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TELERADIOLOGY: FAST FORWARD
Mallinckrodt Institute of Radiology was an outgrowth of the need for a larger, more comprehensive department of radiology to support the research in gallbladder disease by these four men: (left to right) Evarts Graham, M.D., professor of surgery; Warren Cole, M.D., department of surgery; Glover Copher, M.D., department of surgery; and Sherwood Moore, M.D., department of radiology, who was the first director of MIR. Photograph courtesy of the Visual Collections of the Archives, Washington University School of Medicine.
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Radiology moves into the twenty-first century sending images over fiber optic telephone lines.

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**ON THE COVER:**
Teleradiology will soon connect urban, suburban, and rural areas to radiologic expertise through computers and telephone fiber optic cables. Illustration by R. G. Michaels.
Purdy At Helm Of ACMP

James A. Purdy, Ph.D., professor and chief of radiation oncology physics, was appointed to a one-year term as chairman of the American College of Medical Physics (ACMP). Purdy was elected vice-chairman in 1989 and progressed to the rank of chairman in 1990.

The ACMP, founded in 1982 by action of the Board of Directors of the American Association of Physicists in Medicine, boasts 250 members who are the most senior medical physicists in the profession. The organization has three specific purposes: to enhance the quality of the practice of medical physics, to engage in professional activities that benefit the medical physics community, and to promote the continuing competence of medical physics practitioners.

Under Purdy’s chairmanship, the ACMP will continue to promote licensure and certification programs for medical physics services in the areas of radiation oncology, diagnostic imaging, and hyperthermia.

Gilula Elected To Honorary Membership

Louis A. Gilula, M.D., professor of radiology and director of the musculoskeletal section, was unanimously elected to honorary membership in the American Society for Surgery of the Hand (ASSH), a national organization now in its 45th year.

Gilula, the only radiologist among the more than 25 honorary members, has been an important contributor to the ASSH through participation in educational panels and courses as well as the teaching of refresher courses and publication of articles in the Journal of Hand Surgery. Under his direction, Mallinckrodt Institute is now a major referral center for problems relating to the wrist and hand.

Evens Calls For Cost/Benefit Analysis

On January 26, Ronald G. Evens, M.D., professor of radiology and director of the Institute, concluded his talk on “Diagnostic Imaging in Cancer Care, The Role of Cost/Benefit Analysis” by saying that “cost/benefit analysis can be effective in evaluating efficacy, including the use of diagnostic imaging procedures. When appropriate studies are performed, the results are often not utilized for patient management or for establishing public policy. This is as good a time as any to change.”

Speaking at the American Cancer Society’s National Conference on Advances in Cancer Imaging, Evens explained that economic evaluation affects all aspects of our lives. Medicine and cancer diagnosis and treatment should not be excluded from this evaluation, particularly since medicine is a large part of both the nation’s and the individual citizen’s budgets.

Evens, highly regarded for his socioeconomic expertise in health-care delivery in the United States, explained the three components of a cost/benefit analysis for selected diagnostic procedures and how they are utilized in specific cancers: patient safety, patient benefit, and the efficacy of a new product, procedure, or technology.

As Evens pointed out, “There are many critical issues in diagnostic procedures for which economic data could be effective in decision making, including strategic planning, setting public policy, and allocating monetary resources to medical care.”
X-ray Films May Become Obsolete

Based on information gathered from a collaborative effort with Siemens Medical Systems, Jeffrey J. Brown, M.D., assistant professor of radiology, predicts that conventional X-ray films may be replaced by a computer system that will enable radiologists to electronically review and archive images. "I predict that the use of digitized images will eventually replace film in most or all radiology departments. However, it may take some time before it is practical or cost effective to switch to a fully digital radiology department," explained Brown. "The ultimate goal, of course, is to improve patient care by increasing our efficiency and achieving the highest quality of image interpretation."

Small Changes, Significant Advantages

Speaking at the Fourth Annual Daniel R. Biello Memorial Lecture on February 12, John W. Keyes, Jr., M.D., professor of radiology and internal medicine at Georgetown University School of Medicine and director of the division of nuclear medicine at Georgetown University Hospital, discussed the advantages, disadvantages, and advances of single photon emission tomography (SPECT) in his lecture "Recent Advances in SPECT: A Technology Comes of Age."

SPECT, a camera-based system using a rotating gamma camera to acquire data, has been available in the United States since 1979 and in Europe since 1978. In those 11 to 12 years, Keyes says, "Relatively small changes in SPECT technology have produced rather significant advantages." He cited as an example the option of moving from circular to non-circular orbiting that has resulted in a 20 to 30 percent improvement in resolution for body imaging.

Keyes pointed out that in the future, SPECT will play an important part in antibody studies, receptor imaging, gated blood-pool imaging, lung perfusion, and physiology studies.
As children, our imaginations conjure up improbable images. We connect two tin cans and a length of string and, through force of will and belief, make them into telephones. We envision worlds of comic-book utopias where technological marvels serve humanistic purposes, where telephones send not only words but pictures sailing across oceans and continents, connecting the peoples of the globe with vast networks of wire. At the Mallinckrodt Institute of Radiology (MIR), at Washington University, and at Southwestern Bell, a group of scientists, engineers and physicians is now transforming some of our childhood fictions into useful fact.
The basic work—sending high-quality pictures, ranging from X rays to video, over telephone lines—sounds deceptively simple. But its practical accomplishment remains a complicated business: a project with complex ramifications for the everyday business of the radiology department, the telecommunications industry, and perhaps the average consumer.

The research is known as the Fast-Packet Project and its essential aim is the demonstration of a fast-packet network: a high-speed, fiber optic communications system capable of transmitting voice, data, video, and high-resolution images. Southwestern Bell has contracted with Washington University to design, build, and test the elements that will form the basis of this advanced communications network. The first trials will use X-ray images from MIR to prove the network’s usefulness.

