers have something to do with growing cells and there is a large body of scientists—a group of biomathematicians in cell kinetic research—interested in those very questions today," says Dr. Roti Roti.

Those questions lie at the core of this biophysicist's work. In over forty scientific articles, he and other collaborators have described the effects of radiation treatment or hyperthermia on cell survival, DNA repair, and the replication of molecules important in cell proliferation. Classical biochemical methods such as cell culture or electropho-



Joseph L. Roti Roti, Ph.D.

retic separation of proteins, flow cytometry, and fluorescence microscopy are the techniques Dr. Roti Roti depends on. But he has also developed mathematical models to describe these events.

"At one point in time, I thought that in order to understand something, you had to be able to explain it mathematically. I still have that desire; I consider mathematics a tool for making biological processes less complicated. For instance, in some of my research, I

devised biomathematical models which illustrate, or simulate, how nuclear protein or DNA in a population of cells responds to the induction of heat or radiation," says Dr. Roti Roti. At first appearance, these models look like land-mapping studies of mountainous terrain produced by a computer. The rise and fall of the terrain represents fluctuations in the population of a specific group of cells. "This is such a new way of studying the human cell that the responses of biologists are more



often unfriendly than not." But that kind of reception hasn't prevented this researcher from striving closer towards his ultimate goal: to understand why radiation is able to destroy cells.

Radiation biology, says Dr. Roti Roti, is part of the curative process in the treatment of cancer with radiation or heat. "We (as cancer biologists) study the effects of radiation on the cell in order to help radiation therapists understand what happened and why. We aren't teaching therapists how to treat tumors but we provide information on the results of the radiation given."

"For scores of years, no one has been able to understand why radiation destroys cells. There have been a lot of guesses but no one really knows. With the combined knowledge of radiation therapists—the clinicians—and biological researchers, we will be able to single out new research, or clinical trials, which will have a high probability of success. These small successes will lead us to the answer to that mystery."

The new chief's strategy for advancing knowledge gained in cancer biology includes the development of a "spectrum of scientists, investigating different aspects of radiobiology at various levels." This team of investigators won't function like a clinical team; the individual scientists will have research questions which are their own. "This spectrum will allow us to build the tremendous pool of knowledge required. One scientist may study the behavior of tumors in animals; another may examine the proliferation of certain cell populations; another will analyze cells as individual units; and still another may ask questions about particular molecules within the cell," says Dr. Roti Roti.

The spectrum has its beginnings in place with the biologists who have helped make the division of radiation oncology a world leader. **Drs. Hsiu-san Lin** and **Alexander Nakeff** are international authorities on hematology and the variable growth patterns of bone marrow cells and **Dr. Leonard**



Cancer biologists, front, left, Drs. Ryuji Higashikubo and Joseph L. Roti Roti. Back, Drs. Alexander Nakeff, Hsiu-san Lin, and Andrei Laszlo. Dr. Leonard J. Tolmach is not pictured.

**Tolmach** is well-known for his investigations of radiosensitivity in the cell cycle.

**Drs. Andrei Laszlo and Ryuji Higashikubo** are recent additions to the staff. A cell biologist and geneticist, Dr. Laszlo is considered an expert in the cellular and molecular biology of oncogenesis and hyperthermia. His research is focused on gaining an understanding of modifiers of cellular responses to hyperthermia which in the future may be applied to clinical hyperthermia. With an extensive background in biology, electron microscopy, and flow cytometry (FCM), Dr. Higashikubo will conduct investigations on the kinetics of normal and tumor cells and tissues under various conditions as well as the functional and structural correlation of cells and tissues. In addition to this research, Dr. Higashikubo will manage the operations of the division's FCM Facility and work towards improving current FCM technology, cytochemistry, and histochemistry relative to FCM.

Dr. Roti Roti's own career includes a kaleidoscopic list of achievements made in more than one branch of science. He has served on the faculties of the departments of biophysics, biochemis-

try, anatomy, and radiology at the University of Florida in Gainesville, the University of Utah at Salt Lake City, the Lawrence Livermore and Brookhaven National Laboratories, and other nationally known institutions. He has also done research in biostatistics and biomathematics and later participated in the organization of a course on flow cytometry at the University of Paris. In 1965, Dr. Roti Roti received his BS degree in physics from Michigan Technological University, in Houghton, Michigan, and in 1972, obtained his PhD degree in biophysics from the University of Rochester in New York.

