

Military doctors of the world's great armies almost immediately sensed the significance of Röntgen's discovery of X rays as it related to surgical treatment of battlefield injuries. The initial uses of X rays were to localize bullets and facilitate their extraction and to aid in the diagnosis of fractured bones. In time, many other benefits were also discovered. X rays easily demonstrated that a previously unexplained swelling of the foot experienced by soldiers after prolonged marching was caused by a fracture of the second metatarsal bone. As World War I loomed on the horizon, enlistees were required to undergo chest radiography to exclude tuberculosis. Eventually radiology became an integral part of military medicine. The effect of this integration on the specialty as a whole relates primarily to the standardization of X-ray equipment and the training of both radiologists and technologists. The chronology of these events is traceable through the armed conflicts occurring since 1895. In addition, the radiologic pathology correlation course given at the Armed Forces Institute of Pathology (AFIP) and the radiology residencies thriving in military teaching hospitals have contributed significantly to the training of radiologists in the United States.

**Earliest Military Uses of the X Ray**

The first use of X rays in the diagnosis of wounded soldiers is attributed to Lieutenant Colonel Giuseppe Alvaro during the Abyssinian War of 1896. Italy invaded Abyssinia in an effort to compete with other European powers in the annexation of African colonies. After the Italian Army lost a major battle at Adowa on 1 March 1896, casualties were taken home to Naples by ship. In May 1896, only six months after Röntgen's announcement, Alvaro successfully radiographed two soldiers with forearm fractures and retained bullets. Thus localized, the bullets were removed with ease even though previous probing had been unsuccessful.

As was true in other Balkan wars, when hostilities broke out between the Greeks and Turks in 1897, the powerful European nations were divided in their support. The Turks counted the Germans as their sympathizers, and the Greeks received help from the British, Russians, and French. This war provided the earliest opportunity for evalu-
ing the new technique of radiography near the battlefront. The British support team established two hospitals in support of the Greek forces. The one at Chalcis was ten hours closer to the front, but there was no possible source of electricity for the X-ray apparatus. The other hospital was established at Phalerum, which was close enough to Athens for the Greek surgeons to transfer cases there for further care. The H.M.S. Rodene, a warship of the Royal Navy, supplied electric power for the X-ray apparatus in that hospital. A description of the use of X-rays in field conditions by Francis Abbott, who operated the X-ray unit at Phalerum, was the first information available to the British Army on this subject and influenced the availability of X-ray equipment in future military actions.¹

At the same time, an expedition supported by the German Red Cross was sent to Turkey, where its activities were conducted in Constantinople at the Yildiz Hospital, a large reserve military installation. This expedition also brought X-ray equipment, which was soon put to intensive use. The physician appointed to use the apparatus, Hermann Kuttner, came to the same conclusion as the British: that radiographs were indispensable in military surgery. He recommended their introduction in all German base hospitals.² Kuttner stressed the importance of radiography in estimating injuries to the spine, especially in patients with severe paralysis that might be due to cord compression by bone fragments or cord disruption by bullet injuries, the former being more amenable to surgical intervention.

X-ray equipment was first used on the field of battle in the Tirah Campaign in 1897. Tirah was a district on the Indian border with Afghanistan, a region known as the North-West Frontier. Warlike local tribesmen, the Afridis and Orakzais, occupied this area, and a tenuous peace had been maintained only by a combination of British diplomacy and judicious use of force. This agreement, such as it was, protected travelers through the Khyber Pass and permitted the free passage of British military transports. British support for the Greeks against the Moslem Turks led to a revolt of their coreligionists, who seized the forts in the Khyber Pass in June 1897.³ Colonial Britain amassed an army of one hundred thousand men to reopen the pass. This army was divided into four field forces, one of which was the Tirah Expeditionary Force, an army composed of eight thousand British and thirty thousand Indian troops. After marching through roadless valleys and over high mountains, the army was encamped on the Tirah plateau by October 1897. Over the next four months the tribesmen were subdued and the peace restored.⁴

