Chapter 10

Henri Coutard

(1876–1950)

"Rich only in hope, possessing only incomplete information, incapable of offering precise techniques, adapted to diverse forms of cancer, radiotherapy has, however, obtained definite cures in cases incurable by surgery." (1937)[120]

Henri Coutard was born 27 August 1876 in the ancient town of Marolles-les-Braults (population eighteen hundred), some twenty-five miles north of Le Mans (Sarthe), in France. Situated in a former ducal province (Maine), the area was once part of conquered Roman territory. He was the son of Melanie Marie Josephine Ragot (1848–1930), a merchant of novelties, and Louis Coutard (1840–1918), a functionary in charge of the upkeep of communal roads in the predominantly agricultural community. Henri had one brother, Louis (1871–1939), and one sister, Helène (1882–1960).

Following primary schooling close to home, young Henri, at eleven, entered the Lycée Montesquieu of Le Mans as a boarding student *(interne).* For seven years he was registered at this state institution. He excelled in mathematics, French literature, physics, chemistry, and drawing. He obtained his Baccalaureate in Letters in 1893 and in Mathematics in 1894. He also received an award from the War Minister for his distinction in military exercises and gymnastics.

Following his baccalaureate, Coutard registered at the University of Paris and eventually entered the school of medicine. As a student, he prepared for and passed the competitive examinations, becoming an *extern* of the Hospitals of Paris. He was particularly inspired by the notable internist, Pierre Carol Edouard Potain (1825–1901). While Coutard was in medical school, Röntgen's discovery was followed by that of the Curies. He served his internship in the western city of Nantes. For his doctoral thesis, he reviewed German and English as well as French literature, and collected eight cases to which he added an unpublished one from the Hôpital Trousseau. His subject was the extraperitoneal lesions of the bladder and rectum observed in cases of pelvic fracture.[106] On 17 July 1902 he presented his thesis before a tribunal of the Faculty of Medicine, presided over by Professor Berger. The published version was dedicated affectionately to his parents and friends.

Coutard fulfilled his military obligations as medical officer on the naval intrepid *Chasseurs Alpins* (Fig. 10-1). He decided to remain in the Alps at Les Rousses (Jura) to practice general medicine and to heal his own mild case of pulmonary tuberculosis. On his return to Paris, he became interested in the medical applications of the newly discovered radioactive elements. Jacques Danne and his brother had founded the Laboratoire d 'Essais de Substances Radioactives at Gif, in the Parisian *banlieue.* Coutard became associated with Danne, for whom he had great admiration. Henri Dominici (1867–1926)[B] also did research work there.

In 1912 Coutard presented a paper on the therapeutic uses of the emanation of radium (radon), at the Congress of the French Association for the Advancement of Sciences at Nîmes in southern France. It was a succinct but thorough presentation of the physical properties of the radioactive gas, and its absorption and diffusion when administered experimentally to lower animals by inhalation, ingestion, or injection.[107]

Drafted into service in the first World War, Coutard was put in charge of radiologic services at the military evacuation hospital of Gérardnes, near Baccarat on the eastern front (Fig. 10-2). There he met Claudius Regaud. This proved to be a significant encounter. Coutard was involved in a military mission to Russia, and later worked with Marie Curie in one of her fleet of radiologic ambulances.[495] At the end of the war, as an army major already forty-three years

Fig. 10-1. Captain Coutard in the uniform of the *Chasseurs Alpins.* (Courtesy of M. René Lamare.)

old, he married Anne Marie Adele Rongier in Paris in March 1919.

Promptly after the Armistice, Coutard joined Regaud and Lacassagne, eager to take up again the research work of the Radium Institute of Paris. He was given space in the basement of the Pasteur Pavilion where an X-ray unit was installed. With this single unit, he managed to administer roentgentherapy in addition to doing radiodiagnostic procedures, as well as the experimental irradiation of lower animals.[386] For each one of these procedures, however, a different tube had to be used.

Among his first patients, there were a number of cases of inoperable tumors of the upper air passages. The penetrating ability and good quality of the X-ray beam were primary considerations. To evaluate the tension of the current on the poles of the tube, Béclère's spintermeter was used. Initially, the spark-gap measured twenty to twenty-one centimeters, a probable maximum (peak) of one hundred kilovolts. The secondary intensity was only two and a half milliamperes. A filter of six millimeters of aluminum was chosen, and the irradiations were made with twenty-five centimeter target-skin distance. The doses of radiations administered at first were given in minutes of exposure under fixed circumstances of irradiation. Shortly thereafter, the H-unit was adopted to express doses on the skin in the field of entry. For this measure, the Holzknecht chromoradiometer was used, but more often a simple adaptation of the same principle with the pastilles of Raymond Jacques Adrian Sabouraud (1864–1938) served the purpose. Because the output was very low, the total time of treatments was around fifteen hours. An effort was made to fractionate the total dose into no more than two weeks.

With dosimetry being rather inaccurate at best and estimated only at the level of the skin, Coutard learned to be guided by the radiobiological intensity of the skin and mucous membrane reactions. Regaud and Nogier had described the shedding of the epidermis and denudation of the dermis, which they called "radioepidermitis," dry or moist.[525] It was complete twenty-six to twenty-eight days after the first irradiation. Coutard then observed the counterpart reaction of the oro-pharyngeal mucous membranes, which ended after twelve to fourteen days in diphtheroid false membranes. He called this "radioepithelitis."[170] He carefully noted its chronology in the various irradiated areas of the oral cavity and pharynx. He also became convinced that squamous-cell carcinomas which developed in these areas required, for complete destruction, the same dose that would cause a radioepidermitis on the skin.

