1944

DESCRIPTIVE PAMPHLET, 1942-1944

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THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH

History
Organization
Present Scope of the Scientific Work
Buildings and Equipment
Publications

1942-1944

NEW YORK CITY
NEW YORK
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Endowment

The Rockefeller Institute for Medical Research was founded in 1901 by Mr. John D. Rockefeller, as a philanthropic corporation under the laws of the State of New York. Since its beginning, as needs have arisen for buildings, equipment, and additional endowment, to permit more extensive investigations, gifts have very generously been made by Mr. John D. Rockefeller and Mr. John D. Rockefeller, Jr.

Bequests and Gifts

The opportunities for fruitful medical research are almost unlimited and potentially exceed the limits of any given endowment. On the other hand, individuals anxious to make donations that will promote medical research are often at a loss as to how to place funds so that they will be wisely expended. The organization and control of investigation in the Institute are in the hands of a Board of Scientific Directors, selected from the scientific leaders of the country; and donations accepted by the Institute are expended under their direction with the same care as that devoted to the expenditure of the income from the original endowment. Donors, therefore, who are interested in contributing to scientific medical investigation may have confidence that the Scientific Directors will make a wise use of their donations. The Institute is glad to receive such donations when the Directors and Trustees are satisfied that it can, consistently with its existing policies and commitments, do justice to the purposes of the donors. At the present time the Institute is administering several gifts made for the promotion of cancer research and one for the study of leukemia. Other gifts made for the Institute's general purposes have been helpful in carrying on its work.

Purposes

The purposes of The Rockefeller Institute are set forth in its charter, which states that:

"The objects of said corporation shall be to conduct, assist and encourage investigations in the sciences and arts of hygiene, medicine and surgery, and allied subjects, in the nature and causes of disease and the methods of its prevention and treatment, and to make knowledge relating to these various subjects available for the protection of the health of the public and the improved treatment of disease and injury. It
The Rockefeller Institute for Medical Research shall be within the purposes of said corporation to use any means to those ends which from time to time shall seem to it expedient, including research, publication, education, the establishment and maintenance of charitable or benevolent activities, agencies or institutions appropriate thereto, and the aid of any other such activities, agencies or institutions already established or which may hereafter be established."

Development

The Rockefeller Institute was conceived, not by physicians or scientists, but rather by laymen who studied the state of medical knowledge at the end of the nineteenth century and concluded that the time was favorable for the establishment in the United States of an institute devoted exclusively to medical research, just as institutions devoted to physical or chemical research might be founded.

In the United States before 1900 the growth of medical science had not kept pace with that of the physical sciences, despite the fact that research in medicine had been carried on in universities at a constantly increased rate. The conclusion reached by Mr. Frederick T. Gates, acting as adviser to Mr. Rockefeller, was, therefore, that "medicine could hardly hope to become a science until it should be endowed, and qualified men be enabled to give themselves to uninterrupted study and investigation, on ample salary, entirely independent of practice." This view was accepted by Mr. Rockefeller, who made the initial contribution toward the eventual permanent establishment of The Rockefeller Institute for Medical Research.

The original gift, amounting to $200,000, was in 1901 placed in the hands of a Board of Directors, composed of William H. Welch, President; T. Mitchell Prudden, Vice-President; L. Emmett Holt, Secretary; Theobald Smith, Christian A. Herter, Hermann M. Biggs, and Simon Flexner. This gift was not made for the immediate purpose of building an institution for medical research, but was to be used by a group of scientifically trained medical men to ascertain the resources in adequately trained younger men of the universities engaged in the pursuit of medical research. It was to be awarded in grants and fellowships and expended within a period of ten years. During this period, and in this way, it was hoped that more precise knowledge would be obtained concerning the advisability of establishing in the United States an independent institute for medical research. This information was secured more quickly than had been anticipated, so that early in 1902 the conception of a research laboratory to be located in New York City had taken form
in the minds of the scientific directors, and met with Mr. Rockefeller's approval.

The principles of organization of the research laboratory which constituted the beginnings of the present Rockefeller Institute have continued essentially unchanged. They were, briefly, that there should be a Board of Scientific Directors responsible for the appointment of the Scientific Staff and for the general policies of scientific investigations carried on, while the general direction of the scientific work was to be entrusted to a Scientific Director, who was himself an investigator and in intimate contact with other investigators. Each investigator was to be accorded complete freedom, under the general supervision of the Director of the Institute, in the pursuit of problems within his particular field, but it was thought best to avoid, as far as practicable, the overlapping of problems into contiguous fields, except where problems were investigated jointly by two or more groups of workers.

It was apparent that Mr. Rockefeller's initial gift necessitated that the operation of the original laboratory in New York should be on a limited scale. Accordingly a small building was rented at 127 East 50th Street, equipped for investigations in pathology, physiology, pharmacology, and biological chemistry, and opened on October 15, 1904. The original scientific staff consisted of Simon Flexner, pathologist and Director, with whom were associated Hideyo Noguchi, Eugene L. Opie, and J. E. Sweet, pathologists; Samuel J. Meltzer, physiologist and pharmacologist; and P. A. Levene, biological chemist.

The results achieved with grants given in aid of research, and in the first small laboratory, proved to be so encouraging that a tract of land was purchased by Mr. Rockefeller overlooking the East River at 66th Street, upon which was erected a modern laboratory. In order to provide both for the erection of the laboratory and for its cost of operation, Mr. Rockefeller made an additional gift to be expended and not reserved in part as endowment. This laboratory, known as the Central Laboratory, was opened in 1906, and provided suitable space for the study of the above subjects together with experimental surgery, and, later, experimental biology.

The need for a hospital attached to the Institute, in which disease in man could be investigated under as favorable conditions as possible, was felt early, inasmuch as investigations had been conducted only in the
laboratories, and access to patients suffering from disease had to be secured in a small way at hospitals in the city. In 1908 and shortly thereafter Mr. Rockefeller made gifts for the purpose of erecting a main hospital of sixty beds, and an isolation pavilion, of nine beds, designed for the study of infectious diseases. The hospital was opened in 1910 with Rufus Cole as Director. At that time Mr. Rockefeller provided a suitable endowment for the needs of the Institute as then existing. In 1937 Dr. Cole retired as Director of the Hospital and was succeeded by Dr. Thomas M. Rivers.

The principles of organization of the hospital were, first, that the number of diseases studied at any one time would be limited and only patients suffering from one or another of the diseases under investigation would be accepted; second, that all the scientific staff was to devote its entire time to the duties of the hospital; third, that the work of the hospital staff should consist not merely in observational studies, but in experimental studies equally; and fourth, that no charge was to be exacted from the patients for services rendered. These principles have not been departed from in the thirty-three years during which the hospital has been in operation.

In 1910, with the added endowment and the opening of the hospital, the powers of the Corporation were increased and its membership was enlarged to include the members of a new Board of Trustees as well as the members of the original Board of Directors, the name of which was changed at that time to the Board of Scientific Directors. The new Board of Trustees was composed of two groups: one representing the business or fiscal interests of the Institute and the other the scientific interests. The former group consisted of Frederick T. Gates, as President, John D. Rockefeller, Jr., and Starr J. Murphy; and the latter group of William H. Welch and Simon Flexner. Owing to death and other circumstances, the personnel of the Trustees has changed, and at the present time consists of nine members, with John D. Rockefeller, Jr., as President.

Up to 1914 The Rockefeller Institute was located wholly in New York City and consisted of laboratories and a hospital. In that year a Department of Animal Pathology was created, and Theobald Smith was chosen Director. A suitable country location, about three miles from Princeton University, was secured, on which laboratories and stables for
THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

animals were erected. To these buildings were added dwellings for the Director, scientific staff, and employees. This department was created in order to provide facilities for the study of the comparative aspects of the pathology of disease in various animal species, especially in the more valuable domestic animals, and in order to bring to light such processes as are especially clear in animals but obscure or difficult of access in human beings. In 1930 Dr. Carl TenBroeck succeeded Dr. Theobald Smith as Director.