Accompanying the Tirah force was a regimental surgeon with the Coldstream Guards, W.C. Beevor. Before he left for India, Beevor had selected a type of X-ray apparatus that fit into sturdy wooden boxes and similar containers. Each 100-pound box was suspended from a pole and carried by two Indian bearers (dhooties) during the entire 200-mile journey. Examining more than two hundred wounded soldiers on the Tirah plateau, Beevor became the first person to use X-rays on the field of battle. The apparatus he used was subsequently supplied to the British Army as standard equipment. On the basis of his experience at Tirah, Beevor wrote, “I maintain it is now the duty of every civilized nation to supply its wounded in war with an X-ray apparatus, amongst other surgical aids, not only at base hospitals, but close at hand, wherever they may be fighting and exposing themselves to injury in the performance of their hazardous duty.”⁵

The War of the Sudan (1896–1898) occurred in response to recurrent outbreaks of hostility among the tribes in the Sudan, which were under the supervision of the British. It was decided that an expeditionary force would be sent up the Nile to subdue the natives. The expedition was carefully planned; the force of twenty thousand men, mostly Egyptian soldiers, was led by British officers and equipped with modern weapons. Pleasure boats were used to transport the force up the Nile as far as the first cataracts at Aswan. At that
point, the force and its baggage left the meandering river and set out in a straight line over the desert for the settlement of Berber; several hundred miles farther upstream on the banks of the Nile. Close to Berber and within sight of Khartoum, a forward base camp was established. At Omdurman, from across the river, fifty thousand dervishes launched an attack on the modern army. The attackers posed no serious threat, and in five hours, piles of their corpses littered the desert.  

Surgeon-Major John Battersby was selected to accompany the Nile Expeditionary Force and to be in charge of the roentgen-ray apparatus. Knowing that temperatures in the Sudan ranged from 100 to 122 degrees Fahrenheit, Battersby took the precaution, before he left Cairo, of having thick felt covers made to surround the boxes containing his equipment. By wetting the felt every two hours, he ensured that the temperature of his equipment did not exceed 85 degrees, and it arrived in excellent working condition. The equipment Battersby used was issued by the British War Office as regular medical supplies for the River War. His use of X rays is therefore memorable because it was the first official use in the field of a standardized apparatus by a major armed force. Battersby conceived a unique method for charging the batteries used to power his X-ray machine. Two soldiers pedaled as hard as they could on a tandem bicycle to generate the necessary electricity. With temperatures reaching 110 degrees in the shade, a herculean effort was required, and the peddlers rarely lasted more than thirty minutes on the bike.

Gold discovered in the Transvaal in Southern Africa in 1884 eventually caused the Great Boer War of 1899. As the world became aware of the extensive nature of these valuable deposits, a gold rush occurred not unlike that in California several decades earlier. The Boers, formidable descendants of the Dutch and French Huguenot settlers living in British colonial South Africa, tried to curtail the occupation of their land by foreigners by passing laws governing citizenship and hence ownership of land. When efforts at conciliation failed in 1899, the British, who also wished to control the gold mines, prepared for war. Inasmuch as the war of the Sudan was over, the British sent those medical units to South Africa, along with the X-ray equipment that had been used in that war.

A war that the British had expected to be concluded in only a few months lasted two and one-half years. Medical needs grew as the war was prolonged. Soldiers were transferred from hospitals near the front to larger general hospitals well behind the lines, usually within a day or two of being injured. For the first time in the British Army, X-ray apparatus was provided as part of essential equipment for these general hospitals.

At first, some ingenuity was required to identify an appropriate power source. British Lieutenant Bruce, a veteran of bicycle-produced power in the Sudan, was ordered to take a complete X-ray unit with him from Cairo to the town of Ladysmith in South Africa, where a part of the town hall was used for the X-ray department. A flour mill was situated close to the town hall, and Bruce, remembering the bicycle most unfavorably, sought permission to have his dynamo driven from the mill shafting. This system proved quite efficient for charging the batteries and provided enough electricity to light the operating room at night. Later in the conflict, power for X-ray apparatus was provided by a 2.5 horsepower motorcycle engine and dynamo.

The Spanish-American War (1898)

The American military first used the X-ray to advantage during the Spanish-American War in 1898. American medical tactical policy during that conflict was well defined. At the firing line, hemorrhages were checked, first aid dressings were applied, and wounded soldiers were prepared for transportation to the well-protected dressing stations located 300 to 400 yards behind the front lines. There, injured men were nourished, stimulated, identified, and tagged; tourniquets were removed and dressings further secured. The next
point at which assistance was provided was in the field hospital, several hundred yards farther from the front. At this point, essential operations were performed. Finally, patients were carried still farther back until they were lodged in a base hospital.

