THE PENDERGRASS ERA
1940–1960

Eugene P. Pendergrass, 1937–1961
Departmental Operations in the Early Years of World War II

The department continued to grow and expand in the years following Dr. Pendergrass's assumption of the duties of Chairman, and plans for the new facility promised to provide the highest possible quality. While awaiting its completion the department operated under extremely crowded conditions, but morale was high due to the considerable increase in apparatus and the awareness of imminent improvements.

Despite uncomfortable areas in the department's White Building location, no alterations were made to the space after 1937, since the staff anticipated moving to the new Dulles Building early in 1942. A gift of a periscope for treating cancer of the cervix was received in 1941. This instrument was especially appreciated because it had been designed by a former student in the department, Dr. Percy D. Hay, Jr.¹

As national research progressed on the cyclotron, Dr. Pendergrass became very interested in building one for the department. In 1940 Mr. Donner began a fund for the purchase of a cyclotron.² Dr. Pendergrass had already spent time in Berkeley with Drs. Ernest Lawrence and Robert Stone, where he learned about the medical application of cyclotrons. After returning to Philadelphia, he successfully encouraged Mr. Donner to go to California to meet these gentlemen and see their work first hand. Mr. Donner was asked for funds to construct a building for Dr. Lawrence while there, and he agreed to provide the necessary sum.

Mr. Donner was still most interested in providing the funds for a cyclotron at Pennsylvania, however, being particularly impressed with the Department of Radiology's qualifications to carry on this sort of research after speaking with the specialists in California. Dr. Pendergrass began to recruit the necessary staff and to develop plans for the cyclotron's location. Application was made for the necessary metals, but due to the war effort most, particularly copper, were in short supply. Some time after the initiation of the project Dr. Thomas S. Gates, President of the University of Pennsylvania, received a call from the Secretary of State requesting that he convince Dr. Pendergrass to drop the

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project for this reason. The department remained interested in the cyclotron, but quickly became involved in a number of other projects so that by the time metals would have been available, the staff's activities were directed elsewhere.\(^3\)

The training course for radiologic technicians improved during these years, and applications to enter the program increased so greatly that the department was able to elevate its entrance requirements.\(^4\) The number of students was increased in 1941, and the curriculum made more comprehensive.\(^5\)

The *esprit de corps* and warmth exuded by the department's staff toward patients, students, and visitors made the Department of Radiology one of the most respected in the hospital service. The atmosphere was noted by outsiders, and reiterated over and again by students and physicians who spent time there during their terms of service in the hospital. One intern commented that his reaction was one of "... genuine appreciation for the consideration shown by the entire staff and personnel as to instruction, advice and appointments ..."\(^6\) while another emphasized the "excellent personnel, and spirit in the department ..."\(^7\) The hard work caused by the increasing patient load and the difficulties of working in constrained areas were made easier by everyone's cooperative attitudes. One enthusiastic intern was particularly vivid in his description of the service: "... this department is certainly one of the most outstanding in [the] world for equipment and personnel and it is only natural that young men would like to profit in the utmost from the association."\(^8\)

**Move to the New Department—March, 1942**

Progress in the new installation in the Dulles Building was slow, but the department was able to move into the facility in March, 1942. The space had been specially designed to accommodate private and clinic patients, had ample room for diagnostic, therapeutic, and research activities, and included a sophisticated film processing system. The building was shaped like the letter "T," with the stem part housing diagnostic apparatus and the crosspiece the therapeutic apparatus. There were separate entrances for private and clinic patients, and in some cases separate examination rooms. Private patients also had a room in which to wait. The *film*
processing system was located in the middle of the building between parallel corridors that served private and clinic patients, and was conveniently accessible from either area. The basement provided permanent film storage space.

The department’s ultramodern film processing center was especially impressive. In this facility films were handled in baskets, instead of individually, to speed the developing process and to minimize scratches due to handling. The dryers, specially designed by members of the staff, were located in the wall between the processing room and the film files, and could be adjusted to change both their capacity and the length of drying time. The overall system incorporated the most up-to-date equipment available, and substantially simplified the entire developing process.9

Although eventual expansion in the White Building had created a centralized area for therapeutic work, the move to the new facility in the Dulles Building was especially significant because it was the first time that the design included a comprehensive therapy area. Upon final installation in the new building, the department was able once again to emphasize its comprehensive services and to assert that the new facility would “... bring credit to the Hospital of the University of Pennsylvania.”10

Departmental Operations in the New Facility

The department was very proud of its convenient new facility that was opened during the war years, despite difficulties due to the fact that the move to the new installation occurred simultaneously with the departure of several staff members for military service. The expansion of available services and the resulting increase in the patient load made especially heavy demands on the staff members who remained in Philadelphia.

Eugene Pendergrass was offered and accepted the position of Radiologist to the European Theater for the United States Army, but University Hospital would not release him for military service. In his place he recommended Kenneth A. Allen, a Denver radiologist who had worked with him as an intern during the 1920s. Allen developed a highly successful program.11

A number of staff members from the department left Philadel-
Philadelphia with the 20th General Unit, the University Hospital medical unit which served in India during the war. Within a period of a few months in 1942 the department lost seven physicians, including the two experienced staff radiologists who had worked with Dr. Pendergrass. Philip Hodes went to India with the University Hospital Unit, and George Chamberlain transferred to the Reading Hospital. Pendergrass persuaded Dr. Robert P. Barden, a department Fellow during the mid-1930s, to return to the department from Episcopal Hospital in Philadelphia. These two men continued the operation of the department with the assistance of a single experienced technician. In addition to their routine clinical duties the physicians were ultimately responsible for the complete educational program, training residents, medical students, and student technicians. Dr. S. Reid Warren continued as a consultant and worked as the department physicist. With his help, the assistance of some other consultants, and the aid of a group of residents who quickly assumed responsibility, the department continued to function smoothly.\(^1\)

This smooth operation of the department did not come about easily, however. The experienced staff could only extend itself so far, and even after Dr. Karl Kornblum, a staff member in the late 1920s, returned to work in the department half-time in 1942, the senior men were under considerable pressure. Most of the films were read by residents in the department, although unusual ones were put aside so that Dr. Pendergrass or Dr. Barden could look at them at a later time.\(^1\) In order to finish all their work, physicians remained in the department reading films until late in the evening and worked both Saturday and Sunday as well. Drs. Barden and Kornblum shared responsibility for the department's fluoroscopy on alternate weeks, heading a team that included a physician, two technicians, and two student technicians.\(^1\) Dr. Pendergrass retained primary responsibility for the therapy program following Dr. Hodes's departure, although Dr. Barden was also somewhat involved in this aspect of the department's work. Fellows rotated through the diagnosis and therapy divisions, and coverage was always arranged so that there was one experienced resident in therapy.\(^1\) The department continued to train technicians, but even with this program there was a shortage of technical personnel to assist with all the programs.\(^1\) The staff had little time to participate in seminars or to prepare exhibits for radiological meetings, and their own research projects were relegated to the late evening hours.\(^1\)
A portion of the department's increased patient load was due to an expansion in diagnostic services. During this time the department assumed responsibility for a number of comprehensive surveys, including annual chest examinations for each nurse and intern on the staff at University Hospital, as well as for all the Visiting Nurses in Philadelphia. The staff also began a program of chest examinations of all women who visited the hospital for prenatal care; this marked the implementation of a long-range program to examine the chests of each patient visiting the hospital, whether as an in-patient or an out-patient.18

With the expanded capabilities of the therapy program in the new installation, the Department of Radiology began to function at its maximum daily capacity level, treating approximately fifty patients each day.19 Dr. Hodes's departure had created supervisory personnel problems, and although Fellows generally ran the routine operation, there were serious problems regarding the summer months. In the summer of 1943, a decision was made to close the therapy operation completely for the month of August,20 but after considerable discussion and rescheduling the decision was reversed, and the therapeutic activities continued without a break.21 The mere consideration of such a drastic measure indicates the difficult conditions under which the staff was operating.