In 1931 the department at Princeton was extended to include a Laboratory of Plant Pathology, and the combined laboratories are now known as the Department of Animal and Plant Pathology. Through the addition of plant pathology The Rockefeller Institute has provided in one organization for the study of disease as it occurs in all the main orders of living things.

In 1935 Dr. Simon Flexner retired from the directorship of the Institute and was succeeded by Dr. Herbert S. Gasser.

ORGANIZATION

Administration The Institute's charter provides for a Board of Trustees and a Board of Scientific Directors. The Board of Trustees, of which two members are appointed by the Scientific Directors from their own number, is charged with the maintenance and care of the endowment and property of the Institute. Income from endowment, after taxes and other charges on capital have been paid, is available for expenditure by the Board of Scientific Directors. The Board of Scientific Directors, acting through the Director of the Institute, has control of all the scientific work and of the administration of the several departments of the Institute. Its stated meetings are held quarterly. The expenditures are made under its direction in accordance with an annual budget framed by a Budget Committee consisting of three members of the Board of Scientific Directors and two members of the Board of Trustees. Of the three members of the Budget Committee chosen by the Board of Scientific Directors at least one shall also be a member of the Board of Trustees.

The Trustees of the Institute, who are the custodians of its property, and the Scientific Directors, who have unrestricted charge of all phases
of its scientific work, together constitute the Corporation. The Corporation meets at least once a year to receive reports from the Trustees and Scientific Directors, who consider together, from a common standpoint, the affairs of the Institute as a whole. This organization of the Governing Boards has fostered the aims of the Institute in a most gratifying way, giving as it does to the Scientific Directors the advantage of wise and sympathetic counsel in the relationships of the institution to the community, and affording to the Trustees opportunity to share in the problems, outlooks, and successes which are the inspiration of the scientific staff.

The routine administration of the Institute is in charge of an Executive Committee of the Board of Scientific Directors which acts chiefly through the Business Manager. The fiscal year begins July 1.

**Departments of the Institute**

There are three Departments of the Institute: the Department of the Laboratories, the Department of the Hospital, and the Department of Animal and Plant Pathology. At the head of each of these Departments is a Director, who is also a member of the Scientific Staff. The departmental Directors are appointed by the Board of Scientific Directors, and the Director of the Institute by the Corporation.

The present division of the Institute into the above three departments corresponds with a natural division of medical research into three branches. The Department of the Laboratories deals with the problems of disease in their physiological, pathological, bacteriological, chemical, and physical aspects and admits of the fullest use of the experimental method. The Department of the Hospital studies disease as it actually appears in human beings, facilities being provided not only for scientific observation and treatment of patients, but also—through experiments on animals—for solution of the problems arising from these clinical observations. The Department of Animal and Plant Pathology, through observation and experiment, deals with all aspects of the diseases of animals and plants.

In the different Departments of the Institute separate laboratories have been organized under the guidance of Members or Associate Members.
The Department of the Laboratories

The Department of the Laboratories, which was organized in 1905, is directed by Dr. Herbert S. Gasser. In this Department, investigations are carried on, at the present time, in the following scientific fields: Chemistry, Pathology and Bacteriology, and Physiology. These are conducted by the following staff groups.

Chemistry

A Laboratory of Chemistry is conducted by Dr. Bergmann, in association with Drs. L. E. Baker, Fruton, Moore, Stein, and Stahmann.

A Laboratory of Chemical Pharmacology is conducted by Dr. Jacobs, in association with Drs. Craig and Uhle.

A Laboratory of Physical Chemistry is conducted by Dr. MacInnes, in association with Drs. Longsworth, Rothen, and Shedlovsky.

Research is also being carried on by Dr. Michaelis, Member Emeritus, in association with Dr. Granick.

Pathology and Bacteriology

Laboratories of Pathology and Bacteriology are conducted by Dr. Rous, in association with Drs. Kidd, McMaster, and Smith; by Dr. Olitsky, in association with Drs. Morgan and Schlesinger; and by Drs. Casals-Ariet and Schneider, who were associated with Dr. Webster up to the time of his death on July 12, 1943.

Dr. Landsteiner, Member Emeritus, carried on his experiments until his death on June 26, 1943. The work is being continued by Dr. Chase.

A Laboratory of Cancer Research is conducted by Dr. Murphy, in association with Drs. Claude, Lynch, Hogeboom, and Porter, and Mr. Sturm.

Physiology

A Laboratory of Physiology is conducted by Dr. Gasser, in association with Drs. Lorente de Nó, Woolley, and Grundfest.

A Laboratory of General Physiology is conducted in Princeton by Dr. Northrop, in association with Drs. Kunitz and Herriott.

Research is also being carried on in New York by Dr. Osterhout, Member Emeritus.
The Department of the Hospital

The Department of the Hospital is directed by Dr. Thomas M. Rivers. This Department was established as a Department of the Institute in 1910, in order that the laboratory and experimental investigations which are carried on in the Department of the Laboratories could be supplemented by the study of certain diseases as they actually occur in man.

The particular diseases studied in the Hospital vary from time to time, the choice of problems being determined to some extent by the special fitness of the scientific staff for certain kinds of investigation. The staff of the Hospital is divided into several groups each of which is engaged in studying a special class of diseases, the investigation of which demands especially the employment of the methods of a particular fundamental science. The interests of a member of a special group are not necessarily confined to the disease being studied by his group, however, since, for instance, a student of cardiovascular disease may carry on investigations concerning the circulatory disturbances occurring in an infectious disease, or a physician studying metabolic diseases may investigate the metabolic disturbances occurring in patients with heart disease.

The groups of diseases at present under investigation in the Hospital and the individuals on the staff engaged in the study of each of them are as follows:

1. Infectious Diseases
   
   (a) Acute Respiratory Disease
       Drs. Avery, Horsfall, Goebel, Stillman, Binkley, Curnen, Mirick, and Ziegler.
   
   (b) Rheumatic Fever
   
   (c) Diseases Due to Filtrable Viruses
       Drs. Rivers and Smadel.
   
   (d) Bacterial Metabolism and Physiology
       Dr. Hotchkiss.
2. Metabolic Diseases

(a) Hemorrhagic Nephritis and Nephrosis

(b) Muscular Disorders and Hepatic Insufficiency
   Drs. Hoagland, Shank, and Gilder.

3. Cardiovascular Diseases
   Drs. Cohn, Mirsky, Schroeder, Foster, and Neumann.

Admission of Patients to the Hospital

The Hospital provides accommodation for a limited number of patients, and it has been so organized that the most approved methods of treatment can be adequately employed. Each physician has only a few patients under his care in order that a considerable portion of his time may be given to investigation. The Hospital employs none but graduate nurses.

The work of the Hospital at a particular time is limited to a small number of subjects; bulletins are issued from time to time stating the forms of disease then the subject of study. Only patients suffering from one of these diseases are admitted for treatment. They are admitted only by the Resident Physician, to whom they are referred by physicians or hospitals, or to whom they may apply directly. While making the fullest use of its opportunities for observation and study, the Institute recognizes at all times the paramount right of the patient to receive the most effective treatment within the power of the attending physicians. A patient does not impair that right by the voluntary character of his application for admission.

At the present time admissions are limited almost entirely to patients from the United States Navy received through the United States Naval Hospital in Brooklyn.

Under the By-Laws of the Corporation, no charge for professional care or service rendered, or for board or lodging, is to be made to persons treated at the Hospital.

The Department of Animal and Plant Pathology

The Department of Animal and Plant Pathology is directed by Dr. Carl TenBroeck. This Department was first organized in 1916 as the
Department of Animal Pathology, and work was begun in newly erected buildings in 1917. In 1931, it was extended to include a Laboratory of Plant Pathology, and the combined Laboratories at that time became known as the Department of Animal and Plant Pathology. In this Department, investigations are, at present, conducted by the following staff groups.

