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SPRING 1987

VOLUME 18, NUMBER 1

#### MALLINCKRODT INSTITUTE OF RADIOLOGY

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Indexed

ARCHIVES

THE PIXAR <u>IMAGE COMPUTER</u> From Screening Room To Reading Room



The three-dimensional bone surface reconstruction shown here and on the cover is of the skull in a 4-month-old girl with plagiocephaly (without synostosis). The patient was treated at Children's Hospital by Jeffrey L. Marsh, M.D., associate professor of plastic and reconstructive surgery, with the aid of threedimensional images reconstructed by Michael W. Vannier, M.D., associate professor of radiology, from computed tomography (CT) scans. The Pixar Image Computer, a device well suited to the production of animated sequences of images, promises to be very useful in manipulating such three-dimensional reconstructions to simulate mandibular motion before and after craniofacial surgery. Story on page 8.

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ON THE COVER: Michael W. Vannier, M.D., associate professor of radiology (left), and John Zimmerman, Ph.D., assistant professor of computer applications in radiology, form part of Mallinckrodt's research team investigating the imaging powers of the Pixar computer. Photography by David Burjoski.

# Spot News

#### MIR Receives First Lithostar In Nation

Because of its international research reputation, Mallinckrodt Institute of Radiology was chosen as the first U.S. site for Lithostar, a new system for treating kidney stones using shock waves. Lithostar. manufactured by Siemens Medical Systems, Inc., is a potentially major breakthrough in kidney stone treatment. A secondgeneration extracorporeal shock-wave lithotripsy (ESWL) machine, it eliminates the space-consuming water bath, allowing it to perform other radiological and urological procedures. which should reduce the cost of the treatment.

Lithostar is also safer than first-generation ESWL machines because it triggers release of the shock waves in rhythm with respiratory motion. Since the kidneys move with respiration, this method improves accuracy, requires fewer shock waves and preserves healthy tissue. In addition, because the water bath is eliminated. follow-up radiological examinations can be done on the same system, without moving the patient.

Clinical trials are required before the U.S. Food and Drug Administration approves Lithostar's general use, but it holds great promise, says Ronald G. Evens, Elizabeth Mallinckrodt professor of radiology and director of Mallinckrodt. "Lithostar can be a major improvement in technology for the treatment of kidney stones," he says. "The device should be of interest to everyone: patients, because it should be less traumatic; physi-



cians, because it should allow a less complicated treatment; and medical insurance programs, because it should be less expensive.

"I emphasize that it is a clinical research program," Evens continues, "but I am very optimistic about its success, and we are inviting physicians and their patients with kidney stones to consider participating in our clinical evaluation of the new technology."

In addition to conducting clinical trials in kidney-stone treatment, Mallinckrodt will study Lithostar's use as a treatment for gallstones.

#### MIR And Regional Offer Free Mammograms

Mallinckrodt Institute of Radiology and St. Louis Regional Health Care Corporation announced February 20 their joint sponsorship of free mammographic screening for breast cancer at Regional's five clinic sites.

The Mallinckrodt Mammography Mobile will spend a full day per month at each of the Regional Clinics in turn, administering the lifesaving x-ray tests.

The new program was announced at a news conference at the Lillian Courtney Ambulatory Care Center, one of the four clinics operated by Regional under contract with the City of St. Louis. The Mallinckrodt van will visit all four sites, as well as the specialty clinic for city and St. Louis County patients at St. Louis Regional Medical Center. lorman Hente

"Those of us connected with Regional are very glad about this, because it almost certainly is going to save lives," says Lee M. Liberman, cochairman of the Regional Health Care Corporation's Board of Directors. "We're very appreciative of Mallinckrodt Institute for making this service available."

Officials participating in the press conference included Liberman; Robert Johnson, president and CEO of Regional; Virgil Loeb, Jr., M.D., president of the American Cancer Society; Chester Hines, acting director of the City of



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# SPOT NEWS

St. Louis' Department of
Health and Hospitals;
Ronald G. Evens, M.D.,
Elizabeth Mallinckrodt professor of radiology and director of Mallinckrodt; and
Judy M. Destouet, M.D.,
associate professor of radiology and head of Mammography at Mallinckrodt.

The mammograms will be available to women 35 and older who do not have any symptoms of breast cancer and who cannot afford to pay the regular \$50 charge for a screening mammogram performed by Mallinckrodt. Most of the women receiving the tests are expected to be regular patients at Regional clinics, but others may take advantage of the program as well.

# EinhornDeliversFreundLecture

Lawrence H. Einhorn, M.D., professor of medicine and chief of the Section of Hematology/Oncology at the Indiana University School of Medicine, Indianapolis, presented the Fifth Annual Julia Hudson Freund Memorial Lecture on January 23.

Einhorn's presentation, "Testicular Cancer: A Model for a Curable Neoplasm," focused on the remarkable advances made in the treatment of this disease, the most common cancer in young American males. Almost uniformly fatal only 10 years ago, testicular cancer is now very frequently curable.

The author of more than 150 papers and a contributor to numerous prestigious texts, Einhorn is a pioneer in the management of testicular tumors with cytotoxic agents. His many awards include the American Cancer Society Medal of Honor (1983), the National Cancer Institute Outstanding Investigator Grant (1985) and the Gottlieb Award from M.D. Anderson Hospital and Tumor Institute in Houston (1986).

Einhorn has served on several national committees, among them the FDA Advisory Committee. He presently sits on the National Cancer Institute's Board of Scientific Counselors and holds the position of professor of clinical oncology with the American Cancer Society.

Einhorn earned his medical degree from the University of Iowa Medical School in 1968 and completed his internship and residency at Indiana University Medical Center. After serving as a physician for the U.S. Air Force and following a Medical Oncology Fellowship at M.D. Anderson, Einhorn returned to Indiana University Medical Center in 1973.

The Freund Lecture was established by the Freund family of St. Louis in memory of Julia Hudson Freund and recognizes meritorious research in clinical oncology. Carlos A. Perez, M.D., director of the Radiation Oncology Center of the Mallinckrodt Institute of Radiology at Washington University Medical Center, coordinates the lecture.

#### Anderson Elected AAWR Vice-President

Dixie Anderson, M.D., associate professor of radiology, was elected vicepresident of the American Association of Women Radiologists (AAWR) at the Radiological Society of North America (RSNA) meeting in December. The AAWR's objectives are to provide a forum for women to discuss and influence issues unique to women radiologists, to encourage and support women in the mainstream of radiology and to serve as a resource organization for women in radiology.

"One of the first priorities of the AAWR was to establish a position paper on the issue of pregnancy among women radiologists," explains Anderson. "Historically, this has been an almost-taboo topic among radiologists, but there is a very real need for discussion, since more and more women are entering radiology. Our goal has been to confront the problem and provide the platform for discourse."

Opening up channels of communication by disseminating information is another way to approach the issue. Anderson said that in the last 3 to 4 years there have been a number of editorials and articles in radiology publications dealing with the topic of pregnancy that have helped initiate discussions among professionals.

"Though as an organization we deal with issues facing women radiologists, we don't limit membership to women," Anderson says. She points out that Ronald G. Evens, M.D., director of the Mallinckrodt Institute of Radiology, is also a member of the AAWR. "A number of chairmen of departments from around the country are members of AAWR, because they see us as an important organization for influencing current topics."

#### **Beetham Gives Evans Lecture**



Karen L. Beetham, Ph.D.

Karen L. Beetham, Ph.D., instructor in cancer biology in radiology, delivered the Eighth Annual Titus C. Evans Memorial Lecture at the University of Iowa in Iowa City on October 6.

Beetham was selected for the award on the basis of her contributions to the field of cellular radiation biology. Her presentation was entitled "Recovery from Radiation Damage— From Grasshopper Embryos to Human Tumor Cells."

In her remarks, Beetham credited Evans' work with grasshopper embryos, begun more than 50 years ago, with foreshadowing future studies of the survival of cells exposed to radiation. She went on to detail some of her current research on the effects of irradiation and caffeine on the survival of HeLa cells. Beetham explained that when cells are treated with certain agents (such as caffeine) after irradiation, they are unable to repair damage sustained during exposure to radiation, effectively increasing the number of cells killed during treatment.

The Titus C. Evans Lectureship is awarded annually in memory of

# SPOT NEWS

Titus C. Evans, Ph.D., late professor and head of the Radiation Research Laboratory at the University of Iowa. Evans was one of the pioneers in the field of radiation biology and the editor of the first 50 volumes of the journal *Radiation Research*, the offical organ of the Radiation Research Society.

#### Cancer Biology Hosts Radiation Research Meeting

The Second Annual Midwestern Regional Meeting for Radiation Research was held November 14–15 at Mallinckrodt. Hosted by the Cancer Biology Section of the Radiation Oncology Center, the meeting featured more than 20 papers presented by speakers from eight universities and research institutions within a 400-mile radius of St. Louis.

The presentations covered aspects of current research in radiobiology at Mallinckrodt and other institutions. The highlight of the 2-day event was a dedication symposium marking the opening of the new laboratory at the Forest Park Building, which will be occupied by Leonard J. Tolmach, Ph.D., professor of radiobiology in radiology, and his research group.