Despite an ever increasing patient load, the Department of Radiology continued to work on cooperative research projects with other departments in the University. In 1941 Drs. Gaylord P. Harnwell and Louis N. Ridenour, Professors of Physics, presented the department with a radium measuring device and provided valuable help on therapeutic difficulties. Dr. Warren and Mr. O'Neill from the Moore School continued to provide assistance to the radiologists, particularly regarding the purchase of more equipment for the new installation in the Dulles Building.22 Beginning about 1943 the Department of Radiology also expanded its research to include work in orthopedics and became increasingly close to the hospital's Orthopedic Department. An orthopedist spent time in the Department of Radiology each day reading films, and once a week the two departments held a joint conference to analyze particularly interesting cases.23

As was the case with World War I, during these years the department offered a variety of courses geared toward training members of the Armed Forces. General refresher courses were offered, designed specifically for radiologists, sometimes in con-
junction with programs organized by other departments in the hospital. One interdepartmental program, six weeks in length, was specially organized for physicians in the Army and included work in maxillofacial surgery, thoracic surgery, and surgery of the extremities, in addition to the study of radiologic techniques and diagnosis. The Navy sent personnel, generally not physicians, to the Department of Radiology for two months of intensive training in the fundamentals of radiologic technique. These men functioned in the capacity of X-ray technicians. The department's staff also participated in "Wartime Graduate Training," an organized series of refresher courses, generally in the format of lectures and panel discussions, for servicemen stationed at nearby locations.24

The department's operation during the war years was further complicated by shortages, and in some cases rationing, of both X-ray tubes and X-ray film. The film supply became critically low at times, forcing the staff to borrow films from other hospitals or exercise influence within the Armed Forces structure to secure badly needed films.25 The film shortage was understandable: prior to the war ninety percent of the available national supply had been used in medicine, whereas during the war the Army and Navy used twenty-five percent of the total supply and industry utilized another twenty-five percent, leaving nonmilitary medical installations in the country without sufficient supplies to make unlimited diagnostic exposures.26

When the installation in the Dulles Building was completed, the department possessed the very latest in modern apparatus, including advanced therapy equipment and diagnostic apparatus to execute almost any examination with dispatch.27 The original plans had called for expansion to include a cyclotron, but following the delay of that project due to material shortages and military needs, the department changed the focus of its plans for growth and instead decided to expand the therapy operation to include a million-volt unit.

This unit was specially designed and built by the Westinghouse Company for the department and was unique because a special gas insulation system enabled it to be more economically packaged than a conventional million-volt unit. After the apparatus had been built and paid for, however, the government discovered that its oscillations would scramble German broadcasts, and at the request of a number of high-level government officials, the department released the unit for the war effort. It was in-
stalled in northern Scotland and enabled the Allies to interrupt the German broadcasting which had been disturbing much of England, Wales, and Scotland.28

Following the release of the million-volt unit, the department reconsidered its plans once again, and in early 1943 the decision was made to acquire a 400 kilovolt unit and a betatron. Mr. Donner’s contributions had been responsible for the financing of these planned acquisitions from the start, and in March, upon receipt of his approval, the department attempted to acquire the two new pieces of apparatus.29 However, no 400 kilovolt therapy machines were available at the time, though one manufacturing firm thought that it could make one for the department, nor were there any commercial betatron models available.30 The 400 kilovolt unit was eventually installed, but this early delay, and the general expenditure of time and frustration, taxed the staff’s energy.

Dr. Pendergrass and the rest of the staff kept in close touch with staff members in the Armed Forces and each staff member was kept on the payroll, the department paying the balance between his or her military salary and the salary which he or she would have received in Philadelphia. Despite increases in the staff to replace those members in the military, Dr. Pendergrass promised that everyone’s job would be retained, and after the war most personnel were reabsorbed into the department’s operation.31

The team effort and esprit de corps among the department’s staff helped it to pull through several difficult war years. Shortages in personnel and equipment, and disappointments regarding new purchases of apparatus, presented psychological as well as practical obstacles to the operation, yet the staff continued to function effectively, to pursue individual interests, and to offer increased services to patients. The expansion might have been smoother without war shortages, but with the constant support of their Chief, the staff operated a first-rate department and continued its reputation for excellence.

Dr. Pendergrass’s Participation in the Atomic Bomb Program

Although he was unable to go to Europe to serve in that theater during the war, Eugene Pendergrass was commissioned in both
the Army and Navy from 1946 until 1948, and served as a Radiation Safety Officer during the testing programs that followed the explosion of the nuclear warheads over Japan. He was assigned to a large group responsible for analyzing and predicting the results of exposure to radioactivity and served with a number of other scientists and radiologists.

Pendergrass's portion of the project was under the direction of Dr. Stafford Warren, Professor of Radiology at the University of Rochester. After indoctrination, the group was sent to an island in the South Pacific where some 80,000 Americans, including specialists in every aspect of science, were gathered to carry out this research. Classes were held each day, and lecturers did their best to hypothesize the long range effects of radiation exposure. Dr. Pendergrass's primary responsibility was to warn people when and how to protect themselves. As a physician, he was also responsible for general medical work and became involved in some counseling situations as well. There was real concern among many of the servicemen about their safety on this operation, and Pendergrass found the chaplains and priests especially helpful in allaying fear among the men.

Pendergrass was most directly involved during the series of underwater detonations of the atomic bomb. A number of Navy vessels were deserted, tightly sealed, near the test site, and it was his responsibility to analyze the degree of contamination following the explosions. Results showed a surprisingly high degree of radioactivity. Pendergrass and his associates were repeatedly exposed to considerable amounts of radiation, but not a single individual suffered permanent damage.

After a few months Dr. Warren was required to return to the United States, so Dr. Pendergrass was in complete charge of the operation for a time. He was in the South Pacific for close to six months in 1946, and was also made a consultant to the Atomic Bomb Casualty Commission when it was established in Tokyo, Hiroshima, and Nagasaki. He returned to Philadelphia shortly thereafter, but remained involved with the Commission as an interested, though distant, consultant.32
The department's staff was involved in teaching on a myriad of levels: undergraduate medical students, graduate medical students, interns, residents, student technicians, and physicians from other institutions. The approach combined both formal and didactic instruction, and there was considerable personal interaction with the staff members.

The teaching program for undergraduate medical students was rather limited during the 1940s, its scope much the same as it had been in the 1930s. As in the past, the first and second year students were introduced to the department, along with a number of other specialties, at clinical conferences. Practical exposure to radiology came only during the third year, and even that was limited. Planned changes in the curriculum in the late 1940s would offer electives in radiology for the first time. Third year students would be able, possibly, to choose instruction in either diagnosis or radiation therapy. Students would also be encouraged to work in pathology or anatomy and combine that work with a project in radiology, and especially interested students could work with radio-isotopes. These curriculum changes were not implemented immediately but marked, for the first time, a real interest in undergraduate medical education.

Even before these opportunities for elective course work in radiology, however, medical students and graduate students in other fields had expressed interest in the specialty by working in the department during summers, or pursuing independent research projects during the academic year. Two medical students spent the summer of 1944 working in the department, and beginning in 1947 John Hale, a graduate student in electrical engineering, began to express an interest in the field and to work with the staff physicians and consultants from the Moore School. He was later to become the department's first full-time radiological physicist.