His accomplishments in science, or subjects related to science, do not begin and end in his professional life. He has designed and published a science-fiction board game named "Starship and Empire." He has also created a number of computer simulation games, all of which are derived from history's most famous wars. His greatest pastime, however, is more a matter of history than science. During the last fifteen years, Dr. Roti Roti has hand-painted an extensive collection of military miniatures reproducing the dress and weaponry of soldiers from medieval times to World War II. ■





*Pediatric technologist Susan Wagy gives David a little extra "therapy" before the CT exam begins.*



# CHILDHOOD CANCER

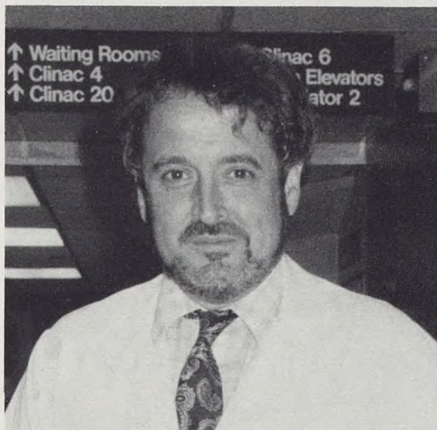
"Childhood cancer is not just a disease of the child," says **Dr. Patrick R.M. Thomas**, pediatric radiotherapist. "It affects the parents, siblings, and members of the extended family."

One of an estimated 35 physicians in his specialty in the nation, Dr. Thomas is the only pediatric radiotherapist on staff in Mallinckrodt Institute's division of radiation oncology and at Children's Hospital. His leading research on Wilms' Tumor, medulloblastoma, and the late effects of radiation therapy has been described in several scientific articles and book chapters.

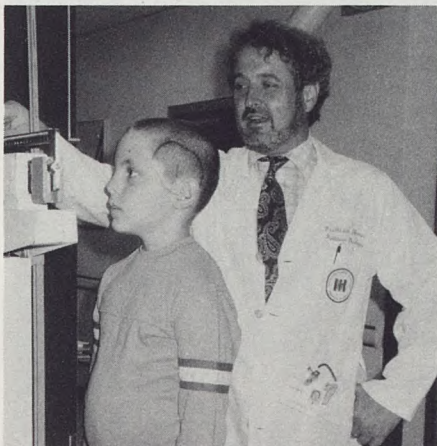
These investigations are important because after accidental deaths, cancer remains the chief cause of death in children aged 3 to 14. This year, the National Cancer Institute estimates that some 6,000 newly diagnosed cases of childhood cancer will be reported.

In a year's time, Dr. Thomas will see or consult on approximately 40 new cases involving children with cancer. He also sees children who have been treated with radiation in preceeding years. These children remain a part of his caseload as he observes their response to treatment.

Over the last several years, Dr. Thomas has become one of the country's key investigators of Wilms' Tumor, a rapidly developing malignant mixed tumor of the kidney, which usually affects children during the first five years. This tumor is the most common malignancy of the genitourinary tract in children. It also accounts for nearly 20% of all childhood solid tumors and



Dr. Patrick Thomas, pediatric radiotherapist



9-year-old patient Heath Bishop watches where the counterweight will land when Dr. Thomas checks his weight.

*Today's pediatric oncologists—the physicians who treat the child with cancer—are saying the word "cure" with more confidence than ever.*

*According to statistics from the National Cancer Institute (NCI), 75% of the children who have cancer in the U.S. today will benefit from treatment, compared with less than 25% in 1971. NCI also reports that more than half of the children who died of cancer in the 1950s would be able to survive today. And striking advances continue to be made in the prognosis of many pediatric tumors.*

approximately 450 new cases every year in the United States.

"We're finding that we are able to cure a very high percentage of patients with the tumor but still have to cope with the late effects of treatment," says Dr. Thomas. "For instance, about 70% of the irradiated patients with Wilms' Tumor will acquire curved backs. If we can reduce the amount of treatment by pinpointing the exact amount needed at various stages of the disease, patients will be cured with fewer long term disabilities."

Additionally, the treatment of childhood cancers can be more complicated because cancer in the child is not the same thing as cancer in an adult. The most common cancer of adults occurs in epithelial (lining) tissue while childhood cancers usually affect developing tissues such as the blood, bone, brain, nervous system, and kidney.

"A pediatric radiotherapist has to plan treatment which will hopefully eliminate the tumor while keeping the normal tissues growing. The information gained from this treatment enables physicians to make near accurate predictions on how different cancers might act in adults or how the diseases may respond to various therapeutic modalities," says Dr. Thomas.

The physician who treats a child with cancer has to consider more than the child. "The physician finds himself spending more time than usual with the patient's family because radiotherapy for pediatric tumors is a very emotional experience," says Dr. Thomas.



## Childhood Cancer

### How Parents Cope

Despite the uncertainties and fears which accompany a diagnosis of cancer, the families of children with cancer do find ways to cope. Among the children treated by Mallinckrodt Institute's division of radiation oncology and their families are remarkable examples of courage and determination.

### As Long As We Understand

**February 22, 1985.** Dr. P. (ophthalmologist in Springfield, Illinois) called St. Louis to see if appointment could be moved to an earlier date. Eye has been getting progressively worse.

**February 26, 1985.** (Arrived at the Washington University Medical Center) Saw Dr. B./Dr. M., Barnes' specialists. Chest X-ray. CT head scan. Admitted to Children's Hospital.