During the Spanish-American War X rays were employed in these base hospitals (Fig. 25.1). At sea, the hospital ship corresponded to the base hospital. During this war seventeen X-ray machines were deployed: five powered by static devices and twelve with coil machines. X-ray machines were placed in the most prominent and important of the general hospitals and on the three hospital ships, Relief (Fig. 25.2), Missouri, and Bay State. The use of the X-ray machines obviated exploration of wounds by probes or other means and therefore reduced the danger of infection and additional trauma in injuries due to bullet wounds with lodged missiles. The Americans believed that X rays should not be used in the field, primarily because they might provide an additional incentive to surgeons to operate under conditions that were not adequately aseptic. Radiologic experience in subsequent wars was to prove this to be a poor prophecy.

Each type of unit (static or coil) had its own disadvantages. The static generator weighed approximately 500 pounds, and the current delivered varied with the climate and the skill of the operator. The coil machines were equally bulky; they derived their primary current from storage batteries filled with noxious, caustic liquids.

Given the fact that recommended exposure times ranged from a couple of minutes for extremities to approximately twenty minutes for pelvic and
skull films, it is surprising that only two cases of "X-ray burns" were documented in the Spanish-American War. However, the Americans made only limited use of X rays in that war, as relatively few soldiers were wounded. At that time, X-ray burns were believed to be superficial and transitory. It was not until 1904 that a consensus developed that X rays could cause permanent damage.

**World War I (1914–1919)**

When the United States entered World War I in 1917, the army and navy had no X-ray apparatus available except the machines installed at regular posts or hospitals (Fig. 25.3). Although some portable units (consisting for the most part of small battery-powered X-ray machines mounted on old gurneys) were in use in some hospitals, there was no "military X-ray machine." Field X-ray equipment was not standardized, not available in quantity, and was difficult to transport. Likewise, there were few well-trained radiologists in either service. Surgeon General William C. Gorgas, who established a Division of Roentgenology in the army under the direction of Colonel Arthur C. Christie, is credited with solving these problems.  

Under Christie's guidance, a portable X-ray apparatus was soon produced in quantity (Fig. 25.4). This machine was powered by a single-cylinder, air-cooled gasoline engine and could be carried from building to building and wheeled from bed to bed. Furthermore, the regular army motor ambulance was modified to carry the new portable unit, resulting in a complete mobile roentgen-ray department (Fig. 25.5) with facilities for developing plates or films and for doing fluoroscopy as well as radiographic work. Because the glass plates were too heavy and fragile for military use in the field, however, most diagnostic work was done by fluoroscopy. In the early days of the war some American units had to use French or English X-ray machines, but by the time of the armistice in late 1918, 719 sets of roentgen-ray apparatus of various kinds had been sent abroad. The trend toward
standardization and portability of equipment significantly influenced the civilian practice of radiology in the years to come.

L. G. Cole was president of the American Roentgen Ray Society (ARRS) when America entered the war, and he subsequently appointed a Committee on Preparedness, which cooperated with Christie. It soon became apparent that the number of qualified radiologists in the United States was comparatively small and that a plan would be needed to augment their numbers. The first action was to establish radiology schools in various parts of the country in hospitals where there were appropriate facilities and materials for teaching. These schools were to train not only radiologists but also technical assistants, who were called “manipulators.” The army published an X-ray manual for use as the textbook of the schools.

On 2 January 1918 the Camp Greenleaf School of Roentgenology, at Fort Oglethorpe, Chickamauga Park, Georgia, became the sole school for training radiologists and manipulators. At Camp Greenleaf, conditions were ideal for training men in any branch of medicine; at any one time, more than two thousand medical officers were stationed there to undergo instruction in various medical specialties and in military orientation.

During the first few months of its operation, any officer coming to Camp Greenleaf who expressed any knowledge of or experience in radiology was interviewed by the director of the radiology school before any other unit or organization could have access to him. When the demand for radiologists increased, the commanding general ruled that the radiology school might have access to any officer who had not been accepted for training as a surgeon. This meant that the radiology school had first choice among any officers with experience in the specialty and second choice among all officers. Physicians in the school underwent a two- to three-month program of intensive study, which included principles of interpretation, anatomy (particularly of the bones and joints), pathologic changes, radiographic positioning, fluoroscopy, report writing, and mechanical aspects of radiology such as plate handling, film filing, and basic machine repair. The manipulators, in particular, were thoroughly drilled in the operation and maintenance of the X-ray apparatus. The various electric circuits were initially wired with wires of different colors so that each circuit could be traced without difficulty. After a student familiarized himself with the various circuits, all wires were removed and the student had to place each wire in its proper place. Finally, the student had to wire the apparatus completely with wire of one color only.