Interns had been serving rotations in the department for nearly twenty-five years by the end of the 1940s when changes in the hospital's internship program necessitated concurrent changes in the department's scheduling of intern instruction. During the 1930s and early 1940s, interns had complained because their two month service in the Department of Radiology was shared with responsibilities in both the Eye and Receiving Wards. There was
not a uniform exposure to the department's many programs, since interns spent varying amounts of time learning about the department's many functions. In 1949 the term of service was shortened, and the intern generally spent two weeks or less working solely in the Department of Radiology. The advantages of concentrating in one department were offset by the exceedingly short length of the service, and although the staff revamped the approach with an eye to the overall operation, the amount of practical experience was minimal.35

The department continued its program to train X-ray technicians throughout the 1940s, although at times during the war years it seemed likely that this program would be phased out. The curriculum became more extensive, the calibre of the students improved early in the decade, and by 1942 the teaching approach included practical demonstrations by other technicians and physicians as well as special classroom courses. During the 1930s the student technicians had joined the graduate physicians for Dr. Warren's course in radiological physics, but in the fall of 1942 he introduced a new physics course, taught specifically for the student technicians.36 Staff physicians had considerable contact with these students and, in addition to demonstrating practical techniques, were responsible for weekly quiz sessions.37 New classes of technicians began at sporadic intervals throughout the 1940s, and the students gained, through a combination of formal and preceptorial instruction, a thorough knowledge of X-ray technology.

The department's primary teaching emphasis was directed toward the group of physicians composed of Fellows and residents. At some times this semantic distinction was of particular importance (a Fellow might be a physician staying on after his residency for special work, or he might be receiving funding from a specific outside organization), but at other times the titles were used interchangeably. However, it was generally felt that the term "Fellow" carried more status throughout the hospital, and it was used as much as possible.

During the 1940s the fellowship program was three years in length and most of the physicians were also enrolled as degree candidates in the Graduate School of Medicine. Their initial exposure to the department included rotations through both the diagnostic and therapeutic divisions, and later often included rotations through other departments in the hospital as well. Fellows were enthusiastically encouraged to pursue independent
research projects and were often asked to report on the progress of their work during staff meetings.

Dr. Pendergrass stressed the active participation of Fellows in the department’s routine as soon as possible, and encouraged other staff members to allow residents to execute various techniques after a minimum of observation. Fellows were also eventually assigned their own interns and were responsible for training them during their term of service in the department.

Throughout their training in the department, the Fellows were treated as respected members of the professional team, and Dr. Pendergrass expected them to work just as hard as the rest of the staff. They worked in a supportive, non-competitive atmosphere, and their opinions were sought and listened to at staff meetings. Dr. Pendergrass had the knack of encouraging these young physicians, knowing when to give them responsibility. Under this guidance they made effective contributions to the department’s operation.

There was a definite emphasis on diagnostic training during this period, and although residents were exposed to the therapy program, it always took second place to the diagnostic side. This was particularly clear when Fellows were assigned to cover for doctors who were attending conferences, because the physicians on the treatment side always provided the necessary manpower to replace the absent doctor. Residents were also responsible for staffing the department on evenings and weekends to provide necessary emergency coverage. Provisions were made for modest accommodations at the hospital for the physician on call, and during these times this individual was responsible, with the assistance of a technician, for the department’s complete operation.

The staff also encouraged the Fellows to spend a portion of their training outside the Department of Radiology, so residents rotated to other departments in the hospital or to other hospitals. Fellows often spent time in the Departments of Pathology, Surgery, and Surgical Research, and in 1949, for the first time, a resident rotated through the Department of Gynecology.

Interaction with the Department of Gynecology was particularly important because that department had been treating its patients with radium ever since 1917, with little or no input from the radiologists. Dr. Pancoast had originally suggested that Dr. John Clark, Chief of Gynecology, treat his own cancer patients, but subsequent lack of communication and cooperation meant that the gynecologists were working without any consultation on
treatment programs or consideration of possible new techniques. When Dr. Pendergrass sent his first Fellow to the Department of Gynecology, he had him make radiographs after the insertion of radium in the vagina by the gynecologists. His results showed that in nearly eighty percent of the cases the radium slipped, making the treatment ineffective for treating cancer of the cervix, and potentially dangerous. Although initially upset, the gynecologists acknowledged their difficulty and began to send their residents to the Department of Radiology for training in various types of therapy. This exchange of residents proved very successful and was the beginning of a good cooperative relationship between the two departments.43

Residents were also sent on rotations to other hospitals to give them an opportunity to see radiology departments in different contexts, including community hospitals and rural institutions. Since a number of these physicians would not be practicing radiology in a large university setting with the special problems of an academic department, the rotation to other hospitals was a particularly important part of their general radiological training.

By the end of the 1940s Dr. Pendergrass had begun to secure outside funding to help finance the fellowship program. This was important because he was in the process of increasing the program’s length to four years. The number of Fellows had increased dramatically following World War II, and this substantial increase in staff, without concurrent increases in departmental income, would have placed a heavy strain on the operating budget. Considerable funding came from the National Cancer Institute and the national and local branches of the American Cancer Society, in further recognition of the department’s reputation and status in American radiology.

At about the same time the department was also given its first fellowship, by members of the Heublein family. Established in 1946, the Arthur Carl Heublein Memorial Fellowship was named in memory of an eminent radiologist from Hartford, Connecticut. His son, Gilbert W. Heublein, had trained as a radiologist under Dr. Pendergrass at Pennsylvania, and his association with the department was responsible for the establishment of the memorial to the senior Dr. Heublein at University Hospital.

Members of the Heublein family and Heublein, Inc., the family liquor company, established the original fund and contributed to it periodically. This fund was used to supplement the stipends
of outstanding Fellows, and was important in later years because its unrestricted nature allowed the department to use it to support a number of foreign physicians who were ineligible for federally funded grants.

The department’s extensive participation in educational programs was supplemented by programs for practicing radiologists from Philadelphia and nearby communities. A series of Tuesday conferences, originally geared toward graduate students, was gradually reoriented toward advanced radiologists, and they gathered at University Hospital to review interesting cases and discuss difficulties. Staff members also worked with the Philadelphia Roentgen Ray Society to organize special seminars and refresher courses, some in conjunction with the American College of Radiology. This commitment to education, and the staff’s desire for exposure to inquisitive students as well as to new advances in radiology, kept the creativity, enthusiasm, and competence of the department at a high level.

Growth in the Department Following the War

The department’s staff began to expand after the end of World War II; this growth was only partially due to the return of the physicians and technicians who had been serving in the Armed Forces. The residency training program grew considerably during this period, and several of the radiologists who had trained in the mid-1940s remained affiliated with the department following their residencies, so that there were often four or five associates on the staff in addition to eighteen or twenty residents. This growth allowed the physicians to become somewhat more specialized in their responsibilities and allowed the department to expand its areas of investigation and service.

Dr. Pendergrass was gone for several months during 1946, while serving as a Radiation Safety Officer for the postwar atomic bomb tests, but by this time the regular staff had begun to return and there were enough physicians adequately to run the department. Dr. Barden was given full responsibility for the therapy program, the operation in which he had been partially involved with Dr. Pendergrass during the war. With the assistance of Dr. Richard H. Chamberlain, a young physician who completed his
residency in 1946 and actually ran the treatment program, the
operation proceeded smoothly.45

The entire world was extremely conscious of radiation expo­
sure following the bombing of Japan, and this attitude presented
some difficulties for the department’s normal operation. The
physicians and physicists had to maintain a sensible approach
toward the possibility of hazards and, at the same time, calm
patients who were overly concerned about radiation exposure.
Careful attention was paid to protective gloves and aprons worn
by operators and patients to assure maximum possible safety.