*Animal Pathology*

Laboratories of Animal Pathology are conducted by Dr. TenBroeck, in association with Drs. Nelson, Little, J. A. Baker, and Bang; by Dr. Pearce, who is continuing the work of Dr. Brown; by Dr. Shope; by Dr. Glaser, in association with Drs. Trager and Ferguson; and by Dr. Stoll, in association with Dr. Graham.

*Plant Pathology*

Laboratories of Plant Pathology are conducted by Dr. Kunkel, in association with Drs. Holmes, Black, Price, White, Braun, Elrod, and Laskaris; and by Dr. Stanley, in association with Drs. Lauffer, Knight, and Miller.

*General Statement*

The three departments of the Institute are organized for research only. Under normal conditions no provision is made for the enrollment of individuals or classes for formal instruction in the medical sciences or in laboratory or clinical methods. Thus the Institute absolves its staff from the necessity of devoting time and energy to formal teaching or to the consideration of subjects and problems chosen for reasons other than because of their value and promise for the advancement of science.

The scope of the Institute's work is wider than the study of problems whose solution has an immediate application to human pathology. It has, in fact, been the principle of the Institute's organization that it can best serve medical science by devoting a great deal of attention to the investigation of fundamental biological, physical, and chemical subjects. These aspects of science, as well as those of direct clinical importance, have been constantly under investigation, and together with problems of general biological interest, have largely occupied certain of the scientific staff and have used a considerable share of the Institute's annual budget.
It is not the aim of the Institute to perpetuate the lines of investigation in which it may engage, or even Departments or Laboratories, should the usefulness or promise of these at any time become doubtful, either from changes in the requirements and outlooks of science, or from lack of leaders of vision or achievement. On the other hand, the elucidation of fundamental problems may proceed under favorable conditions and with adequate support for an indefinite period, unhurried and unhindered by the urgency of obviously practical or immediate results. The organization of the Scientific Staff of the Institute is thus flexible and adaptable to the ever shifting requirements of research, so that at any time its Directors may alter the emphasis of its work, and focus its various resources upon different aspects of complex problems.

While the various phases of research which are being carried forward at the Institute are more or less independently conducted in the several Departments and Laboratories, it is aimed as far as is possible, through coordination and cooperation, to make them mutually helpful and stimulating. Thus through frequent symposia, the common services of publication, library, illustration, and other accessory services, and the lunch room shared by the scientific staff, a helpful community of interest is maintained.

**Appointments to the Scientific Staff**

Appointments to the Scientific Staff are made by the Board of Scientific Directors, upon recommendation of the Director of one of the Departments. They are held at the pleasure of the Board for a term not exceeding the period specified. The appointment of a Member of the Institute is without limit of time; the appointment of an Associate Member is for a term of years; all other appointments are for a term not exceeding one year, unless otherwise specified.

The following grades are fixed by the rules of the Board: Member of the Institute, Associate Member of the Institute, Associate, Assistant, and Fellow. The clinical staff of the Hospital may have in addition to the appropriate Institute titles, as above, the following titles indicating their special functions: Physician to the Hospital, Assistant Physician to the Hospital, Resident Physician, and Assistant Resident Physician.

Applications for appointment may be made at any time. Blank forms of application are furnished on request. Appointments are ordinarily made only as vacancies occur. They may be sought for the purpose of
permanent or indefinite association with the Institute, or for the purpose of temporary association with the Institute with one of the following objects: (1) experience in methods of investigation generally; (2) training in a special line of investigation; or (3) opportunity to work more or less independently on a particular problem which may be the subject of study at the time.

The qualifications for appointments to the scientific staff include preliminary training such as would be represented by an M.D. or a Ph.D. degree and, in addition, a knowledge of research, or a training such as would ordinarily be appropriate to the higher degrees in the biological or physical sciences.

The Institute requires all who serve on its scientific staff to give full time to the work, permitting them to pursue no gainful occupations outside of its organization and paying them a stipend fixed with reference to their complete devotion to whatever may be their special assignments. No part time workers are accepted.

All staff appointees are paid investigators with the exception of a small number of visiting investigators and special appointees, usually persons receiving fellowships awarded by various institutions in the United States and abroad. Those who come to the Institute under fellowships awarded by it, or by other institutions, are ordinarily privileged to enter the United States as "students" under the Immigration Laws. The visiting investigators and those receiving fellowships also give their entire time to the scientific work on which they are engaged, under the direction of one of the heads of laboratories of the Institute. Volunteer investigators wishing to pursue individual subjects of research foreign to the investigations being carried on in the laboratories of the Institute are not, as a rule, acceptable.

Language plays no part in the eligibility of visiting investigators. They are expected to be self-supporting, but there are no laboratory charges imposed either for space or materials.

**Technical Employees**

The Institute employs a group of men and women who act as technical assistants to the scientific staff. This group is largely made up of technicians, skilled helpers, and helpers. The technicians have had training equivalent to a B.S. degree, or considerable experience in special laboratory technique. The skilled helper and helper groups are composed mainly of young men and women who are high school graduates and who have a special interest in
scientific work. Applications for employment may be filed with the Assistant Business Manager.

**Services Auxiliary to Research**

The organization of the Institute provides for the maintenance of a series of Auxiliary Services for the scientific staff, thus relieving the latter of such personal routine as can be wisely delegated to specially trained persons. The following are now in operation in New York: Publication, Library, Illustration, Purchase and Supply, Culture Media and Glassware Preparation, X-Ray, Animal House, and Instrument-Making. Also of service to the scientific staff, as well as in maintenance work, are the Power House, Machine Shop, Carpenter Shop, and Paint Shop.

At the Department of Animal and Plant Pathology at Princeton a number of these services are also maintained.

**Discoveries and Inventions**

All discoveries and inventions made by any person while receiving compensation from the Institute, or while using the facilities of the Institute, become the property of the Institute, to be placed by it at the service of humanity in accordance with the beneficent purposes of the founder.

**PRESENT SCOPE OF THE SCIENTIFIC WORK**

As previously stated, in the organization of the scientific work of the Institute the principle has been recognized that the ultimate purposes of medical science may be greatly served by the study of fundamental biological, chemical, and physical problems. It will thus be seen that the scope of the Institute's work is broader than the study of problems whose solution would have an immediate application in the treatment and prevention of diseases of man, animals, and plants.

**The Department of the Laboratories**

Dr. Herbert S. Gasser, Director of the Institute, is also Director of the Department of the Laboratories, in which investigations are being carried on at the present time in the following scientific fields: Chemistry, Pathology and Bacteriology, and Physiology.

**Chemistry**

Dr. Bergmann and his associates are studying the chemistry of proteins and proteolytic enzymes. The composition and the structural pattern of
various proteins are investigated by analytical methods which are being developed for this particular purpose.

Other researches concern the enzymatic formation and transformation of proteins. The enzymes which direct the synthesis and degradation of proteins have been found to exhibit a high degree of specificity. Methods permitting the qualitative and quantitative characterization of the specific action of these enzymes have been devised. With these methods a comparative study is being made of the specificities of the intracellular proteolytic enzymes of normal and pathological animal and plant tissues.

In the study of intracellular proteolytic enzymes, particular attention is given to the reversible activation phenomena that regulate the action of many proteolytic enzymes of plant and animal cells.

The biological production and reproduction of proteins consist in sequences of coupled enzymatic reactions. The mechanism of such coupled enzymatic reactions and their particular specificity phenomena are also under investigation.

At the present time Dr. Bergmann and his staff are engaged entirely in the investigation of special problems assigned by the National Defense Research Committee.