**February 27, 1985.** Biopsy; mass behind the orbit of the right eye. **Rhabdomyosarcoma.**

These notations are from the diary which Mark and Nancy Maurer began keeping on the day they learned that their daughter, 5-year-old Megan Yvette, has cancer. On the pages which follow, the Maurers, like most parents of children with cancer, have recorded every detail of their child's treatment.

"It is important for us to know as much as possible about Megan's treatments," both parents agree. "As long as we understand what is being done and what we have to do for Megan, we can handle the long road ahead."

As for Megan, she is learning to ride a bicycle this summer and looking forward to beginning the first grade in the Fall.



Mark Maurer, an engineering student, and his wife Nancy, a registered nurse at Memorial Medical Center in Springfield, Illinois, have taken turns staying in St. Louis with their daughter Megan.

### Everyone Wants To Help Us

The news that their son David had a brain tumor (ependymoma) came as a double blow to Richard and Nancy Burke of Pacific, Missouri. Just four months earlier, in May 1984, an electric response audiometry test at Children's Hospital had determined that their youngest child, Adam, who is now three years old, is profoundly hearing impaired.



Nancy Burke and her 8-year-old son, David, are learning sign language so that they can communicate with David's younger brother, Adam, who is deaf.

Although their situation seemed bleak in the first months following David's diagnosis, the Burkes have developed a positive outlook about their children's problems.

"Everyone wants to help us," says Nancy Burke. "During David's hospitalization for surgery and later during his radiation therapy program, which involved daily trips to Mallinckrodt Institute, our neighbors cooked dinner for us. Teachers from the local school district offered to babysit our children (Aaron, 11, and Sarah, 9, in addition to the younger boys), and a secretary from my husband's office even cleaned my house for me."

"At the suggestion of the Mallinckrodt staff, we obtained temporary homebound teaching services for David. This was a very successful experience. David's tutor, who had worked with other sick children, scheduled her visits at times when David felt his best. David returned to school after the Christmas break and completed second grade with his class in May."

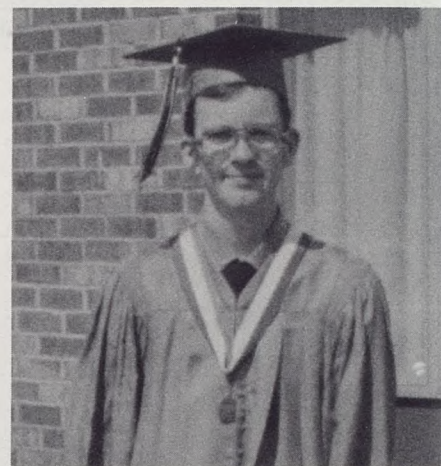
With nearly a year of cancer treatments behind them now, the Burkes are "taking life one day at a time and having fun together."

### A Normal Daily Routine

"I found it important to treat the child with cancer as normally as possible," says Jenny Medcraft. Her son, Rease Henry McDaniel, was first diagnosed with cancer (desmoplastic medulloblastoma, a rare tumor affecting the brain and spinal cord) on Christmas Eve 1981.

"In spite of your sudden preoccupation with hospital visits and doctors' appointments, the parent of a child with cancer needs to maintain as normal a daily routine as possible. The child still needs discipline, for his own sake as well as for that of his siblings, and the parent should continue to teach him how to live and be well-adjusted in society."

Rease has kept his life on a steady upward tract despite two bouts with cancer (a second tumor was discovered in February 1985). In October of 1982, ten months after having surgery to remove a brain tumor, he earned the Eagle Scout Award, the highest award in scouting.



Rease Henry McDaniel, a two-time veteran of cancer, graduated from high school in the class of '85. He traveled to Virginia this summer for the Boy Scout National Jamboree and will begin his freshman year at the University of Evansville in Indiana in September.

Although he missed the entire second semester of his freshman year and nearly half of his senior year, Rease graduated with his class at William Henry Harrison High School in Evansville, Indiana, on June 5, 1985. A member of the National Honor Society, he accumulated an average grade point of 3.7 on a 4.0 scale. The subject of his senior term paper—cancer treatments



## We Have Lots of Faith

Religion has always been important to Bobby and Hester Beckum, the parents of Keeven Anthony "Tony" Beckum who, like Megan, has a tumor (rhabdomyosarcoma) behind the orbit of the right eye.

"Not a single moment has been easy since we learned that Tony has cancer, but we have lots of faith," says his mother. "We believe in prayer and are encouraged by our pastors, relatives, and friends who stop by everyday when Tony is in the hospital and remind us to have faith and trust God."

It also helps to have a wonderful child like Tony. He has really been great through all of the tests and treatments."

For his sixth birthday on August 22, Tony will probably visit his favorite place, the St. Louis Zoo.



Tony Beckum and his mother, Hester, draw pictures to pass the time at Children's Hospital.



Poplar Bluff, Missouri, is home for Misty Ellis and her mom, Teresa (insert). They stay at the Ronald McDonald House in St. Louis when Misty has her cancer treatments.

