TEACHING AND RESEARCH
IN MEDICINE

THE MEDICAL LABORATORIES AND THE
SCHOOL OF MEDICINE

The Medical Laboratories

The School of Medicine is situated in the extensive structure of brick and limestone, known as the Medical Laboratory, which lies along the south side of Hamilton Walk just west of Thirty-sixth Street. The building contains two amphitheatres seating 150 students each, where are given formal demonstrations in the six preclinical subjects—pathology, pharmacology, physiology, bacteriology, anatomy, and physiological chemistry; three lecture rooms in the basement for formal lectures in these subjects; and the medical library of seventeen thousand volumes. It contains as well the offices and laboratories of the departments teaching the preclinical subjects, and museums of anatomy and pathology. On the second floor of the tower over the front entrance are the offices of the Vice-President in Charge of Medical Affairs, the Dean of the School of Medicine, and the Dean of the Graduate School of Medicine.

In a broad sense, medical teaching is carried on not only in the laboratories just mentioned, but also in the Laboratory of Public Health and Preventive Medicine; the University Hospital and its various medical and surgical clinics and laboratories; the Graduate Hospital; the Henry Phipps Institute for the Study, Treatment, and Prevention of Tuberculosis; the Evans Institute (Dental School); the Veterinary School and Hospital, and the School of Animal Pathology, to mention only those which are directly a part of the University. The Wistar Institute of Anatomy and Biology, which adjoins the Campus, is an affiliated organization, and its staff carries on biological and anatomical research in close cooperation with the medical faculty of the University. In addition most of Philadelphia’s
other hospitals and medical institutions (medical schools excepted) cooperate with the School of Medicine and the Graduate School of Medicine, making a total of nearly sixty medical organizations which contribute to and benefit from the instruction and research in medicine carried on by the University of Pennsylvania.

So extensive is the work in medicine that in 1931 the Trustees of the University created the office of Vice-President in Charge of Medical Affairs, to which was named Dr. Alfred Stengel, of the class of 1889 Medicine. Until his death in 1939, Dr. Stengel administered an organization with physical assets valued at nearly $11,000,000, endowments amounting to approximately $12,500,000, and a total annual budget of over $2,000,000.

The Medical Laboratories, the heart of this organization, comprise the largest single building of the University, exceeded in size only by the University Hospital group, the dormitories, and the combined Palestra and Hutchinson Gymnasium. The Laboratories as they now stand are the result of two building operations, one completed in 1904, the other in 1928. Construction of the original unit, then known as “The New Medical Laboratory,” was made possible through the generosity and energy of Provost C. C. Harrison. It is two stories high and is in the shape of a B, the inner courts providing necessary light, usually from the north, to the large laboratory rooms. The architectural design is an English collegiate style of the mid-seventeenth century, which harmonizes with the dormitories stretching along the north side of Hamilton Walk.

The library, a marble-wainscoted room hung with oil portraits, is directly opposite the front entrance and up a half flight of marble stairs. Over the door is the famous painting by Eakins of Dr. D. Hayes Agnew in his clinic. Before 1928 the library had scanty quarters on the west side of the second floor, and its present room was the upper part of two adjacent amphitheatres each holding three hundred students, a number in excess of that which the rigid restriction of the size of the entering class made necessary. The steep pitch of the amphitheatres was therefore lowered and a floor was constructed across the upper half of the original space. The result was the reading room of the library and lecture rooms “A” and “B” in the basement, each seating 213.

Four departments use most of the space in the original building. The Departments of Physiology and Pharmacology occupy the first floor and basement, while the laboratories and museum of the Department of Pathology are on the second floor, along with the
Department of Bacteriology. In addition to these, other departments now occupy parts of the New Medical Laboratory. In the basement are the museum of anatomy and numerous small research laboratories allotted from time to time to various departments. On the first floor is the Laboratory for Dermatological Research, established by Dr. Milton J. Hartzell, a machine shop, a photographic darkroom, and a room where a skilled glassblower fashions intricate research apparatus for workers in the School of Medicine and other departments of the University. On the second floor considerable space is occupied by the Department of Research Surgery, which also extends into the newer wing of the building shortly to be described.

Although the architects were responsible for the appearance of the New Medical Laboratory and the soundness of its construction, it was designed by the three professors who were then in charge of the work in pathology, physiology, and pharmacology—Simon Flexner, E. T. Reichert, and Horatio C. Wood. Anticipating the inevitable growth of their subjects, they provided about a quarter of a million square feet of laboratory floor space, much of which was subdivided into small research laboratories, now considered commonplace but in that day a radical departure from the usual design of medical school buildings.

No place had been reserved in the New Medical Laboratory for anatomy and chemistry. Until 1928 the dissecting room remained on the fourth floor of the Hare Building, with storage equipment in the basement; and chemistry for medical, dental, and veterinary students continued to be taught on the first three floors of that building. Plans for modern laboratories for anatomy and chemistry were realized in 1928, when these departments were given a new home in an addition to the laboratories built in 1904. Half the cost of constructing and equipping the addition was provided by the Rockefeller Foundation and the General Education Board.

The new laboratories, which join the rear of the original building at the west end and the center, are in the shape of a Y, the longer element of which extends for 264 feet along the "Blockley" wall. They are four stories high (one wing is five stories) over a basement and sub-basement. Space in the building is divided fairly evenly between the Departments of Anatomy and Physiological Chemistry. The sub-basement, basement, and the two lower floors are devoted to anatomy, a total of more than sixty thousand feet of floor space, while the two upper floors and storage loft provide more than fifty thousand feet of space for physiological chemistry.
THE SCHOOL OF MEDICINE

There are two conspicuous features in the limestone carvings on the entrance to the Medical Laboratories. One of these is the thistle, which also forms the ornamental border of the elaborate chart of the professors of the Medical School which hangs on the second floor near the Dean’s office; the other is the two medallions which bear the names of Morgan, Shippen, Kuhn, and Rush. The thistle and the names are closely related. The former symbolizes the University of Edinburgh, from which John Morgan, William Shippen, Jr., Adam Kuhn, and Benjamin Rush, the first four professors on the medical faculty, received their degrees of Doctor of Medicine.

The School established in 1765, the first in America, seems puny in comparison with that of today; there were but two professors, a minimum of five courses was required, and at the first commencement, held June 21, 1768, ten graduates received degrees. But considering the state of medicine and the small population of Philadelphia in 1765, the significance of the school can hardly be overlooked.

Today the course of study seems sufficiently impressive to the 120 young men and women (women were first admitted in 1914) who are accepted each year. The catalogue of the School of Medicine describes the work of the first two years as being arranged according to “a modification of the concentration system,” whereby the student concentrates on and masters a few subjects before progressing to others. For four years the students spend an average of thirty-five hours each week in lecture rooms, laboratories, and clinics, not to mention the hours spent over textbooks in their rooms. Rigidly selected though they are from the top ranks of college graduates, many feel that they have just begun to study when they first make the acquaintance of the nearly five hundred professors, associate professors, assistant professors, and others who comprise the various departments of the School of Medicine.

In the main, the first two years are devoted to the six preclinical subjects, taught in the Medical Laboratories, but some time is spent in hospital clinics in order to demonstrate the dependence of medicine and surgery on the fundamental sciences. Following the opening of the New Medical Laboratories in 1904, when especially extensive laboratory facilities were provided, most of the work of the first
two years has been practical, so that the greater part of the student's time is spent in laboratories and not in lecture rooms.

During the last two years the student does most of his work in the University Hospital and other cooperating hospitals, studying the so-called clinical subjects—medicine, surgery, obstetrics—and the specialties. The primary aim of the course is to graduate doctors who are prepared for the practice of general medicine, but an elective trimester is offered in the fourth year to give the student an understanding of the training needed for specialization and to pave the way for advanced study after graduation. In addition, encouragement is given to students capable and willing to engage in investigative or advanced work, whereby they may gain an insight into the opportunities for research and the need for trained investigators and teachers in the medical sciences.

DEPARTMENTS IN THE MEDICAL LABORATORIES

Anatomy: The Department of Anatomy stands first in the Medical School catalogue because it is with anatomy that the student commences his medical course proper. First place might have been granted this department because it occupies more space in the Medical Laboratories than any other department and the students give more time to the triple phases of anatomy—gross and microscopic anatomy and neurology (a total of 695 hours in the first three years)—than to any other laboratory subject. To the historically minded a reason might be that the Department of Anatomy can be said to be older than the Medical School, for in 1762 Dr. Shippen, the first professor, started teaching anatomy to twelve students in the rear of his father's house on Fourth Street. Indeed, Shippen's even more famous successor, Dr. Caspar Wistar, author of the first book of anatomy published in America, once claimed that this was the origin of the Medical School.

The present staff and facilities of the Department represent an advance over the conditions of 1762 that need not be figured in percentages. The laboratories can accommodate at least 500 students and research workers at one time. Approximately 400 students are taken care of each year, of whom 120 are medical students, an equal number are dental students, and 160 are students in the Graduate School of Medicine. The present staff of fifteen more than adequately carries on the traditions of teaching and discovery set by Shippen, Dorsey, Physick, Horner, Leidy, and Piersol.

The laboratory of gross anatomy, the largest room used by the department, is on the first floor, and in it 120 medical students,
working in groups of four, spend the major part of the 436 hours devoted to gross anatomy during their first year. The adjoining histology laboratory accommodates a maximum of 148 at one time and is used by medical, dental, and graduate students. On the floor below there are a large dissecting laboratory and several smaller ones for students in the Dental School and in the Graduate School of Medicine.

These large laboratories comprise less than a third of the space used by the Department. In addition there is an animal house with double, odor-proof doors, an aquarium, a room equipped for motion picture photography, an artist’s studio, and the Piersol Library of Anatomy, the gift of the late Dr. Piersol, whose *Human Anatomy* is a classic of medical literature; and there are rooms for X-ray, used in teaching living anatomy, for gross photography, for photo-micrography, and for embalming.

The museum of anatomy is in the basement of the older part of the Medical Laboratories, off one of the lecture rooms, in which its wax models and preserved specimens are used, but more important in the instruction, which is given mainly in the laboratories and conference rooms, is the reference specimen room near the laboratory of gross anatomy. In the “humidor” tables of this room are kept moist specimens, replenished each year from the dissections made by the medical students, which may be handled directly by any student or physician wishing to study or review anatomical structures.

The thirty-nine small research laboratories which, singly and in suites, are used by members of the staff and advanced students are largely responsible for a steady stream of published articles. Possibly the most important single item of research now in progress is the systematic investigation of the growth and behavior of living structures studied with the aid of a new technique developed in this laboratory. The method consists of the installation of a double-walled transparent chamber in the rabbit’s ear, in which individual living cells and groups of cells can be watched under high-powered microscopes. Not only can the normal tissues such as blood and lymphatic vessels be studied minutely, but also cells transplanted from other parts of the animal’s body.

Current work by the staff includes study of the growth of blood vessels, of regulation of the flow of blood through the small vessels, of new growth and activity of lymphatic vessels, of living endothelium, connective tissue, and wandering cells; of the growth of bone and of transplanted thyroid follicles, of the anaphylactic reaction,
of certain phases of the silicosis problem, and of the effects of various chemicals, including carcinogenic substances, upon the growth and behavior of tissues.

Physiological Chemistry: The Department of Physiological Chemistry occupies the third and fourth floors of the new wing of the Medical Laboratories. Here the first-year medical students devote 116 hours to the subject, becoming pretty thoroughly acquainted with the chemistry of proteins, fats, carbohydrates, enzymes, blood, urine, bone—in fact with most of what the body is made of, consumes, or excretes. In addition to the 120 medical students, 150 dental students, and 50 veterinary students, about 20 graduate physicians and a varying number of candidates for the M.A. and Ph.D. degrees work under the direction of the ten members of the Department.

Most of the class instruction is carried on on the fourth floor, in the large laboratory at the west end of the building. This laboratory, which has seven thousand square feet of floor space, will accommodate 154 students and is used by medical, dental, veterinary, and graduate students. On this floor also are balance rooms, animal rooms, a large recitation room, and a large store room, fifty by eighty feet, such as is needed in every chemistry laboratory. On the floor below are the offices and research laboratories of the members of the staff. In addition to a warm room and a cold room, there are constant-temperature rooms, animal rooms, and a seminar room. Indeed there is everything that a thoroughly modern department of physiological chemistry ought to have, including an excellent departmental library.

The first man to occupy an independent chair of chemistry in America was Benjamin Rush, Professor of Chemistry in the University, although Dr. John Morgan and the first Provost, William Smith, had taught chemistry before him. A voluminous writer on all subjects, Rush was the first of a long line of investigators, some of them physicians like himself, who gained distinction for themselves and for the University by their research in chemistry. The Director of the Laboratory also holds the Benjamin Rush Professorship of Physiological Chemistry, a chair created by the Trustees in 1922. Under his direction a great amount of research activity is carried on in the laboratory, some of it in cooperation with other departments of the Medical School. Chemistry, especially in recent years, has invaded most of the divisions of medicine, and such joint effort is to be expected. The Department is also cooperating with the University Museum in its study of the chemistry of old pottery.
A joint project with the Department of Obstetrics and Gynecology devoted to the study of the gonadotropic hormone of pregnancy urine (the hormone involved in the "rabbit test") led to the announcement in 1939 of the isolation and purification of that hormone. Other work is concerned with nutrition, especially as it applies to tetany and rickets, with the action of enzymes and the chemistry of compounds containing nitrogen. One member of the staff is prosecuting fundamental investigations of the spectro-photometry of hemoglobin and its derivatives.

Physiology: When the Medical School was inaugurated in 1765, Dr. John Morgan was appointed Professor of the Theory and Practice of Physick. The "Theory," no doubt, covered what little was known of the underlying sciences of the art of medicine. In 1789 the Trustees of the College appointed Dr. Caspar Wistar to the chair of the Institutes of Medicine, as physiology was then known. With the merging of the College of Philadelphia with the University of the State of Pennsylvania in 1791, Dr. Benjamin Rush succeeded Dr. Wistar. In 1877 the name of the Department was changed to Physiology, and a year later the comparative anatomist Dr. Harrison Allen was appointed. The latter was succeeded in 1893 by Dr. Edward T. Reichert, who served until his retirement in 1921. Including Dr. Morgan, there have been only ten incumbents of the chair.

In 1904, with the construction of the Medical Laboratories on Hamilton Walk, the Department was transferred from the Hare Building and has since been assigned the major part of the first floor and part of the basement. One of the rooms is a large laboratory accommodating 132 students. The others are offices of the eight members of the staff, private laboratories, preparation rooms, a glassblowing room, and a machine shop. Practical laboratory instruction was not given until 1900, under Dr. Reichert and his assistant, Dr. Edward Lodholz. As a result of the efforts of these two men, the teaching laboratory was completely equipped with apparatus, and probably excelled any teaching laboratory then in existence.