"It’s a demonstration of a new technology that we think is going to be the key for telecommunications in the last half of the ’90s," says principal investigator Jerome R. Cox, Sc.D., professor and head of Washington University’s department of computer science. "Fast packet allows all types of communications to be carried over the same facilities; everything from low-speed data—like reading a meter once a month—to very high-speed communications between computers, as well as voice, high-resolution images and video."

"Packet" refers to the digitizing of information and then grouping that information into small packets. "Fast," in turn, denotes the high data transmission speeds (100 million bits per second) made possible by a switch designed by Jonathan S. Turner, Ph.D., associate professor of computer science, a principal investigator in the project, and an internationally recognized leader in the development of advanced communications systems.

The development of new forms of switching was necessitated by advancements in optical fiber. Formerly, all telephone communication was done over copper wire, capable of only relatively slow transmission speeds. But optical fiber, which now is increasingly being used to replace copper wire, has much greater capacity.

Currently, communications systems are designed for specific applications such as the transmission of voice, computer data, cable television, or video. The fast-packet network is intended to take advantage of optical fiber’s ability to handle a wide range of different applications equally well.

"The switching systems that are currently being used have been designed exclusively around voice," says Turner. "And so they take the bandwidth on an optical fiber and divide it up into a large number of channels that are suitable for carrying voice but are too limited to carry X-ray images, for example. While there’s ample bandwidth potentially available on the fiber, it’s being divided up into such small pieces that it’s both inconvenient and expensive to use it in that form. So new switching systems which allow you to more flexibly allocate the bandwidth on the optical fiber into channels of differing capacities are needed to really handle the
The Fast-Packet Project is the latest phase of ground-breaking collaboration among the departments of radiology, computer science, and the telecommunications industry. (left to right) R. Gilbert Jost, M.D.; Jonathan S. Turner, Ph.D.; and G. James Blaine, D.Sc.

Albert Winterbauer, director of Advanced Network Technology Resources, Inc. (TRI), says that the Fast-Packet Project offers a first glimpse at telecommunications' future: "There is a new vision of where the telecommunications industry is going, and it's called broadband ISDN. This switch that Jon Turner has designed and is building is really one of the forerunners to broadband ISDN."

ISDN, an acronym for Integrated Services Digital Network, is the industry's term for the simultaneous transmission of voice, data, and image. Narrowband ISDN, which uses the existing copper-wire network and offers a limited version of the services the Fast-Packet Project promises to deliver, is already available, and experiments using this technology are already under way at MIR; broadband ISDN, with vastly higher transmission speeds and greater versatility, is the goal toward which Turner and his co-researchers are striving.

"This is a research project to demonstrate the viability of very high-bandwidth telecommunications," says Winterbauer. "What we're trying to do is seed applications that can use this new high-bandwidth. We're trying to understand what the new generation network is going to look like, what kind of applications really fit."

Radiology is one of the first fields in which the telecommunications industry is sowing its seeds.

"Part of the demonstration project is to move X-ray images using these switches developed at Washington University," explains R. Gilbert Jost, M.D., chief of Diagnostic Radiology at MIR and a leader in the development of electronic radiology. "The goal will be to move high-resolution medical images from place to place. Original plans called for these switches to be installed at the Electronic Radiology Laboratory at MIR, at the main campus, at Southwestern Bell's TRI offices at Maryville Center, and at Southwestern Bell Telephone's Advanced Technology Laboratory in downtown St. Louis."
One of the reasons X rays are being used as test images in the demonstration project is their high resolution and the large number of data bits their transmission requires. Chest X rays can have a resolution as high as 4,000 by 5,000 pixels, or 20 million pixels. Because each pixel contains gray scale information, a single chest X-ray can contain as many as 320 million separate bits of information. Using current modems and phone lines, which typically send no more than 10,000 bits a second, one X ray would require nearly nine hours of transmission time. For high-quality teleradiology to become practical, high-speed communication lines are an obviously necessary first step.

A dramatic change in the way radiology is done will occur if we can take full-resolution images and transmit them,” says Jost. “But it means wider communications pathways than we have today. It’s that area of research that’s going on here at MIR and at Southwestern Bell.”

Those high-speed information highways are now being laid. As Turner points out, “With the demonstration network we’re going to be putting together, a typical digital X-ray can be transmitted in a few seconds.”

Another important component of the project, and the major element for which MIR is responsible, is the demonstration of a physician’s workstation for viewing radiological images sent over phone lines. G. James Blaine, D.Sc., associate professor of computer sciences in radiology and an investigator in the project, says, “It’s principally a software development and integration problem as opposed to custom designing a special workstation specific to a physician.” By using existing hardware, including a high-resolution display terminal that MIR helped develop, Blaine hopes to hold costs to a reasonable level.

“We have actually taken delivery of what we’re calling the intermediate physician workstation,” says Winterbauer, “which Jim Blaine and his researchers have put together. The first test is going on right now with magnetic resonance images.”

For these initial trials, the researchers are using narrow bandwidth ISDN lines to transmit the images, which are of comparatively low resolution. “What we’re experimenting with is the ability of these low-bandwidth lines to serve data and images to a physician’s workstation,” says Blaine.

Problems remain to be solved before a demonstration of broadband ISDN’s capabilities, using high-speed optical fiber and fast-packet switches, is possible. For example, says Blaine, “Current technology of workstations is not capable of absorbing the rates of data that you can deliver over fiber optic channels. So there needs to be some evolution of the workstations themselves in order to absorb the data that fiber optics will support. It’s a rapidly evolving technology, but you can’t just buy it off the shelf.”

“There’s a lot of engineering work that needs to be carried out to make this all come together,” adds Turner. “Part of that effort involves designing integrated circuits, part involves control software for the switching system. Our timing for this project is middle to late 1991.”

MALLINCKRODT INSTITUTE OF RADIOLOGY
Jerome R. Cox, Jr., D.Sc., Welge professor and chairman, department of computer science.