At the dedication, Tolmach was recognized for his long and excellent contribution to the field of radiobiology. Joseph L. Roti Roti, Ph.D., associate professor and chief of the Cancer Biology Section, says that Tolmach was particularly deserving of this honor "because of his fun-



Guest speakers at the dedication symposium were Robert B. Painter, Ph.D., professor of radiation biology and head of the Laboratory of Radiology at the University of California, San Francisco, and George Hahn, Ph.D., professor of radiation oncology in the Department of Radiology at Stanford Carlos A. Perez, M.D. (left), Joseph L. Roti Roti, Ph.D., Leonard J. Tolmach, Ph.D., Robert B. Painter, Ph.D., and George Hahn, Ph.D.

University School of Medicine, Stanford, California. Painter spoke on "Ataxia Telangiectasia, DNA Synthesis and Caffeine." Hahn addressed "Simulation of Cell-Killing Based on Data Obtained with Synchronized Cell Populations."

#### Evens Debuts Hornick Lecture

Ronald G. Evens, M.D., Elizabeth Mallinckrodt professor of radiology and director of Mallinckrodt Institute of Radiology, delivered his 15th distinguished lectureship—the First Julie and Newton Hornick Lecture—on November 12.

Evens spoke for the University of Pittsburgh and the Pittsburgh Roentgen Society on "The Increasing Impact of Socioeconomic Issues on the Specialty of Radiology." The Hornick Lecture commemorates the lives of Newton Hornick, M.D., a leader in the field of radiology in Pittsburgh, and his wife, Julie, a registered nurse and homas Murry

mother of two sons. In the past, Evens has served as the 40th Hickey Lecturer for the Michigan Radiological Society, the 40th Carmen Lecturer for the St. Louis Radiological Society, the 12th Hampton Lecturer for Massachusetts General Hospital in Boston, the 23rd Annual Merrill C. Sosman lecturer for the Brigham and Women's Hospital in Boston and the Seventh Annual Peter Kiewitt Memorial Lecturer for the **Eisenhower Medical Center** in Palm Springs.

Hornick practiced radiology for 33 years and was head of Radiology at Suburban General Hospital for many years. He was past president of both the



# SPOT NEWS

Pittsburgh Roentgen Society and the Pennsylvania Radiological Society and had been fellow, counselor, chancellor and secretarytreasurer of the American College of Radiology (ACR). He was also instrumental in organizing the Radiology Resident Socioeconomic Program under ACR sponsorship.

#### RSNA Features MIR Physicians In Key Roles



Michael W. Vannier, M.D.

The 72nd Scientific Assembly and Annual Meeting of the Radiological Society of North America (RSNA) hosted an estimated 30,000 attendees during its week-long run in Chicago, November 30–December 5. Mallinckrodt was well represented at the conference, with several staff members playing featured roles.

At the Opening Session, "Major Events in Radiology 1986," on November 30, Bruce L. McClennan, M.D., professor of radiology and chief of the Abdominal Section and Genitourinary Radiology, served as a panelist. His presentation, "The New Low-Osmolality Contrast Media: When, Where and How Much?," was the "State of the Art" contribution in the January 1987 issue of *Radiology* and will form the basis for an *RSNA Today* video segment to be taped in April.

Ronald G. Evens, M.D., Elizabeth Mallinckrodt professor of radiology and director of Mallinckrodt, participated in a Special Focus Session, "Evaluation of New Imaging Equipment and Procedures," on December 1. Evens presented "Economic Considerations of New Technology and New Forms of Practice for the Radiologist" and engaged in a question-and-answer discussion with the panel members and audience.

On December 2, Michael W. Vannier, M.D., associate professor of radiology, fielded questions from the media at a press conference on "Three-Dimensional CT Imaging of Skeletal Fractures." (See page 7 for more details.) For a complete listing

of Scientific Sessions, Refresher Courses and Scientific Exhibits presented by Mallinckrodt faculty, see pages 18–19.

#### McClennan Appointed To ACR Post

Bruce L. McClennan, M.D., professor of radiology and chief of the Abdominal Section and Genitourinary Radiology, was appointed to the Executive Committee for the American College of Radiology (ACR) Intersociety Commission in November. McClennan was named the Society of Uroradiology representative to the commission in September.



Bruce L. McClennan, M.D.

"The Intersociety Commission," explains McClennan, "is made up of representatives of the different radiology and subspecialty societies." McClennan is a senior member of the Board of Directors of the Society of Uroradiology.

The purpose of the Intersociety Commission, adds McClennan, is not to set policy but to make recommendations to the ACR Board of Chancellors. The commission holds a summit meeting each year to discuss a preset agenda that has been determined by the Executive Committee, a group of four or five individuals selected from among the representatives to the Intersociety Commission.

"As a member of the Executive Committee, I will help determine that agenda by polling committee members and taking suggestions from society members," says McClennan. Past agenda items have included the issues of primary access radiology and subcertification.

Following the summit meeting—scheduled to be held August 7–9 in Colorado —the Intersociety Commission will submit a report of the summit proceedings along with recommendations to the ACR Board of Chancellors, which will determine official ACR policies on the issues presented.

#### Vannier And Conroy Awarded NIH Grant

Michael W. Vannier, M.D., associate professor of radiology, and Glenn C. Conroy, Ph.D., professor of anatomy and anthropology, were recently awarded a 3-year, \$400,000 research grant from the National Institutes of Health (NIH). Using endocasts obtained from the Cavo Santiago skeletal collection in Puerto Rico, researchers from Washington University, Purdue University, and Northwestern University will study the heritability of asymmetrical cortical brain features in the rhesus monkey.

With principal investigator Dean Falk, Ph.D., associate professor, Department of Anthropology and Sociology, Purdue University, West Lafayette, Indiana, and James Cheverud, Ph.D., associate professor, Department of Cell Biology and Anatomy, Northwestern University, Chicago, Conroy and Vannier will digitize the endocranial casts using photogrammetric and threedimensional computer graphics techniques.

Animal models of cortical asymmetry are of particular interest to health scientists because of the association between brain asymmetries in man and certain immune diseases, learning disorders and handedness. The project is unique in that hundreds of monkey brain endocasts with known genealogies are available for study using advanced computer graphics equipment made available by McDonnell Douglas Corp.

# MEDIA FOCUS



Cameras, notebooks and recorders remain familiar sights on board the Mallinckrodt Mammography Mobile, as reporters continue to spread the vital news about breast cancer. COPE, a magazine devoted to cancer issues, noted the mobile's early success in its October issue, interviewing Judy M. Destouet, M.D., associate

professor of radiology and head of Mammography, and printing a photo of the van and its "crew." Destouet also spoke on breast cancer and the importance of early detection with mammography in an October 28 report by **KPLR-TV** reporter **John Schieszer**. The van was videotaped for the news spot during its stay at **Mercantile Bank**  downtown. On radio, KMOX-AM's Margie Manning produced an informative four-part series on mammography and breast conservation treatment entitled "Stalking the Silent Killer." Featured were Destouet; Gary Brink, R.T., B.S., FASRT, chief technologist and administrator of MIR's Mammography Outreach Although not yet as familiar a landmark as the Gateway Arch, the Mallinckrodt Mammography Mobile is becoming a well-known—and welcome sight at area businesses and shopping centers.

Program; and Robert R. Kuske, M.D., associate radiation oncologist. Patient Mary Ann Svoboda, whose breast cancer was discovered on the van, offered eloquent testimony to mammography's lifesaving benefits. The reports aired the week of December 15. On February 3, St. Louis Post-Dispatch news maven Jerry Berger gave "cheers" to Schuyler Gott Herbert, president of the Junior League of St. Louis, for the organization's sponsorship of a Mammography Mobile visit to the St. Louis Galleria. Finally, the February 16 edition of the St. Louis Business Journal quoted Destouet in an article by Patricia Miller on the increasing use of mammography-and mobile x-ray technology-to detect breast cancer.

Reporter Gary Schwitzer, of the nationwide Cable News Network (CNN), videotaped the first use at Mallinckrodt-and in the United States-of Lithostar, Siemens' new extracorporeal shock-wave lithotripsy (ESWL) device (see story on page 2). The report, which ran on February 17 and 18, included an interview with Bruce L. McClennan, M.D., professor of radiology and chief of the Abdominal Section and Genitourinary Radiology, and a post-procedure talk with the patient.

# MEDIA FOCUS

James A. Purdy, Ph.D., professor and chief of the Physics Section, and Joseph L. Roti Roti, Ph.D., associate professor and chief of the Cancer Biology Section, both of the Radiation Oncology Center, were caught in the St. Louis Post-Dispatch's "Spotlight" on October 26. The newspaper took note of Purdy's NCI research contract to develop guidelines for electron beam radiation treatment planning and Roti Roti's two NCI research grants to study the effects of hyperthermia on cell structure. The St. Louis **Business Journal** carried the same good news in its "People" section on December 29. In addition to his print appearances, Roti Roti was recently seen in the electronic media on KSDK-TV. In a Tom O'Neal "Focus on Health" broadcast on February 24, Roti Roti helped clarify the potential health effects of common x-ray examinations.