Already within the first year of his efforts, he had seen the complete disappearance of an advanced carcinoma of the tonsillar region with a metastatic upper cervical adenopathy.[109] He also observed that recurrences took place because of insufficient irradiation of deep areas of the tumor. He insisted on the need for radiations of the shortest possible wavelength, and for this purpose, he increased his kilovoltage (to a twenty-five centimeter spark-gap) and his filtration. Treating carcinomas of the nasal cavities, he became aware of the need to protect the patient's eyes from the effects of radiations. He also noted that a lead shield had to be coated by a lighter substance (wax) to avoid injurious secondary irradiation of the eye and conjunctiva.[108] Early in his work he adopted important measures of protection for himself and personnel.

Coutard's carefully sustained observations of patients under treatment revealed differences in radiosensitivity among the various tumors. In the summer of 1920, he saw a fifty-year-old man with a pharyngeal tumor and cervical adenopathy. On histologic examination, Regaud noted that the tumor consisted of clear epithelial cells fused in a sort of syncytium, heavily infiltrated by lymphocytes. He named this

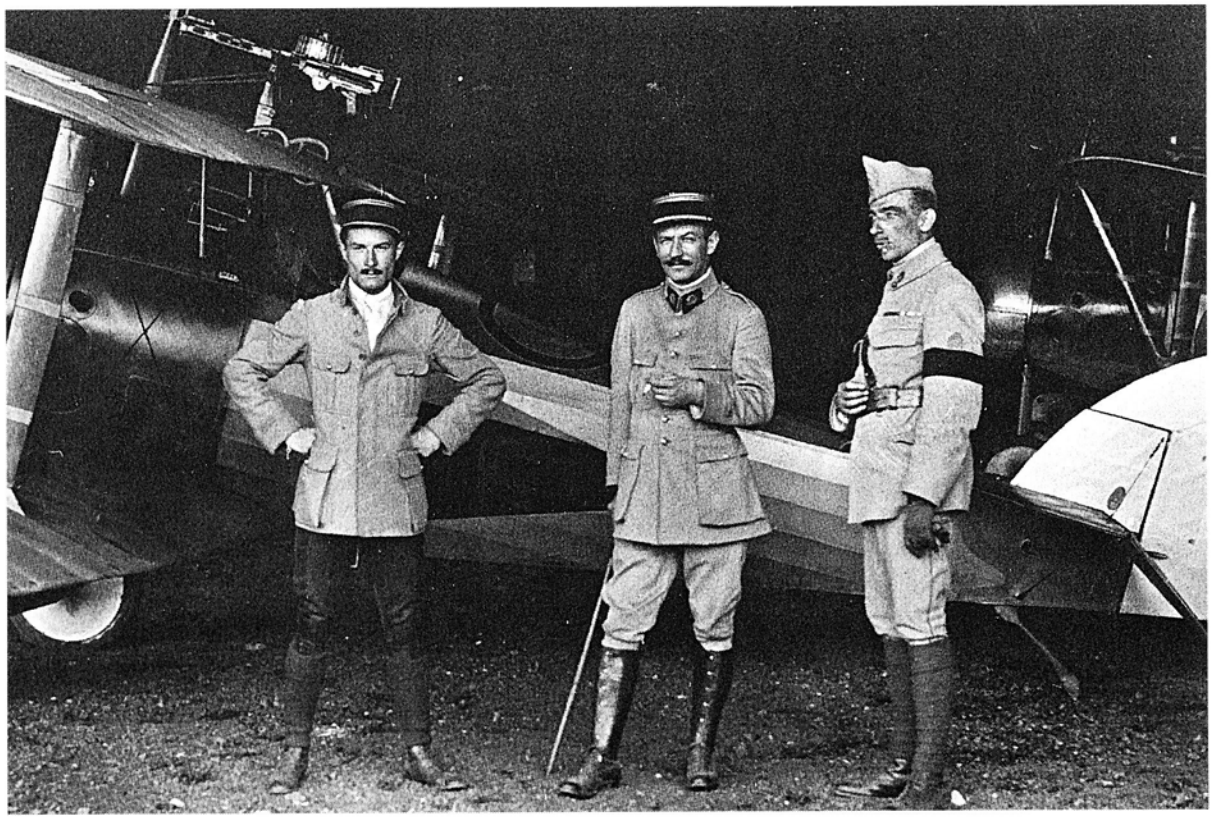

Fig. 10-2. Major Coutard (center) by an early airplane of the first World War, 1917. (Courtesy of M. René Lamare.)

new entity "lymphoepithelioma." Irradiation resulted in a rather rapid disappearance of the tumor and its node metastasis without intensive reactions of the skin and mucous membranes. The recognition of this different kind of tumor and its curability was the result of his capable association of histologic skill and careful clinical observation.[533] In addition, Coutard's patients were under close medical surveillance for their general health, other possible difficulties, and the effects of irradiation on their general status.[125] He recognized early the radiocurability of carcinomas of the endolarynx.[123,126]

While treating patients with carcinoma of the larynx, Coutard became aware of the fact that a lateral roentgenogram of the soft tissues of the neck, with appropriate technique, gave invaluable assistance in the appraisal of tumor extent and cartilage invasion.[111] Thus, he made his one valuable contribution to radiodiagnosis.

Regaud and Lacassagne had painstakingly perfected techniques and dosimetry for intracavitary applications of radium in the vagina and the uterus, for cancer of the cervix. Follow-up examinations had shown that Stage I lesions were effectively cured in high proportions by the application of radium alone. However, the results fell below expectations for carcinomas of the cervix in Stages II and III.[519] As early as 1921, Coutard began external pelvic irradiation in such patients. However, the insufficient voltage of his equipment made much of his effort fruitless.