In the Laboratory of Chemical Pharmacology, Dr. Jacobs and his associates are engaged in the study of the chemistry of natural products not only of demonstrated usefulness as medicinals but also of interest because of their pharmacological significance. In this connection, special attention is being given to certain groups of alkaloids the chemistry of which has been little understood. Following recent work of the laboratory, which has afforded a picture of the chemical structure of the alkaloids of ergot, synthetic studies are now in progress not only for substantiation but with the aim to make such or related substances synthetically available. A study is also in progress of the chemistry of the two groups ofaconite alkaloids and of the several groups of veratrine alkaloids. This is being done to determine their chemical structures, the possibility of structural interrelationships among the different groups, and the significance of such structures in relation to their pharmacodynamic effects.

At present this program is largely suspended in the interest of solution of problems of immediate importance during the emergency.

In the Laboratories of Physical Chemistry, work is being conducted as follows:
Dr. MacInnes and his associates are carrying out investigations on physicochemical methods for studying proteins, ampholytes, and salts. These methods include electrophoresis by the moving boundary method, surface films, diffusion, density, and high centrifugal fields.

The precision of ultracentrifugal measurements, including particularly the variables temperature and rotational speed, is being improved by a study of typical pure proteins. A research is in progress on the effect of centrifugal fields on simple galvanic cells. Such measurements will yield transference numbers not readily obtained by other means. The various types of moving boundaries are being studied in detail, including improvement of the optical systems that make such studies possible.

Researches on proteins of biological and clinical interest are being conducted in collaboration with investigators both inside and outside the Institute. The reactions between antigens and antibodies as surface films are being studied. A method is being developed which will increase the accuracy of the determination of the thickness of such films.

Most of the time of this group is now occupied in the solution of special problems assigned by the National Defense Research Committee and by the Navy.

Dr. Michaelis, Member Emeritus, and his associate are investigating the physical chemistry of reversible oxidation and reduction in organic compounds. The occurrence of intermediate steps of oxidation in the form of free organic radicals has been made the subject of investigation during the past years, and the studies have led to the conclusion that the existence of such radicals as intermediate steps is the *conditio sine qua non* for the reversibility of oxidation-reduction. To the previous methods of experimental approach to this problem the measurement of magnetic susceptibility has been added. The magnetic equipment has been utilized also for the measurement of magnetic properties of other compounds of biological interest such as crystallized catalase, various specific proteins, and the crystallizable iron-containing protein called ferritin, important in iron metabolism. Photoelectric spectrophotometry has been added as a further tool for the study of these problems.

A Spectroscopic Laboratory is conducted by Dr. Lavin, in which a central service for spectroanalysis is maintained for various laboratory groups throughout the Institute.
Pathology and Bacteriology

This laboratory was the first to be established and has been in operation since 1904. Until his retirement from the directorship of the Institute in 1935, the laboratory was in general charge of Dr. Flexner. The investigations are now being carried on in a number of laboratories in charge of the persons indicated below.

Dr. Rous and two associates are engaged in studies of tumors, with special reference to the share of viruses in causing these. The task involves a broad search amongst the neoplasms of unknown cause for signs of the action of viruses and the development of direct and indirect methods to tell whether they are present. An immunological exploration into the antigens contained in growths of differing types is under way and an experimental analysis of the successive conditions which culminate in the malignant state. In collateral to this last inquiry the question has been taken up of why tumors are sometimes elicited by stimuli which themselves are devoid of the power to initiate neoplastic change. Dr. McMaster’s work is directed toward an understanding of the mechanisms of fluid exchange within the tissues in health and disease. By means of special microtechniques he is studying the physiology of the lymphatic vessels, the conditions affecting the intercellular fluid, and those alterations within the tissues which determine fluid transfer and the formation and flow of lymph.

Dr. McMaster is now entirely engaged on a problem assigned by the National Defense Research Committee, and Dr. Kidd is largely occupied with a problem coming from the same source.

Dr. Olitsky and his associates are studying the mechanism of immunity in virus infections. A problem now under consideration concerns differences between non-specific resistance and true immunity characterized by the presence of specific antibody. One approach has been a study of the differences in immune response developing with increasing age of animals; another, the relation of virus-neutralizing antibody to resistance to active virus introduced by various routes. The virus of equine encephalomyelitis lends itself conveniently to these experiments and is therefore mainly used. The readily available virus of spontaneous encephalomyelitis of mice (so called poliomyelitis of mice), in view of its similarity in many characteristics to the virus of human poliomyelitis, is
also being investigated, chiefly from the standpoint of immunology and host range. The question of whether there may not be a group of "poliomyelitis" viruses characteristically indigenous to different species is being studied; and the extent to which the virus of the mouse infection can be conveyed to animals of other species which in nature are not carriers is being examined.

At present the program is directed to accord with the requests of the Commission on Neurotropic Virus Diseases of the United States Army. Dr. Webster and his associates have been studying genetic and nutritional factors in resistance to infectious disease. Tissues from inherently resistant and susceptible mice have been compared for their ability to support growth of pathogenic bacteria and viruses. Dietary substances affecting resistance of mice have been sought by adding suspected materials to a basic ration which has been as completely adequate and chemically defined as possible, and then determining their effect on the resistance of the mice to experimental infection.

In continuing studies on virus encephalitis in man, a diagnostic test which involves the complement fixation reaction has been developed. An antigen from brain tissue is employed and non-specific and anti-complementary effects have been largely controlled. This test is now being used to diagnose and bound epidemics of primary encephalitis.

The work on rabies embracing a method for diagnosis plus a method for evaluating rabies vaccines has been confined chiefly to the testing of a new vaccine in mice, dogs, and man. This vaccine consists of the supernatant fluid of a 5 per cent virus-infected brain tissue emulsion rendered non-virulent by exposure to ultraviolet light.

Recently the work has been directed along lines suggested by the Commission on Neurotropic Virus Diseases of the United States Army. Since Dr. Webster's death the laboratory program has been continued by Dr. Casals-Ariet and Dr. Schneider.

Dr. Landsteiner, Member Emeritus, and his associate have been conducting investigations on the chemistry of antigens and the nature of immunological specificity. In extension of work carried out with artificially conjugated antigens, which showed correlations between chemical structure and immunological properties, the determinant groups operative in the reactions of proteins have been examined. The production of allergy to simple chemical compounds has also been studied experimentally. In
this study especial attention was directed to the relation of drug allergy to immunization by ordinary antigens, to the mechanism of the sensitization process, and to its dependence on hereditary factors. Another part of the laboratory program dealt with the serological differences of human bloods and has led to the distinction of a number of individual properties. The chemical nature of the blood group substances has also been investigated.

Since Dr. Landsteiner's death, the experiments have been continued by Dr. Chase.

In the Laboratory of Cancer Research, Dr. Murphy and his associates are conducting studies on induced, transplanted, and spontaneously occurring tumors and leukemias in mice, rats, chickens, and rabbits. As material for the study of factors which influence the onset of malignant disease, two pure-line strains of mice are maintained, one with a high organ-specific spontaneous tumor rate, and the other with a high leukemia rate. Several conditions have been shown to modify the inherited tendency. To secure definite information on the difference between malignant and normal tissue units, a detailed study of the cell is in progress. A recently developed method makes it possible to separate the various cell components by mechanical means. A cell particle indistinguishable chemically from a particle of similar size which may be isolated from actively growing normal tissues has been shown to carry the tumor-producing activity of fowl tumor extracts; and now the nature and function of other cell components are being investigated. Included in the program is also a study demonstrating the influence of the cytoplasm on the development of the frog embryo, as opposed to the influence of the genes.

Dr. Hogeboom is entirely engaged on a problem assigned by the National Defense Research Committee.

Physiology

In the Laboratory of Physiology, Dr. Gasser and his associates have been studying conduction in the central nervous system. The methods employed are principally electrophysiological, and in the interpretation of the experiments extensive use is made of the constants previously determined for normal mammalian nerve fibers. Attention has been focused upon the properties of conduction across a synapse and upon the
neuron linkages involved in the neural events. As these linkages have been followed there have been revealed the mechanism of facilitation and inhibition, and the manner in which a given set of conditioning impulses selects and controls the pathway through the neuron chains which mediates the end reaction.

