



JeffersonTM
University Hospitals

*RESIDENCY AND FELLOWSHIP TRAINING
PROGRAMS*

DEPARTMENT OF RADIOLOGY

THOMAS JEFFERSON UNIVERSITY HOSPITALS

PHILADELPHIA, PA

<http://www.jefferson.edu/jmc/radiology/>

DEPARTMENT OF RADIOLOGY
THOMAS JEFFERSON UNIVERSITY HOSPITAL

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INTRODUCTION

One of the major strengths of the Department of Radiology of Thomas Jefferson University Hospital is its strong and balanced underpinning in all three of the traditional missions of academic medicine – clinical practice, education, and research. Because of the solid expertise and national reputation of many of its faculty members, the department has been able to build a huge practice, encompassing over 300,000 studies per year. Our residency program is recognized nationally as one of the best, and our fellowship programs are also highly desirable. We regularly compete successfully with other top academic departments in the country for the best applicants at both the residency and fellowship levels. Extensive research programs, as summarized later in this booklet, cover virtually all aspects of radiology and lead every year to a large number of publications and presentations at major national radiology meetings

DEPARTMENT OF RADIOLOGY OVERVIEW

<u>Divisions</u>	<u>Directors</u>
Breast Imaging/Ambulatory Radiology	Barbara Cavanaugh, M.D.
Body CT/Abdominal Imaging	Laurence Needleman, MD
Cardiovascular/Interventional Radiology	Daniel Brown, M.D.
Musculoskeletal Radiology and General Radiology Imaging	William Morrison, M.D.
Chest and Cardiac Radiology	Narainder Gupta, M.D.
Magnetic Resonance Imaging	Donald G. Mitchell, M.D.
Neuroradiology/ENT Radiology	David P. Friedman, M.D. Adam Flanders, M.D.
Nuclear Medicine	Charles Intenzo, M.D.
Ultrasound	Barry B. Goldberg, M.D.

The faculty consists of 45 attending staff radiologists and 6 basic scientists in full-time research – 4 with expertise in medical physics, 1 in radiopharmaceutical drug development, and 1 in health services and economics.

The Department performs over 300,000 examinations per year. Nearly 117,000 general diagnostic studies are performed, including plain film examinations of the gastrointestinal and genitourinary tracts. In the subspecialties, roughly 12,000 pediatric examinations, 37,000 ultrasound examinations, 48,000 magnetic resonance imaging (MRI) examinations, 12,000 nuclear medicine scans, 1,000 in vitro isotope studies, 33,000 mammograms, 36,000 CT scans, and 9,400 arteriograms and interventional procedures are performed yearly.

At present, the Department's equipment consists of 5 multi slice CT scanners, 4 all-digital angiographic suites, 3 remote control fluoroscopic units and 2 tableside fluoroscopy units, 30 ultrasound scanners, 8 nuclear medicine scanners, 11 general radiographic rooms, 6 portable x-ray units, 8 dedicated mammography units, and a stereotactic core breast biopsy device. In MRI, we interpret for eleven 1.5T units, as well as 2 open MRI units and 1 3T MRI. Most of this equipment is housed on the Jefferson campus, but some is located at 4 outpatient imaging centers, which are operated by the Department. The Department has several of its own specialty designed conference rooms with facilities for videotape recording, radiographic and slide projection and video projection.

The Department is very active in research with a number of projects in progress. During the last academic year, these resulted in 220 publications in medical journals and textbooks and over 318 presentations at scientific meetings or other academic institutions. Also during the last academic year, the department had 45 separate grants in force – 31 from the NIH or other federal agencies, 3 from foundations or nonprofit medical organizations, and 11 industry-supported clinical trials. The total level of grant support during the course of the year was over \$3.2 million. Thus, Jefferson trainees in radiology can be assured that the department is staying at the very forefront of new developments in the field.