At MIR,'" says Jost, "we’re headed toward electronic storage, transmission, and display of medical images. That’s inevitable, and we believe it’s probably the most important development in the next decade."

When such an all-electronic department exists, it will significantly alter the practice of radiology. Not only will physicians have ready electronic access to medical images within the hospital, but X rays will also be able to be obtained at one site and interpreted at another. An electronic link with Barnes West County, for example, would allow difficult cases to be transmitted to MIR for consultation and evaluation by specialists in the field.

"If you think about it even further," says Jost, "the technology is likely to be there five to ten years from now to move high-quality diagnostic images anywhere in this country. There will be a potential then for moving films to the areas where there are experts. That’s providing a different level of patient care, particularly for areas of the country where high-quality radiology service is not available. That will have implications for the way all radiology is practiced."

In addition to receiving images from distant sites for interpretation, a related goal of teleradiology is sending the images back out to referring physicians. "Hospitals and doctors’ offices can be linked by these emerging networks more easily than homes might be," says Cox. "The transmission of radiological images is seen as a near-term application. Furthermore, it’s needed in radiology and in medicine generally in order to allow physicians to have all of the patient information in front of them when they make medical decisions."

Using these new telecommunications pathways, doctors thus would not only receive a written report of the diagnosis but also be given electronic access to the X ray itself at a workstation in their homes or offices. "This is a key goal," Jost asserts, "although it will probably come a little later than the ability to bring the images here for interpretation."

"This has applications both for physicians and other professionals," says Turner. "The idea is to incorporate within a workstation a video camera so that you can display a video image of the person you’re talking to on a window on your workstation while simultaneously transmitting images to the workstation screen. So there’s this potential for working cooperatively on a project even though you’re not physically close to one another."

Albert Winterbauer of Southwestern Bell is optimistic: "Video conferencing, video surveillance, and ultimately entertainment video distribution are all services we’ll be looking for in this new technology. The ‘picture-phone’ of twenty years ago—when it really wasn’t quite ready—is now ready."

Winterbauer emphasizes that although these developments will not occur overnight, the future of many of these technological transformations is not all that distant from today. "We’ll be running our network trial, we believe, by the middle of 1991. The commercial generation should be right behind."

Albert Winterbauer: "High-definition television will ultimately also traverse these networks."
An avid traveler, a French-cuisine chef, and an antique afficionado, John Sutter can continue his activities, free of gallstones and the accompanying pain and stress.
Four months ago John Sutter was one of the 20 million Americans who have gallstones. Ideally, there would have been several choices for correcting his condition: surgical removal of the gallbladder, the pear-shaped organ that collects bile and produces the painful stones; biliary lithotripsy, a non-surgical procedure that uses shock waves to reduce the size of the gallstones; or gallstone-dissolving drugs. Unfortunately, the odds for undergoing any of these procedures were against John Sutter.
A survivor of two major heart attacks in the past five years, Sutter, who also has diabetes, is considered a high-risk patient for any type of surgery. His heart, weakened by an obstruction of blood flow to the heart muscle, cannot handle the effects of anesthesia, especially during a prolonged surgical procedure. Sutter, 56, an active man who, because of his medical problems, had taken an early retirement from his catering business, was finding it difficult to cope with the physical constraints placed on him. The final straw seemed to be the no-win situation with his gallstones.

Surgical removal of the gallbladder is the current treatment of choice for most patients with gallstones. In otherwise healthy patients, the surgery can be performed with a very low mortality rate—an average of less than 0.5 percent. In high-risk patients, particularly senior patients with cardiac or pulmonary disease, the mortality rate increases dramatically, as high as 10 to 30 percent.

So, what about patients like John Sutter? Clinicians are often limited in the selection of treatment by the location, size, and type of stones, the local availability of technology and expertise, and the general health of the patient. Using the team approach, gastroenterologists, biliary surgeons, interventional radiologists, and primary care physicians can form a tailored therapeutic plan that is individualized for each patient with biliary disease. That team approach and a new interventional radiology procedure called percutaneous cholecystolithotomy (removal of gallstones through the skin) worked for John Sutter.

"We've yet to come across stones that couldn't be fragmented."
Left: Under the direction of Daniel Picus, M.D., the MIR vascular and interventional radiology center has become the most comprehensive facility of its kind in the nation.

Far left: Steven A. Edmundowicz, M.D., and G. Pino Aliperti, M.D., play a vital part in tailoring a treatment plan for gallstone removal in high-risk patients.

G

Pino Aliperti, M.D., Division of Gastroenterology, first received a phone call from Sutter's cardiologist about six months ago. Sutter was suffering with indigestion, pain, and overall digestive distress from gallstones that had been diagnosed five years earlier. At that time, Aliperti was told, the stones were not causing much trouble and the patient had other problems to deal with first, so treatment had been postponed until a real need occurred. Now that treatment was imminent, the real problem was in finding a procedure that required no anesthesia, was relatively stressless, and removed the source of the distress—the gallstones.

Aliperti now had the task of tailoring a specific treatment plan for this high-risk patient. As the treatment plan progressed, Aliperti ruled out lithotripsy; Sutter had more than four stones larger than 0.5 to 3 centimeters in diameter, and the stones were highly calcified. He decided against orally administered gallstone-dissolving drugs which can take up to one year for the stones to be totally dissolved; Sutter would not be able to withstand the stress of
such a prolonged treatment. The logical choice was a procedure called percutaneous gallstone removal, performed by Daniel Picus, M.D., associate professor of radiology and chief of vascular and interventional radiology.

In the past year, 17 high-risk patients have undergone percutaneous gallstone removal by the physicians in the vascular and interventional section at MIR, one of the few centers in the nation to perform this procedure. Aliperti was convinced this procedure would throw the odds back in Sutter's arena. As testimony to that confidence, Steven A. Edmundowicz, M.D., Division of Gastroenterology and Medical director of the Gallstone Center at Washington University Medical Center, says, "We've yet to come across stones that couldn't be fragmented."