Owing to activities of the staff in connection with the war, the work along these lines is for the time being suspended.

Dr. Lorente de Nó is studying the relationship between the difference of electric potential that exists across the plasma membrane of axons in the state of rest and various manifestations of nerve activity. Polarization of the membrane and the membrane reaction to subliminal stimuli have been extensively examined in order to get a complete correlation between the subthreshold potentials and those appearing after the initiation of impulses, and between the excitability states that obtain during the existence of these potentials. Studies have also been made of the connection between the development and maintenance of the membrane potential and the initiation and conduction of impulses. When the chain of reactions in the normal mechanism of potential maintenance is broken, either by depriving the nerve of oxygen or by application of various metabolic poisons, the potential drops and the ability to conduct impulses is lost. From the states produced in each of these several ways the potential can be restored by anodal polarization, and this restoration is accompanied by reconstitution of the capacity for functional activity to an extent permitting the conduction of hundreds of thousands of impulses. Investigations are now being carried out to determine the mechanism by which an externally applied current brings about the restitution.

Dr. Woolley and his associates are studying problems in nutrition. The rôle of inositol as a vitamin has been demonstrated, and studies are being made of substances that inhibit the action of vitamins.

In the Laboratory of General Physiology at Princeton, Dr. Northrop and his associates are engaged in the study of proteins, especially enzymes, antibodies, and bacteriophage. Five enzymes have thus far been isolated and crystallized, and found to be proteins. Diphtheria antitoxin has also been isolated and crystallized. An amorphous preparation of bacteriophage, which has the properties of a nucleoprotein, has been obtained. The methods devised for the isolation and crystallization of these substances are being applied to other similar compounds.
These proteins have very peculiar properties and hence must have some, as yet unknown, chemical structures. This peculiar chemical configuration must be known before the chemistry of the enzymes can be considered solved. The structure of the physiologically active proteins previously isolated is under investigation.

The mode of formation of these substances is also being studied, and it has been shown that some of the enzymes form themselves, by an autocatalytic reaction, from inert precursors.

It has been suggested that the formation of antibodies is analogous to the formation of "adaptive enzymes," and it is possible that the production of viruses is a related phenomenon. The production of bacteriophage is being studied from this point of view.

At the present time Dr. Northrop and his staff are engaged entirely in the investigation of special problems assigned by the National Defense Research Committee.

Dr. Osterhout, Member Emeritus, is continuing in New York his studies on the fundamental properties of protoplasm and the forces that create and control its activities. Use is made of large plant cells, which have especial advantages for such studies, particularly in dealing with the interior of the cell. The investigations center about the non-aqueous protoplasmic surface layer which has a low conductivity, low dielectric constant, and large capacity. The electric potentials of the cell appear to depend largely on diffusion potentials in this layer.

The permeability of the surface layer in all its variable aspects is being studied as a means of analyzing the structure and composition of the surface. An examination of the apparent mobilities of inorganic ions in the layer has revealed that the mobilities differ greatly from those in water, and that they can be changed by the addition of organic substances or by the removal of organic substances normally present. The effect of the addition or removal of these substances is being studied on the action current. The action current resembles that of muscle and nerve; and under the relatively simple conditions in which it occurs it provides a favorable source of information fundamental to the theory of excitation.

A further understanding of the behavior of the cells is gained by the setting up of physicochemical models that imitate features of the cell activity.
The Hospital was established as a Department of the Institute in 1910 in order to “extend the field of its [the Institute's] research so as to include the study of disease in the clinical aspects, under conditions as near as possible to standards of laboratory exactness and efficiency.” From its beginning up to the time of his retirement in 1937, its Director was Dr. Rufus Cole. In that year Dr. Cole was succeeded by Dr. Thomas M. Rivers.

Although the ultimate purpose of the work carried on in the Department of the Laboratories is the prevention of disease and the relief of suffering, it has been found that in order to accomplish these ends it is frequently necessary that the studies undertaken shall concern fundamental biological processes and not necessarily have a direct relationship to any special diseases. On the other hand, the studies carried on in the hospital, and in the laboratories directly connected with it, have in general a fairly direct relationship to the diseases being investigated at any given time and are undertaken with the more immediate objectives of prevention and cure. Even in the hospital, however, it has been deemed important that the work shall consist not merely in observation of the more superficial manifestations of disease in the patient, but that an effort shall be made to determine the causes of disease and the nature and the course of the abnormal symptoms. For carrying out these investigations laboratories in the hospital have been equipped for the employment of the methods developed in the contributing sciences of physics, chemistry, physiology, and bacteriology. Moreover, it is believed to be important that the physicians caring for the patients shall themselves engage in these studies, since not infrequently careful observation of patients may yield suggestions for lines of research which might otherwise be overlooked. The present scope of the investigations being carried on in the hospital is outlined below.

1. Infectious Diseases

(a) Acute Respiratory Disease. Various forms of acute pulmonary infections are being investigated, especially acute lobar pneumonia due to pneumococci of the various types. In suitable cases specific serum is administered and the results are believed to be very beneficial. Considerable attention is being given to the chemical composition of the various components of the pneumococcus cells, and to their antigenic
properties. Especially has study been devoted to the capsules of these cells. It has been found that the substances forming the capsules are polysaccharides and that these substances determine the type specificity. Bacterial enzymes have been discovered which act specifically on certain of these polysaccharides, and they do this not only in vitro, but also in the animal body. This work has been extended to include other adaptive enzymes of bacterial origin specifically active on substrates of biological importance. Studies of the chemical nature of the active substances in specific immune serum are also being made, and constant efforts are being exerted to improve the activity of the serum.

Since the advent of sulfapyridine, compounds of the sulfonamide group of drugs are being used in the treatment of patients and experimentally infected animals in order to ascertain their value and to determine the mode of their action.

In connection with the study of acute pulmonary infections not associated with the presence of pneumococci, other bacteria which apparently play a rôle have been investigated.

The alterations observed in physiological functions of the body during the course of pneumonia are being studied.

(b) Rheumatic Fever. Clinical studies extending over many years have demonstrated the chronic and recurring nature of this disease, and have indicated the deleterious rôle of these relapses in the evolution of chronic heart disease. The protean manifestations and the frequent paucity of clinical symptoms of active rheumatic infection often make it difficult to separate atypical rheumatic fever from some other diseases. Efforts are being made, therefore, to find additional signs indicative of active infection, because continuing and recurring rheumatic carditis are important factors in the development of heart failure. Many different techniques have been employed in attempts to transmit this disease to laboratory animals, or to induce typical histopathological lesions in them, without success. Because of the close relationship between hemolytic streptococcal infections in patients and the subsequent development of rheumatic fever, extensive studies of hemolytic streptococci have been made; and a system of immunological classification has been elaborated, whereby the myriad varieties of these microorganisms can be differentiated into groups and types. This system of classification has opened new methods of studying streptococcal infec-
tions in respect to the variety of streptococcus concerned; and recently
detailed comparative investigations of the reactions of rheumatic and
non-rheumatic individuals to hemolytic streptococcal infections have
been undertaken.