RESIDENCY TRAINING PROGRAM

The Radiology Residency Program at Jefferson has an outstanding national reputation. The principal objective of our program is to produce well-trained, competent radiologists who will find themselves highly competitive for successful careers in both academic and private practice sectors. This objective is achieved by promoting a friendly and stimulating environment conducive to learning. The educational curriculum is continually updated in order to keep pace with the rapid advances in radiology. The design of the resident rotation schedule prioritizes the educational needs of the residents over the service needs of the department.

The American Board of Radiology requires four years of training in Diagnostic Radiology and a one-year clinical internship prior to radiology training. We receive approximately 600 applicants each year, from which 10% are selected for interviews. Our program is fully accredited, and we are in the process of increasing the resident complement from eight to nine residents per year.

The core curriculum consists of twelve weeks each in musculoskeletal radiology, gastrointestinal radiology, pulmonary radiology, pediatric radiology, cardiovascular/interventional radiology, ultrasound, body CT and MRI, and breast imaging; eight weeks each in genitourinary radiology and emergency radiology; and sixteen weeks in Neuroradiology/Head and Neck and Nuclear Medicine. During the third year, residents spend four weeks at the Radiologic Pathology course given by the Armed Forces Institute of Pathology. In addition, there are twelve weeks of elective time in the senior year.

In the first two months of the academic year, an introductory course is given in general diagnosis. This program includes formal lectures in normal radiographic anatomy, basic diagnostic principles, and radiographic technique. For the remainder of the year, two hours of teaching conferences in diagnostic interpretation are given daily, Monday through Friday, by the attending and fellow staff. These conferences are in each of the major radiology subspecialties, and include a mixture of didactic lectures and case presentations. During case presentation, the residents have the opportunity to discuss the radiographic findings and differential diagnoses. An intensive course in radiologic physics is given during the summer of each year to first- and second-year residents. The Departmental Radiology Conference is held the 3rd and 4th Wednesday of every month. This consists of: 1) Grand Rounds covering topics of interest in all radiology subspecialties. These are presented either by the departmental faculty or by invited outside speakers. 2) Radiology research conferences presented in a unique Journal Club type format. This allows everyone in the department the opportunity to present the results of their research activities to the Radiology Department. Residents are required to complete and present at several stages at least one research project at this conference and to submit their work to a national meeting.

During each workday, all studies are reviewed by the resident and staff together prior to dictation. Thus, each case becomes a teaching exercise. This type of review demands extra effort from the radiology staff, but is worthwhile in its end result of training and patient care.

Night call responsibilities begin in the second year of Radiology residency. Two residents (1 Junior and 1 Senior) will be on call every evening using a night float system from 9PM to 9AM on Weekdays, and 8PM to 8AM on Weekends and Holidays. A separate ER Resident (2nd through 4th yrs) covers from 11AM to 9PM weekdays, 12Noon to 8PM on Saturdays and 8AM to 8PM Sundays and Holidays. On-call residents are responsible for all general radiology,

neuroradiology, body CT and US, except for CVIR and neuroradiologic procedures. Back-up is available by both fellows and attending staff.

The vast majority of our residents easily pass both parts (written and oral) of the American Board of Radiology Examination, often ranking well above the 90th percentile on portions of the written examination. During the last seven years, we have had a superb performance on the Oral boards. No resident has failed or conditioned any section. Following residency, most residents elect to take fellowships either at Thomas Jefferson University or some other outstanding academic institution before going on to academic or private practice careers. The Department faculty is active in counseling residents about their career choices and helping residents and fellows secure the best possible positions upon completion of their training.

FELLOWSHIP TRAINING PROGRAMS

For residents completing their training program, the Department of Radiology offers one- or two-year fellowships in each of the following areas: Ultrasound/CT/MRI, Body MRI, Combined MRI (Musculoskeletal/Neuro), Neuroradiology/Head and Neck Imaging, Breast Imaging, Musculoskeletal Radiology, Cardiovascular/Interventional Radiology. Candidates must be board eligible or board certified in Diagnostic Radiology.