According to Picus, "Other studies show that rates of gallstone recurrence following nonsurgical treatment vary from twenty to fifty percent in five to twenty years following the procedure. Taking into consideration the usual severity of these patients' other medical problems, the probable recurrence of gallstones is not a major concern for the patient."

John Sutter was admitted to the hospital on a Friday. An average hospital stay of seven days is necessary for monitoring a high-risk patient's response to the procedure. Depending on the severity of the cardiac or pulmonary disease, some patients may require a longer stay. The actual treatment is done in two stages. Sutter was given a local analgesic, resulting in "conscious sedation." Next, a catheter, or tube, was placed through his abdomen into the lumen (cavity) of the gallbladder, requiring a small puncture but no incision.

Sutter had successfully undergone the first part of the treatment and was returned to his hospital room. The second stage, fragmenting and removing the stones, would begin on Monday.

But, as Sutter explained, "I had made previous plans to attend the ballet with a friend on Saturday. I was feeling so well that the doctors allowed me to check out of the hospital and attend the performance as scheduled. I checked back into the hospital on Monday and proceeded with the second stage of the treatment."

On Monday, using both X-ray guidance and direct observation with an endoscope, the tube was exchanged for a thin Teflon sheath. A small probe with a spark gap on the tip was inserted through the tube. The shock waves, called electrohydraulic lithotripsy, emanating from the probe reduced the stones to sandlike particles that could be removed through the tube.

"It turned out that I had six stones each about the size of a
The X-ray on the left shows a catheter being placed in a gallbladder full of stones. Stones are being fragmented by shock waves in the center film, and, on the right, a stone-free gallbladder after percutaneous gallstone removal.

nickel, all highly calcified," says Sutter. "I ended up with two Dixie cups full of the remains of my gallstones."

After a total of seven days in the hospital, Sutter returned home with an attached drain bag for the remainder of the bile and a small dressing covering the puncture site as the only visible signs of his hospital stay. "I'm an active person and had several errands to run, so I drove my car the same day I was released from the hospital," he adds.

The tube remained in place for approximately one week after he left the hospital and was removed during a follow-up visit. The puncture closed on its own within six to eight hours after the tube removal.

Four months out, Sutter has had no problems resulting from the procedure and says that he feels 100 percent better. He echoes the feelings of his cardiologist, "This procedure is a godsend for high-risk gallstone patients."
Shirley and Debbie Parks

Three-dimensional reconstruction of the bones of the wrist.
Debbie Parks has coped with varying degrees of pain for most of her 15 years. The discomfort and inconvenience of constant aches has become second nature for the teenager. A sufferer of severe migraines since the age of four, Debbie rarely complained about the headaches and seldom did her physical ailments hinder her normal activities. Debbie was and continues to be an active, young lady. But two years ago she began having another type of problem—a constant hurting in her left wrist.
The pain was centered over the scaphoid bone, a boat-shaped bone within the row of carpal (wrist) bones, on the thumb and underside, of the wrist. At first, the pain was bothersome but bearable. As the weeks progressed, any movement of the wrist produced intense pain. Debbie had to forego two of her favorite pastimes, bicycle riding and playing the piano. The positioning of her wrists on the piano keyboard and on the bicycle handlebars was too painful.

In August of 1987, the pain in Debbie’s left wrist was accompanied by acute swelling and redness of the skin. Her wrist was very hot to the touch and even the slightest pressure resulted in excruciating pain. Debbie recalls that when she attempted to put an ice pack on her wrist to reduce the swelling, the coldness would produce a burning sensation and the pain would increase.

Shirley Parks, Debbie’s mother, explains, “I realized the pain in Debbie’s wrist must have been terrible for her to even mention it to me. She had withstood the pain of her migraines with very little complaint. She’s definitely not a complainer nor one who points out every little ache.”

Shirley sought medical help for her daughter. But it would take almost 12 months before a conclusive diagnosis would be reached. An uneasy feeling about a first diagnosis of “possibly tendinitis” and a recommendation for exploratory surgery prompted the family’s search for a second opinion. And that search brought them to the Washington University Medical Center.

“I was willing to get a third or fourth opinion or as many as it took until Debbie and I were comfortable that surgery was the answer,” says Shirley. In August of 1988, Debbie’s pediatrician then referred the family to Samuel E. Logan, M.D., Ph.D., who at that time was assistant professor of plastic and reconstructive surgery at Washington University School of Medicine. Logan is now on leave of absence from the Medical School and working as a missionary surgeon in Bangladesh.

A routine series of X rays ordered by Logan faintly showed early signs of sclerosis on the edge of a lucency in the scaphoid bone. A subsequent bone scan confirmed the importance of this finding. Magnetic resonance (MR) imaged a collection of fluid next to the lucency (clear area) with possible indications of cell death due to deficient blood supply. Computed tomography (CT), however, showed a well-defined lucency with a definite thin rim of sclerosis, making cell death extremely unlikely.

To aid in the diagnostic workup, Logan had called in Louis A. Gilula, M.D., a radiologic authority on wrist and hand problems who is professor of radiology and co-chief of the musculoskeletal section at Mallinckrodt Institute of Radiology (MIR). Theirs would not be a new collaboration. Gilula was a logical choice. The Institute has the largest radiological musculoskeletal section in the world. Under his direction, MIR has become a major referral center for problems relating to the hand and wrist. Gilula and other physicians in the musculoskeletal section are accustomed to working closely with members of the department of plastic and reconstructive surgery, under the chairmanship of Paul M. Weeks, M.D., chief of the Division of Plastic Surgery, and the department of orthopedic surgery, under the direction of Paul R. Manske, M.D., chairman of Orthopedic Surgery. Both Weeks and Manske are internationally recognized for their surgical expertise on the wrist and hand. The collaborations of Gilula, Manske, and Weeks have resulted in an overall approach in dealing with patients who have wrist problems.