Since 1921 the practical instruction has been greatly changed. The older method of using lower forms of animal life for experimentation has been greatly abridged, and the majority of experiments are now performed upon mammals. Even the students are the subjects of carefully supervised experiments. In addition to the medical students, approximately 120 dental students receive instruction for four months of the year.
At present a group in the Department is carrying out extensive investigations of circulatory and cardiac changes under varying conditions of climate, a project that is being supported by the John and Mary R. Markle Foundation. Other current researches are on permeability, secretion, exchange of gases through the skin, reactive hyperemia, anesthetics, spinal reflexes, the brain temperature during transcerebral diathermy, skin temperatures, galvanic currents between dental fillings of different constituents, and the osmotic pressure of the blood under varying temperatures.

One little-known fact concerning the Department is the publication in 1803 of a thesis entitled *An Experimental Inquiry into the Principles of Nutrition and the Digestive Process*, by Dr. John R. Young, who was graduated in that year and unfortunately died the next. Dr. Garrison in his *History of Medicine* says, "[Young] showed that the solvent principle of the gastric juice is an acid, turning litmus paper red and softening bones into a pulp, [and that] this acid is a part of the normal gastric secretion." In a day when analytical chemistry was not so accurate as at present, Dr. Young wrongly inferred that the acid principle was phosphoric acid. Nevertheless his pioneer investigation demonstrates the high standard of work done during the incumbency of Dr. Rush. Over a hundred years later, another student demonstrated an accurate method for determining the capillary blood pressure, one of the classical experiments of physiological research.

**Pharmacology:** Under different names and with a varying emphasis that has reflected the progress of medical practice, what we now know as pharmacology has been taught at the University since the founding of the School of Medicine in 1765. Dr. John Morgan first paid attention to it as Professor of Theory and Practice of Physick. Then in 1768 Dr. Adam Kuhn was appointed Professor of Materia Medica and Botany, teaching the latter subject, apparently, only as it had a direct bearing on drugs. With the appointment in 1789 of Dr. Samuel Powell Griffitts, who later was primarily responsible for the founding of the United States Pharmacopoeia, the title of the chair was changed to Materia Medica and Pharmacy, and it was changed to Materia Medica and Therapeutics in 1850, when Dr. Joseph Carson, the historian of the first hundred years of medicine at the University, was appointed. Dr. Carson’s successor, Dr. Horatio C. Wood, bore the cumbersome title of Professor of Materia Medica, Pharmacy, and General Therapeutics, but this was shortened to Professor of Therapeutics and Pharmacology during the
tenure of Dr. Wood's successor, Dr. David L. Edsall; and finally in 1910, when the present incumbent was appointed, the title became simply Professor of Pharmacology.

The name "pharmacology" means simply the science of drugs, but ever since the subject was first established as an independent branch of medical science, in Strasbourg in 1871, its aims have tended more and more away from the study of the drugs themselves and toward the study of the influence which they exert upon the body. These aims now find expression in activities of three main types. One is to obtain a better understanding of the ways in which chemical substances can influence the functions of the body; this type of investigation has not only enabled the practitioner to use his drugs to better advantage, but it has also added significantly to knowledge concerning body functions. Another aim is to discover new and improved remedies, and efforts along these lines have been conspicuously successful, especially in recent years. Finally, it attempts to ascertain the harmful potentialities, not only of substances now used or suggested as remedial agents, but also of materials and agents used in industry—a field of interest of constantly growing importance and one in which pharmacology is able to contribute methods of established value as well as an understanding (often denied the chemist and industrialist) that it is much easier to make a substance than it is to test its actions adequately.

This then is the subject taught in the Department of Pharmacology's extensive laboratories in the basement and on the first floor of the Medical Laboratories. Most of the instruction is devoted to the systematic exposition of the actions of useful drugs and to experiments, conducted in small groups under adequate supervision, which demonstrate and clarify the effects of drugs upon the heart, the blood-vessels, the gastro-intestinal tract, the respiration, the kidneys, and other physiological systems. Since the course comes at the end of the second year, when the students have already received instruction in anatomy, biochemistry, bacteriology, and pathology, and since the action of chemical substances on living tissues is now a matter of great interest to all these subjects, it has become possible for pharmacology to assume the task of correlating and coordinating the preclinical sciences and not to limit its instruction to items related directly to the actions of drugs. This attitude toward the subject is continued in a course in clinical pharmacology which is conducted during the third year in the wards of the University Hospital and in which an attempt is made to correlate the findings of the laboratory with observations made at the bedside. The older
aspects of pharmacology, namely materia medica and pharmacy, which comprise the origin, nature, manufacture, and preparation for use of drugs, are covered by suitable lectures and laboratory exercises, but the emphasis in the course at all times is on the physiological rather than the chemical or botanical aspects of the subject.

Since the course in pharmacology attempts to correlate the preclinical sciences, an instructorship in this branch has proved attractive to young physicians who contemplate a career in scientific medicine, and one of the useful services performed by the Department has been, and continues to be, the training of a group of such men, some of whom retain their connection with the Department by assisting in the course in clinical pharmacology. The staff of the Department has also been active in research along various lines, notably the function of the kidney, the actions and uses of ephedrine and related substances such as benzedrine (both of which had their first use in this country in this laboratory), the nature and mechanism of addiction to morphine in man and animals, the action of various drugs on respiration, the cerebral circulation and its adjustments, reflexes from the carotid sinuses and from the carotid and aortic bodies, and a series of systematic quantitative studies—the first of the kind ever made—of the action of commonly used drugs upon various functions in normal and diseased human beings. Department members also collaborate with the staff of the Johnson Foundation in studies of the action of drugs on the nervous system. This research program has been aided by substantial grants from the Commonwealth Fund, from the Northern Masonic Jurisdiction of the Scottish Rite Masons, and from other donors who prefer to remain anonymous.

Pathology: Pathology, which is the study of disease in all its relations, especially of the structural and functional changes that it produces, naturally plays an important part in medical research and in the instruction of future physicians. It was not recognized as an independent discipline, however, until the nineteenth century. The first incumbent of an independent chair at the University of Pennsylvania was James Tyson, who was one of the earliest apostles in this country of Virchow’s theory of cellular pathology.

For many years the Department has occupied most of the second floor of the Medical Laboratories. Here are located the laboratories of gross morbid anatomy, experimental pathology, and histological pathology, the museum of pathology, the numerous research labora-
tories used by the staff and advanced students, and the valuable departmental library of five thousand volumes, which are also catalogued in the main medical library and so are generally available.

The equipment of the laboratories includes apparatus needed for the routine study of pathological processes both in gross and microscopic specimens, and also for advanced study and research by physiological, chemical, bacteriological, biophysical, or any other suitable methods. And if not a part of the equipment of the Department, at least a part of its facilities are the autopsy rooms of the University Hospital and the Philadelphia General Hospital, where the Department is responsible each year for more than two hundred and twelve hundred autopsies, respectively.

As with other medical subjects, the teaching of pathology has greatly changed since the early days, when an assistant, attached probably to the Department of Medicine, gave a few lectures augmented by some poorly prepared slides and faded gross specimens, with rare autopsies that were usually beyond the comprehension of the undergraduate. Changed also is the teaching of a somewhat later time, when the conscientious professor, his course attended toward the end by only a few stalwarts, argued pathological problems through some two hundred lectures and even then perhaps failed to cover all the chief systems of the body; when slides were often studied without previous mention of the disease condition, and the gross specimens illustrating the condition were not seen until a year later; when autopsies were observed, like surgical operations, in the dim distance only, and the dynamic functional aspects of the subject were never encountered.

The present teaching aim is threefold: to give some training in evaluating knowledge acquired at first hand or from others, an understanding of the general concepts of disease, and a reasonable stock of pathological information in its correlation with clinical medicine. To achieve this, the Department believes in fewer formal lectures and more actual observation of the effects of disease revealed by dead and living tissue. No attempt is made, of course, to turn out professional pathologists.

The pathological museum, containing about six thousand specimens, serves as a basis for the undergraduate and graduate teaching of that part of gross pathology that cannot be observed at autopsies. Started as a medical museum in the early nineteenth century by Caspar Wistar and carried on by Horner, Wistar's successor in the chair of anatomy, it has continued to receive additions of new specimens, notably those of the George B. Wood collection. The 1888 fire
in Medical Hall, occurring at a time when the medical sciences were rapidly developing, led to the foundation of the Wistar Institute and the housing there of the non-teaching part of the Wistar and Horner Museum. The remainder, which is constantly being added to, has continued to aid in pathological teaching and research.

In his non-teaching time, each member of the Department's staff of thirty-one is engaged in research. One member has for many years devoted himself to the microscopic study of obscure types of tumors; another, after investigating phagocytosis and the semi-permeability of animal cells, has greatly expanded our knowledge of malignant tumors in cold-blooded animals; another is concerned with the endocrines, especially the pituitary in its structural and functional relations with other glands; others have studied various phases of the chemotropism of leucocytes. Investigations are being carried out on infections and neoplasms in reptiles, on experimental anemia and nephritis, on vitamins and their relation to anemia, and on various problems of the blood-forming organs. The results of this constant research effort, some of it financed by grants from foundations, societies, and other sources, appear at intervals in Studies from the Department of Pathology, now in their sixth volume.

Medical Bacteriology: The University of Pennsylvania was a pioneer in bacteriology in America, for it was in 1892, only six years after the founding of the Pasteur Institute in Paris, that the Laboratory of Hygiene (now the Laboratory of Public Health and Preventive Medicine) was opened. Medical bacteriology, however, was taught in the Department of Pathology until 1899, when it was transferred to the Laboratory of Hygiene, then under the direction of Dr. Alexander C. Abbott, author of one of the first textbooks of bacteriology and a founder of the Society of American Bacteriologists. Dr. Abbott's successor in 1928 was Dr. David H. Bergey, who was known throughout the world as an authority on systematic bacteriology. His Manual of Determinative Bacteriology has passed into its fifth edition.

Upon the retirement of Dr. Bergey in 1931, instruction in medical bacteriology was removed from the Laboratory of Hygiene to its present location on the second floor of the Medical Laboratories for the better correlation with other departments of the Medical School, especially pathology and research surgery. Here are located a large laboratory which is shared with the Department of Pathology, and thirteen research laboratories used constantly by the fifteen members
of the staff. Another laboratory is on the top floor of the tower, and in the basement is a large room where media and materials are prepared on almost a commercial scale.

The new Department of Medical Bacteriology was formed around a nucleus of former students of Theobald Smith, Hans Zinsser, and F. G. Novy, three distinguished pioneer American bacteriologists, at least one of whom had received part of his knowledge directly from Pasteur and Koch, the founders of the science. The quality of the instruction offered in the Department each year to the second-year class of about 110 medical students is attested by the fact that it has been adopted by other medical schools, either in part or practically in its entirety, and has also been voted one of the best organized courses by the medical students themselves.

The Department is especially active in research. During the first eight years of its history, some eighty publications appeared. Medicine has profited from the researches on phagocytosis, air-borne infection, the uses of convalescent serum, and the preservation of biological products. Many additions have been made to the science of bacteriology and immunology as a result of the investigations of hemolytic streptococci, the cause of scarlet fever, child-bed fever, erysipelas, etc., and on the microorganisms causing diphtheria, whooping cough, and typhoid fever. Many contributions have been made to various fields of science in the perfection of such new techniques as improved serological diagnostic tests, the breaking up of microorganisms by the use of a ball mill or by sonic vibrations, phagocytosis, and the preservation of labile substances under high vacuum.

THE UNIVERSITY HOSPITAL AND THE CLINICAL DEPARTMENTS OF THE MEDICAL SCHOOL

The University Hospital

The University Hospital, which was opened in 1874, was the first in the United States directly connected with a medical school, and from the beginning the clinical members of the faculty of the School of Medicine have composed its staff. Although the Hospital is not immediately under the administration of the Trustees of the University, all but two of the twelve members of the Board of Managers are appointed by the Trustees. The two exceptions are representatives of the Board of Women Visitors.
Although in 1874 the ground on which stood the original building, designed by Thomas W. Richards, offered what seemed ample room for expansion, at present its various units crowd the two city blocks between Thirty-fourth, Thirty-sixth, Spruce, and Pine streets, and if a new unit is to be constructed, an obsolete one must first be torn down, as has happened thrice in the past.

A few statistics from the report of the Managers for the year ending May 31, 1939, give some idea of the Hospital’s share in caring for the sick. The thirty-one out-patient departments and sub-divisions received 118,224 visits during the year, each at a cost to the Hospital of $1.11; of the 11,061 patients treated in its twenty wards and seventy-one private rooms, 3,244 paid but a part of the $5.62 per day which they cost the Hospital, and 2,933 received free care. Nearly 1,000 babies were born in the maternity division, and 16,584 persons received emergency treatment. The total budget for the year was approximately three-quarters of a million dollars. When the new construction, to be described below, is completed, the Hospital will have 94 private rooms, 40 semi-private rooms, and a minimum of 518 ward beds, providing a total of 652 beds for the care of in-patients.

The Hospital is the largest aggregate of buildings in the University; most of them front on Spruce Street. At the corner of Thirty-fourth Street is the J. William White Surgical Pavilion, named for the distinguished Professor of Surgery, father of physical education at the University and an important benefactor. The ground floor of the White Pavilion houses the Department of Radiology. The third floor is devoted exclusively to gynecology. The remainder of the eight floors (except the sixth, which contains only machinery) serves the Department of Surgery primarily. There are two surgical wards for women, one for men, three surgical amphitheatres, laboratories for surgical and neurosurgical pathology, a surgical record room, a library, and various offices. Construction of the White Pavilion was begun in 1914, but increasing costs caused by the World War delayed its completion until 1922.

South of the White Pavilion is the main building of the Nurses’ Home, which accommodates 150 of the 253 student and graduate nurses connected with the Hospital. It was erected in 1886 in memory of Mrs. Richard D. Wood. This building houses the School of Nursing, which was organized in 1886 and which graduates fifty nurses each year. In addition to the dormitory, there are classrooms and a well-equipped dietetic laboratory.

On the east side of Thirty-fourth Street an annex to the Nurses’
Home provides much-needed additional space for seventy-two nurses. The Annex, title to which was acquired from the City in 1910, continued to house the Children's Department of the Philadelphia General Hospital until 1928, when the modern buildings of that hospital were erected.

To the west of the White Pavilion on Spruce Street once stood the front of the D. Hayes Agnew Memorial Pavilion, a surgical building erected in 1897 in memory of the famous Professor of Surgery, and then considered the last word in hospital design. In February 1937 fire destroyed the Agnew Clinic in the front, but spared two public wards and a private floor to the rear. Construction of a new five-story unit which will replace the damaged part and add considerable additional space began in 1939.

The unit is in two sections. The eastern section replaces the front of the D. Hayes Agnew Pavilion and will bear that name. The western section, which extends from the street to 166 feet south of the corridors stretching from end to end of the entire hospital group, will be known as the Crothers Dulles Memorial Hospital, in memory of William Crothers Dulles, whose mother and sister contributed funds for its erection. The design of the additions is such that the floors in front of the corridors will function as units, and likewise the floors to the rear.