The Abdominal Imaging Fellowship, which is accredited by the Accreditation Council for Graduate Medical Education (ACGME), consists of comprehensive training in MR, CT and Ultrasound. There is also elective time in which fellows may choose clinical rotations to supplement their fellowship experience or work on a research project, which is required. Clinical duties during these rotations include time divided between MR, ultrasound and CT. CT includes multidetector angiographic imaging and volumetric reconstructions for chest, abdominal and pelvic scanning as well as advanced vascular applications, including coronary angiography. Interventional CT includes work with CT fluoroscopy and CT guided biopsy procedures. MR is performed on a multitude of scanners including 3T magnets. Scans are performed in a variety of settings including hospital, outpatient clinics, and one open magnet facility. The MR division is a leading center for liver and pelvic MR applications. Ultrasound includes diagnostic studies includes general inpatient and outpatient studies as well as dedicated vascular, musculoskeletal, obstetric and gynecology, and prostate training. Extensive training in ultrasound guided interventional studies is also offered. State of the art GI/GU imaging is incorporated into US, CT and MR rotations, including: virtual colonoscopy, CT/MR angiography, CT/MR urography, MRCP, prostate ultrasound, sonohysterography, and research studies with various techniques including sonographic contrast agents. The didactic curriculum includes daily lectures from July

through September on all basic aspects of abdominal imaging and imaging for abdominal emergencies. During the remainder of the year, there are four case conferences per week, distributed among ultrasound, body CT, body MR and GI/GU. Opportunity is given for optional clinical and basic science research.

The **Body/Musculoskeletal MRI Fellowship** is a dedicated one-year program for one fellow. It incorporates all aspects of non-neuro-related magnetic resonance imaging (both clinical and research), including basic and advanced principles of MRI. All aspects of clinical non-neuro MR imaging will be covered, including the chest, heart, breast, abdomen, male and female pelvis, the extremities (musculoskeletal system), and body and extremity vascular applications, including MR angiography (MRA), MR cholangiopancreatography, and use of new contrast agents. In- and out-patient services are active and the fellow will help plan protocols, monitor studies and provide appropriate diagnoses and consultations to the referring clinical services. The fellowship provides ample time and opportunity for active ongoing research related to magnetic resonance imaging. Jefferson operates 15 MRI units—including two at 3T, eight at 1.5T, and others from 0.3T to 1.0T—all of which send images to our PACS system for filmless interpretation.

The **Combined MRI (Musculoskeletal/Neuro) Fellowship** is a dedicated one-year program for three or four fellows incorporating all aspects of clinical magnetic resonance imaging. This includes brain, ENT, spine, and extremity applications. There are separate rotations to the neuro. and musculoskeletal services. Opportunities are also available for clinical and basic research.

The **Neuroradiology/Head and Neck Imaging Fellowship** offers an ACGME accredited one-year program with up to four positions. One fellow can spend an additional year at The

Children's Hospital of Philadelphia in a combined adult-pediatric program. The Division has access to six multidetector CT scanners (four 16 slice and two 64 slice units), thirteen MRI scanners (including six closed 1.5T units, one 1.5T open unit, one 0.3T open unit, two 3T units, and three additional scanners), two dedicated bi-plane angiographic and interventional units, a linear accelerator, a Gamma Knife, and a PET-CT scanner.

Extensive training is given in interpretation of plain films, CT, CT angiography, CT perfusion, MRI, and advanced MR techniques, as well as in the technical aspects and interpretation of myelograms, neuroangiograms, and interventional neuroradiologic procedures. Case interpretation and reporting are conducted daily under the guidance of the neuroradiology staff. In addition, there is a rotation for each fellow at The Children's Hospital of Philadelphia for concentrated, in-depth experience in pediatric neuroradiology. Consultation with referring physicians from Neurology, Neurosurgery, Orthopedic Surgery, Head and Neck Surgery, Rehabilitation Medicine, Medical Oncology, and Radiation Oncology is an ongoing responsibility and learning opportunity. There is weekly active participation in Neurosurgery Grand Rounds, Neurology Grand Rounds, Stroke Conference, Brain Tumor Conference, ENT Grand Rounds, Head and Neck Tumor Conference, as well as two weekly Neuroradiology Conferences for residents and fellows and a weekly conference with the clinical staff of the Regional Spinal Cord Trauma Center based at Thomas Jefferson University Hospital. An extensive on-line teaching file of proven examples of neurologic abnormalities is available. Ample opportunities exist for research at the clinical level.