The three-dimensional The three-united tomography work of Michael W. Vannier, M.D., associate professor of radiology, remains fascinating news, as evidenced by media interest at the RSNA. At the Chicago meeting in November, Vannier both participated in a four-person press conference on the subject (see story on page 3) and offered expert commentary on the threedimensional exhibits and hardware at the meeting to reporter Willa Marcus of the Canadian Broadcast Corporation. Heather Carswell, in the January 28 issue of Medical Tribune, followed up on the RSNA news conference with a page-one piece on three-dimensional imaging, highlighting

Vannier's research with the wrist. Two views of the computer-reconstructed joint illustrated the article. Vannier's collaboration with Glenn C. Conroy, Ph.D., professor of anatomy and anthropology, has generated recent press coverage as well, including an article by Grover **Cleveland** in the November 10 issue of the St. Louis **Business Journal** on their fossil reconstruction project. The February issue of Diagnostic Imaging, in separate articles, detailed both this ongoing research with Conroy and Vannier's wrist imaging work. Vannier also makes an appearance in a new McDonnell **Douglas Astronautics Co.** promotional videotape for the company's many products, including the 3Space Digitizer used in Vannier's lab.

Washington University's current display at **Plaza Frontenac** features "The Body in Sight," focusing on the innovative imaging modalities used at Mallinckrodt. The kiosk, which is located on the plaza's first level, contains explanations of PET, MRI and three-dimensional CT, with photos of Michel M. Ter-Pogossian, Ph.D., professor and director of the **Division of Radiation** Sciences; William A. Murphy, Jr., M.D., professor and cochief of the Musculoskeletal Section; Michael W. Vannier, M.D., associate professor of radiology; and Jeffrey L. Marsh, M.D., associate professor of plastic and reconstructive surgery. The exhibit, developed by the School of Medicine Office of Public Relations, runs through April.



**Bahman Emami, M.D.,** associate professor of radiology and clinical director of the Hyperthermia Program, explained recent progress made with hyperthermia to **KTVI-TV** medical reporter **Lisa Allen** in a November 18 report. Part of a series on the challenge of cancer, the segment explored promising new treatments for the disease, including the use of heat, lasers, transplants and

National Geographic, in its January 1987 issue, cover-featured a wellillustrated article by writerphotographer Howard Sochurek on "Medicine's New Vision." The piece, a survey of new radiologic technologies such as computed tomography (CT), Bahman Emami, M.D.

interferon. The treatment session with patient **Robert Jackson** shown on camera included "cameo appearances" by **Kristie G. Jones, M.D.**, fellow in radiation oncology; **Leonid Leybovich, M.S.**, instructor in radiation physics in radiology; and **William Straube**, assistant clinical physicist (hyperthermia).

magnetic resonance imaging (MRI), positron emission tomography (PET), digital subtraction angiography (DSA) and ultrasound, includes comments by **Klaus Sartor, M.D.**, associate professor of radiology, and a number of Mallinckrodtgenerated images.



## FROM SCREENING ROOM TO READING ROOM Imaging Enters A New Dimension With The Pixar

#### by Cliff Froehlich

n today's sophisticated medical environment, F/X often precedes Rx. Hollywood shorthand for special effects, the term "F/X" remains associated more with the movie theater than the radiological reading room, but a new computer created under the aegis of Star Wars director George Lucas is at present establishing a promising interface between the seemingly disparate worlds of film art and medical science.

The Pixar Image Computer, originally developed for synthesizing visions of the fantastic in Lucasfilms' actioneers and space operas, is now enhancing x-ray images in real-life clinical situations. Researchers at Mallinckrodt Institute of Radiology are currently engaged in identifying still other means of adapting the Pixar's imaginative power to practical radiological ends.

rganized as a separate corporation in February 1986, under the direction of cofounders Ed Catmull, Ph.D., and Alvy Ray Smith, Ph.D., and former Apple entrepreneur Steven P. Jobs, Pixar maintains its high-visibility profile in the film industry-producing computer animation and special effects sequences for movies such as Young Sherlock Holmes-while expanding into other image-related fields, including medicine, satellite data interpretation, geophysical analysis and the graphic arts.

In partnership with Pixar, Philips Medical Systems, Inc. is developing potential radiological applications-and associated software and workstations-for the image computer. Employing a unique research-anddevelopment approach, Philips is donating the machine for 1- to 2-year periods to what R. Gilbert

The Clinical Image Evaluation Laboratory, headed by John Zimmerman, Ph.D., assistant professor of computer applications in radiology, serves as home to the Pixar and host to other investigators of the computer's uses.

Because the Pixar has "a humongous storage" for color pixels, the greater are the clarity and quality of its images.

Jost, M.D., chief of Diagnostic Radiology, identifies as "those institutions that have a high likelihood of defining the best applications." Mallinckrodt is among the first to receive a Pixar with which to explore avenues of medical interest.

ccording to Andy Oldroyd, Ph.D., senior research associate in Washington University's Computer Science Department, the Pixar provides a powerful engine for traveling those research roads. Oldroyd describes the system's basic architecture as containing three major components in addition to its Sun host computer: a highresolution video display, a spacious memory and an extremely fast, generally programmable microprocessor.

Because the Pixar has "a humongous storage" for color pixels-the individual parts that comprise the picture whole-the greater are the clarity and quality of its images. "The Pixar stores 4 million pixels," explains Oldroyd, "which is equivalent to 24 megabytes of active memory. That's an enormous quantity compared to most computers."

The Pixar also generates its images quickly. Each of Pixar's four "channels"-which store, for each pixel, a standard red, blue and green and an extra "color" to express transparency—is actually operated by its own microprocessor. "These microprocessors are very fast,' Oldroyd says, "and allow you to do computational operations on all four colors simultaneously.'

John Zimmerman, Ph.D., assistant professor of computer applications in radiology, amplifies Oldroyd's statements. "The microprocessors each run 10 million instructions per second. If you run all four of them simultaneously, which is how the Pixar is designed, you get 40 mil-

#### FROM SCREENING ROOM TO READING ROOM

lion instructions per second. That may make it the fastest machine on either campus."

"What this means," summarizes Oldroyd, "is that you can process color imagery in large masses very fast. People generate color synthetic images now, for example-it's not a new thing-but when you do it on a VAX-class computer, a complicated, realistic scene can take 1 to 2 hours for every frame. If you're going to animate a 10-minute sequence, which requires over 14,000 frames, that's an incredible amount of time. With a Pixar, the time required to do that same processing is reduced by an enormous factor.'

"Applying the Pixar Image Computer to medical problems," asserts Robert Hindel, Ph.D., manager of advanced planning at Philips, "will sufficiently speed up certain important image manipulations so that sophisticated image processing can be carried out in reasonable time. Routine usage in the operating or treatment room then becomes feasible."

A lthough the Pixar undoubtedly represents the current state of the image processing art— "There is no commercially available machine I know about that is superior," Zimmerman states—the medical applications Hindel envisions remain somewhat undefined.

"The Pixar is a device with a great deal of potential, one that we're excited about having here to investigate," says Jost, "but at this stage it's really a solution in search of a problem."

Working on the thesis that the Pixar holds many answers, Mallinckrodt is thus posing more than a single question during the initial investigation period. "It's



James A. Purdy, Ph.D., professor and chief of the Physics Section of the Radiation Oncology Center, believes the Pixar may answer important questions in the development of a real-time threedimensional radiation treatment planning system.

difficult to know at the outset which of several potential paths will be the most fruitful," Jost explains. "After 6 months, we will re-evaluate our progress and, after consulting with Philips, we'll concentrate our resources on the most promising pathway."

Physically located in the Clinical Image Evaluation Laboratory (see sidebar) in the Clinical Sciences Research Building, the Pixar will quickly be integrated with the Mallinckrodt digital imaging network. Pictures generated by computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine, ultrasound and the new Philips Computed Radiography (PCR) system will therefore be available for processing on the computer.

The Pixar's power and

general programming abilities appear to make it an ideal mechanism for implementing and developing algorithms for the manipulation of such digital images. Contrast enhancement, using promising new processes such as Adaptive Histogram Equalization, is an area of primary interest.

"Adaptive Histogram Equalization is a very nice, very powerful method for increasing the contrast of a picture," says Zimmerman, "but it is somewhat expensive in terms of the computation required. We anticipate that this process, which can take several minutes on a regular computer, can be done in a few seconds on the Pixar, perhaps making it possible to eventually put it into everyday clinical use."

Another tantalizing possibility offered by the Pixar is the combining of images from different modalities, such as CT and MRI, to increase information content and physician understanding without attendant confusion. The job of preserving the methods' salient characteristics, eliminating overlapping data and

**1** ike DeFilippo

bringing the images into correct registration presents a daunting challenge, but the Pixar's computing tools seem appropriate to the task.

erhaps one of the most intriguing uses Mallinckrodt is considering for the Pixar is in the field of three-dimensional radiation treatment planning. Under the direction of James A. Purdy, Ph.D., professor and chief of the Physics Section of the Radiation Oncology Center, the institute is exploring ways to visualize patient anatomy, tumor volumes and radiation beam arrangements three-dimensionally, thereby optimizing the delivery of radiation to complex cancerous sites such as the lung. The Pixar's display power appears well suited to aiding such efforts.