Formed by eight small bones (capitate, hamate, lunate, pisiform, scaphoid, trapezium, trapezoid, and triquetrum) that fit together like a puzzle in motion, the wrist is a complex joint often presenting diagnostic difficulties. The Institute’s experience in this field has evolved over several years, since 1973. The radiologists have the benefit of numerous techniques including, triple-phase bone scan, plain films with specialized views, three compartment wrist arthrography, computed tomography, and magnetic resonance imaging. But Gilula points out that while some other centers may have the same techniques, “ours is unique because we have radiologists who are interested specifically in utilizing all these techniques to answer a patient’s
problems. That extended interest is largely due to my long-standing interest in wrist problems, along with the Institute's large volume of patients."

The final diagnosis for Debbie turned out to be a common ailment—a ganglion, a benign cystic tumor that often forms on those flattened tendons connecting a muscle that moves a part of the body, such as the wrist or foot. The cyst fills up with a clear fluid and causes a visible bulge but usually no pain. Thousands of people in the United States have some type of ganglion. The majority of the cysts causes no complications for their hosts and the two live out a peaceful coexistence.

However, as in Debbie's case, there is that small percentage of ganglia, called intraarticular-intraosseous, that go awry and begin growing inward, into the bone or the joint. As the cysts enlarge, they may erode or destroy part of a bone. Intraarticular-intraosseous cysts occur most frequently in the hip, ankle, and knee joints; rarely do they occur in the wrist.

During the surgery in October of 1988, Logan found no cyst; a probable assumption is that the cyst had ruptured, causing the swelling, redness, and intense pain Debbie had endured earlier. The operation showed soft tissue and bone deterioration; bone from her forearm was grafted into the scaphoid bone defect. She sported a cast from hand to shoulder for eight weeks, later to be replaced by a cast to the elbow. Follow-up images confirmed incorporation of the bone graft, and, for the first time in more than a year, Debbie had no pain in her left wrist.
This reprieve was to be short-lived. While her left wrist was immobilized in the cast, Debbie began to experience pain in her right wrist—in the same location as and more severe than the pain that had been in her left wrist. X rays taken in February revealed a defect similar to that in the left wrist. Subsequent surgery in May removed a ganglion that extended from the joint of the wrist into the soft tissue between and beneath ligaments and onto the scaphoid bone. The cyst was removed intact and bone was grafted from the forearm. Debbie was once again the owner of a hand-to-elbow cast that remained in place for six weeks.

According to Gilula, "Debbie's case was very interesting and unusual. Intraosseous ganglia commonly develop in middle-aged patients, with the average patient being around forty years old. In medical literature we've found a report of one other teenager with this type of cyst, but the clinical details were not recorded. And there is documentation of only one other patient, a thirty-five-year-old man, with scaphoid ganglion cysts in both wrists."

As for Debbie Parks, all that remains of her two years of pain is a faint scar on each wrist. She underwent physical therapy for both wrists, regaining full mobility in the right and to a lesser degree in the left. Scar tissue from the ruptured cyst and a lengthy stay in the cast may have attributed to the lesser mobility. "Not being able to move my left wrist as much doesn't cause a problem for me; it's very livable," says Debbie. "Plus the more I use my wrist, the better it gets. Not having the pain is more important."
THE DIRECTOR’S OFFICE REPORT

NEW STAFF
William R. Banks, Ph.D., research associate, Division of Radiation Sciences

Ginger Braune, B.A., assistant for clinical research in radiology

William D. Wright, M.S., research assistant, Division of Radiation Oncology

Zuofeng Li, D.Sc, research associate, Division of Radiation Oncology

OFF STAFF
Jerold L. Saeft, M.D., completed two years of residency in Nuclear Medicine and has joined the Robert L. Batey Cardiology Center in Bradenton, Florida, as nuclear cardiologist.

NUCLEAR MEDICINE RESIDENTS
Curtis S. Hammerman, M.D., received his undergraduate degree in biology from Washington University and his medical degree from St. Louis University. Hammerman completed a four-year residency in Diagnostic Radiology at the Mallinckrodt Institute of Radiology/Jewish Hospital Washington University Affiliated Program.

NEW FELLOWS
Si-Won Kang, M.D., Ph.D., visiting research fellow in musculoskeletal radiology, received his medical degree and his Ph.D. in radiology from the Catholic University Medical College, Chung-Nam, Korea. Kang is an assistant professor of radiology at the Catholic University Medical College in Chung-Nam, Korea.

R. Gilbert Jost, M.D., professor of radiology and chief of the Division of Diagnostic Radiology, chaired the conference for Medical Imaging IV, the primary meeting dealing with digital imaging and picture archiving and communication systems (PACS). Jost chaired an invited session on “Ultra-High Resolution Display Systems,” Newport Beach, California, February 4-9.

Joseph K. T. Lee, M.D., professor of radiology and director of magnetic resonance imaging, as guest professor presented courses on “CT of the Biliary Tree,” “CT of P focal Hepatic Lesions,” “CT of Indeterminate Renal Masses,” and “CT of Acute Renal Infection” at the University of Michigan, Ann Arbor, March 2. He presented “New Contrast Media—1990” at Washington University, Urology Grand Rounds, St. Louis, March 24.

William A. Murphy, Jr., M.D., professor of radiology, was an invited speaker and panelist for “Diagnosis and Staging of Bone Neoplasms” and lectured on “Staging and Follow-up of Malignant Bone Tumors” at the American Cancer Society National Conference on the Advances in Cancer Imaging, New York, January 24. Murphy spoke on “Magnetic Resonance of Muscle” and co-moderated the Scientific Session on “Magnetic Resonance Contrast Agents” for the Society for Magnetic Resonance Imaging, Washington, D.C., February 26. As guest speaker, he spoke on “Radiology of Death Investigation” for the South Central Kansas Radiology Society, Wichita, March 13. As visiting professor, Murphy lectured on “Bone Marrow Imaging” at HCA Wesley Medical Center, Wichita, Kansas, March 14.