The new buildings represent a great addition to the University Hospital and will make possible important changes in the location of various departments. The ground floor of the front section will be shared by the Department of Obstetrics and Gynecology and the Department of Radiology, the latter department using also the ground floor of the rear section and part of the basement. The third floor of the front section will be used by the Department of Ophthalmology; on the fourth floor of this section, adjoining the operating floor of the White Pavilion, will be six operating suites; the fifth floor will contain laboratories for surgical research; the rest of the new building, front and rear, will be used by the Department of Obstetrics and Gynecology.

Next to the Agnew-Dulles buildings is the original building of the Hospital, in which are the administrative offices, a students' ward, and private rooms; adjoining to the west is a modern building of Jacobean architecture. The lower floors of both these buildings house at present most of the out-patient departments of the Hospital.

The newer of these central buildings is the modernized front of the Gibson Wing of the Hospital, which was erected in 1883 and
was named in honor of Henry C. Gibson. The Jacobean front was dedicated in 1909 and housed the Medical Out-Patient Department until the Maloney Clinic—the adjoining ten-story building on the corner—was completed in 1929. In addition to the out-patient departments, this section has a large amphitheatre and a complete laboratory where medical students learn to perform the various diagnostic tests. The older part of the Gibson Wing is devoted mainly to metabolic diseases and pediatrics.

To the rear of all these buildings are other important units of the Hospital. One of these is the Maternity Department, which occupies a group of connected buildings just south of the Maloney Clinic. The entrance is in a red brick building facing Hamilton Walk that was erected in 1897 through the efforts of the late Dr. Barton C. Hirst. Behind it is a small wing built in 1890 and now a dormitory for nurses. It was here that Dr. Hirst and Dr. Howard Kelley, later of Johns Hopkins, began the first actual bedside instruction in obstetrics in America, which previously had been taught only in lecture rooms with a dummy as the sole means of demonstration. The most modern part of the Maternity group is on Thirty-sixth Street facing the dormitories. It is a brick and limestone structure of Elizabethan style erected in 1916. To the rear of this building is the Anna Dike Scott Memorial Amphitheatre, in which two hundred students can be seated. When the Agnew-Dulles unit is completed, the Maternity Department will vacate its present quarters and the Department of Neurology and the Neurological Institute will move in, but not before one or two floors connecting with the Maloney Clinic have been added.

The other units of the Hospital which do not front on Spruce Street consist of a small isolation building for housing the few cases of contagious disease that develop after patients are admitted, a laundry, and an attractive, well-lighted shop for occupational therapy, which was presented to the Hospital by Mrs. Sabin W. Colton, Jr., in memory of her mother.

The Martin Maloney Memorial Clinic

The Maloney Clinic is the expression of a plan outlined in 1913 by Dr. Alfred Stengel for a medical out-patient department with a salaried staff, a comprehensive social service department, an efficient clerical force, and an elaborate physical equipment, including special laboratories and roentgenological apparatus. Sixteen years later, in 1929, the plan became a reality when the Maloney Clinic, a ten-story building at Thirty-sixth and Spruce streets named for the late
Martin Maloney, who had contributed generously to its construction, was completed.

The Maloney Clinic represented a unique development. It was not a new hospital or a new unit of a hospital with a single specific purpose, but rather a supplementary section of the Medical Clinic, having multiple functions all connected with the demands made upon the medical division of a modern teaching hospital.

Some indication of the importance of the building is revealed by the activities which it houses. Much of the room is devoted to the Medical Out-Patient Department and its special sections for the study of cardiovascular disease, of gastro-intestinal disease, of allergy, of chest conditions, of diabetes, of glandular disease, and of blood diseases. It also includes the William Pepper Laboratory of Clinical Medicine, the John Herr Musser Department of Research Medicine, the Department of Physical Therapy, a morgue, a pharmacy, a library, a floor for animal research, twenty-three private rooms, and offices for certain members of the staff of the Department of Medicine. Carried on in the building is the work of the Robinette Foundation for research in circulatory disease, the Kinsey-Thomas Foundation for gastro-intestinal research, the Cox Medical Research Institute for the investigation of diabetes, and of various other funds which are used for research in internal medicine. The Maloney Clinic also houses the Johnson Foundation for Research in Medical Physics.

The Maloney Clinic as a whole serves three important functions. One of these is the treatment of many patients who would otherwise receive ward care, whereby the Hospital is relieved of the expense of supplying board and lodging for such cases—a potential saving in the gastro-intestinal section alone estimated at about $10,000 annually. Another is the training of young physicians, both for the practice of medicine and for a special kind of clinical investigation on ward and ambulant patients. And of course there is research.

The annual report of the University Hospital lists the current publications of the members of the Hospital staff, the research for which was carried on primarily in the various divisions of the Hospital. The 1938 report gave 279 such publications, of which 58 were the result of work completed primarily in the medical division. For 1939 the figures were 179 and 70.

DEPARTMENTS IN THE MALONEY CLINIC

The Department of Medicine: Some of the offices of the staff of the Department of Medicine are in the Maloney Clinic; and there also
are the ten special sections of the Medical Out-Patient Department of the Hospital, many of them supported largely by endowments. But so varied are the activities of the Department—the teaching of the many branches of internal medicine, the diagnosis and treatment of patients, and research—that it is impossible to give the location of the Department more definitely than to say that it is in the University Hospital. Indeed, that statement is not strictly true, for in the clinical teaching of medicine, use is made of facilities in the Pennsylvania Hospital, the Philadelphia General Hospital, and, for special work in tuberculosis, the Phipps Institute.

The teaching staff of the Department, which now numbers slightly less than a hundred, is the largest in the Medical School, and the student hours are among the highest. Morgan, Kuhn, Rush, G. B. Wood, William Pepper, Primus and Secundus, and Alfred Stengel have all occupied the principal chair of medicine. These men and many others have contributed to the evolution of the present course of study, in which clinical work has played an increasing part, especially since the opening of the University Hospital in 1874.

Since the course in the School of Medicine is designed primarily to qualify students for the practice of general medicine, the Medical Clinic with its ten sections enters into the medical instruction with special importance. The Diagnostic Section, to which new patients come, is on the first floor of the Maloney Clinic; the others are on various floors of the building. Of these sections, only those that are supported by important endowments will be described.

Gastro-Intestinal Section (Kinsey-Thomas Foundation)

The Gastro-Intestinal Section of the Medical Clinic was organized in 1927. At first it had no budget, no special quarters, and no nursing or technical assistants, but in time the hospital management rendered financial aid and a few small private donations were secured. When the Maloney Clinic was completed, special quarters were assigned on the third floor, the Hospital made a more generous annual contribution, and the private donations increased so that it became possible to have a small professional staff on a part-pay basis.

In 1937, for the first time, some permanent funds became available through a bequest in memory of Miss Mary Kinsey and Mr. and Mrs. Augustus Thomas, the income to be expended for the operation of the Section. This income has been augmented by additional donations and grants by the American Medical Association, Mr.
The service of the Section to the community has continued to be its prime purpose, but its investigative work especially has attracted attention in the United States and abroad. Within a ten-year period its staff has contributed sixty-seven articles to medical literature and has presented papers before most of the national societies having an interest in clinical digestive problems. Awards for special work have been made to staff members by the American Medical Association, the American Roentgenological Society, the American Radiological Society, and the American Gastro-Enterological Association.

The work of the Section that has attracted most attention has been the invention and development of what is known as "intestinal intubation," by means of which a tube can be introduced into whatever level of the bowel it is desired to reach. In addition to providing more satisfactory diagnoses, this technique has permitted the development of a nonoperative method of dealing with serious cases of intestinal obstruction; in some instances rendering operation unnecessary, in others permitting operation to be delayed until it is a relatively safe procedure. Its value in the latter respect is indicated by the fact that already the mortality in obstructed cases so managed has been reduced by fifty per cent.

Another use now being made of the technique is the study of conditions of spasm or relaxation within the bowel. This has been made possible by the development by the Johnson Foundation of a small but complicated device which can be attached to the intestinal tube and is so controlled by an electrical apparatus outside the body that the most minute variations in pressure can be recorded. It is believed that this extended technique may lead to important new discoveries regarding the action of the intestine under both normal and abnormal conditions.

The Cardiac and Peripheral Vascular Sections
(The Robinette Foundation)

The Robinette Foundation was established in 1928 through the generosity of the late Edward B. Robinette, a graduate of the College in 1909.

Mr. Robinette's purpose was to promote research in circulatory diseases, especially those of the degenerative type. Knowing that medical science had greatly increased the average length of human life, particularly by limiting the dangers of the diseases of infancy and childhood and of infectious disease generally, he recognized
that the next great chapter in medical history must be the prevention and control of the diseases of the later half of life.

The Cardiovascular Section of the Medical Clinic was chosen as the nucleus for the work of the Foundation, and as activities increased, it was found necessary to divide the original Section into two: Cardiac and Peripheral Vascular. These and the offices of the Foundation are located on the third floor of the Maloney Clinic, where more than four thousand patients are examined each year by means of electrocardiographs, fluoroscopic machines, and the other apparatus used in the diagnosis of circulatory diseases. In 1929 the medical staff consisted of but three; at present there are sixteen.

The research work of the Foundation is conducted mainly in experimental laboratories on the eighth and ninth floors of the Maloney Clinic. Many of the projects have been carried out entirely within the Foundation, while others have been in cooperation with other departments of the University Hospital or the Medical School. The Foundation has also supported promising investigations in other hospitals, especially the Philadelphia General Hospital.

The clinical and experimental activities of the Foundation have produced significant results. A series of investigations has led to the use of chest leads in electrocardiography and to the first demonstration of their usefulness in the study of coronary occlusion. The new technique has been said to be the most important advance in cardiac diagnosis during the past twenty-five years. Another important contribution has been the study by graphic methods of the time relationship between heart sounds and other cardiac events. This has made possible a new classification of heart sounds and has greatly increased the existing knowledge of the mechanism of the production of heart sounds. In the course of this study various methods of diagnosis have been improved, including the development of a simple technique for the accurate timing of roentgen-kymographic curves by means of electrocardiography.

For the treatment of peripheral vascular disease, the staff has developed the first suction-pressure pump for restoring normal circulation. This apparatus, perhaps the most effective yet designed, has saved numerous extremities which otherwise would have been amputated. The staff has also conducted a series of experimental and clinical studies of hypertension (high blood-pressure). These have resulted in important contributions to the knowledge of the mechanism of papilloedema (swelling of the nerve-heads of the retina) in hypertension; improved methods of studying hypertension by means of small animals; and new procedures for the differentia-
tion of clinical types of hypertension. Of great importance also has been the study of edema, a watery swelling of tissue. This has resulted in a new clinical classification that is now generally recognized.

The Diabetic Section (The Cox Institute)

The work of the Diabetic Section of the Medical Clinic is carried on by the George S. Cox Medical Research Institute within the Department of Medicine of the University. The Cox Institute, an independent foundation, was set up under the will of the late George S. Cox, a prominent Philadelphian. It is the first endowment in America exclusively for the study of diabetes.

In 1931 the Trustees of the Institute and the Trustees of the University of Pennsylvania agreed on an arrangement whereby the Institute would occupy space in the Maloney Clinic and would conduct the Diabetic Section of the Medical Clinic. As a result the Institute benefits from the use of research facilities already in existence at the University and in turn greatly benefits the University itself, especially in the practical management of the patients, who make more than two thousand visits to the Clinic annually. The latter is on the second floor of the Maloney Clinic; the research activities are carried on on the eighth floor.

The recent work of the Institute has been directed mainly toward discovering the relationship between the pituitary and adrenal glands and diabetes. The ultimate goal of the research is to discover means of preventing diabetes, at the same time advancing the control of the disease with the modern use of insulin and other measures.

Other work of the Institute, in which the Clinic has played a part, includes a study of the rôle of vitamin B and vitamin C and the value of the proper amount of exercise in the treatment of diabetes. A small metabolic ward is maintained for the study of diabetic patients, and a camp for children is conducted in the summer.

Physical Therapy: The Department of Physical Therapy occupies most of the fifth floor of the Maloney Clinic. Adjoining, on the top floor of the Gibson Wing of the Hospital, is a gymnasium equipped with the usual bicycles, stall bars, trapezes, and similar apparatus. The space in the Maloney Clinic is divided into numerous rooms and booths provided with equipment for light treatments, for diathermy, for the suction-pressure treatment of infected limbs or limbs threatened with gangrene, and for hydro-therapy. Although the Department gives instruction in physical therapy to fourth-year
medical students, its primary function is the care of Hospital patients, who receive more than thirteen thousand treatments a year.

The Pepper Laboratory of Clinical Medicine: Provost William Pepper was the father of laboratory development in the University Hospital. In 1895 by the foundation of the William Pepper Laboratory of Clinical Medicine in honor of his father, William Pepper (1810-1865), he established a department to serve as a connecting link between the Medical School and the patient, and also to provide for research. The Pepper Laboratory was the first of its kind in the country. Generous endowment by the founder and substantial additions by Mrs. William Pepper, Mrs. Phoebe A. Hearst, Dr. George Woodward, and Mr. Samuel Dickson established the investigative foundation upon which subsequent history is based. Dr. Pepper specified that graduate investigation, not undergraduate work, was to be pursued.

The ivy-covered, square, red brick building at Thirty-sixth and Spruce which originally housed the Pepper Laboratory and where such men as Alfred Stengel, W. G. Spiller, S. S. Kneass, C. L. Leonard, D. L. Edsall, A. E. Taylor, C. H. Frazier, and D. J. McCarthy laid the foundation for their careers was removed in 1928 to make way for the Maloney Clinic, on the seventh floor of which a new location was found. The original frieze on the northern face and the door of the old building are preserved in the new quarters, and there are portraits of all the professors in the Medical School since John Morgan, an oil portrait of William Pepper, Primus, by Meynen, and a marble bust of the founder.

The Pepper Laboratory was the mother of all the specialized laboratories of clinical medicine and teaching. The present departmental laboratories of roentgenology, surgical pathology, gynecological pathology, surgical metabolism, hematology, cardiology, and ophthalmology had their origin in it.

The success of investigative work in the early days made it imperative that, for the patient's sake, routine tests be easily available. In 1914 the University Trustees and the Managers of the Hospital expanded the work and gave financial support without interfering with the autonomous position, the endowment funds, or the special studies of the Foundation. Whereas in 1923, a total of twenty-five thousand tests was made, in 1939 the figure was 165,000, an increase of over six hundred per cent. The present staff consists of five professional and twenty-one non-professional workers.

As was conceived by Dr. Pepper, the laboratory continues to func-
tion as a place where analyses and special studies can be made for the sake of patients and where there can be laboratory investigation of all proposed methods for the advancement of medical science and the preparation and publication of such studies. The latter appear periodically as bound volumes, thirteen of which have been published since 1900. Forty-seven associates and assistant associates have passed through the Pepper Laboratory. Temporary work is also done by representatives from other departments; for a time senior medical officers required that their juniors spend a short time here. Every hospital interne must pass at least two months of his service at laboratory work.

The Laboratory serves for routine purposes the in-patients and out-patients; it controls the milk hygiene in the Hospital and the sterility of the surgical divisions; in addition it carries out investigative work.

The Division of Chemistry was originally interested in diet and nutrition, then in nephritis. Today it has still under study the blood urea quotient, the electrolyte content of the blood, the significance of blood volume, and clinical toxicology.