Experience with equipment at a thousand-bed hospital in France in 1917 indicated that the full output of the standard X-ray apparatus available early in the war was approximately 2 milliamperes (ma.); for fluoroscopic studies a 1 ma. technique was used. Exposure times for roentgenograms varied between fifteen seconds and two minutes. By 1920 the equipment was able to generate 7 ma., but long exposures were required, and the radiologist typically used heavy muslin bandages fastened to the table to immobilize patients during the exposure.

Unfortunately, the radiologist was also occasionally subjected to prolonged exposures during such studies. The first
medical officer in the military to die as a result of exposure to roentgen rays was Colonel Eugene G. Northington. After twenty years of pioneering work beginning in World War I, he developed on his hands, burned as if by fire, cancerous nodules. Over a period of many years, he underwent seventy-six surgical operations for the removal of the successive cancerous growths. Before his death, he lost his fingers, hands, and arms. 20

In all, 744 physicians were trained in the basics of radiology during the war. This group subsequently went on to better define the emerging profession of radiology in the 1920s. The establishment of radiology as a stand-alone specialty was advanced by the belief of the Surgeon General's Office that all roentgenologists must have medical school training. The nonmedical technician was believed to lack the experience or training necessary to adequately consult with a surgeon. Indeed, from the beginning of the war, only graduate physicians could be assigned for duty as radiologists. 21

**WORLD WAR II (1939–1946)**

During World War I most military officers who practiced radiology were clinicians who had begun to use radiologic studies in their civilian practices on a limited basis, if at all. In the years between the world wars, radiology evolved tremendously as a recognized specialty, mainly because of the improvement in radiologic equipment and standardization in training of radiologists. As a result, at the outbreak of World War II radiology was a well-recognized specialty in its own right, and radiography was an established diagnostic tool.

The major radiologic achievement during World War II was implementation of the routine diagnostic use of radiology in disease and in both combat and noncombat trauma. Throughout the war, radiology was an integral part of every hospital, from those near the front lines, where radiology was a significant component of teams performing front-line surgery, to the base hospitals far in the rear. It has been ruefully stated that radiology service during this war seems almost to have been taken for granted.

Perhaps much of this smooth integration of radiology into the war efforts can be attributed to B.R. Kirklin who, while serving as president of the American College of Radiology (ACR), was appointed X-ray Consultant to the Surgeon General of the Army on 20 April 1943 and given the rank of colonel. 22

As the war began, many trained radiologists volunteered their services, but because their numbers did not meet the manpower requirements, it became obvious that active measures had to be instituted. It fell to Colonel Alfred A. de Lorimier, a senior physician in the Medical Corps, to develop training in radiology for nonradiologist medical officers at the Army Medical School. In 1931 de Lorimier, with William Leroy Thompson, had taken a refresher course at the Army Medical School stressing the scientific aspects of roentgenology. This experience significantly influenced his development of the radiology curriculum at the school.

Graduates of the program came to be called "de Lorimier's ninety-day wonders," and civilian criticism emerged almost from the beginning. Some radiologists believed that the time allotted to the course was too brief to produce adequately trained radiologists. The Surgeon General of the Army did not agree, however, and the Army School of Roentgenology continued to function according to its scheduled program throughout the war.

Originally located in Washington, D.C., the Army Medical School housing the School of Roentgenology soon outgrew its facility, and in 1942 the School of Roentgenology moved to the campus of the University of Tennessee College of Medicine in Memphis. In the new location the basic course in roentgenology, which ranged from a review of basic physics and electricity through complex diagnostic radiographic techniques, was expanded in length from twenty-eight days to twelve weeks.