(c) Diseases Due to Filtrable Viruses. Measles is a disease typical of
this group, and therefore from time to time it has been a subject of in­
vestigation in the wards and laboratories of the hospital. A culture vac­
cine virus has been developed for the intradermal vaccination of human
beings against smallpox, and investigations have been made to deter­
mine the duration of immunity induced by it. The chemical nature and
antigenic components of the elementary bodies of vaccinia are being
investigated. The cause of “postinfection encephalitis” has not been
determined. Indeed, there is doubt whether the disease has been pro­
duced experimentally. In view of the fact that such an encephalitis
sometimes occurs during or after antirabic vaccination in which con­
siderable amounts of rabbit brain are injected into subjects, a number of
macaque monkeys were given repeated intramuscular injections of fresh
normal rabbit brain. In these experiments some of the animals showed
clinical evidences of involvement of the central nervous system and
sections of their brains and cords revealed perivascular demyelination.
Further work regarding the manner in which such lesions are produced
is in progress. It has been shown that the virus of lymphocytic chorio­
meningitis is the cause of some of the cases of aseptic meningitis occur­
ring in human beings. Attempts are being made to ascertain the im­
potence of this new virus as an incitant of disease in man. Already
complement fixation has been found of great assistance in the rapid
diagnosis of the malady.

(d) Bacterial Metabolism and Physiology. The sciences dealing with
immunity and chemotherapy have much to gain from a more accurate
knowledge of the structure and metabolism of bacterial cells. The
study of microorganisms as independent living agents by physiological
and biochemical methods analogous to the ones used for investigation of
higher forms of life may suggest new types of substances capable of
attacking the structure of bacterial cells or of interfering with enzyme
systems essential for bacterial growth in such a manner as to act as anti­
infectious agents. In the past this type of work has led to the discovery
of certain adaptive enzymes capable of destroying the disease-producing
properties of pneumococci and to the finding of chemical substances endowed with bactericidal power against Gram-positive microorganisms. This study will be continued with the hope that from saprophytic organisms compounds specifically directed against substances of biological interest will be obtained.

2. **Metabolic Diseases**

   (a) **Hemorrhagic Nephritis and Nephrosis.** At present some of the metabolic studies in this hospital are being concentrated on problems developed in the study of nephritis. It has been found in this study that until more than 90 per cent of the functioning renal tissue has been destroyed no serious inconvenience may be felt, as long as complications are absent. Such complications are circulatory disorders, disturbances of mineral metabolism, anemia, malnutrition, and particularly edema, which is often the result of malnutrition. Success in controlling these complications frequently means prevention of years of invalidism, even when the progress of renal destruction cannot be stopped. After nephritis has become chronic, the best therapeutic aim apparently attainable at present is maintenance of activity and well-being in the best possible state up to the onset of the terminal uremia, which does not occur until the glomeruli approach 95 per cent destruction. Achievement of this aim appears attainable in proportion to our understanding of the metabolic conditions. Studies are being carried out to clarify the problems of metabolism, nutrition, and renal physiology involved, and to provide methods for prosecution of these problems.

   (b) **Muscular Disorders and Hepatic Insufficiency.** Progress in understanding the chemical nature of vitamins, biocatalysts in general, and their rôle in normal and abnormal metabolic processes has made desirable an extension of studies on these systems to a larger group of diseases than is represented by simple or mixed deficiencies. Since the functions of vitamins and other biocatalysts are for the most part mediated through enzyme systems, certain diseases in which there is a reason to suspect changes in the normal enzyme processes have been selected for investigation. At the present time studies are being conducted on progressive muscular dystrophy and atrophy as a group of diseases in which interruption of normal muscle metabolism is apparent, and on advanced, non-malignant diseases of the liver, such as cirrhosis, in which a marked depression of hepatic function is known to occur.
3. Cardiovascular Diseases

In the study of cardiovascular disease, the changes in the behavior and structure of the heart and blood vessels due to advancing age have been investigated. Studies have also been undertaken on the anatomy and on certain functions of the heart, such as its volume output of blood, and the mechanism of the distribution of heat in heart failure. More recently investigation of the function of the larger arteries, principally of their elastic properties throughout the aging process and in cardiovascular disease has been begun. Beside anatomical and physiological researches, pharmacological ones with drugs having an action on the heart and the blood vessels have from time to time received attention. The drug digitalis, which has so powerful an action on the heart, has been almost continuously under investigation. A number of glucosides related to strophanthsin have been isolated in pure form. The action of these has received systematic study. In this connection it was found advantageous to conduct new investigations concerning the electrocardiogram, especially in relation to the structure and behavior of the T wave. Whenever suitable opportunity is afforded, experiments on animals are made, to further knowledge in ways which are not possible by clinical methods. When occasion presents itself, problems having to do with the functions of the lungs and of the kidneys, especially in cardiac and vascular diseases, are included in these researches. At the same time, the course of events in the heart in infectious diseases, such as rheumatic fever, is being analyzed.

Investigations on the occurrence of high arterial, especially high diastolic blood pressure have been undertaken. This phenomenon occurs very widely but it seems possible now to divide patients into groups exhibiting different etiologies. The differences in the groups present variants in physiological mechanisms—whether dependent on the kidneys, the central nervous system, glands of internal secretion, or based on neurotic disturbances. For successful attempts at therapy an analysis of these classes of the disease is naturally important and is being undertaken.

An effort has more recently been made to understand the mechanism which occasions high arterial pressure at least in certain cases. The current idea is that the pressure rises as the result of a defect in the kid-
neys. The addition of enzymes (tyrosinase and an amine oxidase) to the blood stream seems to correct this situation in experimental animals. Further investigations along these lines are under way in the hope of obtaining additional information regarding the malady in human beings.

4. At the present time the research program in the Department of the Hospital is extensively modified to permit the investigation of problems presented for solution by the Committee on Medical Research.

The Department of Animal and Plant Pathology

The Department was organized as the Department of Animal Pathology in 1916, and the laboratories were opened in 1917. From its beginning in 1917 up to the time of his retirement from administrative work in 1929, its Director was Dr. Theobald Smith. Dr. Smith was succeeded by Dr. Carl TenBroeck, who became Acting Director in 1929 and Director in 1930. In 1931 Plant Pathology, under the direction of Dr. Louis O. Kunkel, was added.

Animal Pathology

The purpose of the establishment of the Laboratory of Animal Pathology was the investigation of animal diseases in the broadest way, unaffected by immediately practical considerations. The original objective was the development of the comparative aspects of pathology by a study of disease in various animal species. A comparative pathology of this kind must be preceded by a continuously expanding, accurate knowledge of specific animal diseases. To bring this about, the Laboratory has been preoccupied from the start with such a study devoted thus far more or less exclusively to diseases affecting the more valuable food-producing domesticated animals, such as cattle, swine, sheep, and poultry.

Most of the staff are working as individuals on specific problems in the field of comparative pathology. Dr. TenBroeck and his associates have been interested in the epidemiology of equine encephalomyelitis and the cause of calf scours, calf pneumonia, and bovine mastitis. The stock laboratory animals are carefully watched and some hitherto undescribed infections are being studied. Dr. Shope had under investigation the possible rôles played by parasitic worms in the epidemiology of several swine diseases. The work was being pursued along lines similar to those employed in the studies of the swine lungworm as intermediate host for
the swine influenza virus. During his absence on military service the work has been discontinued. Dr. Nelson is continuing his work on catarrhal infections of chickens, mice, and rats. The interrelation of the causal agents and their position in respect to the pleuropneumonia-like organisms are being considered. As a wartime problem he is studying bacillary dysentery and the organisms associated with it. Dr. Glaser and his associates have been studying certain parasitological and related nutritional processes in lower animals, using for material pure cultures of protozoa, parasitic worms, and insects. An investigation has also been made of factors influencing migration and localization of trematodes in fish. Dr. Stoll is studying conditions favorable to the culture and development in vitro of parasitic stages of nematodes and is continuing work on the interrelations of helminths and their hosts.

Dr. Pearce is continuing the investigations of the rôle of constitutional factors in disease, based on an animal population. These studies are now concerned primarily with metabolic disorders and the degenerative processes of mature life including such conditions as cardiovascular, renal, and hepatic disease and dental affections of various types.