The Division of Metabolism, a branch of the Division of Chemistry in charge of the Woodward Fellow in Physiological Chemistry, is interested in metabolism of thyroid disease and in vitamin balances. Formerly this division did notable work in the daily blood sugar curves, and the establishment of correct insulin dosages.

The Division of Bacteriology, begun in 1896 by S. S. Kneass, fresh from the Pasteur Institute of Paris, has contributed notably in the rapid diagnosis of infectious conditions, for the clinician must get this information as quickly as possible for the patient's sake.

The Division of Bioscopical Pathology is designed for the study of glands, puncture fluids, and pieces from the lungs and larynx. For twenty years it has paid special attention to the lymph nodes and spleen, publishing ten articles on them.

The Division of Serology has kept pace with the studies in this difficult subject, notably by participating in the nation-wide standardization of the Wassermann test.

The Routine Division cares for the simpler tests and supervises the Hospital's blood bank and the donors, keeping a careful card index check of every step.

The John Herr Musser Department of Research Medicine: The Department of Research Medicine, which is on the eighth floor of the Maloney Clinic, was created in 1909 by a gift to the University
by Mrs. Harriet C. Prevost, a friend and patient of the late Dr. John H. Musser, then Professor of Clinical Medicine in the University. Following the death of Dr. Musser in 1912, the name was changed by the donor to the John Herr Musser Department of Research Medicine. The purpose of the Department was to apply the methods of bacteriology, pathology, physiology, chemistry, or pharmacology to the investigation of disease.

The first Professor of Research Medicine, Richard Mills Pearce, directed the Department from 1910 to 1919. A major interest of Dr. Pearce’s was the training of young graduates in medicine for experimental research, an activity in which he was supremely successful, for most of those who worked under his direction now hold professional titles in various university medical schools. During Dr. Pearce’s directorship 108 papers were published from the Department. These dealt with experimental studies of physiology of the spleen, and anemia, nephritis, anaphylaxis, and immunity.

In more recent years the Department’s research activities have been in the field of the physiology of blood electrolytes, of hemoglobin and its derivatives, and of tissue respiration. There has been active collaboration with the Pepper Laboratory, the Cox Institute, the Department of Surgical Research, and the Department of Physiological Chemistry.

The Milton B. Hartzell Department of Research Therapeutics: This department, which was organized in 1933, was endowed by the will of Dr. Milton Bixler Hartzell, the distinguished Professor of Dermatology in the School of Medicine from 1911 to 1922. Its laboratory is on the eighth floor of the Maloney Clinic, where research has been conducted on new methods of therapy, especially on drugs of the choline series and physical methods for the relief of pain by counter-irritation. Much work has also been done to devise methods by which the action of the therapeutic agents used in heart disease can be investigated and assessed by measurement of the amount of blood pumped by the heart each minute.

The Johnson Foundation for Medical Physics: The Eldridge Reeves Johnson Foundation for Research in Medical Physics was established in 1929 by a munificent gift from Mr. Eldridge R. Johnson for endowment and to provide suitable laboratories.

The Foundation, which is the first and largest institute in the world devoted exclusively to research in the physical aspects of medicine and biology, occupies twenty-two rooms on the sixth floor
of the Maloney Clinic. These include a large shop equipped with modern tools and machines for the construction of scientific apparatus, a reference library, offices, photographic rooms, and sixteen rooms for research in various aspects of biophysics.

With these exceptional facilities the Foundation, in accordance with the terms of the endowment, is furthering the development of medicine and biology by applying the principles and methods of the physical sciences to the study of living organisms. This it does through the research of the members of the Foundation staff, by the creation of new physical methods and apparatus for the use of research workers in other departments of the University, and by teaching and research training.

The Foundation's investigations have covered a wide range of biological and medical subjects. These include extensive studies on the effects of radiation on living organisms, the use of high intensity sound waves for liberating immunologically important substances from bacteria and the general biological effects of such waves, the molecular structure of living cells, the mechanism of muscular contraction, the nature of visual processes, and the properties of the nervous system which make possible the coordinated control of the organism. By measuring the electrical changes from moment to moment in single nerve cells the Foundation has been a pioneer in the development of a new era in experimental neurology. The wide recognition of the importance of this work has attracted to the Foundation doctors from universities throughout the world who have come for a year of research training in this science.

Such training in research constitutes an important part of the work of the Foundation, for in this way investigators now active in institutions in many parts of the world have been fitted to utilize more effectively the methods and principles of physics in the study of disease. An occasional graduate student who shows exceptional aptitudes in both the biological and physical sciences is accepted as a resident scholar. After a series of graduate courses in various departments of the School of Medicine, in the Moore School of Electrical Engineering, and in the Towne Scientific School, he is apprenticed to one or more of the members of the Foundation for three years of research. Most of the students, however, are mature scholars who have already received their doctorate at another university and come to the Foundation for a year or more of specialized training. During the first ten years there have been over thirty of these visiting fellows from Finland, Sweden, Germany, Scotland, England, Italy,
One of the most important contributions of the physical sciences to biology and medicine is the devising of instruments for measuring biological processes and the condition of the body, and for administering therapeutic procedures. The close proximity of the laboratories of the Foundation to the wards and clinics of the University Hospital and to the laboratory departments of the Medical School and College enables the members of the Foundation to be of service in the development and application of physical methods to the research problems which arise in other departments. An extensive supply of physical apparatus is available for special problems, experts in various phases of engineering and physics devote much of their time to consultation with members of other departments, and more than half of the services of the large instrument shop are employed in the design and construction of apparatus for scientists throughout the Medical School and in other universities.

As part of its program for expanding and improving the biophysical approach to medical science, the Foundation sponsors the Eldridge Reeves Johnson Lectures. At about two-year intervals one of the most distinguished workers in this field of biophysics is invited to reside at the University for some weeks and to give a series of lectures on the most significant aspects of his research. Up to the present the lecturers have been A. V. Hill of the University of London, E. D. Adrian of Cambridge University, Joseph Erlanger of Washington University, H. S. Gasser of the Rockefeller Institute, and Irving Langmuir of the General Electric Company. The lectures that have been published by the University Press are recognized as the outstanding publications in this field of science.

As the work of the Foundation has demonstrated the increasing usefulness of physical principles and methods in the medical sciences, the scope of its activities has increased. This has brought a steady increase of financial support and an increasing number of workers. From an initial staff of six the number of workers had increased to twenty-one in 1939.

The Institute of Neurology: Much of the most distinguished research of the Johnson Foundation has dealt with problems of neurology. This is not by accident, for in a number of instances the personnel of the staff of the Johnson Foundation and that of the staff of the Institute are the same.

At present the clinical work of the Institute is carried on in
various parts of the University Hospital, and the experimental re-
search activities, which are supported in part by a generous endow-
ment from Mr. Fred M. Kirby and Dr. Daniel J. McCarthy, Pro-
fessor of Medical Jurisprudence, make use of facilities on the sixth
floor of the Maloney Clinic provided by the Johnson Foundation.

With the completion of the Agnew-Dulles section of the Hospital
the present Maternity building will be modified for the use of the
Institute and two additional floors will be added in order to provide
quarters for clinical and research laboratories. These will be con-
ected with the Johnson Foundation by a bridging corridor. In this
way it will be possible to relate the fundamental research of the
Johnson Foundation to the clinical research of the Institute. Many
special laboratory facilities will be shared by the two organizations.

The Institute of Neurology was established in 1936. More than a
mere department of neurology, it has as its primary purpose the
coördination of the various research, clinical, and teaching activi-
ties related to neurology in the University. It is thus possible to
focus on neurological problems the activities of many departments
of the Medical School, the Graduate School of Medicine, the Veteri-
nary School, and certain departments of the College.

But neurology at the University began much earlier than 1936.
It was introduced formally into the Medical School in 1875, when
Dr. Horatio C. Wood was appointed Professor of Nervous Diseases.
The subject could hardly have received a great deal of attention,
however, for during most of his career Dr. Wood served also as
Professor of Materia Medica, Pharmacy, and General Therapeutics.
Originally "nervous diseases" included those diseases which have
an organic basis and also those which have symptoms revealed pri-
marily in behavior and changes in personality, but a division was
made in 1893, when a separate professorship of mental diseases (now
psychiatry) was established.

Dr. Wood made important contributions to the literature of
neurology, as did his successor, Dr. Charles K. Mills, who was Pro-
fessor of Neurology from 1903 until 1915. Very widely known also
was the late Dr. William G. Spiller, who served from 1915 until his
retirement in 1932. The author of more than two hundred books
and articles, Dr. Spiller was recognized throughout the world for his
contributions to clinical neurology and neuropathology. One of the
important units in the new quarters of the Institute of Neurology
will be the William G. Spiller Laboratory of Neuropathology. An-
other will be the Charles W. Burr Library of Neurology, named for
the distinguished Emeritus Professor of Mental Diseases.
Radiology: The Department of Radiology occupies about ten thousand square feet of space on the first floor of the White Surgical Pavilion—a considerable increase over the facilities used by Dr. Charles Lester Leonard, the first roentgenologist at the University. In 1896 the University Hospital, one of the first institutions to employ the x-rays as a diagnostic agent, allotted Dr. Leonard a small room on one of the upper floors of the Pepper Clinical Laboratory, which seemed ample in view of the meager equipment then available and the number of patients. In 1900 Dr. Leonard reported that he had examined eighty-six patients during the preceding year.

The diagnostic portion of the present quarters consists of six radiologic rooms, three fluoroscopic rooms, a developing room, a record room where one hundred thousand non-explosive films are filed, and numerous other rooms which serve as dressing rooms and offices. The office of the head of the Department is in what was formerly an orthopedic gymnasium, and here the instruction in radiologic diagnosis and therapy is given to undergraduate physicians with the aid of a projectoscope which throws on a screen greatly magnified images of the fractures, infections, tumors, pulmonary and gastro-intestinal disturbances, and foreign bodies which trouble the patients examined in the clinic.

The clinic is a busy place, not only because of the number of patients—sixteen thousand in a year—but because many of them remain for a long time, waiting between examinations while the barium and sodium-iodophenolphthalein they have swallowed reaches or leaves the parts to be examined. A complete gastro-intestinal examination takes a good part of two days, during which as many as fifteen films may be exposed. The process has been speeded up, however, by the recent installation of motor-driven fluoroscopic tables with special mechanical devices for "spot film" gastro-intestinal work and switches which automatically control radiographic technique. Modern shock-proof therapy apparatus likewise enables the clinic to care for patients more rapidly and with greater comfort. This equipment includes two 200 kv. machines and one 135 kv. machine. There is also a highly specialized low-voltage Chaoul machine, the latter presented to the clinic by Mr. William H. Donner.

The equipment of the Department had a value in 1939 of approximately $100,000, including five hundred milligrams of radium.
It is modern and adequate, but it is to be greatly increased when the Department moves into its new quarters on the first floor of the Agnew-Dulles section of the University Hospital. A large gift from Mr. Donner for equipment is expected to make the new clinic second to none.

Since roentgenology is a young science, there have been but three heads of the Department. The first was Dr. Leonard, whose work in urological roentgenology brought him many honors. His career was cut short in 1902, when he was forced to retire because of x-ray burns, so frequently suffered by pioneers in radiology. He died in 1913, a martyr to the science. Such injuries do not occur in the Department today. Working behind lead screens, with vastly improved apparatus and with lead-impregnated canvas and rubber gloves, the roentgenologists insist that injuries are now likely to be caused only by carelessness.

Dr. Leonard's successor was Dr. Henry K. Pancoast, who died in 1939. Under him the work of the clinic expanded so greatly that in 1904 it was given ten rooms in the Agnew Pavilion. In 1905 Dr. Pancoast was appointed Lecturer in Skiagraphy in the Medical School, and in 1912 a chair of radiology was established for him, the first in this country and one of the first in the medical schools of the world. Dr. Pancoast's investigations in the roentgen treatment of leukemia, first published in 1906, are still considered authoritative, and his studies in pneumoconiosis, begun in 1916, gained for the Department an international reputation.

Recently much of the research of the Department has been directed toward the effect of dust on the pulmonary system. This work, financed largely by a grant from the Air Hygiene Foundation, has been carried on in cooperation with the Department of Anatomy and the Moore School of Electrical Engineering. The studies have been concerned largely with the diagnosis, treatment, and prevention of such diseases as silicosis. An interesting investigation has been the development of a new technique whereby sensitized paper becomes satisfactory for survey purposes. These negatives are much less expensive than the regular x-ray film in making preliminary examinations of large groups of industrial workers.

Surgery: In the early years of the School of Medicine, surgery received only a part of the attention of one professor—Dr. William Shippen, Jr., who found time to teach anatomy, surgery, and midwifery. But in 1805 a chair devoted solely to surgery was established, and the man who was appointed to it is generally recognized as the
father of American surgery. This was Dr. Philip Syng Physick, who held the chair from 1805 until 1819.

Another Professor of Surgery during the nineteenth century was Dr. D. Hayes Agnew, who was, perhaps, the most famous teacher the School of Medicine has known. Appointed to the chair of surgery in 1872, he became the John Rhea Barton Professor of Surgery in 1878, when the chair was endowed by Mrs. Susan R. Barton in honor of her husband, a noted member of the class of 1818. Two of the best-known holders of the Barton chair during the present century have been Dr. John B. Deaver and Dr. Charles Harrison Frazier, who served from 1918 to 1922 and from 1922 to 1936, respectively. Dr. Deaver, one of the most successful surgeons this country has produced, attracted patients from all over the world. Dr. Frazier, one-time Dean of the School of Medicine and a noted author, was widely known for his work in neurological surgery, especially for the relief of tic douloureux.

There have been many subdivisions of the Department of Surgery since 1805, when a separate professorship was first established. Gynecology, ophthalmology, and otolaryngology have become separate departments, as has radiology, which was originally under the Department of Surgery. With the trend toward specialization, urology (once known as genito-urinary surgery, a field in which two Barton professors, Dr. J. William White and Dr. Edward Martin, were especially distinguished), neurological surgery, and orthopedic surgery have been established as separate divisions. Another is the Division of Anesthesia, now one of the best in the country.

Until 1841 the teaching of surgery was confined almost entirely to didactic lectures and demonstrations. In that year clinical instruction was instituted with the establishment of a system of "dispensary cliniques," and in 1847 a chair of clinical surgery was created. Today a staff of almost fifty surgeons introduce the student to surgery during his preclinical years by lectures and clinics designed to point out the value and importance of the relationship between the preclinical and clinical studies. In addition to the 112 didactic lectures that he now receives during his four-year course, the student, in his third year, spends 120 hours in the Surgical Out-Patient Department, and for one trimester of the fourth year he serves a clinical clerkship on the surgical wards of the University Hospital, the Pennsylvania Hospital, the Episcopal Hospital, the Philadelphia General Hospital, or the Presbyterian Hospital, where he is in constant contact with and under the supervision of members of the University surgical staff.
The object of the instruction is not to turn out finished surgeons, but men with a scientific and clinical foundation in surgery. To the student who enters a branch of medicine other than surgery, the object is to give a fundamental understanding of surgical lesions in order that he will know when to call a surgeon in consultation. To the student who will ultimately specialize in surgery, this teaching serves as a foundation for several years of advanced study and training.