## One Thing At A Time

Four-year-old Misty Ellis also has rhabdomyosarcoma. (A tumor of the soft tissues of the body, usually muscle, rhabdomyosarcoma occurs predominantly in infants and small children.) As with Megan and Tony, Misty's tumor developed behind her eyes.

To keep their fears in perspective, Teresa Ellis, Misty's mother, often writes about them. Shortly after Misty completed radiation therapy at Mallinckrodt last December, Teresa used the word "radiation" to help her record the thoughts that give her hope.

*Relax, it is hope.*

*Allow time for fears and tears, but don't drown in them.*

*Deal with one thing at a time.*

*Imagine how you can be strong—then do it.*

*Ask if you don't know. Now you are rid of one fear.*

*Time. Remember it comes in seconds. Enjoy each one.*

*Intake what you can today. Leave the rest until you are rested.*

*Only you? It's not true, I'm here too.*

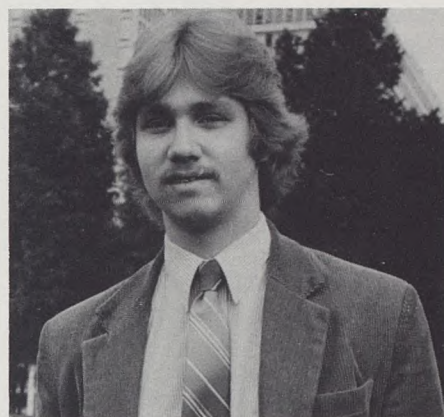
*Now leads to tomorrow.*

Teresa Ellis

## Life after Childhood Cancer

What quality of life succeeds a childhood fight with cancer? After six years of courageously facing the disease, nineteen-year-old Jeffrey "Jeff" Shannon, of Webster Groves, can respond "a happy and successful one."

Jeff had a cancerous lump (synovial sarcoma) removed from his left leg in 1979. During the six weeks of radiation therapy and one year of chemotherapy that followed, he was plagued with intermittent sickness and lost 20 pounds and all of his hair.



Jeffrey Shannon, a cancer patient with a victory

"Family friends drove me to the hospital everyday," he recalls. "I missed a lot of school for the treatments, but kept up with the work and graduated with my class in 1984."

Jeff's high school graduation coincided with the physical examination which proved him to be cancer-free for five years. Having recently completed an eight-month course in computer programming at Bryan Institute in St. Louis, he hopes to soon find a job that allows him to combine his programming skills with his linguistic abilities. (He speaks both Spanish and German fluently).

"The area where the tumor was removed is injured easily, and I have a slight limp. But, otherwise, there is no indication that I once had cancer. I never even think about it," says Jeff.

"Having cancer was really not an all-bad experience. It helped me to develop a closer relationship with my mother and enabled me to make friends at the hospital. My doctors, who spent a lot of time talking with me over the past six years, have been a very positive influence in my life."



## From the



Armand Diaz,  
R.T., R.N., FASRT

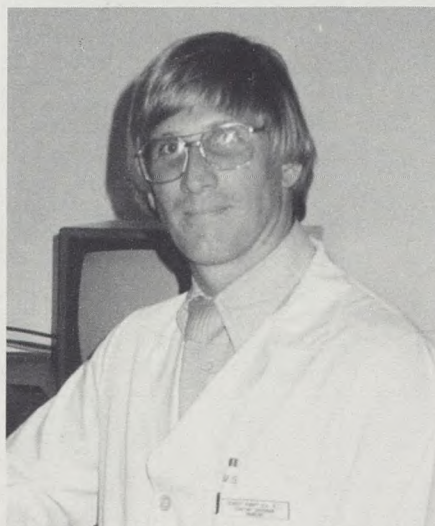
## Technical Administrator

**Generation of Three-Dimensional Images From CT Scans: Technological Perspective**, written by **Robert H. Knapp, B.M., R.T.**, assistant supervisor, special procedures, and assisted by Jeffrey L. Marsh, M.D., and **Michael W. Vannier, M.D.**, was selected as the cover story for the July-August edition of **Radiologic Technology**, the journal of the American Society of Radiologic Technologists (ASRT). Additionally, the manuscript has been included in the ASRT Directed Readings Program, a continuing education course administered by the society.

Mr. Knapp's article is the first to describe ways in which a technologist can improve 3-D surface reconstruction images produced from CT scans. He has recorded information about specialized CT programs and advanced digital image processing techniques which can be used with the 3-D programs to produce optimal results for patient care and management.

Initially developed for the pre-operative

## Knapp Reviews Technological Perspective



Robert H. Knapp, B.M., R.T.

evaluation of complex craniofacial anomalies, 3-D imaging is emerging as a routine radiological procedure. At Mallinckrodt Institute, where the techniques have been in use for more than three years and applied to over 700 patient studies, applications have been found useful in orthopedics, neurosurgery, radiation therapy planning, anthropology, paleontology, and industrial testing.

"Each of these applications brings with it special problems which can be overcome by the use of a variety of advanced processing techniques," says Knapp. "These advanced methods often require skilled technical control to produce a useful result."