The **Breast Imaging Fellowship** is a one-year program that includes intensive experience in interpretation of problem solving mammography, screening mammography, breast

ultrasound and breast MRI. Additionally, training is provided for the performance of pre-biopsy mammographic needle localizations, core biopsies and cyst aspirations using mammography, ultrasound or MRI for guidance. The fellow will participate in teaching of residents and medical students, and will be responsible for coordinating the weekly mammographic-pathologic conference. Research opportunities are available in mammography, breast ultrasound, and MRI. A **Combined Breast /Cross-Sectional Imaging Fellowship** includes 6 months of training in breast imaging and 6 months of experience in cross-sectional imaging. The cross-sectional experience may be tailored to the interests of the fellow. Fellows have trained in body CT, body MRI, ultrasound, and musculoskeletal imaging.

The **Cardiovascular/Interventional Fellowship** offers ACGME accredited one- or two-year fellowship programs. One position is available each year through the NRMP match program. Completion of one year of post-graduate clinical training and a radiology residency program are prerequisites. The department also offers a Direct Pathway CVIR residency training program for one resident per year. Training includes all aspects of interventional radiology, including arterial, venous and nonvascular diagnostic and interventional procedures. Clinical patient management is emphasized, and includes daily patient rounds with the attending staff, and morning review conference. Other conferences related to patient care are given each year by faculty from clinical departments. The division has its own admitting service and dedicated clinic.

The division performs over 9,400 procedures each year. These include procedures such as chemoembolization and radiofrequency ablation of liver tumors, uterine artery embolization for fibroids, balloon angioplasty, vascular stent placement, TIPS (transjugular intrahepatic

portosystemic shunt), and IVC filters. Nonvascular procedures account for approximately 25 percent of cases, and include a wide range of biliary and urologic interventions.

A busy conference schedule includes didactic lectures on interventional topics, case presentations, a monthly journal club, and combined conferences with vascular surgery, nephrology, oncology and other clinical specialties. A new division conference room with amphitheater style seating for 28, and advanced audiovisual capabilities is utilized for most of these conferences. Other educational or research activities are facilitated by Division and Department libraries, as well as a University library with electronic journal subscriptions.

The two-year program is oriented toward applicants considering an academic career, and includes six months of dedicated research time. Research may include animal or clinical projects depending on the interests of the fellow. The division maintains several databases, and has its own server and several workstations, which may be used for research projects.

The **Musculoskeletal Radiology Fellowship** is a one-year ACGME-accredited clinical program with research endeavors encouraged. There are three positions available yearly. The curriculum includes intensive training in musculoskeletal imaging modalities with MRI being the primary focus, but also including CT, CR, arthrography, and MSK ultrasound. MRI volume is approximately 100 cases per day from numerous closed and open MR systems at field strengths of 3.0, 1.5, 1.0, 0.7 and 0.3 tesla, and all interesting cases are reviewed weekly. Approximately one fourth of the year is dedicated to procedures including image guided MSK biopsy, vertebroplasty/kyphoplasty, pain procedures including selective nerve blocks and facet injections, discography and radiofrequency ablation. A comprehensive conference schedule includes two dedicated MSK radiology conferences weekly, as well as correlation conferences with orthopaedics and sports medicine specialists

including spine, shoulder, hand/wrist, foot/ankle, and MSK oncology. Fellows also participate in office hours with orthopaedics subspecialists at the Rothman Institute. Members of the musculoskeletal radiology section are active in clinical research in the fields of musculoskeletal MRI, radiology-oncology-orthopaedics correlation, bone and joint diseases, orthopaedic trauma and sports medicine, and fellow participation in research endeavors is encouraged.