A part-time social worker was first assigned to the department
in 1947, and she provided a special contact for therapy patients
dealing with practical or emotional problems as a result of their
chronic illnesses. Although the department had long been cred­
ited with the sensitive care of these patients, the addition of a
professional trained to do this type of counseling improved the
department’s services and relieved the physicians of some of this
responsibility.46

A new radium room was completed in 1947 and furnished with
the most up-to-date equipment for radium therapy.47 The ther­
apy program was further expanded in the spring of 1948 when
a new Brache-Seib superficial therapy machine was installed.48
Potential difficulties in treatment had arisen in June 1948, when
the last Chaoul therapy tube was in use and there was some
question as to whether or not replacement tubes existed. Two
additional tubes, found in Europe, would serve to alleviate this
problem, and the acquisition of the superficial therapy apparatus
provided some backup should the Chaoul therapy machine be­
come inoperable.49 Isotope techniques were also being introduced
in the department at this time. Dr. Richard Chamberlain was
most closely involved with the expansion of this program.50

Improvements were also made to the department’s physical
plant in 1948, with the beginning of a program to air-condition
the entire department. This project was not completed until seven
years later, but did provide relief as it was gradually expanded
throughout the facility.51

Dr. Pendergrass and his associates remained cognizant of the
difficulties faced by veterans in the employment market follow­
ing the war, and at the encouragement of one of his residents he
hired a blind veteran to run the department’s film processing
operation. Minimal design changes were implemented to make
the operation compatible with his disability. This proved very
successful, setting a precedent which was followed in a number of other departments throughout the nation.\textsuperscript{52}

As the decade of the 1940s drew to a close the department was growing steadily, not only because of an increased patient load, but also because new advances in the field of radiology opened a myriad of opportunities for scientists and physicians. The Department of Radiology at University Hospital, always a forerunner in the field, was to maintain its position as the specialty continued to expand.

The Association of Pendergrass Fellows

The Association of Pendergrass Fellows was formed in 1948 by four physicians who had served as residents under Eugene Pendergrass: Fay K. Alexander, George W. Chamberlain, John H. Harris, and Philip J. Hodes, to show their respect, affection, and loyalty for their Chief. In their letter to him, telling of the Association's formation, they further explained that it was to be: "... an informal organization which is dedicated to you, to the principles for which you stand, and to friendship.\textsuperscript{53}

In the early years the group met annually for a dinner meeting in conjunction with one of the national radiological conferences. The first meeting was in Cincinnati in October, 1949, and the Fellows presented an inscribed silver tray, autographed by all those present, to Dr. Pendergrass. The tray was periodically returned to the engravers for more signatures, and even physicians who were unable to attend the meetings included themselves in this memento.

A magazine, Grassroots, was published yearly beginning in 1950. This communication kept track of the various Fellows and their current positions and kept members of the Association up-to-date with the developments in the department at University Hospital. It provided an excellent communications link—former Fellows could find out about current residents and the changes in and additions to the department where they had trained, as well as the activities of their Chief and his colleagues.

At their annual meeting in September, 1951, the members of the Association decided that it would be appropriate for Dr. Pendergrass's portrait to be painted, to be completed in the near
future while he still looked as they would remember him. Pen­
dergrass was somewhat reluctant to have the Association pay for the portrait, although he was enthusiastic about its execution, but he eventually agreed to accept the portrait as a gift from the Fellows. It was painted by Roy Spreter, a well-known portrait artist in the Philadelphia and New York areas, and completed in the fall of 1952. The portrait hung in Dr. Pendergrass’s home until 1961 when he retired; upon his retirement he gave the portrait to the University and it was hung in the Department of Radiology at the hospital.

In the mid-1950s the Fellows changed the format of their annual meeting and began planning seminar gatherings at various east coast resorts. Early seminars were held at the Greenbriar and at the Homestead, and offered an opportunity for the members of the Association to bring their wives, to play golf or tennis, and to see their old friends. Mornings were spent in seminar sessions with formal presentations by Fellows, offering an opportunity for professional discourse and a tax deduction.

Gatherings of the Association of Pendergrass Fellows continued throughout the decade, and the ranks of the Association grew with each year’s class of residents. The establishment of such an organization, inspired by the personal warmth and knowledge of a single physician, explains perhaps more than anything else the calibre of the work in University Hospital’s Department of Radiology.

Departmental Operations During the 1950s

As the department’s programs and services began to expand during the 1950s, there was a concurrent increase in staff at all levels. However, the growth of the staff did not keep pace with the increase in the patient load due to Dr. Pendergrass’s concern about unstable financial conditions, and throughout the mid-1950s he added to the staff only cautiously. A particularly heavy work load was placed on the department’s technicians as they assumed responsibility for much of the pre-examination interviewing formerly done by physicians. In addition, some assistance was provided by two technicians’ aides who were hired to assist with fluoroscopy.
The radiology installation which opened in the Dulles Building in 1942 had provided ample space for the department's programs at that time, but by the early 1950s the diagnostic and therapeutic facilities were overcrowded and there was a critical shortage of laboratory and research space. The construction of the Thomas S. Gates Memorial Pavilion in the early 1950s provided a major new hospital facility designed for out-patient care, and although the department was not assigned any space in the new building, it was able to plan the expansion of the diagnostic operation into six rooms east of its administrative offices and library, following the relocation of the Obstetrics and Gynecology Clinic. Unfortunately, there was no space available for the simultaneous expansion of the therapeutic and research operations. Long range plans included expanded facilities for these operations in the basements of the Dulles and Gates Pavilions, but these plans were never fully realized.

By 1952 the department had decided to build a large film reading room (subsequently dubbed the "Ball Room") in the new space, as well as to use a portion of it for an out-patient diagnostic clinic which would operate separately from the main radiology facilities. This separate clinical operation served two purposes: one purpose was to isolate patients resident in the hospital from out-patients, and the other was to function as part of the hospital's newly organized Private Diagnostic Clinic. This special clinic, modeled after the Mayo Clinic and partially funded by William H. Donner, opened in 1954 to provide superior diagnostic care by a staff of specialists. This was the first cooperative effort by the hospital's physicians, and it was hoped that Philadelphia corporations would send their employees to the clinic for thorough periodic examinations.

The department formed an independent division under the direction of Dr. Roderick Tondreau, a radiologist who had worked at the Mayo Clinic, to operate this new out-patient facility. His staff included a senior resident, a staff technician, a student technician to work in fluoroscopy, a receptionist, a file clerk, and a darkroom attendant. The new facility was called "Clinic Radiology" or "Out-patient Department" (commonly referred to as the OPD), as opposed to the older diagnostic division, which would be called "Hospital Radiology" or "In-patient Radiology." These titles were somewhat imprecise, however, because the new facility served only two specific groups of out-patients: patients in the Private Diagnostic Clinic and regular
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clinic out-patients. Private out-patients continued to be examined in the older diagnostic facility, along with hospital in-patients. The new facility was designed to accommodate approximately forty patients each day, thirty-five of whom were clinic out-patients and five of whom were patients in the Private Diagnostic Clinic. There were three fluoroscopic rooms and five radiographic rooms in the separate department; its staff used the "Ball Room" for viewing films with the rest of the staff.

The Private Diagnostic Clinic never achieved substantial success because many of the hospital’s physicians still preferred to see all their patients privately rather than to participate in this cooperative program. The Department of Radiology supported the program wholeheartedly, however, and radiological services were donated free of charge in hopes that this might help the Clinic to become self-sufficient. Although it did not attract great numbers of patients for in-depth diagnostic studies, the clinic did provide annual diagnostic examinations for many local corporate executives.

The continued separation of the department into diagnostic and therapeutic divisions contributed to its ongoing efficiency. There was some disruption of general operations in 1953 when the administrative offices were temporarily relocated in the Gates Pavilion during construction, but, as usual, the staff accommodated its work to this added inconvenience. By the mid-1950s the staff was reading clinic films in the afternoon which had been exposed that morning, and was working toward a goal of reporting an entire day’s work the same day the films were exposed. Films were checked for technical errors before a patient left the department, preferably before he redressed. This responsibility was assigned to the physician on call, usually a resident; indeed, this procedure was so important that technicians were instructed to ask a senior staff member to read the wet films if the doctor on call was unavailable, rather than delay a patient unnecessarily. Special precautions were taken to insure that the films of private out-patients were properly checked.