Mr. Knapp graduated from the radiologic technology program at Mallinckrodt Institute in 1982, and has served as a clinical instructor and assistant technical supervisor at MIR. Since 1984, he has assisted full-time in the special projects directed by Michael W. Vannier, M.D., associate professor of radiology. ■

## Scaling and Anti-aliasing



Figure A



Figure B

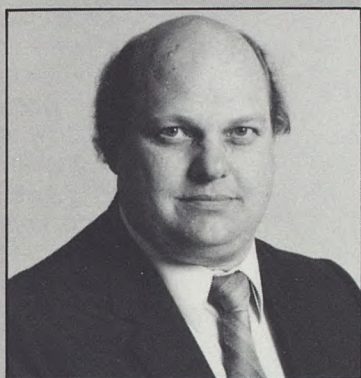
Mid-sagittal bony surface views of the head before (Figure A) and after (Figure B) scaling and anti-aliasing. Patient is a three-year-old child with a major craniofacial syndrome, Unilateral Coronal Syntosis, examined post-operatively.

The three-dimensional surface image reconstruction process is based on level slicing (2mm thickness) with single or multiple thresholds for contour extraction and image segmentation. For each succeeding CT scan image, a bony surface contour is processed and stored on a disk storage unit as a single line. A soft tissue contour is obtained in the same way.

Included in the computer technology is a program which scales to proportional size the composite 3-D reconstruction images that result, and then special computer programs called smoothing filters are used to reduce the coarse, steplike "digital" appearance. An anti-aliasing, non-linear digital filter, based on local averaging and median filtering, produced the dramatic change in the subjective quality of Figures A and B.



## Hente Elected ASRT Regional Director



**Norman L. Hente, R.T.B.S.**, supervisor of MIR's medical photography department, has been elected director of Region V for the American Society of Radiologic Technologists (ASRT). He was inducted into the office at the 57th Annual Conference of the ASRT, which was held in Denver, Colorado, on June 22-27.

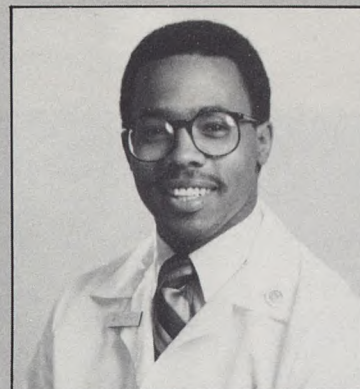
The regional directorship involves a two-sided responsibility. Mr. Hente will represent his region, which includes

Arkansas, Iowa, Kansas, Missouri, and Nebraska, on the ASRT board of directors; and will serve as a representative of the ASRT at state conventions.

An active member of the ASRT since 1970, Hente is honored to be a regional director and is looking forward to the year ahead.

"I welcome the opportunity to be an active participant in the development and change of our national professional society," he said. ■

**Carol (Barbier) Cassel, C.N.M.T.**, 1983 graduate of MIR's Nuclear Medicine Technology program, recently received the "Superior Performance Award" for her work at the Veterans' Administration Hospital in Sepulveda, California. Ms. Cassel, who is a nuclear medicine staff technologist and deputy radiation safety officer at the hospital, was similarly recognized in 1984. The daughter of **Mr. and Mrs. Jean Barbier**, Ms. Cassel earned a degree in medical anthropology at Washington University in St. Louis before pursuing training in nuclear medicine technology.



**Michael D. Ward, R.T.B.S.**, assistant program director in radiography, has received the 1985 Mallinckrodt Fellowship Award from the 4th District of the Missouri Society of Radiologic Technologists (MSRT). Sponsored by the Mallinckrodt Pharmaceutical Company, the award is presented annually to a technologist and radiography student who have contributed significantly to the regional society and to radiography. The Fourth District also honored **Norman L. Hente, R.T.B.S.**, with life-time membership for continued service to the organization. ■

## Artifact Suppression

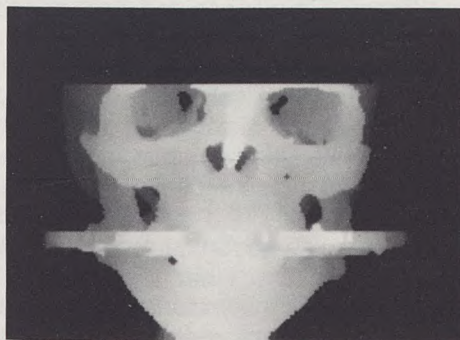


Figure C

Frontal bony surface view (scaled and anti-aliased) with artifact in the teeth due to dental fillings.



Figure D

Same view as Figure C, after artifact removal.

Imaging artifacts which occur during the CT scanning process can significantly degrade and obscure details on subsequent 3-D surface reconstructions. Typically, these artifacts are relat-

ed to patient motion during the scanning procedure, metallic components such as tooth fillings and prostheses, misregistration of images, missing slices, or various mechanical malfunctions.