The **Nuclear Medicine Residency** consists of both a one-year and two-year program, which fulfills all of the requirements of the American Board of Nuclear Medicine. The two-year program is targeted to trainees having at least one year of clinical training in other medical specialties. The one-year program is open to individuals who have completed four years of a general radiology residency in any ACGME-accredited program. Both programs qualify residents for certification by the American Board of Nuclear Medicine. Extensive training is provided in all areas of both nuclear imaging and therapy, particularly SPECT imaging and I-131 therapy. There is a strong emphasis on general nuclear medicine, cardiovascular nuclear medicine, oncologic nuclear medicine, and neuro-nuclear medicine. Radionuclide functional studies of every major organ system are performed, including tumor imaging with radiolabeled peptides and monoclonal antibodies, as well as infection imaging with radiolabeled leukocytes. A dedicated PET/CT scanner is housed in the outpatient center. There are ample opportunities for basic and clinical research. The Division works closely with specialists in many clinical departments such as Medicine, Surgery, Neurology, Neurosurgery, Radiation Oncology, and Pediatrics.

DIVISIONS OF THE DEPARTMENT OF RADIOLOGY

The **Division of Breast Imaging** performs approximately 33,000 mammograms, 3,000 sonograms, 900 preoperative needle localizations for surgical excisional biopsy, 1200 stereotactic, ultrasound-guided, or MRI guided core biopsies, and 1000 breast MRI examinations yearly making it one of the most active services of its kind in the country. All diagnostic breast imaging studies are performed at the Breast Imaging Center (BIC). Screening mammography is performed at the Mammography Screening Center (MSC). Both centers are located in the hospital complex. There are four state-of-the-art digital mammographic units at the BIC and two at the MSC. The BIC also contains a stereotactic core biopsy table and three high-resolution breast ultrasound units. The Division of Breast Imaging has one full-time staff member and five other staff on a rotational basis. Ongoing research projects include breast ultrasound screening, evaluation of relationship between mammographic breast density and breast cancer, harmonic imaging using an ultrasound contrast agent, evaluation of ultrasound elastography, and evaluation of PET imaging of the breast.

The **Body CT/Abdominal Imaging Division** performs over 20,000 CT examinations per year, consisting of chest, abdomen and pelvis studies. Included in these examinations are aspirations, biopsies, drainages performed under CT guidance and CT angiography. All the studies are supervised and read by the CT division members. The examinations are performed on 2 helical and multislice scanners. These scanners incorporate new post-processing capabilities along with 3D construction. Didactic lectures, in conjunction with ultrasound and MRI, are given during the year. Very close correlation is obtained between CT and the other imaging modalities. Research opportunities are available for the residents and fellows rotating through the division.

The **Division of Cardio-Thoracic Radiology** is the primary group responsible for the interpretation of thoracic images at Thomas Jefferson University Hospital. Chest images are digitally acquired and then transmitted to a central location for interpretation on PACS. CT examinations of the chest at TJUH are interpreted by members of the Thoracic Radiology as well as body CT section. There is a very active pulmonology service at TJUH providing an excellent case mix. The cardio-thoracic division covers all areas of chest disease including:

- Interstitial lung disease
- Lung cancer diagnosis and follow-up
- Work-up of indeterminate pulmonary nodules including CT and PET
- Mediastinal and vascular pathology (including pulmonary embolism)
- Other pulmonary and airway diseases

Interventional chest procedures, utilizing CT as well as ultrasound guidance, are also available and include biopsy and drainage. At TJUH, there are active interventional cardiology, cardiothoracic surgery and cardiac transplant services. The cardio-thoracic division provides imaging for these services including CT & MR cardiac and coronary imaging. In addition to their clinical work, members of the Thoracic Radiology Division are actively involved in education. There is a weekly interdisciplinary meeting for lung cancer in addition to weekly meeting of interesting pulmonary cases. Weekly lectures in cardiothoracic radiology are given to radiology residents and fellows.