In 1923 the newly created Fondation Curie financed the construction of twin two-storied pavilions, named Rothschild and Röntgen, to accommodate the necessary expansion of facilities. The Röntgen Pavilion was provided with a radiodiagnostic unit, examining rooms, office space, and seven roentgentherapy units allowing simultaneous irradiation of patients. The tubes used were Coolidge open tubes. When the filaments were lighted, they gave a beam of light that reflected on the target, reproducing the actual beam of rays. Patients lay comfortably sandbagged on special wheeled couches two feet (60 centimeters) high with running frames brought over the areas treated. These frames supported heavy lead sheets doubled by wood to form the fields. With the help of these lights and the lead sheets, fields of any size or shape were formed on the patients without touching them. Two safety devices were always needed: one to assure that the filters were interposed before each exposure, and another to disconnect the high voltage current in case anyone opened a room by error during the treatments. The new equipment operated at 180 kilovolts,

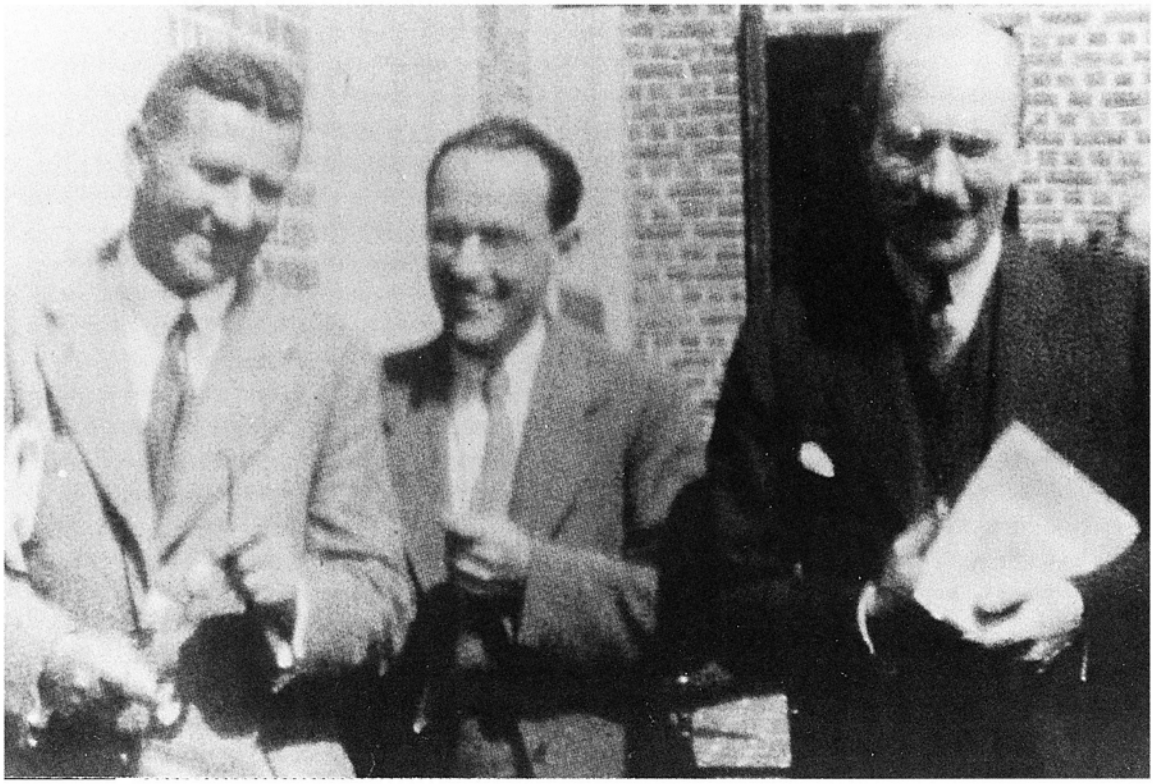

Fig. 10-3. Coutard in the company of Ellis Gustav Emanuel Berven (1885–1966) and of Douglas Quick (1891–1966), during the third International Congress of Radiology, in the courtyard of the Sorbonne, Paris, 1931. (Courtesy of Fred W. O'Brian, M.D.)

and the milliamperes were limited to four. In addition, Coutard insisted on filtering heavily using two millimeters of copper plus three millimeters of aluminum. Consequently, the output was very low.

For carcinomas of the cervix, Coutard developed an approach through six fields of entry: two inguinal, two sacral, and two ischio-sciatic (postero-lateral). For other than Stage I cases, external irradiation was always administered first. Patients were irradiated at sixty centimeters target-skin distance, twice daily to minimize systemic reactions. The dose for each field was measured on the skin by means of Sabouraud's pastilles. In view of the inadequate penetration of the beam, the skin dose had to be brought up to levels that caused reparable moist epidermitis of the inguinal and sacral fields. Treatments lasted over one hour each. Following external irradiation and a short interval, the patients were hospitalized, then received the intracavitary applications of radium. At the end of roentgentherapy, some of the patients were judged ineligible for curietherapy. In the year 1924, sixty-three patients in Stages III or IV received external irradiation only. Nine of these patients (fourteen percent) were reported living and free of disease beyond five years.[120]

Whenever roentgentherapy was applied to the treatment of malignant tumors, the doses administered were empirically chosen and admittedly high, but there was little agreement as to the length of time in which that dose was to be delivered.[486] Seitz and Wintz, in Germany, advocated the delivery of the largest possible dose in the shortest possible time *(Terapia steriliza magna)*.[568] Others, following the gynecological radium technique of Stockholm, preferred repeated intensive short courses. L. Freund (1868–1943)[B] in Vienna favored a greater number of smaller fractions, what was called *verteilte* (apportioned) doses.[248] An exaggeration of this approach was nicknamed *verzettelte* (squandered) doses. Yet another variation was known as the saturation method.[469] The pioneer radiobiological research of Regaud had shown that a smaller total dose delivered in about ten days was more effective than a larger one delivered in one sitting. Regaud was firmly convinced, however, that fractionation beyond ten days led to "radiovaccination" of the tumors and to recurrence. Coutard, in his attempt to enlarge the margin of safety between destruction of the tumor and injury to normal structures, dared to defy this dogma and prolonged the treatment of his patients over several weeks.