Like the course of study, the physical equipment for the teaching of surgery has expanded greatly since Dr. William Shippen, Jr., taught surgery in a small wooden structure on Fifth Street below Chestnut known as Surgeon's Hall. Dr. Physick used rooms in the Presidential Mansion on Ninth Street, which in 1829 was replaced by the new Medical Hall, where there were three lecture rooms, a museum, and offices—all this to accommodate the 421 students registered in the year 1829-30! When the University Hospital was established in 1874, the facilities for clinical teaching were greatly improved, and there was a further improvement in 1897, when the D. Hayes Agnew Memorial Pavilion with its three surgical amphitheatres was completed.

The Surgical Department is now housed chiefly in the J. William White Surgical Pavilion, which at the time of its completion in 1922 was the last word in surgical equipment. The men's surgical ward is on the first floor, the women's surgical ward on the second floor. The third floor is occupied by the gynecological ward, which is soon to be used as a second men's surgical ward. On the fourth floor are three surgical amphitheatres. The laboratories of surgical pathology, neurosurgical pathology, the surgical record room, and the departmental library are on the fifth floor. In 1931 a seventh floor was added to the White Pavilion. This floor accommodates a women's surgical ward and the office of the John Rhea Barton Professor of Surgery.

With the completion of the new Agnew-Dulles building, six additional operating rooms with the most modern equipment available for the practice and teaching of surgery will adjoin the present ones. The new construction will also make it possible to bring the Surgical Out-Patient Department from the central building of the Hospital to the ground floor of the White Pavilion.

The Orthopedic Division of the Department of Surgery has been especially handicapped since the fire of 1937. In recent years only five beds in the University Hospital have been available for orthopedic patients over twelve years of age. The number is so inadequate
that patients have been kept for many months on a waiting list for admission to the Hospital for operation. This situation has existed in spite of a very significant trend in orthopedic surgery.

For long after the Orthopedic Dispensary, or Out-Patient Clinic, of the University Hospital was established by Dr. De Forest Willard in 1877, the chief concern of orthopedic surgeons was the prevention and correction of deformities in children. But during the past twenty-five years there has been an enormous development in this branch of surgery which was stimulated greatly by the World War. One of the very important functions of the orthopedic surgeon today is to rehabilitate the adult who has been crippled or disabled in the extremities and the back, a task that frequently requires surgical operation. The activity of State and Federal agencies which are attempting to bring aid to every crippled child in the country has also increased the demands upon the orthopedic surgeons of the country.

In 1938 the Orthopaedic Hospital of Philadelphia merged with the University of Pennsylvania, an arrangement which has helped to finance the new construction at the University Hospital. The completion of the new Agnew-Dulles buildings will permit a surgical ward in the White Pavilion to be converted into a ward for adult orthopedic cases providing beds for twelve to fifteen patients of each sex. The increased operating-room facilities resulting from the new construction will make possible prompt and adequate surgical procedures. Included will be a special room for putting on plaster casts after operations or manipulations and for the reduction of fractures.

Another improvement will be the enlargement of the Out-Patient Department. The present space available at the rear of the Agnew Pavilion is much too small to take care of patients, to say nothing of the teaching of students who attend during clinic hours. It is expected that greatly enlarged quarters will be made available on the ground floor of the White Pavilion. Until these changes occur, much of the instruction in orthopedic surgery will continue at the Orthopaedic Hospital, which will be closed when the improvements at the University Hospital are complete.

The Harrison Department of Surgical Research: Since 1906, when the Department of Surgical Research was organized, surgical research has been carried on in rooms on the second floor of the Medical Laboratories adjoining the Department of Pathology. With the completion of the Anatomy-Chemistry wing in 1928 the Department expanded into adjacent laboratories in the new building. The laboratories are thus in the center of the research activities in pathology,
physiological chemistry, and anatomy, with which surgical research is closely allied. When the new Agnew-Dulles buildings of the University Hospital are completed, an additional laboratory, elaborately equipped for clinical research in surgery, will occupy the fifth floor of the Agnew Building, where investigations can be carried on more conveniently in cooperation with the Department of Surgery.

This continual increase in the facilities of the Department is owing partly to the recognition of the importance of surgical research and partly to the large endowment of the Department, to which that recognition has led. In 1926, through a bequest from the late Dr. J. William White, funds became available for a chair of surgical research, and the activities of the Department increased considerably. The greatest increase, however, has resulted from the generous bequest for surgical research made by the late George Leib Harrison. In 1936, when the Harrison Fund (the largest endowment in the world devoted to surgical research) became available, the Department was reorganized as the George Leib and Emily McMichael Harrison Department of Surgical Research, with the Harrison Professor of Surgery as Director of the Department. There are now several subsections in the Department. One of these is an excellent laboratory of surgical bacteriological research. Another is a laboratory of orthopedic research, the first of its kind in any surgical research department in this country.

The program of the Department is twofold: On one hand it trains the research fellows who are so important in any program of advanced medical instruction; on the other it conducts research, much of it in cooperation with other departments of the School of Medicine.

There are junior and senior fellows. The junior fellows are selected graduates of class A medical schools who wish to specialize in surgery. For five years they devote their time to study and research in surgery, anatomy, and pathology, both in the laboratories of the Medical School and in hospital clinics. At the end of their training they have become technically proficient surgeons with good surgical judgment, and they may become candidates for the degree of Doctor of Medical Sciences in Surgery in the Graduate School of Medicine. The senior fellows are selected from applicants whose records show that they are capable of independent investigation. As a rule they are already qualified surgeons.

The fellows as well as the permanent members of the staff participate in the important research activities of the Department. In recent years these have been chiefly concerned with the problems of
nutrition, the physiology and pathologic physiology of the liver and gall bladder, surgical shock and high blood pressure, the action of new chemical substances on infections, the effect of a deficient oxygen supply to the brain during anesthesia or from other causes, and the problems of circulating clots (embolisms) which cause unexpected death after operation.

One especially interesting development has been the invention of a perfusion apparatus or artificial heart which will permit the maintenance of life in an animal after complete stoppage of the heart's action. This apparatus apparently is the finest of its type now available, for, whereas other apparatus can be used for a single organ, this device permits of perfusion of the entire animal with sterile blood. It already has permitted the study of circulation under conditions of the most precise laboratory control, and its ultimate purpose is to make possible the medical and surgical treatment of the human heart by measures that cannot now be employed.

Surgical research is no longer primarily concerned with developing new techniques of operations, but with making operations safer. This has been accomplished by acquiring more intimate knowledge of the reactions of the surgical patient to his disease. As an example of what can be done in this direction the following facts are interesting: Prior to 1937 about one in every ten patients operated on for obstructive jaundice died from hemorrhage, but since the administration of bile salts and vitamin K to patients before operation, post-operative hemorrhage is no longer a frequent complication. Similarly, prior to the use of sulfanilamide in conjunction with operations, acute suppurative infections of the appendix were associated with a high mortality. Now the mortality in the University Hospital is less than one per cent. In both instances operative technique remains the same, but pre- and post-operative care has thrown added safeguards around the patient.

Obstetrics and Gynecology: The Department of Obstetrics and Gynecology has three divisions: obstetrics, gynecology, and research, the latter bearing the name of the Gynecologic Hospital Institute of Gynecologic Research. Prior to 1927 obstetrics and gynecology were independent departments, and the present scattered location of the activities of the Department and its staff of forty-four represents partly the earlier division and partly the failure of building facilities to keep pace with the development of medical education.

At present the Obstetrics Division is housed in the Maternity buildings, which were erected largely through the generosity and
efforts of Dr. Barton Cooke Hirst, an inspiring teacher and the author of standard works on obstetrics and gynecology that passed through many editions. Theoretical and clinical teaching in obstetrics is provided for in these buildings and at the Philadelphia Lying-in Hospital. In addition certain lectures are given in the Medical Laboratories.

The work in gynecology is carried on mainly in the J. William White Pavilion at Thirty-fourth and Spruce streets and in the Gynecological Out-Patient Section in the central building of the University Hospital. In the White Pavilion are the John G. Clark Gynecological Ward and the John G. Clark Amphitheatre, both named for the holder of the William Goodell Professorship of Gynecology from 1900 to 1927, in whose honor his patients and friends established in 1931 the John G. Clark Memorial Fund for Gynecology. Another endowment, known as the Dr. John G. Clark Fund, created in 1931 by the bequest of Mrs. J. Louis Ketterlinus, is used for the work in gynecology and for research fellowships. Dr. Clark, a preeminent surgeon and a scientist of the highest order, was a pioneer in the use of radium in gynecologic practice and one of the first to advocate radical operation for cancer of the female genital tract. He was also the founder of the Undergraduate Medical Association, an important research organization in the School of Medicine.

The Cystoscopic Section and the extensive laboratory of the Department are also in the White Pavilion. The laboratory examines more than nine hundred pathologic specimens yearly, and the increasingly important Section on Endocrinology carries out approximately five hundred complex biologic tests relating to sterility, hormones, and pregnancy. Cystoscopy was introduced into the Gynecological Division by Dr. Clark's successor, Dr. Floyd E. Keene, a brilliant surgeon and author, who died in 1938. Dr. Keene was also largely responsible for the inauguration of the work in endocrinology and sterility. For instruction in gynecology, the Department uses all of these facilities and the Radiologic Clinic of the Philadelphia General Hospital.

The Gynecian Hospital Institute occupies several large laboratories in the Anatomy-Chemistry wing of the Medical Laboratories. The Institute is the direct outgrowth of the Gynecian Hospital, founded in 1886 by the late Dr. R. A. F. Penrose, who held the chair of Obstetrics and Diseases of Women and Children in the University from 1863 to 1888. In 1923 this hospital ceased to function, and in 1926 its Board of Governors founded the Gynecian Hospital Insti-
tute of Gynecologic Research to perpetuate the name of the hospital by means of research in the diseases of women, placing the Institute under the auspices of the Trustees of the University.

Four extremely interesting investigations, which the Institute has been carrying out over a number of years, have dealt with the effect of radium and roentgen therapy of women upon the health and development of their future offspring, the reproductive characteristics of parents of congenitally malformed children, new methods for the treatment of the asphyxia of the newborn, and the sensitivity of the uterine muscle. Perhaps the most significant results have come from the first two of these, both of which are primarily concerned with the birth of physically defective children. It seems to have been established that one-third of the children of women who have been subjected to heavy therapeutic irradiation during early pregnancy are born deformed and that one-half of these are microcephalic, and also, that if parents have produced one deformed child, the chances that additional children will also be deformed are twenty-five times greater than with other couples.

In addition various members of the staff are engaged in important research problems carried on independently and in collaboration with the Departments of Physiological Chemistry, Pediatrics, and Radiology. This work, much of it supported by grants from various organizations, is concerned with sex endocrinology. In this field it has been possible, with the Department of Physiological Chemistry, to announce during the summer of 1939 the isolation of the pregnancy hormone involved in the diagnosis of pregnancy. Clinical studies of the toxemias of pregnancy and of the various tumors that afflict women are also under way.

The scattered location of the divisions of the Department will shortly be changed. With the completion of the Agnew-Dulles buildings, all of the work in obstetrics and gynecology will be virtually under one roof. Although some teaching will continue at the Philadelphia Lying-in Hospital and the Philadelphia General Hospital, the remainder of the work in obstetrics and gynecology will be brought to the new building, including all the research activities of the Department. The latter will utilize the entire fifth floor of the Dulles wing, construction and equipment of the floor having been made possible by a grant from the Commonwealth Fund. When the changes are complete, the Department will enjoy centralized facilities in keeping with the record created by a long line of distinguished teachers and practitioners.
That record is long and too complex to give in detail here. It starts with Dr. William Shippen, Jr., who taught anatomy, surgery, and midwifery to the early medical students. In 1810 midwifery, as it was called until the thirties, was separated from surgery with the appointment of a Professor of Midwifery and the Diseases of Women and Children, Dr. Thomas Chalkley James, the first man in this country successfully to induce premature labor. Under Dr. James, gynecology first became officially a part of the medical curriculum. After 1874, when Dr. William Goodell, in whose honor the Goodell Chair of Gynecology was established in 1919, was appointed Clinical Professor of the Diseases of Women and Children, obstetrics and gynecology were separated. Complete separation, however, did not occur until the retirement, in 1888, of Dr. R. A. F. Penrose, who had held the chair of Obstetrics and Diseases of Women and Children since 1863. Finally, in 1927, the two obviously related branches were once more combined under the title of Obstetrics and Gynecology.

Pediatrics: The development of medicine in general is partly responsible for the present importance of pediatrics in the medical curriculum and the practice of medicine, but a contributing factor has been the falling birth-rate in the population at large and the recognition that the fewer children of the future will become more valuable as potential citizens. It is natural, therefore, that preventive medicine and the study of healthy children should be so important in pediatrics today, and that the Department of Pediatrics at the University should make use of the entire facilities of one large hospital and to a lesser extent the facilities of three others.

Something of this development is indicated in the history of pediatrics at the University of Pennsylvania. The diseases of children first received attention in the curriculum in 1810, when Thomas Chalkley James was appointed to the new professorship of Midwifery and the Diseases of Women and Children.

So matters stood until 1874, when a further division was made and Dr. William Goodell was appointed Clinical Professor of the Diseases of Women and Children. Then in 1884, four years before the founding of the American Pediatric Society, the child as an individual and not as an appendage of his mother was recognized at Pennsylvania, and a clinical professorship in pediatrics was founded. This chair was occupied successively by Louis Starr, Hobart A. Hare, and J. P. Crozer Griffith, the latter being raised to the rank of full professor in 1913. In 1930 the chair was endowed and Dr. J. Claxton
Gittings, who had succeeded Dr. Griffith in 1924, became the William H. Bennett Professor of Pediatrics, retiring in 1939.

Although the Department conducts a clinic in the University Hospital, most of the work of its staff of forty physicians is carried on in the Children's Hospital at Eighteenth and Bainbridge streets, a little over a mile from the Campus and close to the Graduate Hospital. Additional teaching is done in the Philadelphia General Hospital and St. Christopher's Hospital for Children.

The Children's Hospital, the oldest children's hospital in America and the third oldest in the world, has its own Board of Managers, entirely independent of the University of Pennsylvania, but in 1930 an arrangement was concluded providing that the Professor of Pediatrics in the Medical School should be a member of the visiting staff of the Hospital and should serve as Physician-in-Chief of its Medical Division, with the privilege of nominating his associates and assistants. Because it is one of the most modern hospital plants in the City, with 120 beds, with out-patient departments that receive more than forty thousand visits annually, and with more than adequate research facilities, the fourth-year students who go there to study both sick and well children are benefited greatly by the arrangement.

In 1925 the Department began its participation in the research activities of the Medical School, and since 1930 most of its contributions to the literature of pediatrics have resulted from investigations carried on through the Research Division of the Children's Hospital. These have comprised studies ranging from improved methods of treatment to the attempt to discover the relationship between heredity and diet and the resistance to disease.