The **Division of Musculoskeletal Radiology and General Radiology** is one of the largest in the country. Each year approximately 30,000 radiographic musculoskeletal exams are performed, in addition to 10,000 musculoskeletal MR exams; staff serve as consultants to the Eagles, Phillies, Flyers, Sixers, Kixx, as well as local college athletes and the Pennsylvania Ballet. The division is very active in procedures as well. Each year, approximately 300 arthrograms (mostly MR arthrograms) are performed in addition to almost 200 bone biopsies. The division also performs interventional spinal procedures, including discography, facet injections, selective epidural injections, vertebroplasty, kyphoplasty and nucleoplasty. Radiofrequency ablation of osteoid osteomas and metastatic lesions is also provided. The staff is active in research, having published approximately 100 articles over the past five years, most with fellows, residents or other trainees as the primary author. Staff train two to three musculoskeletal fellows each year, in addition to residents, cross-sectional fellows and other MRI fellows. Education is a priority, and staff provide numerous didactic and case conferences throughout the year, in addition to clinical conferences with the orthopedic surgeons, musculoskeletal journal club, the regional Orthopedic-Radiology-Pathology conference, as well as three weekend CME courses (Jefferson Spine Imaging Symposium, Jefferson Upper Extremity Imaging Symposium, and Jefferson Lower Extremity Imaging Symposium). Division staff also co-edit a prominent musculoskeletal journal, *Seminars in Musculoskeletal Radiology*.

Under the aegis of general radiology, the division also performs 87,000 studies each year, including plain film radiography, intravenous urography, upper and lower gastrointestinal examinations, and hysterosalpingography. The Division has both remote control and tableside fluoroscopic rooms, and several general radiographic rooms.

The **Division of Neuroradiology/Head and Neck Radiology** performs radiological and imaging procedures related to the nervous system, head, neck and spine. It is staffed by seven neuroradiologists, one head and neck radiologist, and up to four neuroradiology fellows. State of the art equipment, including 13 MRI scanners, three multidetector CT scanners, 2 spiral CT scanners, and a PET scanner are housed either on campus or at our outpatient centers. The nearby Jefferson Hospital for the Neurosciences has two dedicated bi-plane angiographic and interventional units, a multidetector CT, a linear accelerator, a Gamma knife unit and a 1.5 Tesla MRI unit. Jefferson neuroradiologists cover this facility.

The Neuroradiology/Head and Neck Radiology Division is highly active clinically and works in close collaboration with the departments of Neurosurgery, Neurology, Otolaryngology, Orthopedic Surgery, and Rehabilitation Medicine (which runs a widely recognized spinal cord injury service). Approximately 300 selective cerebral arteriograms, 100 myelograms, and 16,000 CT's of the head and spine are performed each year. In addition, approximately 28,000 MRI scans of the head and spine are performed yearly. The division has been very productive in research activities, partly as a result of joint efforts involving the clinical services mentioned above.

Head and neck radiology is part of the division. A large variety and volume of facial, sinus, orbit, temporomandibular joint and neck cases are referred for radiologic evaluation from the busy Department of Otolaryngology/Head and Neck Surgery and the Department of Oral and Maxillofacial Surgery. The residents learn to interpret plain films, CT and MRI studies, and receive extensive one-on-one teaching by a staff radiologist. During their rotation, the residents can attend weekly head and neck tumor conference, where correlation of the physical examination with the radiologic findings is performed.

The **Cardiovascular/Interventional Radiology Division** is located on the 5th floor of the Gibbon Building. The area is separated from the main radiology department, but is conveniently located adjacent to the cardiac catheterization laboratories and the cardiac/peripheral vascular operating rooms. The CVIR area has recently undergone major renovations, including the installation of four new procedure rooms. The new angiographic equipment is all-digital and provides the very latest in sophisticated imaging capabilities. This includes rotational angiography, high-resolution cine-mode digital angiography, and bolus chasing. Some rooms have built in ultrasound capabilities for use in cases requiring ultrasound guidance. The procedure rooms are connected to two workstations that allow case review or image manipulations independent of ongoing cases in the procedure rooms. A PACS workstation in the Division allows easy access to relevant CT or MRI imaging studies for review. The division also shares with the cardiac catheterization labs equipment for mechanical thrombectomy and intravascular ultrasound imaging. The newly reconstructed area also includes a ten-bed, fully monitored recovery area for patients who have been given conscious sedation.