"Tumors are, of course, three-dimensional," says Purdy, "but in the past we were limited in treatment planning to twodimensional images of the body. With the advent of CT and more powerful computing resources, we are now able to model the patient's anatomy in a much more accurate manner and to present the data for evaluation in a three-dimensional display. We are presently developing an advanced treatment planning system in which simulated radiation beams can be oriented in any direction, carefully tailoring them to the desired tumor volume and thus sparing the normal tissue."

Mallinckrodt's current threedimensional treatment planning system, however, displays anatomy and beam arrangements only in outline form. According to Purdy, "The Pixar may give us the capability of displaying this information in voxel form, that is, rendering the anatomy and beams more completely and realistically as a volume, while still maintaining the very fast, real-time display capabilities needed for treatment planning."

Purdy believes the important possibility the Pixar offers to treatment planning in the realtime display of dose distribution cannot be overemphasized. "If one could accurately calculate and display radiation dose distributions very fast," Purdy speculates, "improved radiation treatment techniques might be determined that would allow higher radiation doses to be delivered,

Another tantalizing possibility offered by the Pixar is the combining of images from different modalities, such as CT and MRI.

increasing chances for controlling the tumor without resulting in increased complications. Three-dimensional treatment planning—and thus Pixar—has the potential to allow us to do that. I want to emphasize the word 'potential,' however, because this type of application requires a tremendous software development effort.''

Wiewing the Pixar from a diagnostic rather than therapeutic perspective, Michael W. Vannier, M.D., associate professor of radiology, also sees promise in the computer's three-dimensional imaging capabilities. Vannier is currently adapting his innovative work in three-dimensional reconstruction—of the head, wrist and heart—for display on the Pixar.

"All of our problems tend to be fairly complex," warns Vannier, "so it's difficult to see that one piece of hardware is going to advance that a great deal. The thing that the Pixar allows us to do, since it's a completely new technology, is to rethink a lot of those problems."

Vannier cites a number of projects that could potentially benefit from integration with the Pixar—including research in jaw biomechanics, cardiovascular imaging and surgical procedure simulation-and specifies the accurate, realistic animation of motion within the human body as a particularly valuable use of the device. Although Vannier notes that such animation has only a limited application-most problems can be accurately diagnosed without this additional step-his laboratory has identified the motion of the wrist as a productive area of research.

"I think it's a worthy objective for a couple of reasons," says Vannier. "One, the normal motion of the wrist is still not very well understood, and two, there's good reason to believe that with a device like the Pixar you could figure out that motion."

The Pixar also makes possible the procedure's move from laboratory to clinic. "Formerly, animation was too costly, difficult and time consuming for clinical application," according to Vannier. "Those barriers are going to fall, at least in part, with Pixar."

Onfirming Vannier's assertion, the problems he mentions have already been surmounted for one specific clinical application at the Johns Hopkins Medical Institutions in

#### FROM SCREENING ROOM TO READING ROOM





Baltimore. Elliot Fishman, M.D., associate professor and director of Computed Tomography in Johns Hopkins' Department of Radiology and Radiological Science, has been working closely with Pixar in applying the company's volumetric rendering technique to hip trauma evaluation.

Using information obtained from CT scanning, Fishman uses the Pixar computer to "stack" the slices as a volume. Bob Drebin, the technique's developer at Pixar, explains that "volumetric rendering differs from surface rendering, which is the common approach for creating threedimensional images of CT volumes, in that all of the information from the scans can be preserved, not just the surface boundaries. Object thickness can be seen in the three-dimensional projections." According to Fishman, the Pixar thus produces "true representations of the CT data and does not introduce the computer-generated noise or artifacts associated with surface rendering.'

Once the three-dimensional image of the pelvis—showing both muscle and bone or either alone—is obtained, it can then Left: A CT image of the chest. Right: The same image after Adaptive Histogram Equalization, a contrast improvement method developed at the University of North Carolina by Stephen Pizer, Ph.D., and his research associates, including John Zimmerman, Ph.D. The Pixar's computational power may make the use of this algorithm possible on a routine clinical basis.

be manipulated in real time by the observer in a variety of ways. "We're able to rotate and stop the image, controlling speed and direction, and to change its transparency," says Fishman. "We can also change the gamma, which is the degree of brightness, to better define the fracture line."

For difficult cases, Fishman now routinely produces a Pixar study that includes x-axis (the pelvis spinning to right or left), z-axis (the pelvis somersaulting) and edited x-axis rotations. The images are generated in 20 to 30 minutes—without user intervention—and then transferred to videotape for review by the orthopedic surgeon.

"The rotational aspect is key," says Fishman. "By being able to rotate the image, you're able to stop it at any point you desire to see the optimal view." The z-axis rotation, especially, has yielded positive results. "It's a unique perspective never before possible. The z-axis spin is particularly important on fractures involving the medial wall or posterior column, because you're able to look at the image in a way you can't do with conventional films."

These new views enable the radiologist to diagnose more accurately and the surgeon to determine treatment more confidently. "Most importantly," Fishman concludes, "The Pixar's interactive three-dimensional images provide the radiologist and the orthopedic surgeon with an improved spatial orientation to the pathoanatomy of the acetabular fracture for better patient management decisions."

**F**Pixar's prospects, but many hurdles have yet to be cleared. Concerns over the expense of hardware, computer programming and scanning time and the danger of computergenerated misinformation must be allayed before the device can be applied generally. As research progresses, these difficulties are likely to be overcome, but an important consideration remains to be addressed: What are the practical benefits the Pixar provides to both doctor and patient?

"The major reason I see for three-dimensional display to this point," states Vannier, "is to communicate the results of diagnostic examinations to surgeons, to put CT scans into a form that is more familiar and consistent with everyday experience."

Admitting the Pixar's ability to accomplish that, Vannier follows with a caveat. "It is unlikely that most surgeons other than just for the novelty value—will use a device like the Pixar on a routine basis. So it may be necessary to use it to produce images that we can hand to them, perhaps on film or videotape."

Fishman, who provides videotapes of his Pixar acetabular studies to answer this need, agrees that surgeon acceptance is vital. Happily, his experience to date indicates a surprising degree of openness to the computer and its capabilities by his surgical colleagues.

"We don't have grant money right now," says Fishman, "but if we were to charge \$5.00 a head for every person who came to see the Pixar, we'd be well funded at this point. It's like a magnet. You have to put a guard at the door to keep people away, because everyone has such tremendous interest."

Even assuming surgeons maintain this high level of enthusiasm over time, the related issue of whether the Pixar positively alters patient outcome must still be resolved. "Can you show that as a result of this technology patients are better off?" Vannier queries. "I

### CLINICAL IMAGE EVALUATION LABORATORY

The Clinical Image Evaluation Laboratory, which serves as home to the Pixar, is a recent addition to Mallinckrodt's electronic imaging research effort. Headed by John Zimmerman, Ph.D., assistant professor of computer applications in radiology, the lab will be attempting to identify those elements that constitute a good medical image.

"We are generally trying to find the best ways to display pictures and convey information to the physician," explains Zimmerman. "We're interested in this from the standpoint of both evaluating people's equipment and developing new processing techniques."

A key question the lab will ask and eventually answer, for example, is how

think that will be very difficult to show."

Although the jury is obviously out on this fundamental question, Fishman offers a preliminary verdict. "A lot of people say, 'Well, threedimensional imaging is not important; I can do it in my head.' Those are radiologists who are specially trained, and perhaps a radiologist can do that better than a surgeon. On the other hand, I don't operatesurgeons do. And if they can understand the fracture and what they have to do better with the Pixar, it will definitely help the patient."

images produced on different manufacturers' x-ray machines can be objectively compared to determine which is clinically superior.

"The first project we'll be tackling is the transmission of images to remote sites," says Zimmerman. "We'll be looking at a particular technique for data compression and evaluating psychophysically, that is, by using human observers, what the quality of those images is after they've been compressed and restored."

Zimmerman describes the laboratory as a collaborative effort in which "computer scientist, physicist, psychologist and radiologist come together to pool their expertise and figure out what the best ways are of presenting pictures."

ne of Mallinckrodt's obvious goals is to verify—or disprove—that confident claim, to determine scientifically the Pixar's ultimate usefulness. "There's no question that this is a unique display device, unlike any other available anywhere," says Jost. "But I can't tell you at this moment in time exactly how it's going to be used in the medical field. I don't think anyone can."

However, if the Pixar's proven uses are as yet few, its possibilities are conversely great: The question is not so much how quickly its potential will be reached but how many applications will be found.  $\Box$ 





## Sounding The Body's Depths

A New Generation In Ultrasound Technology

by Candace O'Connor

n a Mallinckrodt Institute of Radiology examining room, G. Leland Melson, M.D., professor of radiology and head of Diagnostic Ultrasound, is studying the gray and white shapes on the ultrasound screen. His patient, a 60-year-old man referred to Mallinckrodt after an x ray showed evidence of a kidney abnormality, is waiting for the results. Is it a tumor or a cyst?