Another type of research carried on by the Department is concerned with diseases that affect both children and adults—a field of investigation that is especially significant because childhood affords the best opportunity for determining the initial changes brought about by a particular disease before the body begins the degeneration caused by age, intemperance, accident, or other diseases.

OTHER CLINICAL DEPARTMENTS OF THE MEDICAL SCHOOL

Ophthalmology: Instruction in diseases of the eye began in the School of Medicine in 1870, when Dr. George Strawbridge established an eye and ear clinic in Medical Hall at Ninth and Chestnut streets. Associated with him was Dr. William F. Norris, who in 1874, when the School of Medicine moved to West Philadelphia,
was appointed Clinical Professor of Diseases of the Eye, becoming Professor of Ophthalmology in 1891.

Dr. Norris was followed by Dr. George E. deSchweinitz, whose fame as a research worker, clinician, and teacher is well known. His ability as a teacher is shown by the fact that no less than twelve of the men associated with him in the Department attained professorial rank in various medical schools, one of whom was his successor, Dr. T. B. Holloway, who had gained before his death in 1937 a national reputation for his writings in many branches of ophthalmology.

During these years the Department was able to take a leading place among similar institutions in spite of inadequate facilities. The Out-Patient Department in the central building of the Hospital was too small for the large number of patients and medical students, the ward space consisted of only fourteen beds, and no funds were available for fellowships or research. There was no secretary, not even an office where adequate records could be kept.

Now, however, the Department finds itself in an era of change and development. Offices in the Gibson Wing and a secretarial staff have been provided. Three three-year fellowships have been established, and the out-patient staff has been enlarged. A considerable sum of money from the Markle Foundation has enabled the Department to embark on a three-year program of research with full-time research fellows and a full-time chemist.

This research is on two major problems. Glaucoma, a disease in which increased pressure inside the eye results in blindness, is being studied from the chemical point of view. It is believed that alterations in the nature of the fluid formed inside the eye may account for the rise in pressure. The second problem, one that has been widely recognized in recent years because of its association with the driving of automobiles at night and in aviation, is "night blindness." The ability of the eye to see at night is affected by the amount of vitamin A in the body, and the Department's studies are directed toward solving the relationship between this vitamin and the ability to see in dim illumination.

The fire of 1937, which burnt out the old eye wards and operating room in the Agnew Pavilion, was an ill wind that blew good to ophthalmology. While plans were being made for the new Agnew-Dulles buildings, a substantial gift in memory of Mrs. John Frederick Lewis was made to the Department. This will provide an entire floor (the third) in the new building, which will house a men's ward and a women's ward, each with twelve beds, a completely
equipped operating room, a preparation room, and an examining room. There will also be three private rooms and three or four semi-private rooms. A room for clinical research in ophthalmology will be provided on the fifth floor, which is devoted to surgical research.

When the new building is completed, the first floor of the front of the Gibson Wing will be used by the Department. It will house a completely equipped pathological laboratory with the valuable collection of slides and specimens made by Dr. deSchweinitz and others. Besides the present offices of the Department there will also be a room for the recording of visual fields, so important in the diagnosis of neurological and neurosurgical cases, rooms for the three fellows, and a large staff room, which will contain the complete library of Dr. deSchweinitz. In addition the Out-Patient Department will occupy the whole wing on the floor below the offices and library.

Otolaryngology: Before 1924 otology and laryngology were taught in separate departments. Since the early 90's otology had been under the direction of Dr. B. Alexander Randall and laryngology under Dr. Charles P. Grayson, both prominent members of the medical faculty and well-known Philadelphia physicians.

In 1924 Dr. George Fetterolf was appointed Professor of Otolaryngology, a newly created chair, and the work of the two departments was combined. A voluminous writer, Dr. Fetterolf remained as head of the Department until his death in 1932. The following year Dr. George M. Coates was appointed to the chair, serving until his retirement in 1939. Dr. Coates was widely known throughout the United States as a surgeon, teacher, and author, and as President of the American Academy of Ophthalmology and Otolaryngology.

Although the Otolaryngologic Clinic is one of the very active divisions of the University Hospital, because of lack of space its work has been carried on with considerable difficulty, especially since the fire of 1937, which destroyed operating-room facilities and ward space assigned to the Department. Nevertheless, in the Hospital more than a thousand operations a year are performed on the ear, nose, and throat. Completion of the new Agnew-Dulles buildings will speed up the operating schedule and will also permit the Out-Patient Department, which receives over five thousand visits a year, to occupy much larger quarters in the central building of the Hospital than the five rooms it uses at present.

An important part of the work of the Department is carried on
by the Bronchoscopic Clinic, which was established in 1920 by Dr. Chevalier Jackson, the inventor of the bronchoscope and the originator of bronchoscopy. Since the fire, the Bronchoscopic Clinic has had a temporary location at the rear of the Agnew Pavilion (to be changed ultimately to the ground floor of the White Pavilion), where each year its staff receives more than 2,500 visits from patients and performs more than 1,200 operative procedures for the removal of foreign bodies from the pharynx, larynx, trachea, esophagus, lungs, and stomach.

Dermatology and Syphilology: This department has its clinic in the University Hospital Out-Patient Department, where it receives more than twenty-five thousand visits from patients each year. Its founder, Dr. Louis A. Duhring, was appointed to a clinical professorship in 1874 and to a full professorship in 1890, becoming the holder of one of the first full chairs of dermatology in the United States. The generosity of Dr. Duhring, who left most of a large fortune to various divisions of the University, provided the endowment for the chair subsequently occupied by Dr. Milton B. Hartzell, who established the Laboratory of Dermatological Research, and by Dr. John H. Stokes, called from the Mayo Clinic in 1924.

A reorganization carried through following Dr. Stokes's appointment brought all the work in syphilis at the University Hospital within the jurisdiction of the Department of Dermatology and Syphilology. Substantial expenditures from the Duhring endowment and the generosity of members of the Board of Managers of the Hospital made possible extensive expansion of physical plant and equipment. The introduction of graduate training and a full-time paid medical staff under the aegis of the Graduate School of Medicine resulted in significant changes in the aims and technique of teaching and research.

The intake of patients was increased many times. Instructional units adequate for teaching and treatment purposes in roentgenology as applied to dermatology, in actinotherapy, in all aspects of the treatment of syphilis, including intraspinal and fever therapy (except malaria), are provided as necessary parts of a teaching and practice center. While in the conduct of the more extensive and intricate forms of investigation into the physiology and chemistry of the skin it has been both necessary and desirable to seek the cooperation of appropriate departments in the Medical School and elsewhere (particularly the Department of Physiological Chemistry), the Department has maintained its own laboratories for the conduct of sero-
logic investigation and, in recent years, for histopathological and other routine clinical as well as investigative services.

Since 1924 the activities of the full-time and part-time staff have resulted in the publication of approximately 150 studies. In the field of dermatology these have been concerned with the effect of emotional and nervous states on the skin, and they have represented extended fundamental work on skin metabolism and chemistry, especially with reference to carbohydrate metabolism and water balance, the physiology of sweat, lactic acid production, and susceptibility and resistance to infection. Studies of the reactivity of the skin and its behavior under roentgen irradiation and studies of anergic tuberculosis and tuberculin reactions have furnished material of doctorate thesis calibre.

In the field of syphilis, the appointment of the head of the Department to the Commission of Experts on Syphilis of the League of Nations Health Organization initiated a connection with the United States Public Health Service and the so-called Coöperative Clinical Group of five major university syphilis clinics. Under grants from a number of sources, including major foundations, the Committee on Research in Syphilis, the United States Public Health Service, and the Abbott Laboratories, which maintain the Abbott Fellowship for Chemotherapeutic Research, the members of the clinic staff concerned with syphilis have contributed to the studies of the results of and methods for the standardization of treatment for syphilis in the United States and throughout the world. Serologic investigation on the accuracy and sensitivity of diagnostic tests, extended and costly studies of experimental syphilis, particularly concerning treatment-resistant strains of the spirochaeta pallida, the germ cause of the disease, have been made possible in this way. Extensive comparative testing of drugs for the more effective treatment of syphilis has been carried on, the study of treatment reactions has been furthered, and original methods for the tracing of the transmission of syphilis through the community and the holding of patients to treatment until cured have been developed.

In 1936, in recognition particularly of the work of the Syphilis Clinic in the field of epidemiology, the State Health Department, with the coöperation of the United States Public Health Service, established in the Department the Institute for the Control of Syphilis, which trains medical and public health nursing personnel for the public campaign against syphilis. In addition, important technical research in the epidemiologic field, including particularly the transmission of the disease by persons who show no active symp-
toms, is under way. Extensive studies of syphilis in the child infected by its mother have been carried on in the Department. As an integral part of these activities, the head of the Department has served on the Advisory Committee to Surgeon-General Parran and as technical adviser to the Division of Syphilis and Genito-Infectious Diseases of the Pennsylvania State Department of Health.

Dermatological Research: The Laboratory of Dermatological Research, which is administered independently of the Department of Dermatology and Syphilology, occupies three large rooms on the first floor of the Medical Laboratories. The Laboratory, or Department as it may be called, was established in 1917 by Dr. Milton B. Hartzell. A portion of the income of the Duhring bequest is assigned to it.

Chiefly concerned with the study and treatment of the patient, the Laboratory is deeply interested in the "whys" and "hows" of clinical dermatology. This is revealed primarily in a very active service in the study of cutaneous biopsy material obtained largely from the Graduate Hospital, the Philadelphia General Hospital, and local and out-of-town physicians. An extremely important activity is the teaching of graduate students in pathology, including animal parasitology and mycology, for a period of eight months each year. In addition to the regular staff a full-time fellow is assigned to the Laboratory for instruction and research.

Prominent among the Laboratory's achievements have been its contribution to the standardization of mycologic mediums, the use of wax reconstructions in the study of such obscure clinical conditions as paraffinomas, multiple sarcoid-like granulomas of the skin, chromoblastomycosis and lymphoblastomycosis. Of special interest has been the study of various types of xanthoma, which, with a report on these yellowing dermatoses, formed the basis of an important monograph.

Psychiatry: Benjamin Rush has been called the first American psychiatrist. For twenty-nine years he was attending physician to the Pennsylvania Hospital and to the mentally ill which it harbored, and his advocacy of the scientific and humane treatment of the "distempered in mind" is well known.

The present Department of Psychiatry, however, is one of the youngest in the Medical School. For many years two distinguished physicians, first Dr. Charles K. Mills and later Dr. Charles W. Burr, occupied the chair of Mental Diseases and gave clinics to the fourth-year classes, usually in the Philadelphia General Hospital. During
most of the time they had no associates and carried the entire burden of teaching.

In 1930 the Department was named Psychiatry to indicate its wider scope, and the work was extended to all four years of the Medical School course. At present Dr. Edward A. Strecker, chairman of the undergraduate department, heads a staff of twenty-two. Psychiatry also plays an important part in the work of the Graduate School of Medicine. When that school was founded in 1919, Dr. Earl D. Bond was chosen Professor of Psychiatry in the Department of Neuro-psychiatry, becoming Vice-Dean for Psychiatry in 1936, when neurology and psychiatry separated.

In the Institute for Mental Hygiene of the Pennsylvania Hospital, which serves as a training ground for students in both schools, the point of view is that all of the psychiatric theories and therapies now being advanced have something of value, but that no one of them possesses all of the truth concerning the complex relationships between the mind and body. Its physicians represent many schools of thought.

With the present emphasis on preventive medicine and mental hygiene, the Institute is interested not merely in aggravated cases, but in persons needing some slight readjustment to their environment. One important aspect of its work is with the Student Health Service at the University of Pennsylvania and at neighboring schools and colleges, where it has clearly been shown that young people respond remarkably well to simple psychiatric measures. Many students have been enabled to finish their college courses successfully or have been saved from serious breakdowns. Psychiatric principles have even been extended into such aspects of everyday life as the mass mind and crowd psychology, as seen in the Salmon Memorial Lectures given by Dr. Strecker.

Although one psychiatrist, interested in the physical symptoms due to emotional stress, is in regular attendance on the surgical and medical wards of the University Hospital, clinical teaching is carried on only at the Philadelphia General Hospital, the Friends' Hospital in Frankford, and the Pennsylvania Hospital. The closest relationship, however, is with the Department for Mental Diseases of the Pennsylvania Hospital and with that Hospital's celebrated Institute for Mental Hygiene. This association is the result of an agreement between the Pennsylvania Hospital and the University under which the Professor of Psychiatry of the University is also Director of the Institute of Mental Hygiene. Although the Institute had been in existence only nine years, its pioneer work in the promotion of men-
tal health was recognized in 1933, when Dr. Bond received the Philadelphia Award.

The Institute provides unusual facilities for the study and treatment not only of neuroses but of the emotional difficulties of people who need help in continuing their family and their business lives. Its unique out-patient clinic makes with the patients appointments lasting a full hour. Diagnosis includes not only the tests given in any general hospital, but a careful and sympathetic study by a psychiatrist of hidden emotional causes of maladjustment, a method which combines both treatment and diagnosis.

Research is an important part of the work of both the Institute and the Department of Mental Diseases of the Hospital. In the Institute the members of the staff are exploring the psychological, chemical, and electrical aspects of normal and abnormal mental functioning. Migraine, for instance, is now being especially considered. In the Hospital itself, where cases requiring acute or prolonged treatment can be studied, research supported largely by the Rockefeller and Markle Foundations is being carried on in many fields. At present one of the most important of these is the treatment of dementia praecox by means of insulin-shock.

The Laboratory and Department of Public Health and Preventive Medicine

This department traces its origin to the appointment in 1892 of Colonel John S. Billings, U. S. A., as Pepper Professor of Hygiene and Director of the Institute of Hygiene, as the laboratory of the Department was then known. In that year the Laboratory, on the east side of Thirty-fourth Street above Spruce, was opened, and the first independent work in bacteriology and hygiene at the University was started. The original part of the present laboratory was the gift of Henry C. Lea, and the equipment was provided by Henry C. Gibson, both of whom were frequent benefactors of the University.

Dr. Alexander C. Abbott succeeded Colonel Billings in 1896, and under his administration the work so expanded that an addition to the building had to be constructed in 1899. This was partly owing to the fact that medical bacteriology, which formerly had been taught in the Department of Pathology, was transferred to the Laboratory of Hygiene, as it had come to be known.

In 1906 Dr. Abbott established a School of Public Hygiene with courses leading to the degree of Doctor of Public Health, but following the founding of the Graduate School of Medicine much of the work in public health was transferred to it, and the School of
Public Health ceased to function. In 1931 a new Department of Medical Bacteriology was organized in the Medical School, and work in that subject was transferred to the Medical Laboratories. The staff of the Laboratory of Hygiene, however, continued to give courses in bacteriology, especially as it relates to public health, food, and industrial processes. These courses are given to the students in nearly every division of the University, including a great number in the Graduate School.

In 1939 the name of the Laboratory was changed to the Laboratory of Public Health and Preventive Medicine, and the same change was made in the name of the Pepper chair. The changes were the result of a reorganization of the work in hygiene by which the old School of Public Health was in effect revived.