The CVIR faculty have wide ranging clinical interests and research experience. The Division is involved in NIH-funded studies of tumor vaccines and renal artery stenting, and was a major contributor to the SIR sponsored Uterine Fibroid Registry. Four of the five attending staff have been Associate Editors, and/or on the Editorial Board of *Journal of Vascular and Interventional Radiology*, and three have been Associate Editors of *Radiology*. Faculty have also had leadership roles in the SIR.

The **Division of Diagnostic Ultrasound** has an ultrasound physicist, seven cross-sectional imaging fellows, and twelve staff physicians, some of which are also active in body CT and MRI. The division occupies over 30,000 square feet on the 7th and 8th floor of the Main and

Thompson Buildings. There are 21 examination rooms and 30 major pieces of ultrasound equipment. The Division now performs over 37,000 examinations annually, covering all aspects of ultrasound, including obstetrics and gynecology, abdominal and superficial scanning, echocardiography, brain, breast, peripheral vascular, musculoskeletal, endoscanning, intraoperative and aspiration biopsy techniques. The facility uses all types of ultrasound equipment, including the most modern high-resolution real-time duplex, color Doppler and 3D and 4D ultrasound machines. An ultrasound outpatient facility with six ultrasound rooms is located in the Clinical Office Building (COB) on Walnut Street, one block from the hospital.

In addition to the extensive clinical activities of the division, there is a large research program with both basic and clinical investigations. Major areas of research include ultrasound contrast agents, endoluminal, musculoskeletal, and 3D ultrasound. A comprehensive ultrasound educational program provides intensive training for fellows and residents in addition to physicians and technologists from this country and throughout the world. On average, over 1,500 physicians and technologists from over forty different countries attend our programs in all aspects of ultrasound each year.

The **Magnetic Resonance Imaging Division** is responsible for all body MRI studies, including cardiovascular MRI. The volume of body studies interpreted daily by this service is among the highest in the country. It is staffed by five body MRI specialists. There are 6 cross-sectional imaging (MRI/CT/US) fellows, and one dedicated fellow for the body MRI division. A number of external and some internally funded protocols are in progress and future studies are continually planned. There are a total of 13 clinical MRI units in operation, including 2 state-of-the-art 3T scanners and several 1.5T scanners from all 3 major MRI vendors. New 1.5T and 3T inpatient units are present in the Gibbon Building.

Two 1.5T units are located in an MRI facility in the Clinical Office Building (COB) at 909 Walnut Street, a block from the hospital. Two 1.5T MRI units, one of which is a short/wide bore system, are present in our new Imaging Center (JCCI) located at 850 Walnut St. (Walnut Towers) on campus. Outpatient satellite MRI centers are located in Langhorne, Doylestown, Jefferson Hospital for the Neuroscience and at the Rothman Institute.

The **Nuclear Medicine Division** is located on the 8th Floor of the Thompson and Main Buildings. It provides nuclear medicine training for diagnostic radiology and nuclear medicine residents. The division has its own two-year ACGME approved residency training program. The teaching responsibilities are shared by two staff physicians and one radiochemist. The division performs approximately 12,000 nuclear medicine procedures annually. There are four single-headed gamma cameras, two dual-headed and three triple-headed SPECT systems, a PET/CT scanner, single and dual energy x-ray absorptiometry, a dedicated research gamma camera, gamma counters, and several computers. The scope of the nuclear medicine services includes in vitro tests, in vivo imaging, and therapeutic uses of unsealed radioisotope sources. There are active research activities within the division, both basic and clinical in nature. The basic research is performed in the radiochemistry section and clinical research is conducted by the clinical staff.