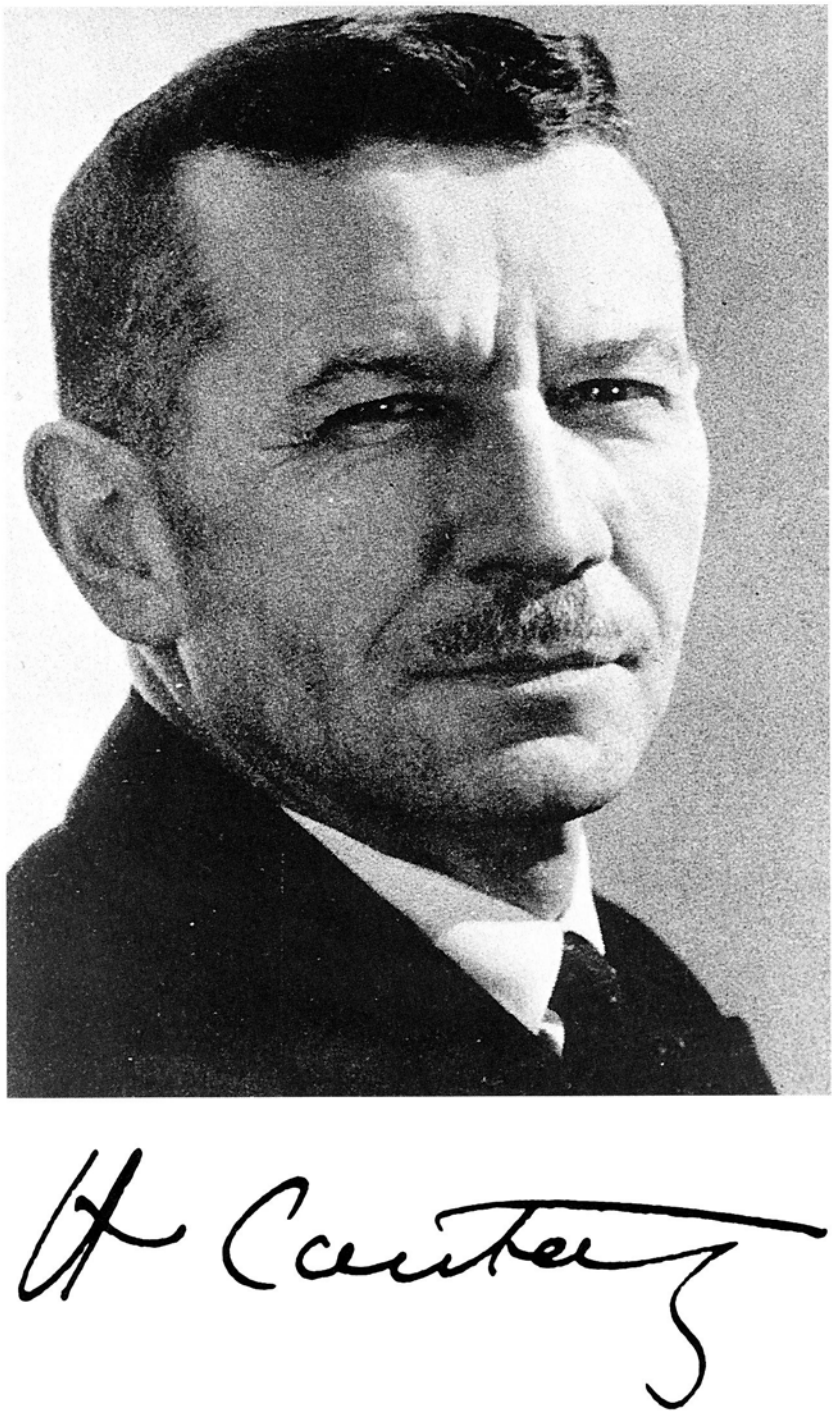

Fig. 10-4. Henri Coutard, chief roentgentherapist of the Curie Foundation (1936).

At the second International Congress of Radiology, held in Stockholm in 1928, Coutard presented his results in the treatment of carcinomas of the tonsil.[112,114] In April 1930 he made a summary of his approach to radiotherapy of cancer for the twenty-first meeting of the German Röntgen Society, held in Berlin.[113] These accurate and honest reports of his work created a sensation. Various interpretations of "Coutard's Method" appeared in publication.[89] Hans Schinz (1891–1966) and his associate Adolf Zuppinger (1904–)[B] visited the Radium Institute and carefully observed Coutard's procedures at work. They concluded that the main tenets of his work were the long duration of the individual treatments (protraction) and the long extent of the series of treatments (fractionation). Thus, they dubbed the technique as the "protracted-fractional method."[704,705]

What escaped the attention of most observers and imitators was the careful clinical control of Coutard's patients.[121] He examined them daily, often more than once, and took care of the proper immobilization of patients at each treatment. To achieve a worthwhile dose in depth, Coutard started his irradiations with a large field which was progressively reduced as the tumors and their adenopathies regressed.[418] The daily dose was made to balance the size of the field of entry, starting with a relatively low dose and increasing progressively towards the end of the treatments. To avoid the development of systemic effects (radiation sickness) so frequently occurring with lower voltages, Coutard placed great emphasis on the proper balance of field and daily dose.[512a] Whenever relatively large fields were required, the daily dose was kept low throughout and, consequently, the treatments were of necessity fractionated over a longer time. Following the international agreement on the roentgen as a standard in 1928, Coutard measured the daily doses by means of an iometer placed in the center of each field over the skin. The special instruments used were the Hammer iometer or the Mekapion integrometer. Most patients developed a moist epidermitis usually requiring daily dressings by the department nurse until completely healed.[118]

Coutard was the only member of the Institute's staff who owned and operated an automobile, as he and his wife lived on the outskirts of the city in beautiful natural surroundings. The few visitors who were able to observe their domestic life were touched by their tenderness to each other. They had no children. Never casually dressed, Coutard was at work early in the morning. At noon, he walked briskly and alone to a gourmet's restaurant in the periphery of the Luxembourg gardens. After his leisurely lunch he threaded his way back through a throng of Sorbonne students and *midinettes,* for an afternoon of work at the Institute (Fig. 10-3).