This course did not produce trained radiologists, nor was it intended to. At best, it provided a functional introduction to radiology for men already trained in medicine. In a typical class of sixty-five
physicians, one or two might have been trained radiologists and two or three others might have had some training in radiology, but the majority were young physicians with no previous special interest in radiology. In all, 887 medical officers received a short course in radiology during the war. The success of this effort is evidenced by the large number of physicians who went on to choose careers in diagnostic radiology after the war. In addition, 1,429 radiology technicians were trained in the schools in Washington and Memphis. This group provided a large civilian contingent of trained technologists following the war.23

Aside from personnel shortages, the other major problem to be overcome was the production and distribution of X-ray equipment. Because planners expected that fronts would be changing rapidly, they considered it impractical to install roentgen-ray apparatus at the most forward medical installations.24 The farthest forward installation at which X-ray equipment and services were provided was the mobile evacuation hospital (Fig. 25.6), and these facilities required rugged and dependable equipment that could be easily assembled and disassembled and was simple to operate and maintain. Although equipment suitable for use by the military had been investigated in the 1930s, practical development and procurement unfortunately had to occur on a crash basis.

Picker X-ray Corporation (Waite Manufacturing Division, Inc.) developed a practical unit that became the

Fig. 25.6a Illustration of use of the World War II Picker field X-ray unit under battlefield conditions. Courtesy of the Center for the American History of Radiology, Reston, Va.

25.6b Army field X-ray unit installed in the 8th Evacuation Hospital in Italy. (Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, photo NCP-2731)

25.6c Foreign-body localization using the field X-ray unit. (a and c courtesy of the Center for the American History of Radiology, Reston, Va; photograph b courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, photo NCP-2731)
standard equipment used in World War II; in fact, army field X-ray units became a Picker specialty. The company developed a shock-proof, self-contained machine that could be assembled or dismantled in six minutes and transported in four easily movable cases. The assembled unit was powered by a gasoline generator weighing less than 400 pounds (Fig. 25.7). Picker produced more than ten thousand of these field X-ray units for the army during the war, and at one time during the conflict more than 85 percent of Picker production was devoted to making these units (Fig. 25.8). However, Picker was unwilling to profit from the war, and for the duration limited its profits to those of 1940, a year in which it did virtually no war business. In 1942 Picker X-ray Corporation was awarded the coveted Army-Navy “E” production award.

On the homefront, physicians found themselves shut out from the many new developments in radiologic equipment because there was a freeze on domestic purchases of both diagnostic and therapeutic equipment. 

Radio-

logists were encouraged to conserve their current equipment, repair damaged apparatus, rescue accessories from private junk heaps, and borrow equipment left behind by physicians who had joined the armed forces.

Further, the shortage of civilian radiologists during the war prompted the Committee on Manpower chaired by Representative Claude Pepper to report that the armed forces were “boarding unused doctors in a ratio double that of the British.”

Adding to the unease at home, many civilian radiologists feared that military medical officers who had received only a few months of training in radiology for service in the army would wish to practice roentgenology on their return to civilian life. These concerns no doubt

Fig. 25.7 Gasoline generator used to power field X-ray units during World War II. (Courtesy of the Center for the American History of Radiology, Reston, Va.)
reflected fear of increased competition as much as issues of training and competence. However, in an effort to recognize military training and experience, the American Board of Radiology permitted physicians called to active duty before completion of their radiology residency to obtain credit for up to one year of military service.30

Another manpower issue involved the staffing of radiology services in military hospitals in the United States, where the Office of the Surgeon General demonstrated that it would go to great lengths to secure radiologists of the highest standing and experience for these facilities. Aubrey Hampton, chief radiologist at Massachusetts General Hospital, was eager to volunteer for military service, but neither his hospital nor Harvard would release him unless he was guaranteed a rank and position equivalent to his civilian status. When the surgeon general offered him the rank of colonel and the position of chief of radiology at Walter Reed Army Medical Center, he moved to Washington.31

POST-WORLD WAR II DEVELOPMENTS

Shortly after the end of World War II the medical department of the United States Army asked several X-ray companies to review their experience and suggest improvements. Well aware of the tremendous contributions radiology had made toward lowering the mortality rate of wounded during the war, the army was seeking a new apparatus to extend these X-ray benefits further.Picker International was again highly competitive in developing a new field unit which was packed into two strong chests that were themselves operating components of the unit when assembled. The disassembled unit was compact enough to be transported in an ordinary jeep or light truck and required only five minutes to set up for operation.

The Picker field X-ray unit was sent to Camp Lejeune, where one of the testing ordeals that it had to survive was a “drop.” The packed chests were loaded on a truck and roped with a long slack line to a tree. At a signal, the truck was started, accelerating rapidly.