At Mallinckrodt, a major commitment to ultrasound as a non-invasive diagnostic tool makes answering such a question easier than ever. In recent months, five new or updated machines have arrived with highly sophisticated ultrasound capabilities. They join two ultrasound scanners already in Mallinckrodt's Pediatric Section at Children's Hospital.

Three of the new ultrasound units allow radiologists to view and analyze certain areas deep within the body using the Doppler effect. The Doppler effect, so named for Christian

Ultrasound provides valuable diagnostic information about a number of anatomical structures, among them the kidneys and ovaries seen here. The transducer pictured in the foreground sends out ultrasound waves and "listens" for returning echoes. These echoes are then electronically processed to produce the actual ultrasound image. Illustration by Lawrence Clifford. Johann Doppler, who noted the phenomenon in 1842, is a change in the frequency of sound waves that occurs when the source and the observer are in motion relative to one another. In ultrasound, the Doppler capability allows the radiologist not only to detect blood flow but also to determine the quality of that blood flow. "Is the vessel clogged or patent? If the flow is present, in what direction is it going? And how fast? These are the questions we ask when we use Doppler to characterize blood flow," says Melson.

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#### SOUNDING THE BODY'S DEPTHS



**F**or several years, it has been possible to simultaneously image and perform Doppler determinations, called duplex Doppler, on superficial vessels. For instance, the study of blood flow in the carotid artery has been particulary useful, says Melson, to assess atherosclerotic disease. Doppler has enabled physicians to move beyond standard sonography, which detects narrowing of blood vessels, to characterize what happens to the blood flow as a result of that narrowing.

During the past year, a new generation in ultrasound technology with the duplex Doppler capability has made it possible to examine blood flow deeper within the body, especially in the abdomen. This development in duplex Doppler, called deep Doppler, will enable Melson's group to evaluate patients after liver and kidney transplants, checking blood flow to the transplanted organ and detecting early signs of rejection. It will also help determine whether flow is normal through access shunts in hemodialysis patients or in surgical repairs of clogged vessels.

Other applications of deep Doppler are still being studied. One in particular is the treatment of infertile women. "It appears that analysis of blood flow to the woman's ovary," says Melson, "may be an even more accurate way of determining when ovulation will occur than measuring the size of the follicular cyst." G. Leland Melson, M.D., professor of radiology, serves as head of Diagnostic Ultrasound at Mallinckrodt.

In addition to the three new Doppler units, Mallinckrodt has also recently acquired two new ultrasound scanners with very specific uses. One is a portable general purpose machine, which can be taken to the emergency room or intensive care unit as needed. Another is specially designed for operating room procedures: in neurosurgery, to pinpoint abnormalities deep within the brain or spinal cord; or in general surgery, to localize gallstones or various lesions within the kidney, liver or pancreas.

U ltrasound, which began to emerge as a diagnostic tool in the 1970s, is an offshoot of sonar technology, which allows ships to detect submarines below. It means "beyond sound," or beyond the usual frequency range we can hear (about 20 to 18,000 or 20,000 cycles per second). Medical applications of ultrasound generally involve frequency ranges from 3.5 to 10 million cycles per second.

At the heart of each ultrasound unit is the transducer, a small crystal that vibrates when it is electrically stimulated. The sound waves it produces are transmitted into the patient, where they hit structures within the body and create returning echoes. When the transducer is struck by these returning echos, it sends a small electrical charge back to the machine. There, very sophisticated electronic signal processors determine the strength of the echo and where it is coming from. That information is utilized to produce an image.

Deep Doppler enables physicians to check blood flow to transplanted organs and to detect early signs of rejection.

In the past 6 years, ultrasound has advanced in three major areas. In addition to the deep Doppler capability, ultrasound scanners can now image in real time, which enables the radiologist to view the rapidly produced images (20 or more frames per second) either as a



This duplex Doppler examination demonstrates normal main renal artery flow in a transplant patient.

motion picture or as a "frozen" single frame. Moreover, improved image processing has made possible finer and more detailed displays of the structures viewed within the body.

ltrasound will play a key role in many important upcoming studies at Mallinckrodt, including one ongoing project determining the number of tumors in the kidneys of long-term hemodialysis patients. Ultrasound should also prove helpful in the detection of testicular tumors in men having hydroceles; in diagnosing benign tumors of the breast, possibly eliminating the necessity of performing diagnostic aspirations of these common lesions; in trying to detect early prostate cancers; and in detecting acute appendicitis.

Ultrasound will continue to complement computed tomography (CT) as a diagnostic technique, says Melson. "Both look at the same types of questions and seek answers to the same types of problems," he says, adding that they do it in different ways. Whereas ultrasound measures the reflection of highfrequency sound waves, CT uses x rays and characterizes structures by determining how much the x-ray beam has been attenuated by passing through them.

Each has its own advantages. Unlike ultrasound, CT scanning is unaffected by bones or bowel gas. Ultrasound, however, is the diagnostic method preferred for detecting gallstones and thyroid disease. It is portable and non-invasive and has no known adverse effects. It can produce real-time images in any anatomical plane and is also less expensive. Whereas an ultrasound machine might cost from \$60,000 to \$180,000, a CT scanner could cost more than \$1 million.

Ultrasound is portable and non-invasive, has no known adverse effects and is relatively inexpensive.

Back in the Mallinckrodt examining room, the most recent ultrasound technology has just enabled Melson to diagnose his waiting patient's kidney lesion. As the bright outline of echoes on the screen indicates, the lesion is a common—and probably inconsequential—cyst in the upper pole of his left kidney.

As a result of this simple, non-invasive test, the patient will leave the institute relieved of concern. No further diagnostic studies or treatment will be necessary. $\Box$ 

Candace O'Connor is a St. Louis free-lance writer who contributes regularly to Focal Spot.

### IN MEMORIAM



Howard R. Green 1945-1987

Howard R. Green. assistant business manager, died suddenly of a heart attack on Saturday, February 14. He was 41 vears old.

Green had served

12, 1986, after working more than 15 years in Barnes Hospital's Patient Accounts Department.

"His impact on the institute, from both a personal and professional point of view, far exceeded the actual short period of time we were privileged to work with him," says Donald R. Stone, business manager. "To know Howard was to respect and like him. He will be sorely missed as an administrator and as a friend."

Born in St. Louis, Green attended Washington University. He is survived by his wife, Kathleen, and five children, Brian, Tricia, Mallinckrodt since August Teresa, Patrick and Laura.

### Symposia

FY

#### RADIOLOGICAL SOCIETY OF NORTH AMERICA

The following Mallinckrodt staff members participated in the 72nd Scientific Assembly and Annual Meeting of the Radiological Society of North America, Chicago, November 30-December 5.

#### **PLENARY SESSIONS**

Bruce L. McClennan. M.D., "The New Low-**Osmolality Contrast Media:** When, Where and How Much?" Major Events in Radiology 1986 Panel

#### **FOCUS SESSIONS**

Ronald G. Evens, M.D., "Economic Considerations of New Technology and New Forms of Practice for the Radiologist," Evaluation of New Imaging Equipment and Procedures Panel

SCIENTIFIC SESSIONS Thomas E. St. Amour, M.D., and Marilyn J. Siegel, M.D., "Radiologic Evaluation of Neonatal and Childhood Hypertension''

Pietro R. Biondetti, M.D., Joseph K.T. Lee, M.D., David Ling, M.D., and William J. Catalona, M.D., "MR Imaging of Prostatic Neoplasms'

Scott N. Nadel, M.D., Thomas E. St. Amour, M.D., Bruce L. McClennan, M.D., David Ling, M.D., and Ralph V. Clayman. M.D., "Role of Ultrasound in the Evaluation of Patients after Extracorporeal Shock-Wave Lithotripsy"

Mokhtar H. Gado, M.D., presider, Neuroradiology (White Matter Disease) Session

Pietro R. Biondetti, M.D., Michael W. Vannier, M.D., Louis A. Gilula, M.D., and Robert H. Knapp, B.A., R.T., "Wrist CT and Three-**Dimensional Reconstruc**tion: Direct Coronal versus Transaxial Scanning'

Louis A. Gilula, M.D., presider, General Diagnosis (Skeletal: MRI) Session

Philip J. Weyman, M.D., Joseph K.T. Lee, M.D., Jay P. Heiken, M.D., Daniel Picus, M.D., Dennis M. Balfe, M.D., David Ling, M.D., Katherine DeSchryver, M.D., and M. Wayne Flye, M.D., "Prospective Evaluation of Hepatic Metastases: CT Scanning, CT Angiography and MR Imaging'

Threasa H. Reiman, M.D., William G. Totty, M.D., Jay P. Heiken, M.D., Horst Weber, Ph.D., Hermann Requardt, Ph.D., Piotr M. Starewicz, Ph.D., Harvey S. Glazer, M.D., and Joseph K.T. Lee, M.D., "Clinical MR Imaging Using a Helmholtz-Type Surface Coil"

James A. Purdy, Ph.D., presider, Physics (Radiation Therapy) Session

Joseph N. Fields, Ph.D., M.D., Patrick R.M. Thomas, M.B., M.R.C.P., F.R.C.R., and K.H. Fulling, M.D.,"Radiation Therapy of Suprasellar Germinomas