To solve the problem of artifact scatter, the technologist often can simply make adjustments in the CT scanning parameters, i.e., the scan time or the dose rate (X-ray tube milliamperage). In other cases, it may be necessary to eliminate the affected slices entirely from the surface reconstruction process, and to replace them with the "averages" of adjacent slices.

When it is essential to maintain the integrity of scan slices, image artifacts can be removed by the use of specialized computer programs which allow the technologist to selectively erase a portion of the image by means of a resistor pad and pen provided on the CT scanner console. This method enables the user to erase only those scatter artifacts which would degrade the surface reconstructions, while preserving the remainder of the image data.



## 1985 Breast Cancer Seminar



Carol Perkins (Mrs. R. Marlin), serving as moderator, introduced each of the panel speakers with notes from her own experience as an officer in the American Cancer Society.

Several hundred women, health care specialists, and physicians attended "Breast Cancer: No Trivial Pursuit"—a panel workshop educating women about the need for early detection and treatment—which was held at Barnes Hospital on the mornings of April 12, 20, and May 11. The free seminar was sponsored by the Barnes Hospital Auxiliary, Mallinckrodt Institute of Radiology, and the Barnes Hospital Health Education and Screening Center.

The panel included medical experts from the staffs of Barnes Hospital and Mallinckrodt Institute of Radiology and lay representatives Geri Rothman (Mrs.

Kenneth J.), a St. Louis Globe-Democrat Woman of Achievement who has had her own battle with breast cancer, and Carol Perkins (Mrs. R. Marlin), a member of the American Cancer Society's national board of directors. The medical staff included: **Ronald G. Evens, M.D.**, director of MIR and radiologist-in-chief at Barnes; **Barbara Monsees, M.D.**, radiologist; **Laurel Wiersema, RN, MSN**, surgical nurse specialist; **Judy Destouet, M.D.**, head of mammography at MIR; **Robert H. Lund, M.D.**, general surgeon; and **Robert R. Kuske, M.D.**, radiation oncologist.

Based on evaluation forms received, seminar participants considered the seminar to be highly informative. They rated the speakers' presentations excellent and especially helpful as they could be understood by the lay public. The majority of participants stated that they would recommend the seminar to friends, associates, and relatives.

One participant commented, "I've been to many seminars on mammography and breast cancer. This is by far the most informative and effective." Another participant, a physician specializing in obstetrics/gynecology, said, "The seminar was an excellent review. It was clear-cut and offered specific recommendations."

Plans are underway for future seminars which will cover other health-related topics. ■



Seminar participants listen as moderator Carol Perkins introduces a panelist.

Ger Rothman is a native St. Louisan known by most Missourians as the wife of former Lt. Governor Kenneth J. Rothman. Until she was honored last year as a Globe-Democrat Woman of Achievement, many Missourians did not know she had endured a personal battle with cancer. During and after her husband's gubernatorial campaign, she underwent radiation therapy for breast cancer at MIR. At the 1985 Breast Cancer Seminar, Geri Rothman reflected on her life with cancer. Here are excerpts from her speech:

## LIVING with Cancer

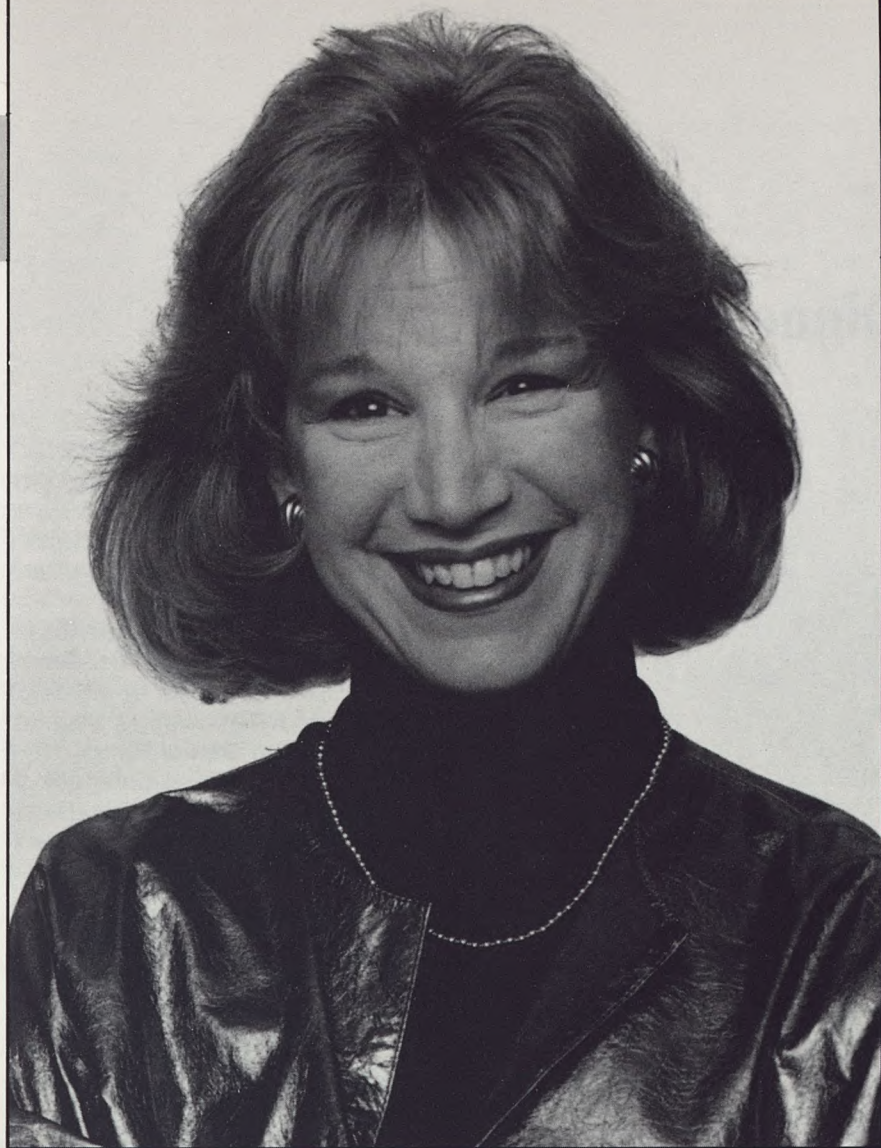
by Geri Rothman

It always happened to someone else, never to me. Still, cancer happened to my aunt, Ken's dad, my uncle, a friend, a friend's child but never to me. Right? Wrong. Cancer can and does happen to us.

I was going about my daily routine basically very satisfied. I had a good marriage to a caring, interesting, and successful man. We had four children for whom I felt exceptionally blessed because two had survived a deadly disease. We had a beautiful new house. And Ken and I had put together a fabulous life that included, besides law and real estate, a successful political career which enabled us to meet and work with some incredible people, and hopefully to have shared in some measure in making a difference in the quality of life for us and others.

One evening for some reason, I decided to do one of my semi-annual breast exams. As I lay there, my fingers felt my world come to a screeching halt.





Geri (Mrs. Kenneth J.) Rothman

Surely this small hard rock couldn't be what is supposed to be a lump in the breast. It was small, very small and hard, very, very hard.

From nowhere, the tears came. At other times in my life, I had had health problems that had evoked the same concern—cancer—and each time, I was very fortunate. Everything was benign. For a moment, I was sure that this was one of those times. In the very next moment, however, the tears flowed heavier. I was sure I had cancer. The battle went on into the wee hours of the morning. I had cancer. I didn't have cancer. I couldn't have cancer.

I felt I should conceal my worst fears from Ken and the children for now. Morning dawned and I knew that, for better or worse, time was of the essence. I called my doctor and told him that, while I was sure I didn't have cancer, I wanted to go to someone who would discuss the situation and give me all my options, of which there are many. I was feeling fairly confident by the time of my appointment with the

doctor. He reassured me that this lump was probably nothing, but should be taken out to be sure.

After keeping my worst fears guarded, it was now time to tell Ken. In my most reassuring voice, I told him I was sure there was nothing to worry about. We had traveled this road before. I was again determined fear would not prevail.

As I lay there in the black of the pre-dawn hours, my normally peaceful alarm sounded like a death toll to remind me that this was the morning...this was the day for my biopsy. My doctor did the biopsy under a local anesthesia and reassured me that everything looked good and to come back in a few days to have the incision checked, and he would have the report back by then.

Very confidently, I went back to his office on the appointed day. By now, I was sure I didn't have the big "C." I was full of chatter about my aches and pains from his surgery and then my eyes met his. I knew. I was wrong, again.

I, me, Geri Rothman, had cancer.

After the tears and fears were handled, it was time to first go on with my public appearances in the next ten days and, in between, to have tests made to see the extent of the cancer. And to learn everything I could about breast cancer surgery.

After my operation, the road to recovery was relatively smooth. I've also had reconstruction surgery. There are many options open for reconstruction. I can't tell you what a fantastic success I have had...I was very, very fortunate. I caught my cancer early.

Unfortunately, eighteen months later, in the middle of Ken's governor campaign it recurred. At this time, it was determined that I needed chemotherapy and radiation; something that I had not needed after the mastectomy, because the cancer had not spread outside the breast. This time, I was not as fortunate, but I was still catching it early. My chemo was administered during the campaign and I missed very few days of work. Radiation was completed after the campaign, here at Mallinckrodt. Neither was terrific, but it certainly was not as bad as I imagined. And I promise you, I'm feeling terrific.

Someone asked me not too long ago if I was afraid to die. If I had been asked that the day before I found out I had cancer, I would have said 'yes, you bet.' But now, after this experience and the myriad of thoughts, I realize that what I fear is not death.