VISITING PROFESSORS & INVITED LECTURERS

Bahman Emami, M.D., professor of radiology, lectured on “Clinical Experience in 3-D Treatment Planning II” at the Treatment Planning in 3D: Process, Evaluation and Implementation session at M.D. Anderson Cancer Center, Houston, Texas, March 14-16.

Harvey H. Glazer, M.D., associate professor of radiology, presented a lecture on “CT of the Mediastinum—Differential Diagnosis” at the Milwaukee Roentgen Ray Society, Milwaukee, February 26.


Focal Spot, Spring, 1990.

Joseph L. Roti Roti, Ph.D., professor of cancer biology in radiology and chief of the cancer biology section, and William D. Wright, under-graduate research assistant in radiology, presented a paper on “DNA Damage and Repair by Image Analysis” for the Analytical Society, Asheville, North Carolina, March 18-23. Roti Roti lectured on “Nuclear Matrix Proteins and Structures in the Responses of Cells to Radiation and Heat Shock” at the Emory University School of Medicine, Department of Biochemistry, Atlanta, March 23. He co-chaired a session on “Basic Mechanisms of the Cell Cycle” and presented papers on “G2 Pulse—G1 Chase Studies of NP170 and Steps to Identify It” and “A Thermodynamic Model of Heat-Induced Cell Killing of Cells in G1 Phase of the Cell Cycle,” coauthored, respectively, with Wright and Michael A. Mackey, Ph.D., instructor in cancer biology, at the Cell Kinetics Society and International Cell Cycle Society, St. Louis, March 28-31.

Stuart S. Sagel, M.D., professor of radiology, lectured on “CT of the Pericardium” for the Society of Thoracic Radiology Post Graduate Course, Naples, Florida, January 7-11.

SYMPOSIA

RADIOLOGICAL SOCIETY OF NORTH AMERICA

The following Mallinckrodt Institute staff members participated in the 75th Annual Scientific Assembly and Annual Meeting of the Radiological Society of North America, Chicago, November 26-December 1.

Michel M. Ter-Pogossian, Ph.D., presented the Diamond Jubilee Lecture in Physics, “The Radiology-Physics Partnership”

REFRESHER COURSES

Harvey S. Glazer, M.D., “CT of the Mediastinum; CT of Lung Parenchyma”

Jay P. Heiken, M.D., “CT of the Retroperitoneum”

Bruce L. McClenann, M.D., “CT of Indeterminate Renal Masses”

Barbara Monsees, M.D.; Ronald G. Evans, M.D., “Patient-Initiated Mammography: The Potential and the Problems”

William A. Murphy, Jr., M.D., “Imaging of Bone Marrow Disorders”

Daniel Picus, M.D., “Advances in Interventional Biliary Radiology”

James A. Purdy, Ph.D.; Robert E. Dryzylama, Ph.D., “Practical Implementation of Three-Dimensional Treatment Planning”

Stuart S. Sagel, M.D., “How to Prepare and Deliver an Effective Audiovisual Presentation”

Michael W. Vannier, M.D.; Louis A. Gilula, M.D., “Three-Dimensional Imaging of the Musculoskeletal System”

SCIENTIFIC SESSIONS


Elvira V. Lang, M.D.; Daniel Picus, M.D.; Victoria Marx, M.D.; Marshall E. Hicks, M.D., “Impact of Transcatheter Embolotherapy on Survival in Patients with Massive Gastric Hemorrhage.”


Bruce L. McClenann, M.D.; Daniel Picus, M.D., “Extra-corporal Shock-Wave Lithotripsy as an Adjunct to Biliary Interventional Procedures.”


William A. Murphy, Jr., M.D., moderator, “Imaging Symposium: Musculoskeletal MR Imaging.”


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


SYMPOSIA

Continued from page 25.

WORKS IN PROGRESS
Mark S. Frank, M.D.; R. Gilbert Jost, M.D.; G. James Blaine, D.Sc.; Steven M. Moore, M.S.; Robert A. Whitman, M.S.; Rosalie Hagge, M.D. “Interpretation of Mobile Chest Radiographs from a High-Resolution CRT Display.”


SCIENTIFIC EXHIBITS
William A. Murphy, Jr., M.D., “History of Musculoskeletal Radiology”

Tom Payne, Ph.D.; Michel M. Ter-Pogossian, Ph.D.; James Kereiakes, Ph.D.; Robert Gorson, M.S., “Milestones in Medical Physics over the Past 75 Years”

Jamie T. Surratt, M.D.; Marilyn J. Siegel, M.D.; William D. Middleton, M.D. received one of the four cum laude awards for “Imaging of Complications in Pediatric Renal Allografts: Histologic Correlation.”

APPOINTMENTS/ELECTIONS

Judy M. Destouet, M.D., associate professor of radiology, was appointed to the St. Louis Regional Cancer Control Coalition. She is also serving on the American College of Radiology Committee on Breast Imaging and the Food and Drug Administration Breast Augmentation Subgroup.

Louis A. Gilula, M.D., professor of radiology, was elected an honorary member of The American Society for Surgery of the Hand. Of the more than 25 honorary members of the society, Gilula is the only radiologist.

Bruce L. McClennan, M.D., professor of radiology, was appointed chairman of the Intersociety Commission of the American College of Radiology in September, 1989.

James A. Purdy, Ph.D., professor of radiation physics in radiology, was appointed chairman of the American College of Medical Physics, 1990.

Barry A. Siegel, M.D., professor of radiology and medicine, and director of the Division of Nuclear Medicine, was appointed chairman of the Advisory Committee for the Medical Uses of Isotopes of the U.S. Nuclear Regulatory Commission.