Scott N. Nadel, M.D., Mark Camel, M.D., Mokhtar Gado, M.D., Klaus Sartor, M.D., and Fred Hodges III, M.D., "Specific MR Features of Cerebral Gliomas'

Lynn Barrett, M.D., Herbert J. Glatt, M.D., Ronald M. Burde, M.D., and Mokhtar Gado, M.D., "CT Evaluation of Optic Nerve Dysfunction in Thyroid Eye Disease'

### THE DIRECTOR'S OFFICE REPORT

#### **NEW STAFF**

Charles F. Hildebolt, Ph.D., research associate in radiology, Diagnostic Radiology

Harm H. Kampinga, Ph.D., visiting research associate in cancer biology in radiology, Radiation **Oncology** Center

Kenzo Ohtsuka, Ph.D., research associate in cancer biology in radiology, Radiation Oncology Center

Henry D. Royal, M.D., associate professor of radiology, Division of Nuclear Medicine

Franz J. Wippold III. M.D., instructor in clinical radiology, Diagnostic Radiology

#### **OFF STAFF**

Beatrice A. Carlin, M.D., instructor in clinical radiology, has joined the staff of Mercy Hospital, Pittsburgh

Peter Herscovitch, M.D., assistant professor of radiation sciences in radiology, **Division of Radiation** Sciences, has accepted the position of head of the Positron Emission Tomography Section, National Institutes of Health, Bethesda, Maryland

William R. Reinus, M.D., assistant professor of radiology, has entered private practice in St. Louis

## FYI

**REFRESHER COURSES** Harvey S. Glazer, M.D., and Alan M. Cohen, M.D., "MR Imaging of the Chest"

William A. Murphy, Jr., M.D., and William G. Totty, M.D., "Imaging of the Hip: New Concepts and Techniques"

Joseph K.T. Lee, M.D., "MR Imaging of the Kidney and Adrenal Glands"

**Mokhtar H. Gado, M.D.**, "Interpretation of MR Images of the Brain and Spine"

**Dennis M. Balfe, M.D.,** "CT of Peritoneal Spaces and Ligaments"

Louis A. Gilula, M.D., "The Imaging Gist for the Painful Wrist"

**Stuart S. Sagel, M.D.,** "Oncologic Thoracic CT"

**Bruce L. McClennan, M.D.,** "Oncologic Imaging of the Genitourinary Tract"

SCIENTIFIC EXHIBITS Kevin C. Funk, M.D., Thomas E. St. Amour, M.D., and Marilyn J. Siegel, M.D., "Ultrasound of Congenital Midline Brain Anomalies"

#### AMERICAN SOCIETY FOR THERAPEUTIC RADIOLOGY AND ONCOLOGY

The following Mallinckrodt staff members participated in the 28th Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Los Angeles, November 2–7.

SCIENTIFIC SESSIONS Robert R. Kuske, M.D., "Mini-Ovoids in the Treatment of Carcinoma of the Cervix with Radiation Alone" **Carlos A. Perez, M.D.,** "Impact of Pelvic Tumor Control after Definitive Irradiation of Carcinoma of the Uterine Cervix" and "Comparison of 2 Time-Temperature Schedules With or Without Irradiation in the Cure of a Murine Rhabdomyosarcoma"

John W. Wong, Ph.D., "Investigation of an Approach to Quantitative Treatment Verification"

Miljenko V. Pilepich, M.D., "Correlation of Radiotherapeutic Parameters and Treatment-Related Morbidity: Analysis of RTOG Study 77-06," and co-moderator, Malignant Lymphoma Session

**V. Rao Devineni, M.D.,** "Magnetic Resonance Imaging of the Neck After Radiation Therapy"

James A. Purdy, Ph.D., "Three-Dimensional Radiation Treatment Planning System"

Perry W. Grigsy, M.D., "Medically Inoperable Stage I Adenocarcinoma of the Endometrium Treated with Radiotherapy Alone" and "Results of External Irradiation of Pituitary Tumors"

Joseph R. Simpson, M.D., Ph.D., "Stereotactic Interstitial Implantation for the Treatment of Malignant Brain Tumors"

Bahman Emami, M.D., moderator, Hyperthermia Session

**POSTER SESSIONS Robert J. Myerson, M.D., Ph.D.**, "Configurations for Improved Radiofrequency Hyperthermia"

PANEL DISCUSSIONS Patrick R.M. Thomas, M.B., M.R.C.P., F.R.C.R., "Post-Operative Radiation Therapy for Rectal Cancer" **REFRESHER COURSES Carlos A. Perez, M.D.,** "Principles and Practice of Localized Hyperthermia (External and Interstitial)"

**RELATED EVENTS** James A. Purdy, Ph.D., presented "Quality Assurance in Radiation Therapy" as part of the Malpractice Crisis in Radiation Oncology Session sponsored by the American College of Radiology and the Council of Affiliated Regional Radiation Oncology Societies.

Beverly J. Kobeissi, M.A., M.B.A., participated in a panel discussion on "Developing Administrative Software" at the Society for Radiation Oncology Administrators Meeting and spoke on "Historical Perspectives to Current Physician Reimbursement Mechanisms" for the Therapeutic Radiology Residents Annual Practice Entry Seminar.

Stuart S. Sagel, M.D., professor of radiology, lectured on the "Role of CT in Bronchogenic Carcinoma" at the Society of Thoracic Radiology, Orlando, Florida, February 14–19. Sagel gave four lectures related to CT of the thorax at the Vail Imaging Conference, Vail, Colorado, February 21–28.

Judy M. Destouet, M.D., associate professor of radiology, spoke on "Breast Cancer Screening" for the SHARE Breast Cancer Awareness Seminar at Barnes Hospital, St. Louis, October 16. "Breast Imaging—1986" was the topic presented for the 54th Annual Postgraduate Assembly at the Omaha Mid-West Clinical Society, Omaha, October 28.

Bahman Emami, M.D., associate professor of radiology, presented "Hyperthermia: Clinical Applications in Malignant Disease" at the Current Issues in Cancer Care Workshop sponsored by the Cancer Care Center of Lutheran General Hospital, Park Ridge, Illinois, October 25. He attended the National **Cancer** Institute Electron Beam Contract Meeting, December 15-17; the Radiation Therapy Oncology Group Meeting, Baltimore, January 18-20; and the Three-Dimensional Treatment Planning Contract Meeting, Washington, D.C., January 28-30. Two talks, "Hyperthermia in Head and Neck Cancer" and "Treatment of Melanomas with Hyperthermia" were given at the B.S.D. Medical Corporation Users Meeting, Park City, Utah, January 10-13.

**Bruce L. McClennan, M.D.**, professor of radiology, coordinated the American College of Radiology and Greater St. Louis Society of Radiologists Resident Practice Workshop, March 28.

Vythialingam Sathiaseelan, Ph.D., assistant professor of radiation physics in radiology, presented an invited review paper on "High-Frequency Techniques: Deep Heating with an Annular Phased Array" at the IEEE Engineering in Medicine and Biology Society's Eighth Annual Conference, Fort Worth, Texas, November 7-9. As an invited participant, he attended the National Cancer Institute's Equipment for Deep Heating Hyperthermia Workshop, Bethesda, Maryland, December 11-12.

## FYI

Carlos A. Perez, M.D.,

### Symposia

Jay P. Heiken, M.D., assistant professor of radiology, presented a symposium on "Radiology and Early Colon Cancer" with Dennis Balfe, M.D., Mallinckrodt, and Igor Laufer, M.D., University of Pennsylvania, in St. Louis, November 8.

#### Harvey S. Glazer, M.D., assistant professor of radiology, presented "MRI of the Thorax" at the American Osteopathic College of Radiology in Orlando, Florida, October 1, and "Pitfalls in Mediastinal CT" at the Postgraduate Thoracic Radiology Course for the Society of Thoracic Radiology, Orlando, Florida, February 16.

Mokhtar Gado, M.D., professor of radiology, spoke on "X-Ray Diagnosis of Spinal Stenosis" and "Magnetic Resonance Imaging: Its Future Role in Diagnosis of Low Back Pain" for the Low Back and Sciatic Pain Seminar at Washington University School of Medicine, St. Louis, December 12. Gado presented "Anatomical Correlates of MRI and CT Imaging," "MRI and CT of the Sella, Orbit and Extracranial Lesions," "Hydrocephalus and Atrophy in Adults" and "CT Cervical Region and Spinal Cord" at the Eighth Annual Winter Conference in the High Sierras sponsored by the American College of Medical Imaging, Lake Tahoe, Nevada, February 22-27.

#### Joseph L. Roti Roti,

**Ph.D.**, associate professor of cancer biology in radiology, participated in a site visit for the National Institutes of Health at Los Alamos National Laboratory, Los Alamos, New Mexico, December 1–3. He served as chairperson for the Cell Cycle Effects Session at the North American Hyperthermia Group of the Radiation Research Society Meeting, Atlanta, February 21–26.