Upon completion of the "Ball Room," the department instituted a unique system of film viewing which proved exceedingly successful for both the department’s staff and physicians from elsewhere in the hospital. All exposures from hospital ward patients were displayed at the end of each day, and they remained on view throughout the following day. Radiologists and physicians from other departments met at prearranged times...
every day to jointly review the films of the referring doctors’ patients, providing an excellent opportunity for inter-departmental interaction.71

Much of the apparatus in the department was purchased in the early 1940s during the move into the new facility, and it had seen hard use during more than ten years of service. Throughout the 1950s purchases were made to upgrade the quality of the apparatus, and, even more importantly, to provide more up-to-date equipment. In 1951 the department purchased two new two-tube radiographic and fluoroscopic units,72 and a year later a Franklin Angiograph was added to the diagnostic equipment. This piece was designed by Dr. Richard Chamberlain at the University of Pennsylvania, Dr. Edward Chamberlain at Temple University, and Bill Hogan, a local manufacturer of radiologic equipment, and was only the second such piece built (the first was at Temple). It was constructed with two tubes at right angles and could take right angle films simultaneously, as well as stereoscopic films at one-half second intervals. The apparatus, used for procedures requiring serial films, was especially valuable for viewing the heart and vessels of the head, chest, and abdomen.73 Additional pieces of apparatus were purchased to increase the capabilities for body section tomography, and cinefluorographic equipment was also introduced.74 In the late 1950s an X-O-Mat mechanical film processing system was installed; it was considerably more efficient and saved a great deal of time, but used ten times more chemicals than earlier equipment had.75

The therapy division was particularly interested in the possibilities for supervoltage therapy, but extensive work was delayed until the construction of a new facility toward the end of the decade. Meanwhile, staff members designed and constructed a rotation therapy device, funded by the State Cancer Commission,76 and added a therapy unit to treat certain forms of deep-seated malignancy.77 In 1955 a twenty-five milligram radium cell was donated to the department by Frank Hartman.78

In 1950 a Physics Committee was established to consider the long range importance of physics in the department’s programs. Composed of Drs. Pendergrass, Warren, Chamberlain, Hodes, Hale, and the staff physician at Jeanes Hospital, this group had many responsibilities: analyzing equipment, measuring instruments, assuring the safety of various protective devices in use, developing new apparatus for diagnosis and therapy, and supervising the electronics laboratory.79
Renovation of the reception and waiting areas was completed in the mid-1950s to redirect traffic flow and to modify operations to allow for the separate out-patient facility, and through the generosity of a friend the air-conditioning of the department was completed in 1955. All private patients continued to be examined in the older facility, and for some procedures there were different examination rooms for private and ward patients. There had been a separate entrance for private patients since 1942, and in 1956 a hostess was hired to expedite their examinations and to make their visits as pleasant as possible.

The department’s income varied markedly during these years, and there was a continuous problem of nonpayment; in many cases the patients were never even billed. The greatest losses arose from patients examined during the evening and weekend hours, when the regular clerical and administrative staff was not working, and at one point in 1958 the department estimated that only twenty-five percent of the potential clinic income was being collected.

There were additional financial problems because therapy patients were rated by the hospital’s billing service, and the calculations made determining their ability to pay were often too low. Many patients were able and willing to pay more than the amount stated for their treatment, but felt that they had been placed in an awkward position by the hospital’s billing office. During the summer of 1954 the department changed its therapy billing procedure, however, and thereafter patients were charged for the actual expenses incurred by the department in the course of their treatment. This system worked well, and substantially increased the income received for therapy.

The department usually charged a flat fee for ward examinations, regardless of the number of exposures taken or the degree of difficulty of the procedure. The reimbursement scale for ward patients was graduated, however, dividing them into categories of “full-paid,” “part-pay,” and “no-pay,” further reducing the amount of the flat fee. Late in the 1950s the department changed its diagnostic rate structure, and began charging ward patients for work actually done. This system financed the true costs of this division’s operation.

Administrative, technical, and financial procedures became more involved during the 1950s as the department expanded its services and facilities and saw an ever-increasing patient load; nevertheless, superior service for patients continued to be the goal of the
entire staff and every effort was made to operate the department in the most efficient and comprehensive manner possible.

Research Programs During the 1950s

The department's staff members carried on a wide variety of research investigations during the decade, which involved the evolution of new techniques, the analysis of clinical data, and the design and construction of new types of apparatus. Work with radioisotopes was just beginning, and this specialization supplemented the established research program in diagnostic and therapeutic radiology.

The explosion of atomic bombs over Japan had generated enormous concern about the effects of radiation exposure, and some staff members pursued the investigation of the biological effects of radiation exposure and their control. This project was begun initially to analyze the impact of radiation on animal life, but was eventually expanded to analyze the effects on humans as well. Much of the research was sponsored by the Army, and also focused on methods of protection from the effects of radiation.

Staff members also worked on the application of television principles to fluoroscopy, in an effort to amplify the fluoroscopic image and thereby improve its quality and reliability. James S. Picker of the Picker X-ray Corporation provided funding for a portion of this research because of his dual interest in improving the fluoroscopic image and in supporting the Department of Radiology at Pennsylvania; the department and the company had worked in close association ever since Dr. Pancoast's time. This project was carried on in the basement laboratory area with the research in both radiation physics and radioisotopes, and resulted in the construction there of an operational unit. By 1954 the apparatus was ready for clinical use, and appropriate patients were taken downstairs to utilize this improved diagnostic apparatus.

Joint research with the Departments of Medicine and Surgery sought to identify forms of cardiovascular disease which were particularly amenable to surgical relief. The success of this research, the early stages of angiography, was due in large part to the apparatus designed by members of the Department of Radiology. Departmental interest in cranial problems prompted a long-
range analysis which proved especially helpful to the hospital’s neurologists and neurosurgeons. Additional diagnostic research involved the reevaluation of the chest roentgenographic routine, and an intensive analysis of procedural and diagnostic fundamentals brought about some substantial changes in both technique and film interpretation. 92

Analysis of dosage patterns in the treatment of cancer of the cervix was carried on in cooperation with the Department of Gynecology. The close interaction with this department, which began in the late 1940s, directly involved the radiologists in planning therapy programs for gynecology patients, and served to expose physicians in both specialities to new developments in the other field. Additional therapeutic research included a more careful analysis of the measurements used in radiation therapy application. 93

Research in radiobiology, initiated as part of the isotope program, was expanded considerably in 1958, when a grant from the Fels Fund enabled Dr. Mortimer Mendelsohn to join the department’s staff. 94 He concentrated on the utilization of radiational techniques for the investigation of problems in cell biology. The resultant interaction with the scientific research community helped to maintain the department’s reputation as a cooperative staff in both the medical and scientific communities, and as one interested in any developments which related to the use of radiation. 95

The wide scope of the department’s research efforts at this time, in addition to an ever-increasing patient load, provided evidence of the staff’s deep commitment to the field of radiology. Each physician, from the Chief to the newest resident, was enthusiastically encouraged to pursue his particular interests, and the result was an extensive research program: “It may be stated with just pride that there are few departments in this country, excluding those that are Federal or State owned, where more fundamental research is being done.” 96

Early Work with Radioisotopes

Richard H. Chamberlain began to work with radioisotopes in the department in 1947, and in 1950 the old radium room was converted to laboratory space for this work. A research project gradually developed, investigating the potential uses of isotopes for
both diagnostic and therapeutic work, and these new techniques were eventually incorporated into the department’s procedures. Chamberlain had assistance from other interested individuals, including the staff physicists, a student physicist, a health physicist, a Fellow, and a technician.  

The laboratory space was extremely crowded, but even under such adverse conditions an amazing amount of clinical and research work was accomplished. A therapy program was initiated in 1951 to treat cancer of the thyroid with radioactive iodine, and radioactive colloidal gold was used therapeutically in the treatment of peritoneal and pleural metastasis. Although these treatments were not cures, the new therapeutic programs utilizing radioactive materials offered considerable hope for the future. Radioactive elements were used diagnostically in tracer studies to analyze diseases and the function of internal systems. Staff members also spent time developing new instruments to safely handle and measure activated elements.