**Plant Pathology**

The plant pathology laboratories were added to the Department of Animal Pathology in 1931 with the purpose of bringing animal and plant pathology into a closer relationship than they had enjoyed previously anywhere in the world. It was hoped that the work in plant pathology would aid in the control of certain plant diseases and thus be of value to agriculture, but this purpose was secondary to that of using suitable plants as experimental objects in studies on fundamental problems of disease, the solution of which might or might not be of immediate practical importance. Since plant diseases caused by bacteria and by viruses were less well understood than those produced by fungi and other plant parasites, attention was concentrated on diseases due to these agents. Studies on the nature of viruses and on the mechanisms of plant responses to infections by viruses and by bacteria have been pursued since 1932 and are still in progress. Some of the subjects under investigation at present are listed below.

Dr. Kunkel and associates have shown that the viruses of potato witches' broom, cranberry false blossom, and peach rosette, that pre-
viously had been mechanically transmitted only by grafting, can be passed by means of the flowering parasite, dodder, to plants that are too distantly related to give successful graft unions with any of the species in which the diseases occur naturally. Some of the new hosts are more favorable for experimental work than the natural hosts. Two closely related leafhoppers were found to transmit specifically the New York and New Jersey strains of potato yellow-dwarf virus. In a third, closely related leafhopper two new viruses were discovered. The plant or plants affected by the new viruses in nature have not yet been found. They produce experimental diseases in crimson clover, a plant that is susceptible to both strains of potato yellow-dwarf virus. The leafhopper that spreads the New Jersey strain of potato yellow dwarf was able to transmit only one of the new viruses; the leafhopper that spreads the New York strain could transmit neither. These findings suggest that three closely related leafhoppers are spreading four closely related viruses. Two of these cause serious potato diseases; the other two probably do not affect economic plants. It was found that crown-gall bacteria effect a change in plant cells that enables the cells to produce galls. Once the change has occurred, the cells continue to produce galls in the absence as well as in the presence of the bacteria. Through a method involving the killing of the bacteria by heat, the change was shown to occur regularly within two to three days after crown-gall bacteria were inoculated into wounded tissues. An effort is being made to determine the nature of the change.

Dr. Stanley and associates have studied the chemical composition of different strains of tobacco-mosaic virus. They also have prepared chemical derivatives of tobacco-mosaic virus and have studied the behavior of these in plants. When the artificially produced derivatives multiply in plants, tobacco-mosaic virus is produced. Several of the derivatives have been shown to have biological activities differing from that of tobacco-mosaic virus. Recently, in support of the war effort, Dr. Stanley and associates have devoted their entire time to work on viruses affecting man.

**BUILDINGS AND EQUIPMENT**

**New York City** The Departments of the Laboratories and the Hospital are housed in a group of buildings situated in New York City, on the cliff overlooking the East River and lying between
64th and 68th Streets (see frontispiece). This location ensures excellent light and air, and greater quiet than could be secured in the more accessible parts of the city. The group consists of three laboratory buildings, a main hospital building, an isolation pavilion, a library building, an animal house, a building combining laboratory and animal house facilities, and a central power house. All these buildings are connected by service tunnels.

Of the laboratory buildings, the Central Laboratory was first erected. It was occupied in 1906, and contains laboratories and administration offices. It covers an area of 136 feet by 60 feet and has five main floors, a light basement, and a suite of surgical rooms and kennels on the roof. The second, or Middle Laboratory was opened in 1916. It contains six floors and two basements and covers an area of 150 feet by 62 feet. The third laboratory building, known as the North Laboratory, occupies a ground area of 197 feet by 60 feet, and has seven floors and two basements. At the present time five floors are occupied for general and laboratory purposes; unoccupied laboratory space has been left free of partitions pending future development.

All the above buildings are fireproof and so constructed that all interior partitions may be altered or removed as occasion requires. Provision is made for supplying hot and cold water, steam, gas, compressed air, suction, and electricity to all laboratories. Numerous cold rooms refrigerated by means of a brine circulation system, and also incubator rooms, are located in central positions in the buildings and form part of their permanent equipment. Pipes, drains, vents, and conduits are either exposed or carried in accessible ducts wherever possible, to facilitate inspection or alteration. In these buildings, largely devoted to laboratories, are also an assembly room and quarters for various auxiliary services.

The Hospital, opened in 1910, consists of a main structure 165 feet long by 54 feet wide, and an Isolation Pavilion 78 feet long by 44 feet wide. The main building has eight main floors, with two additional basement floors in the wall of the East River cliff. It is connected by a covered bridge at the third floor level with the Isolation Pavilion, which is a four story and basement building containing an isolation ward, laboratories, an operating room, and living quarters for the Hospital personnel. The first floor of the hospital provides for administration and reception rooms,
and for quarters of the resident staff. The second floor is entirely occupied by nurses' quarters. The third floor contains a number of small rooms for the accommodation of one or two patients each, with a solarium at its easterly end. The fourth and fifth floors are arranged for ward patients. On the fourth floor is situated the diet kitchen which is arranged for special dietary studies. On the same floor there has been built a chamber in which the oxygen content of the air can be accurately regulated. This chamber will accommodate two patients and is being used for the study of the therapeutic effects of oxygen in patients suffering from pneumonia or heart disease. The hospital is so planned that the staff and nurses may give an unusual amount of attention to each of a small number of patients. The general wards contain six to eight beds each and the open air balconies at each end of the building are large enough to accommodate all of them. The sixth, seventh, and eighth floors are devoted to laboratories, including an electrocardiograph station.

The Library Building, covering an area 89 feet by 70 feet, is located to the east of the Central Laboratory. It has two high stories above ground and three levels of basement floors below. The library is located on the top floor, and with a mezzanine has a capacity of 38,500 volumes. There is also on the lower levels additional storage space to provide for future expansion. On the ground level is located a room with a floor space of 72 feet by 35 feet, which serves as a staff dining room and assembly hall. There are also on this floor a small formal dining room, and a dining room for women employees. In the basement levels are located a kitchen, stack space for the storage of publications of the Institute, and other rooms reserved for general purposes.

The Animal House, which occupies a building by itself adjoining the Middle Laboratory at the east, has an extension to the north. The older part of the animal house is six stories in height and occupies an area of 77 feet by 62 feet. The new section occupies an area of 96 feet by 83 feet and contains four floors. In these buildings are kept small animals such as rabbits, guinea pigs, monkeys, etc., as well as sheep, goats, and horses. Their special equipment includes cold rooms for serum and aquaria, rooms for the storage and preparation of foods, the sterilization of cages, the incineration of refuse, and a garage. All walls are finished so that they can be washed down, and cages are suspended from the ceiling on metal racks rather than being placed on the floor.
The Rockefeller Institute for Medical Research

The **Low Laboratory Building**, constructed as a partly detached wing at the east of the North Laboratory, is 94 feet by 60 feet in area. It is a four story building, with the foundation planned to carry additional floors to the height of the main laboratory.

A **Power House** built and operated by the Institute provides the buildings with heat, light, electric power, compressed air, refrigeration, suction, and filtered water.

A **Greenhouse** has been erected on the grounds of the Institute in which various plants can be grown under controlled conditions.

**Children's Gardens and Playgrounds.** The founder of the Institute has made generous provision for its future physical growth by gifts of land lying between York Avenue and the East River water-front and extending from 63rd Street to 68th Street. Pending the development of the work of the Institute, the Trustees have arranged for temporarily assigning the unused portions of this property adjoining York Avenue between 64th and 68th Streets to the New York Plant and Flower Guild for maintenance of Children's Gardens. The use of the block between 63rd and 64th Streets as a park-playground has been temporarily extended to the Department of Parks.

**Near Princeton, New Jersey** In the autumn of 1914 the Institute acquired for the Department of Animal Pathology a tract of land, which, with subsequent additions, now comprises approximately 780 acres, situated on the easterly side of Lake Carnegie, opposite Princeton, in the township of Plainsboro.