#### Gilbert H. Nussbaum,

Ph.D., associate professor of radiation physics in radiology, delivered two invited papers, "Performance Characteristics of 'Helios,' a Thirty-Beam Ultrasound Device for Deep-Tumor Hyperthermia" and "Externally Induced EM Hyperthermia: Microwave Techniques' at the IEEE Engineering in Medicine and Biology Society's Eighth Annual Conference, Fort Worth, Texas, November 8. Nussbaum gave talks on "Deep Heating with Capacitive Devices," "Deep Heating with Ultrasound Devices" and "Limitations on Deep Heating Imposed by Tumor and Normal Tissue Physiology'' at the National Cancer Institute's Devices and Techniques for Non-**Invasive Deep Heating** Workshop, Bethesda, Maryland, December 11-12. Nussbaum delivered a contributed paper on "Studies on the Induction of Local, Deep Heating with Externally Activated and Controlled Hyperthermia Implants" at the North American Hyperthermia Group of the Radiation Research Society Meeting, Atlanta, February 20-23.

professor of radiology and director of the Radiation Oncology Center, presented "Hyperthermia in the Treatment of Cancer,' "Optimal Utilization of Cobalt-60 in the Curative Treatment of Cancer,' "Multimodality Therapy for Cancer: A Rational Analysis," "Radiation Therapy in **Oncological Emergencies**,' "The Management of Early Carcinoma of the Breast," "Management of Carcinoma of the Endometrium,' "Management of Carcinoma of the Prostate" and "Management of Carcinoma of the Lung" at the XIV Congreso Interamericano de Radiologia, **Buenos Aires**, October 12-17. "Radiation Therapy of Head and Neck Carcinomas," "Definitive Radiation Therapy of Carcinoma of the Breast" and "Radiation Therapy for Soft Tissue Sarcomas" were presented by Perez at the Sociedad Panamena Oncologica in Panama, January 15-16. Perez spoke on "Hyperthermia: Principles and Practice," "Radiotherapy in Carcinoma of the Lung,' "Hyperthermia for Head, Neck and Breast Cancer' and "Management of Carcinoma of the Endometrium" at the 39th Midwinter **Oncology Conference**, Los Angeles, January 30-February 1. He delivered "Definitive Radiotherapy for Localized Prostate Cancer," "Principles and Practice of Interstitial Hyperthermia" and "Carcinoma of Endometrium: Management and Results" at the 13th Annual Post-Conference Seminar of the Midwinter Oncology Conference, Kaanapoli, Maui, Hawaii, February 3-7.

William A. Murphy, Jr., M.D., professor of radiology, spoke on "Forensic Radiology" at the Medicolegal Death Investigator Training Course, St. Louis University School of Medicine, St. Louis, January 19. He lectured on "MRI of Soft Tissues and Joints" and served as session moderator at the Second International Magnetic Resonance Imaging Symposium: MR '87, Garmisch-Partenkirchen, West Germany, January 29-February 1.

Todd H. Wasserman, M.D., associate professor of radiology, presented "Chemotherapy-Radiotherapy Clinical Trials" at the First European Society for Therapeutic Radiology and **Oncology Teaching Course** on the Application of Radiobiology to Clinical **Oncology** and Radiotherapy, Gray Laboratory, Northwood, England, November 11. He delivered "Radiation Sensitizers for Head and Neck Cancer" at the Cancer Control Symposium: Head and Neck Cancer, Radiation Therapy **Oncology Group Meeting**, Baltimore, January 18.

Robert R. Kuske, M.D.,

associate radiation oncologist, presented "Breast Conservation" as part of the Therapy Program at the 54th Annual Meeting of the Missouri Society of Radiologic Technologists, Osage Beach, Missouri, September 24–27.

### VISITING PROFESSORS & GUEST LECTURERS

Harvey S. Glazer, M.D., assistant professor of radiology, presented "MRI of the Thorax," "CT of Lobar Collapse" and "Pitfalls in Mediastinal CT" at Ohio State University and the Central Ohio Radiological Society, Columbus, Ohio, November 13–14.

Joseph K.T. Lee, M.D., professor of radiology, spoke on "MRI of the Liver" and presented cases to residents as visiting professor at the University of North Carolina Medical School, Chapel Hill, North Carolina, November 6-7. As invited speaker, Lee presented "MRI of the Pelvis" and "MRI of the Kidneys and Adrenals" and gave a workshop on "CT/MRI of Lymph Nodes" at the 39th Annual Midwinter Radiological Conference, Los Angeles, January 30-February 1. He delivered "MRI of the Liver," "MRI of Hematoma and Fibrosis,' "CT/MRI of Pancreatic Neoplasms" and "MRI of the Retroperitoneum" at the 13th Annual Post-Conference Seminar of the Midwinter Oncology Conference, Kaanapoli, Maui, Hawaii, February 3-7. Lee spoke on "MRI of the Pelvis," "Pitfalls of Mediastinal CT," "MRI of the Liver," "CT of Pancreatic Neoplasms,'' "CT of the Biliary Tree," "CT of the Larynx" and "CT of the Peritoneal Spaces and Folds" at the Advanced Course in Diagnostic Imaging, Singapore, February 8-13.

Todd H. Wasserman, M.D., associate professor of radiology, while on sabbatical in England, presented "Role of Sensitizers and Protectors," "Abdominal Lymphomas," "Cure of Early Stage Hodgkin's **Disease Without Laparotomy** or TNI," "The Failure of Simplistic Radiotherapy/ **Chemotherapy Interactions:** Clinical and Biological,' "Clinical Trials of Chemotherapy and Radiotherapy" and "Radiotherapy of Plasmacytoma" for the Depart-ment of Clinical Oncology and Radiotherapeutics, University of Cambridge School of Clinical Medicine, Cambridge, September-December. He spoke on "SR-2508: A New Clinical Radiosensitizer," Department of Radiotherapy, University of Bologna, Italy, October 29. "Chemical Modifiers" and "Hodgkin's Disease" were his topics at the Netherlands Cancer Institute, Amsterdam, August 22. He presented "Interactions of Chemotherapy and Radiotherapy" to the Medical Research Council, Radiobiology Unit, Didcot, England, November 25; the Department of Radiation, Royal Marsden Cancer Hospital, Sutton, Surrey, England, December 5; and the Department of Radiotherapy, University of Leuven, Leuven, Belgium, December 11. Wasserman spoke on "The Clinical Use of Combined Chemotherapy and Radiotherapy" at Beilinson Medical Center, Tel Aviv University, Israel, December 23, and at Rambam Medical Center, Technion University, Haifa,

Israel, December 24. He

lectured on "The Potential of Chemical Modifiers in Cancer Therapy" at the Department of Radiotherapy, Institut Gustave-Roussy, Villejuif, Paris, October 17, and on "Abdominal Lymphomas: The Need for Radiotherapy" at the Department of Radiation Therapy, Vicenza, Italy, October 28.

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Gilbert H. Nussbaum, Ph.D., associate professor of radiation physics in radiology, gave three lectures on "Hyperthermia: The Treatment of Cancer with Heat" to senior science classes at Eureka High School, Eureka, Missouri, November 14. He delivered "Physics of Clinical Hyperthermia-Present Practice and Future Prospects" as invited lecturer for the New York Society of Radiological and Medical Physics at the Sloan Kettering Institute, November 18. As invited speaker, Nussbaum presented "Hyperthermia: The Treatment of Cancer with Heat" at the Medical Education Forum, St. Joseph's Hospital, Kirkwood, Missouri, February 11.

Louis A. Gilula, M.D., professor of radiology, as visiting professor presented "Imaging Gist of the Painful Wrist," "Tenography of Ankle Tendons," "Facet Syndrome" and "Is This an Adequate Knee Arthrogram?" at the University of California and the Veterans Hospital, San Diego, December 22–23.

Bruce L. McClennan, M.D., professor of radiology, presented "Low Osmolar Contrast: Facts and Fiction," "CT Staging of Renal Cancer" and "Onco-Imaging of the Bladder and Prostate" at the Medical College of Wisconsin, Milwaukee, January 31.

### Awards

Mrs. Wendell G. Scott, wife of the late Mallinckrodt physician, was honored with a silver platter from the St. Louis office of the American Cancer Society (ACS) at the organization's November banquet. The award, presented by Carol Perkins, pays tribute to Mrs. Scott's many years of service to the ACS. It was also announced that a portrait has been commissioned and a conference room named for Mrs. Scott, who recently retired from an active role in the society.

Dennis M. Balfe, M.D., associate professor of radiology, and Robert G. Levitt, M.D., associate professor of radiology, were cited as reviewers of special distinction and received Editor's Recognition Awards in the January 1987 issue of Radiology. Also honored with awards as reviewers of distinction were Stuart S. Sagel, M.D., professor of radiology, Marilyn J. Siegel, M.D., associate professor of radiology, William G. Totty, M.D., associate professor of radiology, Michael W. Vannier, M.D., associate professor of radiology, and Philip J. Weyman, M.D., associate professor of radiology.

### **A**PPOINTMENTS

Tom R. Miller, M.D., Ph.D., associate professor of radiology, was appointed a member of the RSNA Program Committee and a council member of the Missouri Valley Chapter of the Society of Nuclear Medicine.

**Robert G. Levitt, M.D.,** associate professor of radiology, was appointed to the Editorial Board of *Radiology* as associate editor for chest. He will review 12 to 20 manuscripts per year for the publication.