In the mid-1920s, a great number of foreign visitors began to flow to the Radium Institute of Paris. Among those from England were Brian Windeyer and Ralston Paterson; from the United States, William Harris (1894–1953)[B] and Maurice Lenz (1890–1974).[B] Harris, at Mount Sinai Hospital of New York, and Lenz, at the Montefiore Hospital of the Bronx and Columbia University, became the first advocates of clinical roentgentherapy in the U.S. Another foreign visitor was François Baclesse (1897–1967),[B] from Luxembourg. He had received excellent training in radiodiagnosis and was interested in roentgentherapy. Baclesse applied for a position as *stagier,* and when he completed his obligation, was offered an assistantship in roentgenology. He was hardworking and methodical. Coutard put him in charge of radiodiagnosis and the treatment of patients with gynecological cancer. Coutard retained the entire western wing of the Röntgen Pavilion for the treatment of patients in whom he had special interest, mostly those with cancer of the upper air passages.

Early in 1931, Juan Angel del Regato (1909–), a foreign student sponsored by the Ligu Contra el Cancer of Cuba, was accepted by Regaud as an observer and later assigned by Lacassagne as a *stagier* under Coutard. He became a *boursier* (fellow) of the Fondation Curie and Coutard's direct assistant, responsible for the care of patients during his absences.

In the fall of 1931 at the Mount Sinai Hospital of New York, Coutard made a thorough presentation of the value of radiography in the course of radiotherapy of cancer of the pharynx and larynx.[123] In 1934, at the opening ceremonies of the Marie Curie Hospital of London, he presented a paper on the principles of radiotherapy of cancer.[115] In this exceptional paper, he emphasized fractionation to a total time of no less than forty days, which he thought necessary in the treatment of deep-seated infiltrating tumors. He insisted that fractionation was more important than energy. Strong daily doses were to be avoided to avert damage to the sensitive vasculo-connective tissues. In the summer of the same year, he presented, in Zürich, an account of eighty-nine patients with carcinoma of the hypopharynx he had treated over the years with persistently poor results: only eight patients surviving without cancer after nine years.[117] He indicated the locations and character of those few of these tumors with a relatively better prognosis (Fig. 10-4).

The Fondation Curie received a great number of summer visitors, but there were also those who came seriously interested in training that could not be provided in a short time. Luis Maria Pons (1899–1958)[B] of Argentina spent his last resources to stay over

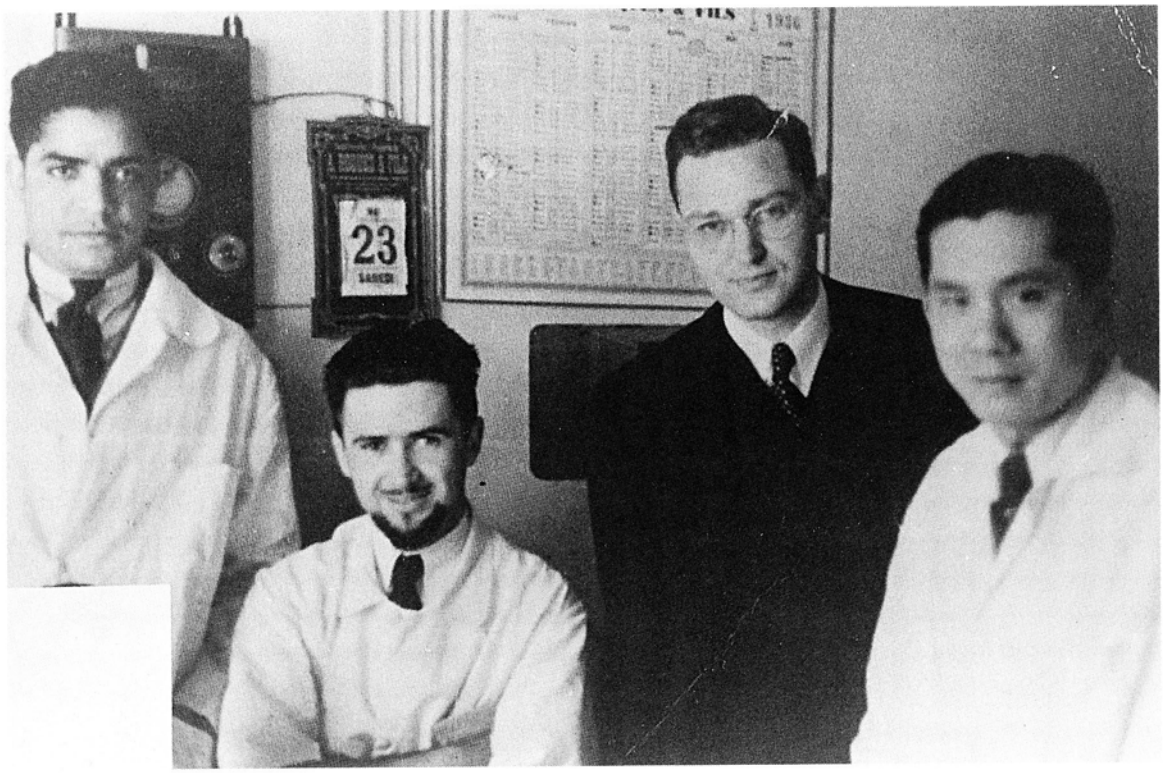

Fig. 10-5. Standing behind assistant roentgenologist J.A. del Regato, *stagiers* Reindal Assad of Haiti, Simeon T. Cantril of the U.S., and Paterno Chikiamco of the Philippines (1936).