Honors/Awards

Ralph V. Clayman, M.D., associate professor of urologic surgery and associate professor of radiology, received the 29th Ferdinand C. Valentine Award in recognition of his work in endourology from the Council of the New York Academy of Medicine, New York City, March 21.

William D. Middleton, M.D., professor of radiology, and Daniel Picus, M.D., associate professor of radiology, received the 1989 Editor’s Recognition Award with Special Distinction from Radiology, a leading radiological scientific journal.

Jeffrey J. Brown, M.D., assistant professor of radiology; Harvey S. Glazer, M.D., associate professor of radiology; Landis K. Griffeth, M.D., Ph.D., associate professor of radiology; Jay P. Heiken, M.D., associate professor of radiology; William H. McAlister, M.D., professor of radiology; Barbara Moussees, M.D., assistant professor of radiology; Henry D. Royal, M.D., associate professor of radiology; Stuart S. Sagel, M.D., professor of radiology; Marilyn J. Siegel, M.D., professor of radiology; Michael W. Vannier, M.D., professor of radiology, received the 1989 Editor’s Recognition Award with Distinction from Radiology.

Michel M. Ter-Pogossian, Ph.D., professor of radiation sciences in radiology, received the Amy Bowles Lawrence Distinguished Scientist in Research Medicine Award from Lawrence Berkeley Laboratory and Donner Laboratory, University of California at Berkeley.

Betty Summers Hayward, B.A., public relations marketing specialist, was elected 1989-90 president of the Alumni Association Board of Directors of Maryville College, St. Louis.

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

**CONTRIBUTIONS**

Mr. and Mrs. Len Schrewe in memory of Norman J. Thompson

Mr. and Mrs. Emerald Schneller in memory of Virginia L. Fox

Viola Lyons in memory of Lillie Barfield

International Brotherhood of Magicians in memory of Maria

Mr. and Mrs. James E. Howell

Margaret Carlisle in memory of Kathy Hubbard

Mr. and Mrs. Charles H. Lampe in memory of Harry Niedringhaus

Mr. and Mrs. Frederick Hermann in memory of August Busch

Mabel J. Durbin in memory of Earle Zelsman

Linda and David Morotz in memory of Henry Hennenhofer

Mr. and Mrs. Frederick Hermann in memory of Leonid Tichvissky

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Ford Motor Credit in memory of Lillie Mae Hampton

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Margaret A. Kiefer

Mr. and Mrs. Al Rosenker in memory of Saul Schwartz

Mr. and Mrs. Sam Budrovich in memory of Paul E. Fey, Jr.

Mr. and Mrs. Randy Thatcher in memory of Barbara Braucksicker

Lena Duke in memory of Connie Morgan

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**CALENDAR**

**April 6-8, 1990**
Missouri Radiological Society
Lake Ozark, Missouri

**April 7-12, 1990**
Radiation Research Society
New Orleans, Louisiana

**April 13, 1990**
Probstein Oncology Lecture
Washington University Medical Complex
East Pavilion Auditorium
St. Louis, Missouri

**April 18-22, 1990**
Society for Pediatric Radiology
Cincinnati, Ohio

**April 19-21, 1990**
Second International Brachytherapy and Remote Afterloading Symposium and Workshop
Mallinckrodt Institute of Radiology
Radiation Oncology
St. Louis, Missouri

**April 21-25, 1990**
American Radium Society
Scottsdale, Arizona

**April 22-27, 1990**
Association of University Radiologists/Society of Chairmen of Academic Radiology Departments
Minneapolis, Minnesota

**April 27, 1990**
Freud Memorial Lecture
Washington University Medical Complex
East Pavilion Auditorium
St. Louis, Missouri

**May 11, 1990**
Stereotactic Symposium
Jewish Hospital of St. Louis
St. Louis, Missouri

**May 13-18, 1990**
American Roentgen Ray Society
Washington, DC

**May 14, 1990**
City-Wide Radiology Conference
MRI of Joints
Mallinckrodt Institute of Radiology
Scarpellino Auditorium
St. Louis, Missouri

**May 15, 1990**
The Sixth International Wrist Investigator’s Workshop
Newport Beach, California

**May 16-20, 1990**
Radiologists’ Business Managers Association
Orlando, Florida

**May 22-25, 1990**
First Conference on Visualization in Biomedical Computing
Ritz-Carlton Buckhead
Atlanta, Georgia

**June 7-10, 1990**
American College of Medical Physics
Austin, Texas

**June 19-22, 1990**
Society of Nuclear Medicine
Washington, DC

**June 24-28, 1990**
American Medical Association
Chicago, Illinois

**July 22-26, 1990**
American Association of Physicists in Medicine
St. Louis, Missouri

**July 28-August 2, 1990**
National Medical Association Section on Radiology
Las Vegas, Nevada
Above: The alumni reception, held in conjunction with the 75th Annual Scientific Assembly and Annual Meeting of the Radiological Society of North America, reunited former colleagues Jonathan I. Wiener, M.D., and Pietro Biondetti, M.D.

Left: Dr. and Mrs. Thomas Getz catch up on news with William Berkman, M.D.
In the 40 years since The Washington University School of Radiologic Technology at Mallinckrodt Institute of Radiology admitted the first group of students, there have been numerous changes in the faculty, the facility, the curriculum, even the name of the School. The one thing that has remained constant, and will continue to be foremost, is the primary responsibility of the School and the Institute—quality patient care.

In 1950, Hugh M. Wilson, M.D., who, at that time, was director of Mallinckrodt Institute, recognized the need for a comprehensive X-ray technology training program in the St. Louis area. As a result of his perseverance, the first classes of the "School of X-ray Technology" began on July 10, 1950, under the supervision of James Morgan, R.T.

The School's curriculum was based on requirements established by the American Medical Association and the Council on Medical Education in X-ray Technology. Classes met on the eighth floor of the Institute where a total of 295 hours of instruction included anatomy, physiology, radiographic technique, radiation physics, and other X-ray technology-related topics.