The tight line whipped the chests out of the truck to crash on a concrete roadway. So violent was the impact that a corner of the larger chest gouged a big chunk out of the pavement, but when the unit was unpacked and assembled it operated as though nothing had happened. These units also ran in chambers where the temperature dropped to -50 degrees Fahrenheit and in rooms where the temperature hit 125 degrees. Since nothing that could be done seemed to faze them, the machines were finally approved by the military for standardization and production.

The lack of literature references to radiographic equipment and radiologists in Korea and Vietnam probably reflects the fact that radiology by that time was taken for granted as an integral part of the medical team by the military establishment. On the other hand, very little is written regarding other medical aspects of the war in Vietnam, perhaps reflecting to some degree the controversy surrounding all aspects of the involvement of the United States in the affairs of Southeast Asia.32,33,34

RADIOGRAPHIC SERVICES IN THE 1990S

Radiographic services up to and including computed tomography (CT) are now a fully integrated part of the deployable fleet hospitals and hospital ships. In January 1991 a containerized CT scanner was shipped to Saudi Arabia for use in Operation Desert Storm (Fig. 25.9); this was the first time a deployable CT had been used in military field conditions.35 The container used vibration isolators to shock-mount the equipment in place. The unit was also augmented with heavy-duty washable filters, improved air flow, and dust covers to counteract environmental hazards experienced in the desert. The first unit to see service in Saudi Arabia was subsequently shipped to Somalia.

The radiographic suites on the hospital ships Comfort and Mercy resemble radiology departments in small hospitals and include fluoroscopic and angiographic equipment as well as CT scanners.
THE ARMED FORCES INSTITUTE OF PATHOLOGY

In 1862 Brigadier General William Alexander Hammond, the army's surgeon general, established an Army Medical Museum to house specimens of morbid anatomy. This museum evolved into the AFIP, a veritable treasurehouse of medical knowledge and a recognized center for consultation, research, and training of physicians in various specialties. The American Registry of Pathology was subsequently formed to accumulate sufficient information about the incidence of each disease process to allow determination of the characteristic course of the disease, the criteria for diagnosis, and the evaluation of methods of treatment. The registry has since grown to include many specialty-specific registries.

In February 1944 Colonel de Lorimier suggested the establishment of a radiologic registry in a letter to Eugene Pendergrass, then the chairman of radiology at the University of Pennsylvania and chairman of the board of chancellors of the ACR. In his letter de Lorimier described a six-week course for radiologists and recommended that one or two radiologists be assigned to the registry at AFIP to help give the course. The organization of the institution as it exists today, almost fifty years later, reflects these ideas.

The ACR formed a special committee to address the issue of a registry, chaired by A. C. Christie; other members were Ross Golden, Laurence Robbins, and George Wyatt. These men shaped the concept, purposes, and scope of the new organization. The establishment of the registry was announced in a special bulletin from the ACR on 20 February 1947. The budget was initially estimated at $10,000 per year, joining the ACR in sponsorship were the ARRS and the Radiological Society of North America. Thus began a fruitful collaboration between civilian radiology and the military establishment.

Activities of the registry were limited during the first couple of years, as only one or two fellows were available at any one time to sort through the backlog of radiographic material to get the library on its way. They were aided particularly by Aubrey Hampton, the first resident consultant, and guided by a few outside consultants. Finally, permanent sustained leadership came in June 1950 when Colonel William LeRoy Thompson, in the process of retiring from the army, was appointed the first registrar.

On the day he was offered the position as the first registrar at AFIP, Colonel Thompson’s personal diary contains a poignant entry:

...very warm—over 90 [degrees] in town [Washington, D.C.]. About midmorning Colonel Robinson, the
Personnel Officer of the Surgeon General’s Office down the hall, called me and told me that he and General Dart had a proposition for me and would I go to see the General. So I went down to the Army Medical Museum where I saw Raymond Dart, Head of the Museum. He and I had been classmates over 30 years ago. He wanted me to come to the Museum to organize, supervise, teach, make speeches, write scientific papers, create a teaching file and collection of x-ray films for distribution to college and radiological societies throughout the country. In short, I was to head the Radiological Section of the Army Medical Museum, the foremost pathological center in the country. I accepted enthusiastically since it is just what I need to end my career. Went back to the Surgeon General’s Office and told Rolly (Colonel Robinson) so. About 4:30 P.M. Colonel Robinson called me at the house and told me I could report for my new duty tomorrow or whenever I wanted to.  