Despite consistently difficult working conditions, the scope of work continued to expand. In 1952 clinical work with radioisotopes included the treatment of severe cardiac disease, as well as treatment for malignant diseases and hyperthyroidism. New diagnostic scanning devices were utilized, and instruments were designed to further minimize the dangers of handling radioactive materials.

In 1953 the hospital’s Board of Managers agreed to provide 3,000 square feet of space, in the basement of the Dulles Building under the department’s therapy area, for the construction of the Research Radiology Section. Construction was financed by a gift from the Mary Hamilton Kuhn Gordon Cancer Research Fund. The space was equipped with a high level laboratory for radioactive isotope work, electrical and machine shops, physics office space, and a conference room. This space facilitated further expansion of this research throughout the decade.

The Beginning of Work in Nuclear Medicine

David A. Kuhl, a medical student who had studied physics at Temple University as an undergraduate, began to do research in nuclear medicine as soon as he arrived at Pennsylvania in 1951.
Kuhl originally worked in the Physics Research Laboratory, located in the medical school, and his projects complemented the main research in the Department of Radiology. He eventually moved to the Dulles Building, into a small room in the middle of the Obstetrics and Gynecology Clinic on the ground floor. In 1953 he moved again, to a convenient location near the electrical and machine shops, when additional space was acquired by the Department of Radiology in the basement of the Dulles Building.\textsuperscript{101}

In 1951, while a first year medical student, Kuhl designed his first scanner. Utilizing this scanner and a scintillation detector, he was able to determine radioisotope distribution in the body. The scanner was located in the Physics Laboratory in a corner of the basement of the Dulles Building, to which patients were brought for diagnostic examinations.\textsuperscript{102} Kuhl continued to work on the problem of creating images of radioisotope distribution while in medical school, with some financial support from John Hale’s grant.\textsuperscript{103} In 1955 Kuhl designed and constructed the first photo-recording system to produce a grey-shade record of the radioisotope deposits in the body viewed by the scanner. This system incorporated a motor-driven detector which moved back and forth across the body of the patient, and used light to create images on film corresponding to the deposits of radioisotopes in different parts of the body.

David Kuhl served his internship at University Hospital from 1955 to 1956, and during that time continued to do work in nuclear medicine in the Department of Radiology. He remained at the hospital for several weeks following his internship before entering the military service, and during that time he continued to see patients. All throughout his medical studies and internship, in fact, he had conducted all the scans on patients himself.

Kuhl returned to the Department of Radiology in the fall of 1958, to serve a regular residency in radiology. His experience and reputation in nuclear medicine had increased considerably during the two years that he was head of the Radioisotope Laboratory at Portsmouth Naval Hospital. When he returned to University Hospital he obtained a grant to support his research. He followed the normal residency program and continued his research work in his spare time. While still a resident he taught courses twice a year in Bethesda.

During 1958 and 1959 David Kuhl and his associates developed the principles of body section tomography in nucleotide
scanning, the forerunners of the principles of the EMI Scanner. These early advances in radionucleotide-computed tomography brought about a major breakthrough in nuclear medicine, indicative of the incredibly important work Kuhl was doing while still a resident in the department.

David Kuhl remained in the department following the completion of his residency, and in the early 1960s the division of Nuclear Medicine was formally recognized within the Department of Radiology. Kuhl’s contributions to the department’s program were recognized as he emerged as one of the most important pioneers in the field of nuclear medicine.104

Interaction in the Hospital Community

Joint research and clinical projects with other departments had long been a tradition in the Department of Radiology, but by the 1950s questions arose concerning day-to-day interactions with other departments in the hospital. Radiology’s position was somewhat unique, since it provided service for almost every department, and since its operation directly influenced work throughout the hospital. This placed considerable outside pressure on the staff.

Particular difficulties arose when staff members from other departments requested information immediately upon the completion of an examination, before the radiology staff had had time to process and interpret the films. An ever increasing patient load, a growing number of Fellows, and an expanded curriculum for undergraduate medical students placed heavy demands on staff time. The demands of physicians from other departments for an immediate diagnosis of their patients’ exposures caused considerably more confusion and inefficiency.

Requests from members of the surgical staff were particularly frequent during 1950 and they prompted Dr. Hodes, then head of the diagnostic division, to seriously consider the department’s purpose: was the department, as a department of radiology within a hospital, intended to function as a diagnostic-clinic department, and would it therefore provide immediate service but disrupt the normal organization of the work flow and teaching program? Or, could the department function more indepen-
dently, maintaining the same autonomy of operation as did others, such as surgery and gynecology? Hodes urged a commitment to cooperative independency, and concluded a memorandum to Dr. Pendergrass in 1950:

No one realizes better than I that ours is a Department dedicated to "service." This is your order to us and it is what all of us are trying to do. But somewhere, "limitless service" must stop if the best interests of our Department are to be served. Unless we are prepared to make radical changes and go to considerable expense, we just cannot go on giving this "limitless service." 105

The specialty of radiology was undergoing introspection everywhere during the 1950s as radiologists considered their role in the expansion into nuclear medicine and the introduction of new procedures, such as angiography, previously considered to be the absolute domain of the surgeon. Members of the Department of Radiology at University Hospital were particularly concerned with these questions.106

Radiologists were also concerned about the acceptance of radiology as a medical specialty, rather than a hospital service, by persons outside of the medical profession. The Blue Shield insurance system, for example, would cover the expenses of therapeutic work for a patient treated by a gynecologist or surgeon, but not for a patient treated by a radiologist. 107 This policy generated considerable concern, not only because it placed severe hardships on chronically ill patients, but also because it created difficulties in public relations. Because the department had been treating patients since 1903, the inequities seemed particularly blatant.

Hospital physicians also relied on radiology staff members to participate in other hospital operations, including taking exposures in the operating room. Once this procedure was in progress the surgeon often assumed control, however, and it was difficult for the radiologist, usually a Fellow from the department, to assert his role as a specialist. 108 Such difficulties were, quite obviously, difficult to resolve.

Because Dr. Pendergrass operated the department independently from the hospital, paying the institution on a predetermined sum to cover rent and maintenance, the question of relocating and financing the department's physical expansion was a difficult one. When plans for the Donner Center for Radiology were under consideration in the mid-1950s, additional problems arose between the hospital and the department regarding the
division of income received from services in the new building. Throughout these years, however, the hospital realized the tremendous impact of the Department of Radiology upon the entire institution, and efforts were made to devise mutually acceptable arrangements with consideration given to maintenance of departmental autonomy. Dr. Pendergrass encouraged his staff to try to develop better relations with the hospital administration, in the hope that this would increase the hospital’s interest in the department’s finances and make it more willing to share some of the expenses. 109

Teaching Program for Physicians During the 1950s

The expansion of the fellowship program, begun after World War II, continued during the 1950s; in the year 1950 there were twenty-one fellows with plans for even more in the future. The length of the program varied: it was lengthened to four years after the Second World War, shortened to three years from the Korean War into the mid-1950s, and later expanded to four years again. Residents continued to rotate through the Departments of Surgery, Pathology, and Gynecology, and some spent time working at other institutions in or near Philadelphia. They were encouraged to pursue original research as well as to analyze clinical studies, and the staff made every attempt to give each resident a project on which he could work during the years he was in the department. 110 A number of papers were published as a result of this research. 111

A portion of the rotation through the Department of Surgery was spent in the operating room, providing X-ray coverage. The resident was responsible for the execution of all radiographic procedures during the operation, and he decided the scope of the examination. 112 Residents working in pathology were responsible for organizing cases to be sent to the Armed Forces Institute of Pathology, and throughout the years the department made many contributions to the Institute. 113 The rotation through the Department of Gynecology was closely allied to their specialized cancer treatment program, and offered an unusual opportunity for residents interested in therapy to see its implementation in another department.
Reciprocal arrangements with Chestnut Hill and Pennsylvania Hospitals enabled Fellows to spend time working in departments which were smaller and more personalized than the one at University Hospital. The radiologist at Jeanes Hospital, a former Fellow under Dr. Pendergrass, encouraged students to rotate there as well. Dr. Pendergrass was also enthusiastic about the opportunities for residents to receive exposure to nonhospital radiology, and was pleased when he was asked to establish a diagnostic facility for the Pennsylvania Manufacturer's Insurance Company. This company, located in center city Philadelphia, equipped a small facility to examine policyholders who had suffered injuries, and a Fellow and a technician from the department ran this operation. This affiliation was structured as a fellowship appointment, as were the trainee positions with the American Cancer Society and the Heublein and DuPont fellowships, and the resident received financial support for his work. The physicians working at Jeanes Hospital during this time were also given small honoraria.\(^114\)

Financing for the continued expansion of the residency training program was substantially aided by a number of trainee positions and fellowships from local and national cancer organizations, industry, and individuals. Many physicians were taken on as residents in their first year or two in the department, and as Fellows in subsequent years; the title change reflected their support from an outside funding source and their individual research projects. Without this outside support the department would have been much more restricted in the scope of its training program.