three years in Paris, then returned to Buenos Aires, where he remained the outstanding radiotherapist in his country until his premature death. Manoel Corte-Real (1904–1970), heir to a prestigious Portuguese name, returned to Lisbon to marry his fiancée and to establish a practice in general radiology. Jean Stuart Riach (1900–1974),[B] a Scotswoman with a heart to give, returned to England to become the first roentgentherapist at the Marie Curie Hospital of London. Paterno Chikiamco (1906–1984), a cultured polyglot who spoke all languages with a heavy accent, returned to Manila and became professor of radiology. A lecture room and library have been dedicated to his memory at the Cancer Institute of Manila. Reindal Assad (1913–), a handsome Caribbean, was later unable to establish a practice of radiology and so became a successful hotelier in Port-au-Prince. Simeon Theodore Cantril (1908–1959),[B] an intensely dedicated and skillful clinician, returned to the U.S. to be a member of the staff of the Chicago Tumor Institute, and later director of the Swedish Hospital Tumor Clinic of Seattle. Cantril was the first president of the American Society of Therapeutic Radiologists and an early researcher in supervoltage roentgentherapy (Fig. 10-5).

In the early days of the work at the Radium Institute, the *stagiers* wanted training primarily in radiumtherapy. In the 1930's the interest shifted rapidly to roentgentherapy and only a few could be accommodated. All candidates were required to stay a minimum of six months. Those completing four such periods became eligible for the Diploma of Radiophysiology and Radiotherapy, issued by the Faculty of Medicine after presentation and defense of a thesis. Stagiers were usually rotated through the several services, but regardless of their preference were all exposed to a range of views and practice in the admission and follow-up clinics where the institution's surgeons were always represented. This constituted a truly multidisciplinary education.[489]

At the invitation of the Mayo Clinic, Coutard visited and admired the institution. At a staff meeting, he discussed briefly two of his cases, one of which was that of a man with carcinoma of the tonsil followed by voluminous metastases to the supraclavicular and axillary regions. All these lesions had been successfully irradiated, and the patient remained well for years.[118] Invited to speak at the annual meeting of the American Surgical Association, Coutard emphasized that in spite of obvious limitations, radiotherapy could cure patients who were incurable by surgery. He also pointed out the relatively different prognoses of closely neighboring carcinomas of the oral cavity and the contrasting long time presented

by the regression of differentiated adenocarcinomas.[120]

In remote parts of the world radiotherapists were busy essaying their own version of Coutard's method, while he proceeded to search for better ways without regard to directions, contradictions, or the artificial image of the work attributed to him. Among other things, he experimented with associated diathermia and with over-fractionation. Most noted among these experiments was his trial, on scores of patients, of a technique of treatment consisting of three separate courses of irradiation within six weeks. The approach was based on the hypothesis that squamous-cell carcinomas had periodic heights of radiosensitivity at which they were most fruitfully irradiated.[116] The total dose delivered was the same as that administered to continuously irradiated patients, but in view of the two interruptions, the average daily dose was higher. Moreover, often each course was shorter than the preceding one, resulting in rather intensive daily doses towards the end of the treatments.

Coutard had observed unquestionable improvements in results as the kilovoltage of his equipment had been slowly raised. However, there was not a chance in the foreseeable future of obtaining generators of more than 300 kilovolts (at best) from French manufacturers. He was alert to reports of supervoltage units being produced in the United States. Charles Christian Lauritsen, Ph.D. (1892–1968), a Danish born engineer working at the California Institute of Technology in Pasadena, had brought forth an X-ray tube capable of operating at one million volts. The next step was to provide the generator to power it. Working with and under the guidance of Robert Andrews Millikan (1863–1953; Nobel laureate, 1923), Lauritsen succeeded in operating a unit of 700,000 volts at Cal Tech. Millikan enlisted the financial help of the Battle Creek philanthropist Will Keith Kellogg, and the Kellogg Radiation Laboratory was created in 1931. It was not long before hope arose that the powerful new source of rays would prove fruitful in the treatment of cancer. Seeley