The Institute underwent an era of rapid expansion in the 1950s and '60s, and this expansion impacted upon the School. It was during this period that classes began meeting on the newly added ninth floor, and the official School name was changed to "The Washington University School of Radiologic Technology." The appointment of Armand Diaz, R.N., R.T., FASRT, as technical administrator and director of education in radiologic technology in 1968 brought about curriculum changes: the clinical educational aspect of the program was brought in line with the demands of the profession, and teaching and learning guidelines and goals for clinical achievement were implemented. The Institute was a leader in the use of "teaching by objective," which is now an accepted teaching method in radiologic technology education nationwide.

MIR's predecessor: The X-ray Department originally located in Barnes Hospital was begun around 1914, a little more than 19 years after Roentgen's discovery of the X-ray, and was called the actinographie laboratory. Photograph, circa 1920s, courtesy of the Visual Collections of the Archives, Washington University School of Medicine.
 Over the years additional administrative changes continued the thrust for excellence in the training program. Two alumni of the School were brought on staff: Chief Technologist Gary Brink, R.T., B.S. FASRT, a 1967 program graduate, was appointed assistant director of education in 1970; Chief Technologist for Quality Assurance Michael D. Ward, R.T., M.Ed., FASRT, a 1976 program graduate, was named director of technical education in 1987.

Students now receive more than 3,700 hours of clinical and classroom training in a 24-month program, with classes held in the East Building on Scott Avenue. Adaptations to the curriculum go hand-in-hand with rapidly changing technology, and, because of the state-of-the-art equipment housed at the Institute and the broad scope of radiologic procedures covered, students rotate through such areas as special procedures, magnetic resonance imaging, computed tomography, ultrasonography, nuclear medicine, and radiation oncology as well as all areas of diagnostic radiology. Classes in quality assurance and radiation safety have been added to the curriculum in the continuing effort to maintain high quality patient care.

The program is approved by both the Joint Review Committee on Education in Radiologic Technology and the Committee on Allied Health Education and Accreditation of the American Medical Association. Certification
is given by the Joint Review Committee in collaboration with the American College of Radiology and the American Society of Radiologic Technologists.

The School's record speaks well of the program's excellence. In the past 40 years, more than 400 program graduates have gone on to become staff technologists, managers in hospitals and institutions nationwide, or have used their radiography education as a springboard into other areas of health-care technology.

**HOME TIES**

Over the years, more than 90 graduates of The Washington University School of Radiologic Technology chose to apply for positions at the Institute and have remained on staff. Many of those staff members progressed to supervisory levels and are now ensuring that the tradition of quality patient care continues.

**From the Class of**

1957 — Phil Sotir is now technical supervisor of pediatric X-ray;
1965 — Leon Fridley, technical supervisor of the cardiac cath lab;
1967 — Gary Brink, chief technologist and assistant director of education;
1972 — Sharon Genetti Albertina, technical supervisor of outpatient diagnostic radiology;
1972 — Mike Albertina, chief technologist;
1972 — Judy Cortner, assistant technical supervisor of in house patients and emergency room X rays;
1975 — Tim Aly, technical supervisor of genitourinary;
1975 — Janet Morgan Lewis, technical supervisor of gastrointestinal and computed tomography;

1975 — Jane Palazzolo, assistant technical supervisor of genitourinary;
1976 — Michael Ward, chief technologist and director of technical education;
1976 — Paul Hanson, assistant technical supervisor, nuclear medicine;
1977 — Cathy Potenos Zielinski, clinical instructor of pediatric X-ray;
1978 — Janelle Sabo, assistant technical supervisor gastrointestinal and computed tomography;
1979 — Dean Brake, clinical instructor of genitourinary;
1979 — Terry Compton, technical supervisor of special procedures;

**The MIR radiotherapy section had a 24-million volt Betatron, first housed in a special treatment area of Barnard Free Skin and Cancer Hospital. Photograph, circa late 1950s to early 1960s, courtesy of the Visual Collections of the Archives, Washington University School of Medicine.**
1979 — Nancy Mazzuca Genetti, assistant technical supervisor of outpatient diagnostic radiology;
1979 — Claudia Backsman Mosberger, assistant technical supervisor of vascular and interventional radiology;
1980 — Roberta Cattron McQueen, assistant technical supervisor of outpatient diagnostic radiology;
1980 — David Ewing, assistant technical supervisor of in-house patients and emergency room X rays;
1980 — Joseph Schwarberg, technical supervisor of in-house patients and emergency room X rays;
1982 — Anna Gutierrez, assistant technical supervisor of ultrasound;
1982 — Robert Knapp, supervisor of the 3-D imaging laboratory;
1983 — Steve Kruzich, technical supervisor of vascular and interventional radiology;
1983 — Kevin Marquardt, technical supervisor of the magnetic resonance imaging section;
1983 — Melanie Elick Mack, clinical instructor of in-house patients and emergency room X rays.

Students of The School of Radiologic Technology, class of 1963, received instructions in orthopedic roentgenography, located on the second floor. Photograph courtesy of the MIR Photography Laboratory.


Above: 1989 Radiologic Technology Graduates: (front row, left to right) Michelle Robart, Michelle Marlowe, Julia Seper; (middle row) Carol Meagher, Barbara Gallion, Christine Collier; (back row) Gilbert Idowu, Ronnie Gibbs, Lori Brooks, James Naes.
Chief Technologist for Quality Assurance and Director of Technical Education Michael D. Ward emphasizes the importance of quality assurance in achieving quality patient care to students in the 1990 senior class of The School of Radiologic Technology.
Positron emission tomography (PET) imaging, as shown above, is clarifying diagnosis and treatment planning for cardiac patients facing possible bypass surgery or coronary angioplasty. Details of this study will be included in an upcoming issue of Focal Spot.