Pendergrass encouraged Fellows to make clinical visits to other institutions throughout the nation, in addition to their regular hospital rotations. Residents would often go to Massachusetts General Hospital, Columbia University, or the University of Minnesota, and this was thought to be particularly valuable because they were able to compare several superior radiological operations. The Fellows would relate important new developments in radiology which they had observed elsewhere to the staff at University Hospital upon their return.\(^115\)

A great deal of a Fellow’s instruction was presented informally, particularly at the many weekly conferences held by the department. Some of these conferences emphasized special subdivisions within the specialty, while others brought together physicians from all over the city to discuss their interesting cases. Many of
these conferences focused on diagnostic radiology, but the staff made certain that the residents serving rotations in therapy had an opportunity to attend a variety of conferences while on this rotation as well. In the mid-1950s the department initiated an especially important weekly conference on radiotherapeutics, bringing together physicists, radiobiologists, and radiologists to discuss both the clinical and the theoretical aspects of radiation therapy. Its reputation grew quickly, and the weekly meetings received favorable comment throughout the United States. The conferences reemphasized the department’s concern for continuing medical education, and its willingness to serve the entire medical community.

The diagnostic training for Fellows centered on practical experience, and residents were given responsibility for reading films shortly after their initial instruction. These films were usually from clinic and hospital ward patients, and the Fellows’ diagnoses were later double-checked by members of the senior staff. This approach extended the resident’s responsibility, because he was forced to make his own analysis of the films, without any immediate feedback, and only later learned whether or not the experienced staff agreed with his diagnosis.

Residents were encouraged to work with Dr. Chamberlain and his research with radioisotopes in the basement, and to apply for special training in this field if they were interested. Exposure to the scanning and related nuclear medicine procedures also came while on the job. A new teaching file system was introduced in 1954, and this resource proved helpful for Fellows, staff, and medical students.

There were some changes in the department’s operation during the Korean War, and as had been the case during prior conflicts, the staff was involved in programs to train medical personnel in radiology. In most cases, however, some emphasis on military medicine was added to the normal curriculum, rather than developing an entirely separate program for members of the Armed Forces.

The University and the Department of Radiology tried very hard to protect their students from the military draft so that there would be a continuous supply of specialists in the field; nonetheless, a number of the department’s residents left in the middle of their training to serve in the military, and returned after their tours of duty to complete their work in radiology. Some accelerated their training, enabling them to complete the program
before they left the department, and the entire program was shortened from four years to three years during this time.\textsuperscript{123}

Graduate instruction in the department was not limited solely to the fellowship program. In 1951 the department cosponsored an interdisciplinary course leading to a Ph.D., combining work with other departments from the School of Medicine and the Departments of Physics, Mathematics, and Engineering. Beginning in 1958, when Mortimer Mendelsohn joined the staff, special projects were initiated in radiobiology, including research in cell biology.\textsuperscript{124}

In addition to their own instruction, Fellows were given teaching responsibilities for the interns passing through the department and for students in the School of Medicine. The responsibilities regarding the interns were the same for each member of the staff: they were assigned an individual intern, escorted him around the department, explained the various programs, and generally acted in the capacity of instructor for the duration of the intern’s short stay.\textsuperscript{125} The Fellows’ more extensive responsibility as educators, however, was toward undergraduate medical students. Changes in the school curriculum in the early 1950s considerably expanded the number of courses offered in radiology, and residents taught the fundamentals of radiology during the first and second years in order to properly prepare medical students for electives in their third and fourth years.

Some Fellows were assigned full-time to the Departments of Anatomy and Physiology, and worked closely with first year students in these two departments. In anatomy the resident provided some assistance in dissection, but was most responsible for teaching roentgen anatomy; in physiology he gave fluoroscopic demonstrations of the pulmonary, cardiovascular, and intestinal systems. During the second year of instruction residents worked in pathology, helping in the laboratory area, performing autopsies, and demonstrating the roentgen manifestations of disease. Considerable time was also spent correlating pathological conditions with their roentgenographic manifestations. In addition, the second year included some time spent in didactic lectures, with some instruction in diagnostic radiology.

This preparation in radiology provided a suitable background for students to come to the department for electives during their third year, and four students rotated through the department every two-and-a-half weeks, spending full days there. The fourth year of instruction concentrated on clinico-radiological
conferences, emphasizing cancer diagnosis and treatment. Besides these formal courses of instruction, a number of interested students spent summers as externs in the department as well, usually between their third and fourth years of medical school.126

The overall expansion in the Department of Radiology during the 1950s provided more diversified educational programs on all levels than ever before, and greater opportunities for Fellows to work with senior staff members in a wide variety of special research projects. Following the Korean War, the length of the residency was again extended to four years to provide sufficient time for instruction in radiation therapy; quotas for time in various subdivisions of the specialty were now dictated by outside groups, especially the American Medical Association and the American College of Radiology, as much as by the wishes of the department’s staff. With a variety of opportunities for specialization and outside work, study in the department offered the Fellow an excellent combination of general diagnostic and therapeutic radiology and exposure to the specialities within the field.

Educational Programs in the School for X-Ray Technicians

The School for X-ray Technicians experienced difficulties during the Second World War, but continued in operation. By the early 1950s its structure had evolved into a series of classroom courses and preceptorial instruction involving the entire department. Classwork received priority in the students’ schedule, however, and the department’s staff did its best to enable students to reach their classes promptly.127

The department’s concern for quality education was just as evident in its approach to the instruction of technicians as it was in the residency training program. Students were taught the fundamentals of X-ray technology in their classes, and were later exposed to a variety of X-ray techniques by working with physicians and experienced technicians.

First year students in the two year curriculum were rotated throughout the various divisions of the department in order fully to acquaint them with the department’s operation, and changed services every two weeks.128 In addition to their learning experi-
ences, student technicians provided backup for the permanent staff, and two student technicians, as well as two Fellows, were always assigned to therapy to provide adequate coverage.\textsuperscript{129}

The department's staff was concerned that the student technicians learn more than the mere fundamentals of X-ray technology while in the department, and care was taken to see that they were given responsibility as soon as they were qualified to work independently. This opportunity to act independently helped the sagging morale of the students in the program in the early 1950s, and made them feel as though they were really part of the department. The supportive and encouraging attitude adopted by staff members bolstered the students' confidence and enabled them to complete the program with a degree of maturity equal to their technical competence.\textsuperscript{130} The program continued successfully during the 1950s and rounded out the scope of training offered by the department.

The William H. Donner Center for Radiology

Expansion into the Out-patient Department somewhat alleviated the severe overcrowding of diagnostic facilities, but there was still a shortage of space which inhibited the expansion of specialized diagnostic and therapeutic procedures and advances in the research in isotopes and radiobiology. Dr. Chamberlain drew up specifications for an Isotope and Radiobiology Wing in 1952, to be added to the present hospital building, and although an estimate was obtained, funding for this project never materialized.