I fear missing out on what this life has to offer. I want to be around to see our children grow. I want to be with Ken in his times of need or exultation. Being robbed of the rainstorms, the rainbows, the sunrises and the sunsets—that is what I fear. The only way this crime won't take place is for all of us to educate, to raise funds for research, and to work as hard as we can, to eliminate this disease.

We have cures today for yesterday's cancers, we must have cures tomorrow for today's cancers. ■



## Residents' Farewell Dinner

On June 11th, MIR staff and friends gathered at the Washington University Alumni Club for the traditional Residents' Farewell Dinner. This year, the occasion marked the completion of training for thirteen senior residents and seven fellows.

Following dinner, **Dr. Ronald G. Evens** congratulated the senior residents and fellows and presented each with a commemorative plaque. For most of them, this was a final farewell to the faculty and staff of Mallinckrodt. Their appointments to new positions are taking them across the country (to eight states) and across the ocean (to



Chief resident Daniel Picus (left) presents Dr. David Ling with the Senior Residents' Distinguished Teaching Award.

Australia).

Six of the honorees said "farewell" only to their residency training programs. They are staying at MIR and will begin new positions in nuclear medicine, abdominal radiology, and neuroradiology.

Chosen for the "Distinguished Teaching Award" this year was **Dr. David Ling**, assistant professor of radiology in the abdominal imaging section. According to **Dr. Daniel Picus**, chief resident, "The senior residents selected Dr. Ling for this award because he showed tremendous interest in resident education and contributed to the



To Dr. Gilbert "I'll be back in a minute" Jost.



To Dr. Barry "...and miles to go before I sleep" Siegel.



To Dr. Bruce "I'll be in here doing push-ups if you need me" McClennan.



To Dr. Dixie "Has anyone ever seen this before?" Aronberg, accepting for the chest radiology section.



To the "Is there an echo in here?" pediatric radiology section.



To the "Who has time for lunch?" first-year residents.



high quality of teaching at Mallinckrodt."

Also recognized during the program were **Dr. Leland Melson**, chief of diagnostic ultrasound, and **Dr. William Murphy**, co-chief of the musculoskeletal section. Both were named fellows of the American College of Radiology last year.

Under the direction of senior resident **Dr. Janice Semenkovich**, the class of '85 reinstated a Mallinckrodt tradition. They presented Dr. Evens, senior staff members, and residents-in-training with carefully chosen gifts to "help" them in the year ahead. In good fun, here is how they said farewell...



To Dr. Ronald "Does this come with earplugs?" Evens.



To Dr. Philip "Here, let me help you" Weyman.

## 1984-85 Residents, Fellows, and Trainees



Front row, left, Drs. St. Amour, Albright, Winthrop, Reiman, Semenkovich, James, Middleton, co-chief resident, Evens, radiologist-in-chief and director of MIR, Picus, chief resident, Shackelford, director of residency training, Sigeti, Schmidt, Law, Schwimmer, Berzins. Center row, Drs. Alexander, Bedont, Funk, Ganz, Grossman, Ward, Conway, Mintun, Nadel, Wu, Garvin, Bolding, Liebsch, Evans, Palaskas. Back row, Drs. Vogel, Amato, Niemeyer, Rholl, Adler, van der Vleit, Unger, Weiss, Barrett, Getz, Tobler, Neeley, Mulholland, Mulick, Martin.









# 1985 Residents' Farewell

## The Class of 1985

### FELLOWS

Steven J. Adler, M.D.  
William Ganz, M.D.  
Greg A. Jamroz, M.D.  
Richard A. Koch, M.D.  
Mark A. Mintun, M.D.  
Arthur L. Mulick, M.D.  
Andrew van der Vleit, M.D.

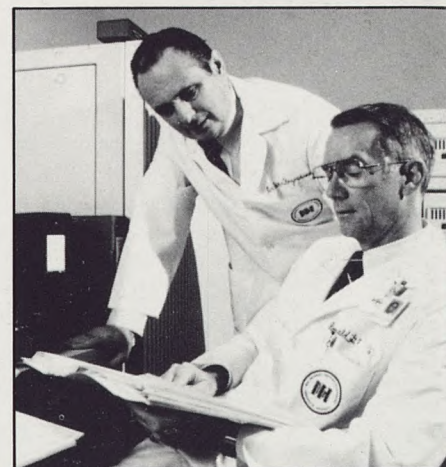
### SENIOR RESIDENTS

Daniel D. Picus, M.D.,  
chief resident  
William D. Middleton, M.D.,  
co-chief resident  
Maryellen E. Amato, M.D.  
Bernice S. Law, M.D.  
Norbert J. Liebsch, M.D.  
David J. Monyak, M.D.,  
chief resident, radiation oncology  
Dan M. Mulholland, M.D.  
J. Patton Neeley, M.D.  
Mark Schwimmer, M.D.  
Janice M. Semenkovich, M.D.  
Paul N. Weiss, M.D.  
James D. Winthrop, M.D.  
Janette L. Worthington, M.D.



*The "last hurrah" for chief resident Daniel Picus, M.D., left, and co-chief William Middleton, M.D.*





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