**Bruce L. McClennan, M.D.,** professor of radiology, has been appointed to the Program Committees for the 1987 meetings of both the RSNA and ARRS. He will also serve on the Program Committee for the Genitourinary Diagnostic Radiology Section of the International Congress of Radiology to be held in Paris in July, 1989.

**Gilbert H. Nussbaum, Ph.D.**, associate professor of radiation physics in radiology, has been appointed the Department of Radiology's representative to the Washington University School of Medicine's Committee on Humane Care of Laboratory Animals. William A. Murphy, Jr., M.D., professor of radiology, has been appointed to the Program Committee for the 1987 RSNA and to the Technical Advisory Board of *Health Technology*.

Jay P. Heiken, M.D., assistant professor of radiology, has been appointed to represent Diagnostic Radiology on the Barnes Hospital Cancer Committee.



Judy M. Destouet, M.D., associate professor of radiology, spoke on "Breast Cancer Screening" for the Obstetrics and Gynecology Grand Rounds at Barnes Hospital, St. Louis, October 1.

**Todd H. Wasserman, M.D.,** associate professor of radiology, presented "Interactions of Chemotherapy and Radiotherapy" at Institut Gustave-Roussy, Villejuif, Paris, December 18.

### CALENDAR

April 2–4, 1987 Missouri State Medical Association Meeting Lake of the Ozarks

FYI

April 6–10, 1987 American Radium Society London

April 7, 1987 City-Wide Radiology Conference Leroy Sante Lecture Bjorn Nordenstrom, M.D., Sweden St. Louis University

April 20, 1987 First Annual Daniel R. Biello Memorial Lecture Pulmonary Embolism: Past, Present and Future Alexander Gottschalk, M.D., professor of diagnostic radiology, Yale University School of Medicine, New Haven, Connecticut Scarpellino Auditorium

April 26–May 1, 1987 American Roentgen Ray Society Miami Beach, Florida



Richard L. Wahl, M.D., a former Mallinckrodt resident and fellow and now assistant professor of internal medicine and codirector of Nuclear Imaging, University of Michigan Medical Center, Ann Arbor, Michigan, was awarded the Sixth Tetalman Memorial Award by the Society of Nuclear Medicine for his monoclonal antibody research. The Tetalman Award is given annually to an investigator 35 years or younger who is pursuing a career in nuclear medicine.

April 27-May 1, 1987 1987 Hyperthermia School: Physical Aspects of Hyperthermia Sponored by American Association of Physicists in Medicine and the North American Hyperthermia Group Duke University, Durham, North Carolina May 11, 1987 City-Wide Radiology Conference Urinary Tract Imaging: The Impact of Current Technology

Bruce L. McClennan, M.D., professor of radiology, Mallinckrodt Institute of Radiology Scarpellino Auditorium

May 25–28, 1987 European Society for Therapeutic Radiology and Oncology Lisbon

May 31–June 6, 1987 European Congress of Radiology Lisbon

Gladden V. Elliott, M.D., a former Mallinckrodt fellow and staff member and now president of the California Medical Association, was a leading spokesman in the successful fight to defeat California Proposition 64, an initiative that would have allowed the quarantine of the state's estimated 300,000 citizens infected with the human immunodeficiency virus. Elliott's role was detailed in the October 17 issue of American Medical News.

The Public Relations Department requests that alumni keep them informed—by either phone or mail—of activities meriting attention in Focal Spot.

### ELECTIONS

**Bruce L. McClennan, M.D.**, professor of radiology, was elected by the St. Louis Metropolitan Medical Society membership to serve as a representative from the Third District to the Missouri State Medical Association House of Delegates. **Robert G. Levitt, M.D.,** associate professor of radiology, was elected a fellow of the American College of Chest Physicians, September 23.

MALLINCKRODT INSTITUTE OF RADIOLOGY

## TECHNOLOGIST NEWS CIC

Michael D. Ward, R.T., B.S., director of Technical Education, was elected by acclamation to the office of president and chairman of the Missouri Society of Radiologic Technologists (MSRT). He was installed September 26 at the 54th Annual Meeting of the MSRT at Breckenridge on the Lake, Osage Beach, Missouri. Ward was named chairman of the Educators Program for the 1987 MSRT Annual Meeting, which is to be held at the Westport Holiday Inn on October 8-10, 1987. He presented "Medical-Legal Aspects of Radiology and Medicine'' to the 11th District, Illinois State Society of Radiologic Technologists, October 23, Fairview Heights, Illinois.

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Norman L. Hente, R.T., B.S., technical supervisor in charge of photography and television, was elected to life membership of the MSRT, the 15th technologist to be so elected in the history of the 55-year-old organization. He installed the new officers of the MSRT in his capacity as regional director of the ASRT. Hente, chapter president of the Midwest-Gateway Chapter of the American Institute of Parliamentarians, presented "How to Structure Committees and their Duties" at the Parliamentary Witchhunt Seminar held in Scarpellino Auditorium, October 25.

Cynthia Daniels, B.S., R.T., senior staff technologist and clinical instructor in general diagnostics, attended the 54th Annual Meeting of the MSRT and was appointed chairman of the MSRT Membership Committee. Tim McNabb, R.T., technical supervisor in special procedures, Charles Schaab, R.T., senior staff technologist and clinical instructor in special procedures, and Phil Sotir, R.T., technical supervisor in pediatrics, attended the 54th Annual Meeting of the MSRT.

Andrea Penberthy, Marie Stein and Patty Suntrup, MIR students, attended the 54th Annual Meeting of the MSRT. With fellow MIR students, they took first, second and third place in the student category of the MSRT's Exhibit Competition. Chera Prater, Penberthy and Carol Hubert won first place for "Extracorporeal Shock-Wave Lithotripsy." Stein, Terry Sconce, Gregory Hudson and Carol Tune won second place for "Pediatric Restraints." Suntrup and Marcia Compton won third place for "3-D Reconstruction-The Face of the Future."

Paul Hanson, B.S.,

**C.N.M.T.**, has been named president-elect, Missouri Valley Chapter, Technologist Section, of the Society of Nuclear Medicine for 1987, and secretary, Board of Directors, Nuclear Medicine Technology Certification Board, through 1987.

The Public Relations Department requests that the technology staff keep them informed of activities meriting attention in Focal Spot.

## News

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

The CIC will again distribute fresh-cut flowers to Washington University Medical Center patients and visitors on its second annual "Flower Day," April 28. April is designated "Cancer Control Month" by the American Cancer Society, and "Flower Day" is designed to help raise awareness of both the disease and the center's many services.

The CIC Appreciation Luncheon, a show of gratitude to all those who have dedicated their services and commitment to the center, was held at Queeny Tower, December 16.

#### **CONTRIBUTIONS**

The CIC has received generous support during this past year. The list of donors from mid-June through November includes: Margaret B. Druschky in memory of Albert Bradley

All the Instructors (care of Mr. and Mrs. Ronald Tucker) in memory of Harold Downing

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Mr. and Mrs. E.F. Thompson, a thank you gift for Mr. and Mrs. R.S. Hawes

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### Editor's Note

Recently, Mallinckrodt Institute of Radiology at Washington University Medical Center was asked to participate in a major advertising program for Digital Equipment Corporation (DEC).

As you are aware, Mallinckrodt has a longstanding and fruitful relationship with DEC, which has offered invaluable aid in establishing our extensive computer system. The company's computer equipment is used throughout the institute, and in 1985 DEC awarded Washington University a \$15 million grant to develop its campuswide computer network, a project in which Mallinckrodt is deeply involved.

Because of that ongoing commitment, Mallinckrodt was happy to cooperate in Digital's new nationwide campaign. In the next few weeks, you will see DEC's advertorial featuring Mallinckrodt in several national publications, including *Newsweek, Forbes* and *Business Week*.

We've included a copy of the advertorial with this issue of *Focal Spot* to preview the upcoming campaign for our readers and to show how proud we are of the national prominence Mallinckrodt has achieved.

Michaele Gold

Michaele Gold Executive Editor

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These startling three-dimensional images of the pelvis were created using a volumetric reconstruction algorithm developed by Bob Drebin and Loren Carpenter of Pixar and computed tomography (CT) scans supplied by Elliot Fishman, M.D., associate professor of radiology, Johns Hopkins Medical Institutions. Software is now being completed that will enable Mallinckrodt to apply this volumetric imaging technique to the skull, wrist and feet. The adaptability of the process to complex osseous anatomical sites other than the pelvis, however, is currently unknown. Story on page 8.

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**Courtesy Pixar** 

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Photographers David Burjoski Mike DeFilippo Norman Hente Thomas Murry

#### Focal Spot magazine

is published three times a year by the Mallinckrodt Institute of Radiology at the Washington University Medical Center at 510 South Kingshighway, St. Louis, MO 63110

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A computer-generated, synthetic picture, this unicycle clearly demonstrates the extraordinary levels of clarity and detail the Pixar Image Computer makes possible. Mallinckrodt Institute of Radiology is currently exploring means of adapting the device to more serious—but no less impressive—medical imaging ends. Story on page 8.