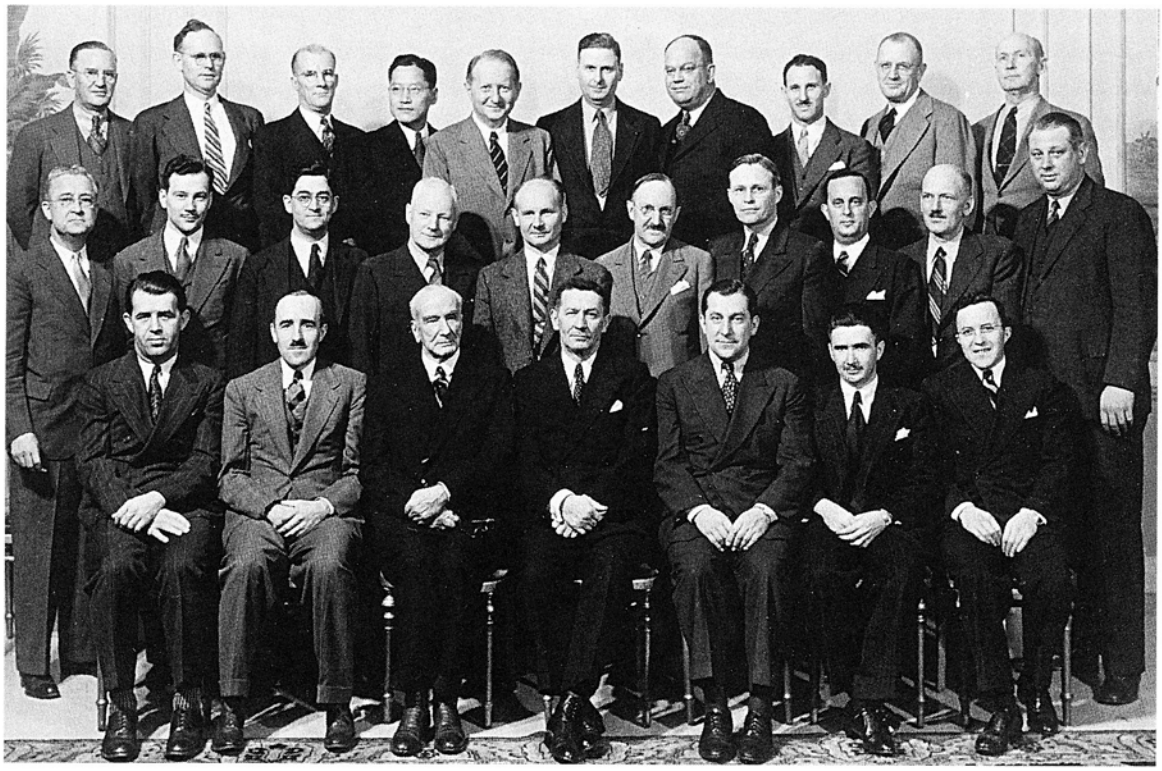

Fig. 10-6. Post-graduate course on radiotherapy of cancer given at the Chicago Tumor Institute, October 1938. Front row: Ralph Caulk, Ernest Wolan, Sir Lenthal Cheattle, Coutard, Max Cutler, J.A. del Regato, and L. Rosenthal. Recognizable in the second row: second from right to left, Leon H. Stuart (1887–1969) of Tulsa; third, Ernesto Fonts, Sr. (1898–1983), radiumtherapist of the Cancer Institute, Havana, Cuba; fourth, William Edgar Eastland (1898–1982) of Oklahoma. Recognizable in the third row: fourth from left to right, Hyan Taik Kimm (1904–1989), then of Peiping, later Director of the Cancer Institute of Tjenzin, Peoples Republic of China. Third from right to left, Nicolás Puente-Duany, Professor of Pathology, University of Havana, Cuba.

Greenleaf Mudd (1895–1968), an internist, was made responsible for coordinating the efforts. Albert Soiland contributed the first patients and was sufficiently impressed that he ordered a 600 kilovolt unit to be installed in his radiologic clinic.

As an emissary of Millikan, Lauritsen visited Coutard several times to invite him to assume clinical research in Pasadena. In fairness, Lauritsen explained that while Coutard would gain an exceptional opportunity to pursue his research interest, the Kellogg Radiation Laboratory would also gain by his presence the consideration of funding by the National Institutes of Health and other private sources. At the same time, Max Cutler (1899–1984)[B] wanted Coutard to head a staff of radiotherapists at the Chicago Tumor Institute. Cutler, trained as a Rockefeller Fellow at the Memorial Hospital in New York, dreamed of creating a similar institution in the American midwest and had obtained important philanthropic pledges for the purpose. After considerable consultation and hesitation, Coutard decided in the fall of 1937 to accept both offers, hoping to gain an advantage in the exploration of new frontiers. He decided to go immediately to California and, after a period of six months, to join the staff in Chicago. Since his plans were only tentative, Mrs. Coutard was to remain in Paris.

In Pasadena, the practical aspects of irradiating patients with an unwieldy source proved to be the main initial difficulty. Richard Stewart Harrison (1906–1986), a Briton who had been a *stagier* at the Fondation Curie and later emigrated to the U.S., was very helpful in this phase. Dr. Mudd made available the help of a group of enthusiastic young physicians: Clyde R. Emory (1901–), who later directed an oncologic surgical clinic; Leo M. Levi (1901–1951); and Mildred F. Wehrly (1901–1976), who retained for their professional lifetimes the inspiration from six months' association with Coutard.

In Chicago Cutler's original plans to build a new structure on Michigan Avenue had to be pared down because of a financial depression and consequent reduction in pledges. An old building on the corner of West Elm and Dearborn streets was remodeled to accommodate the staff provisionally. The supervoltage equipment that had been planned was too expensive, and the staff was offered a lower voltage model. Coutard refused to irradiate through conventional interchangeable lead applicators (cones). He insisted on having a "lighting localizer," as designed by del Regato, to outline the fields. Cutler wrote del Regato, who had temporarily remained in Paris, to send the plans, which were given to General Electric X-Rays. They built the lighting localizers, which became standard equipment in their units in 1938.

Fig. 10-7. Coutard in the company of E. Dale Trout, Ph.D., at the El Pomar Estate in Colorado Springs, 1940.

In April 1938 the Chicago Tumor Institute's staff of radiotherapists, headed by Coutard, consisted of Franz Buschke (1902–1983), with Simeon T. Cantril and J.A. del Regato as junior staff. Sir Lenthal Cheattle (1885–1951), a very reputable oncologic surgeon, came from London. Ludvig Hektoen (1863–1951) was the consultant pathologist. Arthur Holly Compton (1892–1962) was the consultant physicist. Max Cutler was in charge of curietherapie, assisted by Louis Rosenthal (1902–1958). Ernst Omar Wolan (1902–1984) was the staff physicist (Fig. 10-6).

During the spring and summer of 1938, the principal activity of the Chicago Tumor Institute staff was the daily teaching of successive comprehensive courses on the treatment of cancer. These were subscribed to capacity. However, Cutler had failed to enlist the support of the medical community, and there was a scarcity of patients. In the fall, Sir Lenthal returned to London, Cantril and Buschke went to Seattle, and del Regato went to Washington, D.C. With news of impending war in Europe, Coutard tarried awhile longer.