Those general features of the building plan which have been carried out (see frontispiece) are as follows:

1. A **Laboratory Building** which is equipped for work in pathology, bacteriology, parasitology, biochemistry, and allied subjects. This contains the library, general offices, and assembly room. It is of hollow tile, 140 feet long by 37 feet wide with a wing 62 feet by 37 feet, and is placed on the highest part of the land, facing Princeton and overlooking Lake Carnegie. It is three and a half stories high, the floor of the first being below ground level. The equipment is such as to be easily changed as new problems are taken up. The furniture is largely movable, except in the chemical laboratory. It is furnished with the modern requirements of biological laboratories, such as hot and cold water, steam, gas, electricity, refrigeration, pressure, and suction.
2. **Animal Buildings** which are designed for the maintenance of large and small animals. Two of the buildings are divided into units in which animals may be kept isolated for the study of infectious diseases. Each unit contains hot and cold water, steam, gas, and electricity, and the floor is drained. Provisions are made for the changing of the outer garments and footwear of attendants.

A third building, erected in 1917, has been remodeled to provide isolation units for the housing and observation of large animals. A fourth unit 235 feet long and 39 feet wide was completed in 1928. This structure conforms in general architecture with the existing animal houses but differs in that space is provided for the development of laboratory suites.

3. **Combination Laboratory and Animal Unit**, in three connected sections, two of which are 131 feet long by 36 feet wide, and the other approximately 42 feet long by 36 feet wide, for the housing of a breeding and experimental animal colony, and for laboratories, required for studies on constitution. The buildings are one story high and are of a sectional type constructed almost entirely of metal. They are fireproof, well insulated and ventilated, and are built in such a way that they can be taken down and reassembled. Laboratory services, heat, and light are supplied from the general heating and power plant.

4. A **Greenhouse** 34 feet long by 20 feet wide is provided adjacent to and at the rear of the laboratory building for study of diseases of insects and other problems requiring greenhouse facilities. It is equipped with thermostatic control, gas, electricity, and compressed air.

5. **Outdoor Enclosures** for large and small animals under experimentation.

6. A **Power House** which supplies the necessary heat, electricity, refrigeration, and water from two deep driven wells.

7. An intermittent filtration **Sewage Plant** to provide for the safe disposal of fluid wastes from laboratory and animal buildings.

8. **Farm.** As a necessary adjunct to the scientific work conducted by the laboratories a considerable part of the land is under cultivation, requiring an organization and equipment of farm buildings sufficient for its needs.

9. **Staff and Employees' Houses.** The location of the Department being remote from thickly settled sections of the town, it has been necessary
to develop the community by the erection on the Institute property of a number of homes which are rented at moderate cost to the staff and employees.

10. Theobald Smith House. The Director's house occupied by Dr. Theobald Smith up to the time of his retirement has been remodeled inside and furnished for use as a Staff House, thus providing dining space and facilities for recreation for the general use of the scientific staff, and living rooms for a small number of the staff and guests.

11. Laboratory Buildings for Plant Pathology. New buildings for plant pathology were constructed and occupied in the fall of 1932. The main building measuring 143 by 39 feet is of the same type as the laboratory building for animal pathology. It is equipped with lean-to greenhouses opening directly from the laboratories at each end of the basement, and with an underground constant temperature cellar. To the rear of the building, and connected with it by a glass-enclosed corridor are four greenhouses, each 66 feet long by 25 feet wide, four greenhouses each 66 feet long by 18 feet wide, and a potting shed with sterilizing facilities. There are in addition twelve garden frames, each 30 feet long by 7 feet wide, located on either side of the connecting corridor. All of these buildings are served by the present central heating and power plant.

PUBLICATIONS

In order to assist in the dissemination of the reports of scientific investigations conducted at The Rockefeller Institute, and elsewhere, the following publications are maintained by the Institute.

The Journal of Experimental Medicine. This journal, edited by Simon Flexner, Peyton Rous, and Herbert S. Gasser, is designed to cover the field of experimental medicine. It is a medium for the publication of investigations conducted at the Institute, or elsewhere under its auspices, and it also accepts contributions of a suitable character from other sources. It is issued monthly, two volumes appearing in a year. Indexes for Volumes 1 to 20, 21 to 40, and 41 to 60 have been published.

Contributions should be sent to the editors of The Journal of Experimental Medicine. They should be limited preferably to twenty printed pages, not counting the space occupied by illustrations.
Articles which exceed in length twenty-five printed pages will be returned to the authors in order that their contents may be reduced to this maximum. Authors can obtain reprints of their papers at cost.

**The Journal of General Physiology.** This journal, the first number of which appeared in 1918, was founded by Jacques Loeb, and is edited by W. J. Crozier (Harvard University), John H. Northrop (The Rockefeller Institute), and W. J. V. Osterhout (The Rockefeller Institute). It is issued bimonthly, one volume appearing in a year, and is devoted to the interpretation of vital phenomena on the basis of the physical and chemical constitution of living matter.

The editors invite contributions relating to the physicochemical explanation of life phenomena, in whatever field of science they may originate. These should be sent to the editors of THE JOURNAL OF GENERAL PHYSIOLOGY, York Avenue and 66th Street, New York 21, N. Y. The papers should be limited preferably to twenty printed pages, not counting the space occupied by illustrations. Authors can obtain reprints of their papers at cost.

**Studies from The Rockefeller Institute for Medical Research.** Results of investigations made under the auspices of, or with the cooperation or support of The Rockefeller Institute are first reported in a variety of publications. These papers are ultimately assembled in volumes designated STUDIES FROM THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, which appear serially, but at irregular intervals. The first volume was published in 1904, and in January, 1944, the one hundred and twenty-fourth volume appeared. Each volume contains about 600 pages, and is indexed. The number of volumes of STUDIES appearing annually averages four. An AUTHOR AND SUBJECT INDEX for Volumes 1 to 25, and one for Volumes 26 to 50, have been published. An AUTHOR INDEX for Volumes 51 to 116 has also been published.

**Monographs.** The MONOGRAPHS consist of scientific papers which are so extensive, or which require such elaborate illustration, that they are unsuitable for current periodical issues of journals. They are published at irregular intervals, determined by the available material on hand. In a small number of instances the results of investigations carried out by other laboratories have been included in this series. Twenty-three MONOGRAPHS have appeared during the years 1910 to 1944. The publication of new MONOGRAPHS is advertised on the covers of
THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

THE JOURNAL OF EXPERIMENTAL MEDICINE, THE JOURNAL OF GENERAL PHYSIOLOGY, and the STUDIES.

STUDIES FROM THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH and MONOGRAPHS are distributed gratis to a selected list of libraries and laboratories throughout the world, and a small number of the volumes as they appear may be secured through subscription.

Semiannual List. This list enumerates the title and place of publication of the reports mentioned above, as well as of preliminary reports and reviews which are not republished in the STUDIES. Copies of this list will, upon request, be sent regularly to persons interested. SEMIANNUAL LIST No. 55 was published in January, 1944.

Subscriptions, and all inquiries relating to the publications of the Institute, should be addressed to the Publication Service, The Rockefeller Institute for Medical Research, York Avenue and 66th Street, New York 21, N. Y.

The Publication Service does not have reprints of the papers in the SEMIANNUAL LIST, but in some instances reprints can be obtained by addressing a request directly to the author.

SUBSCRIPTIONS

Subscriptions to the above publications may be obtained at the following rates:

THE JOURNAL OF EXPERIMENTAL MEDICINE, $10.00 a year; $1.00 for single copies.

THE JOURNAL OF GENERAL PHYSIOLOGY, $5.00 a year; $1.00 for single copies.

STUDIES FROM THE ROCKEFELLER INSTITUTE, $2.00 per volume. A special rate of $1.00 per volume is made to those who subscribe to THE JOURNAL OF EXPERIMENTAL MEDICINE or THE JOURNAL OF GENERAL PHYSIOLOGY.

MONOGRAPHS, usually $2.00 each. The price is determined at the time of publication.
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