The department eventually developed plans for a more comprehensive expansion program, incorporating projects in super-voltage roentgenology and fluoroscopic amplification, in addition to the work in isotopes and radiobiology, and made a formal presentation to the Donner Foundation in September, 1954. The proposal stressed the quality of the department's personnel, and emphasized the fact that their full potential could be realized only if they had adequate facilities and opportunities. William H. Donner had always demonstrated a preference for investing his money in people rather than in bricks and mortar, and the tone of the appeal, therefore, highlighted these aspects:
These men, with training in several disciplines, are functioning as a team that has already attracted attention and has received major support from several sources. An excellent job has been done with limited facilities and equipment. Members of the Department have the interest and desire to record still greater progress in their chosen specialty—but this can be realized only if additional space and tools are available to them.\textsuperscript{131}

Mr. Donner had died the year before, but the foundation was still very interested in the department's work, and in late September its Board approved a gift of $750,000: $500,000 for the construction of a building adjoining the hospital, and the balance to begin a permanent endowment whose income would cover some of the operating expenses. The new building was to be called the William H. Donner Center for Radiology. The United States Public Health Service also provided $180,000 in matching funds toward the construction of research facilities in the Center.\textsuperscript{132}

The construction of a new facility was especially exciting, because it enabled the department to develop extensive plans for supervoltage roentgenology procedures. Supervoltage therapy was particularly valuable in the treatment of carcinoma of the esophagus, bladder, cervix, and head and neck.\textsuperscript{133} The Donner Foundation donated a two-million-electron-volt Van de Graaff generator for therapy in the new Center, and a one-million-electron-volt diagnostic research machine was obtained through a United States Public Health Service grant.\textsuperscript{134} The department was able to accept the latter piece specifically because it would have an acceptable research facility in which to house it.

Supervoltage roentgenology had long been of interest to William Donner; years earlier, when Eugene Pendergrass first asked for money to purchase such equipment, Mr. Donner had been amazed to learn how expensive it was. The men met with the president of the High Voltage Engineering Corporation, one firm manufacturing such equipment, and learned that each piece was practically handmade. He assured them, however, that production in quantity would be considerably less expensive, so Mr. Donner decided to donate a dozen supervoltage units to hospitals around the United States. With Dr. Pendergrass's help he identified institutions which were centrally located, and developed cooperative arrangements whereby physicians from all over a region were able to use the equipment installed in a single location.\textsuperscript{135} It was particularly fitting, therefore, that supervoltage roentgenology tied in so closely with the new Donner Center.
As soon as the Donner Foundation approved the gift, plans for the building were initiated and the department's staff was invited to make suggestions for its design.\textsuperscript{136} There were several revisions of the plans, however, and they were not finally approved by the foundation until December, 1955. Dr. Richard Chamberlain was deeply involved in the design of the building, partially due to his earlier design for the proposed isotope and radiobiology wing. Construction bids for the building were considerably higher than the $500,000 originally allocated by the foundation, and although the board agreed to increase the construction budget to $600,000, the design plans were also necessarily simplified. Construction of the building began on September 28, 1956, nearly two years after announcement of the gift.

Construction of the Donner Center created some administrative difficulties between the department, the University, and the hospital, because the gift was actually made to the University. The University administration wanted input in the delineation of specific plans for the Center’s organization, operation, and research program, while the hospital was particularly concerned that it would lose therapy income, since treatments would be given in a University facility, rather than a hospital building.

In the past the hospital had received the income from clinic and ward patients receiving treatment or undergoing examinations, and the department had received income from private patients, but with an expansion of services in the new building to include an increasing number of radioisotope procedures for both diagnosis and therapy, the allocation of income from these procedures was in question. After much discussion and consultation, it was decided that the hospital would receive all patient income except that from new procedures, and that the income generated by these new procedures would be returned to the Center, to create an ongoing research fund. The University agreed to pay the hospital for the Center's housekeeping costs, relieving the department of that financial burden.

The Department of Radiology did not receive additional direct income from the Donner Center, and it actually lost some sources of income, since the money from private patients, formerly paid to the department, now went to the hospital if the work was carried out in the Donner Center. Staff time was devoted to work in the Center without reimbursement from the hospital or University. In general, though, the establishment of the Center provided many opportunities for expansion of staff activities, and
the department still received considerable outside funding to cover the costs of special research projects going on in the Center. The hospital was often operating at a deficit at this time, and the department’s agreement to give to the hospital all income from established procedures executed in the Donner Center was one way of easing some of the hospital’s financial burdens.

The staff of the department began to move into the new building in late December, 1957, and the Donner Center was formally dedicated and opened to the public on February 28, 1958. The completion of this facility provided, for the first time, expanded space for research in radioisotopes and radiobiology as well as room to house large pieces of therapy equipment.

National Prominence

Besides their extensive clinical, teaching, and research activities at the hospital and University, staff members of the Department of Radiology were active participants in national radiological and medical societies. Some served as officers or on important policy and planning committees, while others were invited to present annual orations and lectures sponsored each year by various organizations. These activities and awards were but one more indication of the calibre of the department’s staff, and the recognition given it at the national level.

Eugene Pendergrass’s outside activities during the 1950s were especially noteworthy in view of his responsibilities as Chief and his commitment to the ongoing expansion of the department’s program. He served as President of the Radiological Society of North America during 1954, as a delegate to the Section on Radiology of the American Medical Association beginning in 1957, and as President of the American Cancer Society from 1958 to 1959. He was invited to give the Tenth Annual Pancoast Lecture to the Philadelphia Roentgen Ray Society in 1950, and the Caldwell Lecture to the American Roentgen Ray Society in 1957. He received the Gold Medal of the American College of Radiology in 1956, and the Gold Medal of the Radiological Society of North America in 1957.

The activities of the rest of the staff followed this example of excellence: members of the Department of Radiology continually
brought honor to their department, University, and hospital. The scope of their commitment, supported by their outstanding capabilities, ensured the success and prestige of the entire operation.

Eugene Percival Pendergrass—Emeritus Professor and Chief

After more than forty years of service at Pennsylvania, Eugene P. Pendergrass retired in 1961. He was succeeded as Chairman by Richard Hall Chamberlain, his long-time associate and Chief of the department’s radiotherapy program. Dr. Pendergrass turned over the entire operation to Dr. Chamberlain, but continued to practice medicine. The Department of Radiology at Jeanes Hospital needed additional staffing to enable Dr. Edwin L. Lame, a former Pendergrass Fellow, to accept an administrative position at Pennsylvania, so Pendergrass spent the first two years of his “retirement” working there. A close associate on the staff at Jeanes was Dr. Nathan Salner, another former Fellow. From 1962 to 1966 Dr. Pendergrass served as Director of the Bicentennial Observance of the School of Medicine.

Dr. Pendergrass continued to serve as a consultant, particularly on silicosis and related diseases, but he was also interested in new developments in radiology. He was named the first Matthew J. Wilson Professor of Research Radiology, and held that position from 1964 to 1966. In later years he remained active in various radiological and medical societies, as well as on University committees, and served as a trustee of the Presbyterian-University of Pennsylvania Medical Center and as a consultant to the Department of Radiology of the Japan National Institute of Health.

The Association of Pendergrass Fellows continued to meet every few years: in 1965 they held a dinner at the Faculty Club in honor of Dr. and Mrs. Pendergrass and in 1970, on his seventy-fifth birthday, a gala celebration at The Barclay Hotel included the Associates and several distinguished European physicians. Dr. Pendergrass spent time in his hospital office daily until the fall of 1978, and welcomed the opportunity to meet with old patients and friends as well as old and new staff members.
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23. Pendergrass, “Comments.”
27. Pendergrass, “Comments.”
33. Pendergrass, “Comments.”
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39. Ibid., 24 April 1944.
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42. Ibid., 28 February 1944.
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103. Hale, Written Comments, Fall 1976.
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130. Ibid., 1951.
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