Thompson’s teaching skills were legendary, and as the program developed and became more widely known, residents and radiologists came to Washington to surround him in the limited space available in the museum, located on the national Mall (Fig. 25.10). The current building housing the AFIP at Walter Reed Army Medical Center dates from 1951. This building was mandated by presidential directive to be bomb resistant, no doubt because the previous year the North Koreans had crossed the 38th parallel and because the Soviet Union had recently detonated its first atomic bomb. Hence, the building is windowless and formidable (Fig. 25.11).

Over time, the registry’s teaching program progressed from informal discussions to an instructional course based on radiology but focused on disturbed morphology, as opposed to pattern recognition (the “Aunt Minnie Approach”). With close collaboration between radiology and the other registries, radiologists came to realize that they were essentially gross pathologists.

Colonel Thompson carried on his work at the registry until he suffered a cerebrovascular accident in 1966. That same year Elias George Theos, an active-duty commander in the Navy Medical Corps, became the second chairman and registrar of the Department of Radiologic Pathology. He formalized the course in radiologic-pathologic correlation, the format of which is used in the course taught today. At that time, in addition to the chairman, one radiologist from each branch of the armed services served on the staff, but the department subsequently expanded into six sections, each headed by a full-time staff radiologist, either an active-duty military or civilian radiologist. In recent years a radiologist of national or international standing has joined the full-time staff to do research and teach during a sabbatical year at...
the AFIP. Participants in this program have included William W. Olmsted, Alan J. Davidson, Roger K. Harned, Terry M. Hudson, Anne G. Osborn, Robert D. Pugatch, Robert H. Ackerman, Ina L.B. Tonkin, Mahood Mafee, and M.B. Ozonoff. More than 250 residency programs from around the world, including 195 civilian programs and all federal programs in the United States, send their residents to the AFIP for the radiologic pathology course, representing an overwhelming majority of approved residency programs in diagnostic radiology. The six-week course is designed to teach residents the pathologic basis of radiologic abnormalities. The pathophysiology of disease processes is emphasized by the use of microscopic and gross pathologic features to explain the imaging findings.

In addition to its now famous radiologic pathology course, the AFIP also offers many shorter courses in subspecialty areas of radiology each year. These short courses are available for all radiologists, including those in residency training. In addition, the radiology staff consult with AFIP pathologists regarding the radiographic appearance of disease and contribute to the radiologic literature, usually reporting the imaging characteristics of large series of various pathologic processes.

Residency Training in Military Hospitals

The army, navy, and air force for many years have offered training in multiple specialties in their teaching hospitals, including diagnostic radiology. The air force maintains radiology residency programs at the David Grant USAF Medical Center at Travis Air Force Base in California and at Wilford Hall USAF Medical Center at Lackland Air Force Base in San Antonio, Texas. The navy has programs at naval hospitals in San Diego, California, and Bethesda, Maryland. The army has programs at Fitzsimmons Army Medical Center in Aurora, Colorado; Walter Reed Army Medical Center in Washington, D.C.; Tripler Army Medical Center in Honolulu, Hawaii; Brooke Army Medical Center in San Antonio, Texas; and Madigan Army Medical Center in Tacoma, Washington. These nine programs are training approximately 200 residents at any given time. Given the 4,093 radiology residents in training in accredited programs in the United States in 1993, the military programs can take credit for about 5 percent of all radiologists trained in this country.

SUMMARY

The early military uses of radiology, beginning shortly after Röntgen’s discovery, served to establish the specialty as a necessary and integral part of the medical team that evaluated and treated the casualties of war. The necessity of locating equipment near the front lines resulted in the development of standardized X-ray apparatus that was transportable, easy to assemble and use, and extremely durable. These innovations contributed directly to improvements in civilian radiology.

Over the past century armed conflict has had a significant influence on the training of radiologists and technologists. World War I helped establish radiology as a specialty. World War II, because of its vast demands for medical manpower, partially trained many nonradiologists in the specialty and influenced a significant number of these to join the ranks of radiologists in the United States.

A military physician conceived the idea of the radiology registry at the AFIP. A course in radiologic pathology has subsequently become a part of the training process for the majority of radiologists educated in the United States. Finally, military academic centers continue to fully train radiologists in nine accredited programs. Military radiology has played a truly important role in the field of radiology during the first century following the discovery of X rays.

> References