Since 1919 space in the Laboratory has been occupied by the Division of Laboratories of the Pennsylvania State Department of Health, which uses a detached animal house at the rear of the building, a large part of the basement, and all of the first floor except a laboratory occupied by the Department of Chemistry, and the large lecture room seating 310, where the Student Health Service gives a course in Personal Hygiene to all freshmen. The facilities available to the Department of Public Health and Preventive Medicine include an animal room and rooms for the preparation of media in the basement, and on the second floor a large laboratory accommodating eighty-six students, numerous small laboratories, offices for the staff, and the departmental library.

Because the Department coöperates closely with the United States Public Health Service, the State Department of Health, the Philadelphia Board of Health, and numerous industrial organizations as well as with all other departments of the University, the members of the staff are continually engaged in research, the greater part of which is published in government reports and in scientific journals.

THE GRADUATE SCHOOL OF MEDICINE

The office of the Dean of the Graduate School of Medicine is in the Medical Laboratories, and some of the work of the first period of the course, when the basic studies in the medical sciences are pursued for one year, is carried on there. But the Graduate Hospital at Nineteenth and Lombard streets was built expressly as the teaching center of the School, and a great part of the thirteen thousand student hours of instruction given each year takes place there.
Study in the Graduate School of Medicine, however, is not confined to hospitals and laboratories maintained by the University of Pennsylvania, for no less than fifty-seven hospitals and other medical organizations in and near Philadelphia cooperate with the University by providing facilities for the first year of study. Indeed, during the second year, when the student-physician serves as a preceptee under a master clinician, he may work in any approved hospital wherever located, or even as an assistant in the private practice of a specialist of recognized achievement. The third period of study, which is devoted to research, may also be spent in any location, but it is likely to be in the hospitals and laboratories of the University of Pennsylvania.

The Graduate School of Medicine, like the School of Medicine, is a University “first,” and a very successful one. The School, which celebrated its twenty-first birthday in 1940, has already given instruction to 4,650 graduates of practically all American and Canadian schools of medicine and of various other of the world’s English-speaking medical schools. By the end of the Bicentennial year it will have conferred the degree of M.Sc. (Med.) on more than six hundred student-physicians, the degree of D.Sc. (Med.) on fifty, and will have granted to two thousand its one-year study certificate. Each year approximately 270 physicians enroll for study under a faculty that now numbers 445, and although the facilities are extensive, prospective students usually must make application a year before they can expect to begin work.

Prior to the founding of the Graduate School of Medicine, no such adequate facilities for graduate study in medicine were available in America. In a number of places it had been possible for the graduate physician to obtain additional training, but for the most part this had been in polyclinic systems of intensive courses of a few weeks or months, and the obvious failure of this type of effort to meet advanced educational requirements was recognized in 1923 in the report to the American Medical Association of the Council on Medical Education and Hospitals.

Seven years before this report, however, the University had made a significant start toward graduate medical education in America. In 1916 a merger was arranged with the Medico-Chirurgical College and Hospital for the purpose of establishing a graduate school of medicine as a part of the University. America’s entry into the World War prevented the actual opening of the school, but by 1918, when a second merger, with the Philadelphia Polyclinic and College for Graduates, took place, the faculty had been organized, and in 1919
the first students were admitted. As a result of the two mergers and subsequent mergers and benefactions, the University acquired assets totaling more than $4,000,000 for graduate medical education.

The beginnings of the project were due largely to the late Provost Edgar Fahs Smith and two members of the medical faculty, who were aided by the advice of the Carnegie Foundation and the General Education Board. Its organization was placed in the hands of Dr. George H. Meeker, formerly Professor of Chemistry in the Medico-Chirurgical College, who became the Dean of the School. He formulated and put into effect the “Pennsylvania Plan” of graduate study adopted in 1919, which at least in its essentials is looked on as the model for graduate study in medicine in the United States. Under the plan properly qualified graduates in medicine follow a definite and highly organized program of studies lasting from at least one academic year of thirty-two weeks to 136 weeks or even longer. A principal purpose of the program is to qualify the student for the practice of one of the twelve clinical specialties represented in the curricula of the Graduate School of Medicine, at the same time giving him a thorough grounding in the basic medical sciences. Training in research is also an important part of the work, and a satisfactory thesis is required of all who are to receive the D.Sc.

Something of the foresight and high standards represented by the Pennsylvania Plan is indicated by a more recent development in graduate medical education. In order to improve the standards of medical specialization in the United States, various organizations in the medical profession, including the American Medical Association, united to set up the “American Boards,” which conduct examinations to determine whether the physician has fully qualified himself for specialization by means of a thorough and well-planned course including adequate work in the medical sciences and study under master clinicians. It is significant that the requirements of these boards were anticipated from the beginning by the plan of graduate medical education carried out under the supervision of the University of Pennsylvania.

The Graduate Hospital

The principal teaching center of the Graduate School of Medicine is the Graduate Hospital, a twelve-story structure of yellow brick that was completed in 1928. The vertical lines of the architectural design and the large area devoted to windows give the Hospital the appearance of a modern office building—or perhaps better, of a modern city hospital.
The building is on the southeast corner of Nineteenth and Lombard streets and extends south to Naudain Street. It is L-shaped; the shorter wing, in which is the main entrance, faces on Lombard Street. Adjacent on Lombard Street are the buildings of the old Polyclinic Hospital, which now house classrooms, out-patient departments, the Social Service Department, the nurses' home, and administrative offices. The entire block bounded by Eighteenth, Nineteenth, Lombard, and Naudain streets is owned by the University, and it is expected that ultimately the area will be occupied by a modern hospital building of which the section erected in 1928 will be but a wing.

This section, nevertheless, is a large hospital. It has fifty-four private rooms (on the third to ninth floors of the Lombard Street wing), and a total capacity of five hundred beds. It is organized and staffed for all the clinical departments of medicine except psychopathic and contagious diseases and obstetrics.

The first floor contains accident and receiving wards and the diet kitchen, the basement housing all the mechanical equipment. The second floor has the offices of the Hospital, the X-ray Department, and the children's medical ward, which is very busy, for the Hospital is in a densely populated section of the City. The third floor contains semi-private rooms with fifty-eight beds. The fourth to eighth floors have wards for medical and surgical cases and the specialties. The entire ninth floor is devoted exclusively to gynecology. The tenth floor contains the seven operating rooms of the Hospital, an extensive laboratory of surgical pathology, and the Chevalier Jackson Bronchoscopic Clinic. On the mezzanine over the tenth floor are dressing rooms for the staff and the student physicians and entrances to the amphitheatres of the operating rooms. On the roof is a solarium, a lounge, and a restaurant seating 150.

The importance of the Hospital to the Graduate School of Medicine and also to the sick of Philadelphia is revealed by some figures on the records of the Hospital. Each year some 8,000 in-patients spend a total of 50,000 "patient days" in the Hospital, and 35,000 ambulant patients make 175,000 visits to the out-patient departments. The four hundred and more physicians on the staff of the Graduate School of Medicine care for these patients, aided by a resident staff of sixteen internes and nine residents, and a Social Service Department of ten workers.

In addition to graduate medical education, the Hospital conducts courses lasting from a year to eighteen months for hospital workers. Each year some two hundred persons in these courses are learning
to become physical therapists, x-ray technicians, dietitians, and to keep medical records. Included are eighty students in the Philadelphia School of Occupational Therapy, which is affiliated with the Graduate Hospital.

**THE WISTAR INSTITUTE**

On the west side of Thirty-sixth Street, facing Logan Hall, is the yellow brick building that houses the Wistar Institute of Anatomy and Biology, the first anatomical institute in America devoted entirely to research.

The Institute is an auxiliary division of the University, and the relationship is best indicated by the way in which the nine members of the Board of Managers are selected. Six of these are chosen by the Trustees of the University, two by the Academy of Natural Sciences from its own membership, and one must be a lineal descendant of the father of General Isaac J. Wistar, who founded the Institute in 1892 in honor of his great-uncle, Dr. Caspar Wistar, and who by various gifts and the bequest of his residuary estate provided an endowment that will ultimately amount to approximately three million dollars.

The original building of the Institute, which stretches along Thirty-sixth Street from Spruce Street to Woodland Avenue, was dedicated in 1894. In 1897 an addition extending a short distance along Woodland Avenue was completed. At present the Institute owns the entire triangle bounded by Thirty-sixth and Spruce streets and Woodland Avenue, much of the land being the gift of the University. Until 1902 a Philadelphia police station stood at the western end. In that year the City was willing to sell out for $12,000, and part of the station house was converted into a rat colony. The station house was torn down in 1932, when the sandstone basement of what is planned to be a new museum of imposing architecture was constructed along Woodland Avenue. At the same time a new building for the rat colonies was erected in the court in the rear.

Among the Institute's collections are most of the original specimens of the Wistar and Horner Museum of Anatomy, begun in 1808 by Caspar Wistar. The Institute was founded to provide for the safe preservation, intelligent arrangement, and free exhibition of these specimens and their increase to a complete collection useful in the advanced study of biology and anatomy, and to make permanent the progress in anatomical research to which such University scientists as Leidy, Cope, Ryder, and Tyson had contributed so
greatly. The anatomical specimens, which have been continually added to, include preserved embryos, monstrosities, a large variety of skeletons of various human races and other mammals, and specimens illustrating modern surgical methods of overcoming pathological conditions. The collection of the brains of scholars is well known, one of the latest additions being the brain of the English scientist J. B. S. Haldane. All told, there are close to twenty thousand anatomical preparations.

A number of objects of historical interest are in the Institute, mainly in a large room on the second floor filled with General Wistar’s bookcases, which contain the four thousand volumes of his personal library. In the room is a collection of colonial furniture, including a highboy damaged by Pulaski’s cavalry in 1778 and two settees inherited by General Wistar through his mother from Thomas Mifflin, the first governor of Pennsylvania and a graduate of the College of Philadelphia. In a large case near the entrance of the Institute are numerous military relics of the General, who had a picturesque career in the California gold rush and later took part in the Battle of Gettysburg.

The Institute does not believe, however, that it should serve only as a depository of relics and a storehouse of bones. It envisages a new type of living museum in which exhibitions of current medical research and working models, operated and illuminated by electricity, would serve as a textbook of anatomy and physiology for medical students and the general public. A start in this direction has been made by adding to the equipment a library of anatomical, biological, and medical films, many of them with sound track and most of them in color.

Besides the exhibition rooms, offices, library, photographic room, and machine shop, the main building contains three large laboratories, each accommodating four to six men, and fifteen small laboratories, each occupied by a single research worker. Here is carried on research in anatomy, experimental zoology and genetics, neuro-embryology, biochemistry and nutrition.

An important part in this research is played by the famous Wistar rats, now nearing their two-hundredth generation. As a result of the unsurpassed hygienic conditions under which they are bred, the surplus has a ready sale to other institutions. In the colony houses are kept a few specimens of all the rare strains of rats, so that if a war or other catastrophe should destroy European colonies, experiments in these strains could be resumed and the results of years of research would not be lost.
SCHOOL OF DENTISTRY

WISTAR INSTITUTE
PHIPPS INSTITUTE

SCHOOL OF VETERINARY MEDICINE
Because it is independent of any teaching institution and therefore can serve all institutions better, the Institute acts as a center for the dissemination of the results of anatomical and biological research throughout the world. It does this by publishing the following learned journals, which are edited in various institutions, including the University of Pennsylvania and the Institute itself: *Journal of Morphology*, *Journal of Comparative Neurology*, *American Journal of Anatomy*, *Anatomical Record*, *Journal of Experimental Zoology*, *American Journal of Physical Anthropology*, *Journal of Cellular and Comparative Physiology*, *Journal of Nutrition*, *American Anatomical Memoirs*, *Publications of the Biological Survey of the Mount Desert Region*. In addition there is a Bibliographical Service, which issues abstracts of papers in advance of their appearance in journals. The printing of these publications is done in a complete plant located in special quarters of the Institute building on Woodland Avenue.

An important part of the Institute’s research facilities is the Morris Biological Farm of 150 acres near Bristol, Pennsylvania, given in 1928 by Effingham B. Morris, the late President of the Board. The gift included livestock, farm equipment, and funds for scientific equipment and the reconstruction of the early American farmhouse as a residence for investigators. Additional residences have since been constructed, along with laboratories, aquaria, and colony houses for rats and opossums. The facilities for research with opossums and amphibia are unique.

**THE PHIPPS INSTITUTE**

The Henry Phipps Institute for the Study, Treatment, and Prevention of Tuberculosis is one of the world’s productive centers of research in tuberculosis. It was established in 1903 by Mr. Henry Phipps and was given by him to the University in 1910.

During the first ten years of the University’s responsibility for the Institute, it was maintained by annual gifts from the founder. Since then it has been supported by appropriations from the University and by contributions from philanthropic foundations, the Welfare Federation, and private benefactors, including members of the family of Mr. Phipps. In 1928 a considerable endowment was secured, half of it from the Phipps family and half from previous endowments and a contribution set aside by the University.

The Institute occupies a brick building of modified colonial de-
sign at Seventh and Lombard streets, completed in 1913. On the first floor are the general offices, record rooms, examining rooms, a drug room, and treatment rooms; on the second are a large collapse therapy clinic and most of the laboratories; on the third are research laboratories and quarters for experimental animals; on the fourth is the X-ray Department with storage space for the seventy thousand films now on file; on the fifth is the library. The basement is divided: in the front wing are nurses' offices and an auditorium; in the rear wing are shops, laundry, furnace rooms, and certain special research rooms. The location of the building in a highly congested section of the City makes possible especially effective care of ambulant tuberculous patients (no bed patients are cared for) and the Institute's extensive program of research.

On the average about 3,000 patients make 14,000 visits a year to the clinic. They come from approximately 1,000 families that are under constant supervision by the medical and nursing staff of the Institute. Close to twenty per cent of the patients have clinical tuberculosis; the rest are under observation because they are or have been in contact with the disease. In addition to medical and nursing service, more than 10,000 laboratory tests and 4,000 x-ray examinations are made annually. Virtually all of these services are provided to the community without cost by a staff composed of nine full-time physicians, eight part-time physicians, eight public health nurses, and various secretarial, clinical, and technical assistants. Supplementing the regular staff are visiting physicians and nurses sponsored by philanthropic foundations and departments of health, and also a group of ten Negro physicians and twelve Negro nurses, who, supported by the Philadelphia Health Council and Tuberculosis Committee, are engaged in one of the most active Negro antituberculosis campaigns in the country.

In recent years the Institute's research activities have been concentrated on problems of epidemiology, Negro tuberculosis, and the chemistry of the important active principles of the bacteriological cause of tuberculosis.

The epidemiological investigations have attracted world-wide attention. Fundamental studies, inaugurated in 1924, on the spread of tuberculosis in families, have provided the background and many of the technical methods for the present nationally organized campaign against the disease. One of the most notable of modern contributions toward understanding the disease—the knowledge that pulmonary tuberculosis may smolder without giving other evidence
of its presence than that obtained by the x-ray film—is in large part due to the work of the Phipps Institute.