Spencer Penrose (1865–1939), scion of a famed Philadelphia family and holder of a Harvard degree in engineering, had gone west in search of adventure and found wealth in gold and copper smelting. A colorful man with a great zest for living, he married young Detroit widow Julie Villiers (Lewis) McMillan (1870–1956) in Paris in 1906. A heavy smoker, Pen-

Fig. 10-8. Bronze head of Henri Coutard by the sculptor Julio Girona, now in the Department of Radiotherapy of the Claudius Regaud Hospital of Paris.

rose developed a carcinoma of the laryngopharynx and was referred to Coutard for treatment in Paris, in 1932. He was irradiated twice daily for six weeks and was cured. Seven years later, in 1939, he developed a new carcinoma of the esophagus. Intending to return to Paris, he found that Coutard was in Chicago. After proper studies and consultation, it was decided he should receive roentgentherapy. Coutard planned a course of three separate series of treatments. During the first series in Chicago, Penrose summoned the manufacturer's representative and requested that a Maximar 400 kilovolt unit be installed at his El Pomar estate in Colorado Springs. Expense being no obstacle, his wishes were promptly fulfilled, and Coutard agreed to continue the treatments in the Rocky Mountains. With the physics support of E. Dale Trout, Ph.D. (1922–1977), he carried out the remaining treatments, insisting on irradiating twice daily, *twelve hours apart* (Fig. 10-7).

During this period, war had started in Europe, and Mrs. Coutard had died of acute leukemia in Paris. Awaiting what eventually proved to be an unsuccessful result, Penrose donated his valuable equipment to the Sisters of Charity for their local Glockner Hospital. A few months after Penrose's death, in December 1939, Julie Penrose, as President of the El Pomar Foundation, granted the necessary funds for building a pavilion which became the Penrose Tumor Clinic of the Glockner Hospital. Coutard accepted her invitation to continue his clinical research there. Responsibility for overall direction of the clinic was entrusted to James Wallace McMullen (1911–1992), while various members of the staff of the Glockner Hospital were expected to cooperate in the enterprise.

In this last phase of his research, Coutard continued to work intensely but alone. Seeking to study possible indirect effects of radiations, he irradiated patients through sieves. A visitor carried the idea to New York, and soon a manufacturer was making full-paged advertisements for rubber lead sieves. The method had a temporary vogue and was dubbed the "poor man's supervoltage." He also made efforts to irradiate patients with monochromatic X-ray beams; without the proper physics support, this attempt was illusory. He also experimented with the administration of minute doses of radiations. The Victoreen Company of Cleveland made special ionization chambers for his use. As usual, he worked on a variety of hypotheses, unhampered by his own or anyone else's preconceptions. In this last decade of his professional life, he gained a splendid independence, but lost the strong support as well as the critical opinions of his peers. He did not seem to appreciate the extent to which his isolation had hampered his work and dimmed his brilliance. He had no intercourse with those who might have helped him shape his thoughts.

Susanne Rosalie (Methot) Jourjon (–1949), widow of a French movie magnate, came to the United States to marry Coutard. In Colorado Springs, they lived on Culebra Avenue and later, at 2 East Columbia on the corner of Cascade Avenue, within walking distance from the clinic. He went to bed each night after dinner, but awoke and dressed before dawn to work in his den. In Colorado Springs, Coutard was the only member of the staff who did not own or operate an automobile. Once a week he requested a chauffeured limousine from the Broadmoor Hotel to

take him to the Garden of the Gods. In an area called "Calvary," among fantastic figures chiseled on the limestone by the inveterate winds, with the silhouetted mountains in the distance offering wings to the imagination, he spent hours in meditation and contemplation of the natural beauty of the red rocks.

In 1948 Mrs. Penrose visited del Regato at the Ellis Fischel Cancer Hospital in Columbia, Missouri. She was impressed by the multidisciplinary activities of diagnosis, treatment, education, and research. She decided that a Penrose Cancer Hospital was the monument she wished erected in memory of her husband in Colorado Springs. The Sisters of Charity and the medical staff of the Glockner Hospital wanted to see the Tumor Clinic's activities expanded. In January 1949, del Regato was appointed Director of the Penrose Cancer Hospital to attend to the initial steps of organization. Mrs. Penrose had to be persuaded that a free-standing cancer hospital (for which she already had architectural plans) was not suitable for a small community without a larger medical center. In time she agreed to have a cancer hospital to work in conjunction with a modern general hospital replacing the old Glockner facilities. These plans were not to interfere with Coutard's continuation of work as he saw fit.

Mrs. Coutard's health declined, and her children came to take her back to France. Officers of the El Pomar Foundation were pressing Coutard to publish his results, his ideas, or his philosophy. In the fall of 1949, he decided to go to Paris to see his wife and to arrange for a small monograph to be published by Gaston Doin et Cie.[122] After twelve years of silence, his last words show little resemblance to his former works. They contain touching reminiscences and baffling concepts.[429] The few who were close to him, wrote Baclesse, always had difficulty following ideas which came out of his brain like galloping horses in the prairie![18]

Towards the end of 1948 his wife died. He then accepted an invitation to spend some time at the Radium Station of Copenhagen, where Jens Nielsen (1899–1964), one of his faithful followers, was director. Flying back to France on Christmas Eve to join his sister's family, he suffered a cerebral hemorrhage. After three months of infirmity he died in Le Mans, on 16 March 1950. He was a Chevalier de la Legion d'Honneur. In Marolle-les-Braults, a square near the center of town is named in his memory.

Coutard was indeed a man like few others. An austere individualist and a habitual skeptic, he had a mystic's respect for the unknown and a taste for the impossible.[481,482] He felt that in explaining a fact, we often render it strange to ourselves, that names and definitions often hide a world of unknown facts. "Hardened around us, encasing wholly every notion we form," he would say, "is a wrapping of traditions, hearsays, mere words." He had a constant fear of the contemplation of the accomplished task and thought of consistency as a distortion of character. His intellectual aspiration and hidden emotions were often in disharmony, a condition often accompanying brilliant minds.

In 1937, before his departure from Paris, I persuaded Coutard to allow a young sculptor friend of mine to observe him while he worked at his desk in the early hours of the morning. Gradually, he conversed with the artist as he worked on his plaster. I had the product smelted in bronze and brought it to the U.S. It was in my office for fifty years. In 1992, I decided to have it returned to France and donated it to the Curie Institute. The bronze head (Fig. 10-8) was inaugurated in November 1992 in the Department of Radiotherapy (now in the Claudius Regaud Hospital), which Coutard founded in 1919.