HOUSING

Thomas Jefferson University Hospital and Jefferson Medical College are situated on a large upscale section of center city Philadelphia. The campus is surrounded by several of Philadelphia's legitimate stage theaters and fine restaurants. The Academy of Music (home of the world-renowned Philadelphia Orchestra), the beautiful new Pennsylvania Convention Center, and historic Independence Hall are all within five blocks of Jefferson. The University owns two modern apartment buildings on its campus, for medical students, residents and fellows. In addition, many apartments are available at reasonable rentals in the surrounding area, known as Society Hill (one of the Philadelphia's finest neighborhoods). Some residents and fellows prefer to commute from the Philadelphia suburbs, which are 30 minutes from the hospital by mass transit or car. The major suburban rail lines within a 5-minute walk of the campus.

LIBRARY FACILITIES

The Department of Radiology Library contains 300 radiology textbooks and issues of 15 medical journals. There is also computer access to all major Radiology and other medical journals, 24 hours a day, 7 days a week. There is an extensive teaching file of over 1,600 representative radiographs with a written description of their radiographic findings and clinical presentations, including the entire American College of Radiology Teaching File on CD ROM.

The Jefferson Medical College Library, known as Scott Memorial Library, is located across the street from the hospital (between 10th and 11th on Walnut). It maintains a comprehensive general medical library of all major journals and textbooks including those for radiology.

HISTORY OF THOMAS JEFFERSON UNIVERSITY

Dr. George McClellan, who believed that medical students should actively participate in the diagnosis and care of patients, founded Jefferson Medical College in 1824. The new medical college derived its name from Jefferson College (now Washington and Jefferson University in Washington, Pennsylvania). The medical college has always been located in Philadelphia, first in Dr. McClellan's office, then in the former Tivoli Theater, at 418-20 Prune Street (now Locust) near Washington Square, and finally since 1828 at its present site. Today, Jefferson Medical College (JMC) is the largest private medical school in the country. Campus expansion has continued steadily over the last 150 years, accompanied by the development of an outstanding faculty and an ever-enlarging enrollment. To date, Jefferson has educated more physicians than any other medical college in the United States. JMC graduates have been instrumental in founding ten other medical schools in the United States.

From its inception, Jefferson's faculty and alumni have made significant contributions to medical science. A few highlights of these contributions are as follows:

Samuel David Gross, M.D. (JMC Class of 1828) is recognized as the outstanding surgeon of the 19th century and is immortalized in the famous painting "The Gross Clinic" painted by his anatomy student and devoted friend, Thomas Eakins.

Marion Simms, M.D. (JMC Class of 1835) is known as the Father of Modern Gynecology.

Silas Weir Mitchell, M.D. (JMC Class of 1850) and **William W. Perry Keen, M.D.** (JMC Class of 1862) combined their specialties to form the modern study of neurology and neurosurgery.

Carlos Finley, M.D. (JMC Class of 1855) discovered the carrier of yellow fever.

John H. Gibbon, Jr., M.D. (JMC Class of 1927) used the first heart-lung machine successfully on a patient during open-heart surgery in 1953.

James M. Hunter, M.D. (JMC Class of 1953), Director of Jefferson's Hand Rehabilitation Center since 1973, developed the first artificial tendon.

Allen J. Erslev, M.D., Director of the Division of Hematology since 1963, was the first to demonstrate the existence of the hormone erythropoetin which controls red blood cell production.

In 1969, Jefferson Medical College became Thomas Jefferson University, a modern academic health sciences university comprised of four divisions: Jefferson Medical College, Thomas Jefferson University Hospital, the College of Graduate Studies and the College of Health Professions. In 1978, Jefferson opened its new hospital facility, the Gibbon Building, and implemented a number of innovative health care concepts and programs that have helped to keep it at the forefront of modern care nationally. Jefferson's 650-bed hospital is one of the largest on the East Coast of the United States. It has a number of referral centers, attracting patients from a wide geographic area.