In the important field of Negro tuberculosis, the Institute has pioneered in the training of Negro physicians and public health nurses. Experience has shown that the serious problem of tuberculosis among Negroes can best be handled by placing heavy responsibility on well-trained Negroes, who are sympathetic to the traditions of the race.

One of the best-known achievements of the Institute is the purification of the active principle of tuberculin, a substance used in the detection of tuberculosis both in men and cattle. These investigations, which made possible the standardization of tuberculin, were carried on largely by means of a Tiselius electrophoresis apparatus, a precision instrument, the gift of the Carnegie Corporation, that represents the most modern mechanical construction in its particular field of physical chemistry. The work in the chemistry and immunology of tuberculin resulted in the award of the Trudeau medal in 1938 to a member of the staff.

**THE EVANS INSTITUTE AND THE SCHOOL OF DENTISTRY**

The School of Dentistry of the University of Pennsylvania was organized in 1878, shortly after the Robert Hare Laboratory had been completed; and until 1896 it occupied space in both the Hare Laboratory and Logan Hall, which was then called Medical Hall and was the home of the Medical School until 1904. In 1896 a new building on the west side of Thirty-third Street north of Spruce was provided for it, but in less than twenty years the School had outgrown those quarters, partly as a result of a merger in 1909 with the Pennsylvania College of Dental Surgery, which had been founded in 1856, following a separation from the slightly older Philadelphia College of Dental Surgery. In 1915 the Dental School moved into its present home, on the northwest corner of Fortieth and Spruce streets, an H-shaped building of Tudor Gothic architecture.

Over the doorway at the base of the tower the passer-by will read:

- The Thomas W. Evans Museum and Dental Institute
- School of Dentistry
- University of Pennsylvania

And the catalogue of the Dental School, as both the building, and
the justly distinguished school which it houses are known to most Pennsylvanians, is equally ambiguous. The same words are printed (in four lines instead of two) on the cover of the catalogue, without benefit of punctuation. Perhaps a short history of the Evans Institute will clear up a situation that is complicated by a number of legal considerations.

In 1897 Dr. Thomas W. Evans, a native Philadelphian, died in Paris, leaving an estate of $3,500,000, the result of his having cared for the teeth of many of the crowned heads of Europe and other important and wealthy Europeans, and from the wise investment of the funds so acquired. The entire estate was bequeathed to “The Thomas W. Evans Museum and Dental Institute Society” for the purpose of building and endowing a dental “institute” or school at Fortieth and Spruce streets, where Dr. Evans had been born.

Unfortunately no such society had yet been created, and although Mayor Ashbridge of Philadelphia a few weeks later organized one, the French courts decided that the money should stay in France. After years of litigation, however, a compromise was effected and ultimately the Society found itself in possession of about $1,750,000, a handsome sum, but not enough to create a dental school, as Dr. Evans' will had directed, “inferior to none” in the city of Philadelphia. Very sensibly, then, in 1912, the Society entered into an agreement, to last 999 years, with the Trustees of the University, whereby the Thomas W. Evans Dental Institute would be constructed and equipped by the Society, and instruction would be given by the faculty of the School of Dentistry of the University of Pennsylvania, the remainder of the funds serving as endowment. The name over the door is intended to express this relationship without giving undue emphasis to either party of the contract.

The Museum is something else. When the good doctor died, he possessed a most remarkable collection of pictures, statuary, vases, clocks, and other Victorian objects of art, most of them gifts of royalty, to whom it would have been improper to send a bill. He had silver tea sets, chinaware, a Bible collection, scientific and literary manuscripts, autographed letters and decorations from royalty, jewelry valued today at $40,000, and a closed carriage in which in 1870 he had smuggled the Empress Eugénie out of Paris and away from the enraged Commune. At the end of his life, proud of these symbols of a career that had in it something of an Alger book and something of A Tale of Two Cities, he directed in his will that the building erected by the Society should contain “an absolutely fire-
proof room and positively burglar proof," in which the objects should repose forever. Few people now seek to enter the Museum, but the Secretary of the Society is glad to unlock the doors for the occasional visitor and show the carefully guarded treasures on the ground floor of the southeast wing.

Dr. Evans stipulated that the building should be of "refined and artistic beauty," and his will has been faithfully executed. The tower, which rises eighty-four feet over the center of the Spruce Street side, is perhaps the most impressive feature, but the general effect of the building with its richly carved limestone trim and mullioned windows has been greatly admired. The interior design is equally effective. After passing through the main entrance, one glances up a handsome marble stairway to a stained-glass window over a low Gothic doorway. The view is very likely to appear in the class record published each year by the hundred dental graduates who come from all parts of the world to receive the degree of D.D.S. from the University of Pennsylvania.

On the Spruce Street side of the first floor, to the left of the entrance, are the administrative offices with a board room adjoining. To the right is the Museum, the office of the Secretary of the Society, and a diagnostic clinic. Along the entire north side stretches a clinic for plate prosthesis (the fitting of sets of false teeth). Also on the first floor is an x-ray clinic containing machines that are kept busy most of the time. After a patient (20,000 of them come to the Institute each year) has visited this clinic, he is likely to go across the hall to the exodontic clinic, where more than 50,000 teeth are extracted annually.

Stretching along the entire north side of the second floor is an operative clinic. Like the plate clinic below, this room is lighted by huge windows overlooking property owned by the Institute as insurance against the light being cut off by the erection of tall buildings. The room measures 205 by 48 feet and has a ceiling thirty feet high; in it are 132 dental chairs, which, like most of the 228 chairs in the Institute, were replaced in 1931.

The library, which is on the south side of the second floor and is two stories in height, contains more than ten thousand volumes of the standard and periodical literature of dentistry. Included is a collection of cartoons and prints illustrating the practices of the times when dentistry was not the science it is today.

The remaining facilities in the building cannot be mentioned in detail. There are two lecture rooms seating four hundred and three
hundred students, respectively; there are clinics for crown and bridge work and for orthodontia. Bacteriology, histology, and pharmacology, as they especially relate to the mouth, are taught in laboratories in the Institute, but fundamental courses in anatomy, histology, physiological chemistry, physiology, and pathology are given in the Medical Laboratories on Hamilton Walk. In the basement are the mechanical laboratories, where much of the $10,000 worth of gold and other precious metals used each year by the Institute is fashioned into dentures.

Dentistry has advanced since 1878, when the School was founded, and that advance is symbolized by the present course of study—and the ninety members of the faculty who give it—quite as well as by the building and equipment. The constantly increasing knowledge of the relationship of the mouth and teeth to bodily health has made of the modern dentist a physician who is concerned with the whole body. It is natural, therefore, that the course of study should closely parallel in outline the course in medicine, with the first two years devoted primarily to the study of the fundamental sciences of anatomy, bacteriology, physiological chemistry, physiology, and pathology, and the last two years to dental technique and to a clinical study of the diseases of the mouth and teeth, with which the work of the first two years is closely correlated. It is natural, too, that great care should be exercised in the selection of students. In the earlier years of the School virtually no entrance requirements existed, but with the raising of the standards in the profession it was found desirable, in 1927, to demand a preliminary two years of college work of the student who wishes to enroll, and at present nearly half of the matriculates have a Bachelor’s degree.

The purpose of the Institute is not only to prepare men and women (women were first admitted in 1914) for the practice of dentistry, but to stimulate research, and therefore there are individual private laboratories where investigations by members of the faculty, advanced students, and graduates are conducted. Other research is regularly carried on in the Medical Laboratories in cooperation with various departments of the Medical School. Evidence of this activity can be found in the Institute’s annual bibliography, which each year contains considerably more than a hundred entries of publications by members of the faculty and graduates. About one-third of these are by members of the faculty, and deal both with fundamental problems of anatomy, bacteriology, etc., and with problems directly related to dentistry. It is significant that graduates are also active in research.
THE SCHOOL OF VETERINARY MEDICINE AND THE VETERINARY HOSPITAL

The Veterinary building, which is at Thirty-ninth Street and Woodland Avenue, was designed in a style of architecture adapted from the English collegiate of the seventeenth century. It forms a quadrangle 260 by 210 feet, and was erected in four sections at two-year intervals—in 1907, 1909, 1911, and 1913. When everything was complete, the University had acquired an impressive building of brick and limestone, similar in design to the dormitories which extend along the opposite side of Woodland Avenue.

Most of the credit for the building and its original equipment is due to the late Dr. Leonard Pearson, Dean of the School from 1897 to 1909. Appointed State Veterinarian in 1895, he was responsible for the passage by the Legislature of many laws for the control of the communicable diseases of domestic animals which were later copied by other states, and he was the first to use the tuberculin test for tuberculosis in cattle and the mallein test for glanders in horses, two diseases transmissible to man which almost have been eradicated from this country. Largely through the efforts of Dr. Pearson, who was supported by the veterinarians of the State, the Pennsylvania Legislature appropriated funds which made possible the erection and equipping of the present Veterinary School and Hospital.

The main entrance of the building is on Thirty-ninth Street, through a low archway opening on a grassy court, and the principal entrance to the northern half of the building, which is devoted mainly to lecture rooms and laboratories, is to the left of the archway. Here, on the first floor, are the offices of the Dean of the School, the library, and the laboratories of pharmacology and milk hygiene. On the second floor are offices occupied by the Bureau of Animal Industry of the Pennsylvania Department of Agriculture and the laboratories of pathology and parasitology. Also on the second floor, but at the east and southeast ends of the building, are the laboratories of anatomy and physiology. Besides the large laboratories used for the instruction of the undergraduates, there are numerous laboratories for research, in which important investigations are being carried on by the faculty and their six research associates, some of it in coöperation with members of the staff of the Medical School interested in the diseases of animals that are communicable to human beings.
Under the archway on Thirty-ninth Street is the office of the Hospital, to which in a single year are brought more than thirteen thousand animals, large and small. By far the greatest number are dogs, which are followed by cats, horses, and cattle in that order; but the Hospital cares for any animal that is sick, relieving its suffering by treatment and by means of anesthesia if an operation is necessary. Many of the ailments, of course, are diseases found only in animals, but a glance at the records reveals that patients come for accouchement, caesarian sections, thyroidectomies, treatment of angina, arthritis, bronchitis, gastric ulcers, paralysis—even pyorrhea.

The clinic for large animals is on the ground level, and a number of horses and cows, many of them valuable animals brought from long distances, will always be found in the fifty-five box stalls of the Hospital. Besides the usual stocks for holding an animal during an operation, the equipment of the clinic includes apparatus for the artificial induction of fever, and x-ray machines for diagnosis and therapy. The therapy unit, a 220,000-volt machine installed in 1938, is at present the largest apparatus in existence for the treatment of animals. The unit, the most mobile of its type, is manipulated by means of a chain hoist. It is housed in a special room and has a raised operator's booth protected by a ton of lead sheets. Students watching the apparatus in use from an adjacent room look through leaded glass windows set in lead-covered doors. Astonishing results have been obtained with this machine in the treatment of malignant growths in large animals.

Adjoining the clinic for large animals at the west end is a pharmacy; at the east end is a farriery, one of the few in the City, where an expert farrier, supervised by the doctors, fits horses and mules with what might be called orthopedic shoes. Near the farriery is the morgue, to which dead animals are brought for post-mortems from all over the City, for the veterinarians are proud of the fact that only three or four large animals a year die in the Hospital itself.

The clinic for small animals is on the second floor. The four wards, including one for infectious diseases, accommodate a total of one hundred animals. Nearby are a runway for exercising convalescents, a large clinic room where students and internes take care of minor ailments, and a tiled operating room, where veterinary students and white-capped graduate nurses assist the surgeons with instruments, dressings, and in administering anesthetics.

Not all the clinical service is in the Hospital. Because the Veterinary School is in the center of a region rich in livestock, an
ambulatory clinic is maintained which cares for nearly six thousand additional cases each year. There is also the School of Animal Pathology, which was established in 1937 as a result of the gift by the heirs of Effingham B. Morris, a Trustee of the University, of the Bolton Farm of four hundred acres near Bristol, Pennsylvania, where a completely equipped research laboratory was set up and research projects inaugurated as the result of an appropriation of the Pennsylvania Legislature in 1937. The purpose of the School of Animal Pathology is to study the diseases of wild and domestic animals, especially as they affect man and the livestock industry. In this work the farm's exceptional herd of registered Guernsey cattle and other livestock is of great importance.

Although as early as 1807 Benjamin Rush had proposed that a course in veterinary medicine be given in the University, no definite steps were taken until 1882, when Joshua B. Lippincott, a Trustee, and Joseph E. Gillingham contributed funds to establish a Department of Veterinary Medicine. Within a few months a building for the new department was under construction on the site now occupied by the Medical Laboratories on Hamilton Walk. Instruction in veterinary subjects was to be given in this building, but fundamental courses in pathology, chemistry, etc. were to be conducted in the Medical School, as is still done. On October 2, 1884, the new building was opened, and a year later another building, providing facilities for clinical instruction, was added following a second gift from Mr. Lippincott. This plant was further increased by an appropriation in 1889 by the Pennsylvania Legislature for a building, completed in 1892, to house a hospital for dogs and additional laboratories.

Dean of the Veterinary faculty from 1883 until 1889 was Dr. Rush Shippen Huidkeper, a graduate of the Medical School who had also graduated from the veterinary school in Alfort, France, and had studied in the laboratories of Virchow, Koch, Chaveau, and Pasteur. Modeled after the courses in the French and German schools, the three-year course that he instituted was more comprehensive and extended over a longer period than that of any other veterinary school in this country save one. Most of the schools at that time were graduating students after two sessions of six months each, and even the medical school courses lasted only three years.

The original thorough course has since been extended and strengthened greatly. With the aid of gifts from the daughter of Mr. Lippincott and a bequest from Mr. Gillingham, the faculty for many years has been on a full-time basis; new activities such as
the ambulatory clinic and a system of veterinary extension have been established; and the course now extends over four years, with one year of study in an approved college as an entrance requirement, which will become two years in 1940-41.

The program of research has also increased greatly. One of the current projects is a study of swine influenza, a disease closely related to the influenza that affects man. Other investigations are concerned with tularemia, Rocky Mountain spotted fever, and mastitis (caked udder), the latter being the most serious disease from an economic standpoint that now affects cattle. Of obvious importance also is the work of one member of the staff who has succeeded in transferring a type of sarcoma to healthy animals. The investigations have shown that if the animal recovers from the malignant growth it is immune to further inoculation.

Since the opening of the School more than 1,200 students have received the degree of Doctor of Veterinary Medicine from the University. Most of them have devoted themselves to private practice, but many have engaged in teaching, research, the preparation of biological products, and public health work as Federal and State officials in the control of infectious diseases of animals and as officers in the Veterinary Corps of the United States Army, the present organization of which is largely owing to a former member of the faculty and two alumni. Some have contributed to the advancement of veterinary knowledge and practice, and many have had an active part in such achievements as the stamping out of the three epizootics of foot and mouth disease which have occurred since 1903, in bovine tuberculosis eradication, in the control of Bang's disease (the organism of which causes undulant fever in man), in the almost complete eradication of glanders, and in greatly reducing the area infected with the Texas fever tick.