

1926

## DESCRIPTIVE PAMPHLET, 1926

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# THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

## *Organization and Equipment*



NEW YORK  
THE ROCKEFELLER INSTITUTE  
FOR MEDICAL RESEARCH  
1926

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1925-1926

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- WINTHROP JOHN VANLEUVEN OSTERHOUT, A.B., A.M., Ph.D., Sc.D.; *General Physiology*
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- FLORENCE RENA SABIN, B.S., M.D., Sc.D.; *Pathology and Bacteriology*
- HOMER FORDYCE SWIFT, Ph.B., M.D.; *Medicine*
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- PIERRE LECOMTE DU NOÛY, Ph.B., LL.B., Sc.D.; *Experimental Surgery*
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• ANN GAYLER KUTTNER, B.S., A.M., Ph.D.; *Bacteriology*  
• REBECCA CRAIGHILL LANCEFIELD, A.B., A.M., Ph.D.; *Bacteriology*

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- WILLIAM SMITH TILLET, A.B., M.D.; *Medicine; Resident Physician*
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- BERNARD JACOB CORNELIS VAN DER HOEVEN, CH. E.; *Chemistry*
- JAMES VAN DER SCHEER, CH.E.; *Pathology and Bacteriology*
- LARS ALVIN WELO, B.S., M.S., PH.D.; *Pathology and Bacteriology*

### *Fellow*

TELÉMACO SEGUNDO BATTISTINI, M.B., M.D.; *Pathology and Bacteriology*

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NANCY POULTNEY ELLICOTT; *Superintendent of the Hospital*  
MARY BRYCE THOMPSON; *Asst. Superintendent of the Hospital*  
CHARLES BOROMEIO SPIES, PH.G.; *Purchasing Agent and Pharmacist*  
EDITH CROWNINSHIELD CAMPBELL, A.B.; *in charge of Division of Publication*  
LOUIS SCHMIDT; *in charge of Division of Illustration*  
LILLIA MARIE DONNELL TRASK; *Librarian*  
KATHERINE MARGARET CHRISTHILF; *Housekeeper of the Hospital*  
CHRISTINE McDONALD; *in charge of X-Ray Photography*  
IRENE ERMA McFAUL; *Supervising Nurse, Division of Experimental Surgery*  
EDITH LUCINDA RAINS; *Social Service Nurse*  
ANNA LOUISE VON DER OSTEN; *Secretary to the Director of the Institute*  
EDNAH BOLLES HALLSEY, A.B.; *Secretary to the Director of the Hospital*  
MABEL DENNIS REED; *Secretary to the Director of the Department of Animal Pathology*  
HAZEL REED OLMSTEAD; *Secretary to the Business Manager*

## PURPOSES

**T**HE Rockefeller Institute for Medical Research, founded in 1901, is a philanthropic corporation created under the laws of the State of New York. The charter 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 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."

## ENDOWMENT

**T**HE Institute has been generously endowed by Mr. John D. Rockefeller through a series of gifts which have from time to time provided for its growing needs, including the establishment of a service pension fund for members of the scientific staff. The Institute also administers a legacy from the late Henry Rutherford for the promotion of cancer research.

## ADMINISTRATION

**T**HE Institute's charter provides for a Board of Trustees and a Board of Scientific Directors. The Board of Trustees, which includes two representatives of the Board of Scientific Directors, is charged with the maintenance and care of the endowment and property of the Institute. Income from the endowment, after taxes and other charges on the capital have been paid, is available for expenditure by the Board of Scientific Directors. The Board of Scientific Directors 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.



## THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

There are three Departments of the Institute: the General Laboratories, the Hospital, and the Department of Animal Pathology. At the head of each of these Departments is a Director.

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

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 Directors, who consider together, from a common standpoint, the affairs of the institution 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, the outlooks, and the successes which are the inspiration of the scientific staff.

The names of the members of the Board of Trustees, of the Board of Scientific Directors, of the Scientific Staff, and of the higher Executive Officers, are given on pages 5, 6, 7, and 8 of this circular.

## ORGANIZATION AND PRESENT SCOPE OF THE SCIENTIFIC WORK

### THE DEPARTMENT OF THE GENERAL LABORATORIES

**D**R. Simon Flexner, Director of the Institute, is also the Director of the Department of the General Laboratories which was organized in 1905. The work of these laboratories, which has since undergone considerable expansion and differentiation, is conducted under several divisions and subdivisions as follows:

*The Division of Pathology and Bacteriology* is in direct charge of Dr. Flexner and with him are associated Drs. Bronfenbrenner, Webster, Muckenfuss, Pritchett, and Reichert.

Subdivisions in Pathology are conducted by Dr. Noguchi, assisted by Dr. Battistini; by Dr. Rous, assisted by Drs. McMaster, Beattie, and

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Drury; by Drs. Brown and Pearce; by Dr. Olitsky; by Dr. Landsteiner, assisted by Dr. Levine and Mr. van der Scheer; by Dr. Jacobs, assisted by Mr. Gustus; by Dr. Cowdry; by Dr. Gates; by Dr. Baudisch, assisted by Drs. Welo and Davidson; and by Dr. Sabin, assisted by Dr. Doan.

*The Division of Chemistry* is conducted by Dr. Levene, assisted by Mr. Haller, Drs. Meyer, Mikeska, Rolf, Simms, Bass, Pfaltz, and Mr. van der Hoeven.

*The Division of Experimental Surgery* is conducted by Dr. Carrel, assisted by Drs. du Noüy, Ebeling, and Baker.

*The Division of General Physiology* is conducted by Dr. Osterhout, assisted by Dr. Irwin, and Messrs. Cooper, Damon, and Harris; and by Dr. Northrop, assisted by Drs. Hitchcock and Kunitz.

*The Division of Biophysics* is conducted by Dr. Murphy, associated with Dr. Clark and assisted by Drs. Hance, Hawkins, and Lynch.

Special lines of investigation relating to cancer are pursued in this division with the support of the Rutherford Fund.

The lines of research pursued in the several divisions and subdivisions of the General Laboratories are numerous and varied. All work completed for publication will be found mentioned by title in the SEMI-ANNUAL LIST, sent free upon request, while all published scientific work of all departments is assembled in final form in the STUDIES FROM THE ROCKEFELLER INSTITUTE, volumes of which series appear from time to time. (See pages 21 and 22.)

## THE DEPARTMENT OF THE HOSPITAL

IN the course of the orderly development of the Institute, the Department of the Hospital was added to the Department of General Laboratories in 1910. It is obvious that many of the investigations undertaken in the General Laboratories have for their ultimate end the amelioration and even the prevention of disease in man. To attain these ends it is important that the manifestations of any given disease be studied not only in animals in which it is experimentally induced but also in human beings in whom the disease has naturally arisen. Moreover, at present it is impossible to transmit certain human diseases to animals. Hence, in a comprehensive program of research into the sources, incitants, prevention, and cure of disease in man, the Hospital is an essential

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component. Moreover, the direct study of disease in man affords not only inspiration and stimulation to research in new directions, but it tends to prevent certain lines of collateral inquiry from straying too far from the problems of human disease.

Dr. Rufus Cole has been Director of the Hospital since its establishment in 1910. The Hospital has been so organized and equipped that, first, the patients may receive due attention to their personal comfort and the benefit of the best forms of modern treatment; and second, the manifestations of disease in the patient may be observed with the highest standards of exactness and the observations carefully recorded and preserved. It is, moreover, believed to be important that special lines of inquiry suggested by the observation of patients should be pursued by the physicians themselves who make these observations, and for this purpose the hospital has been provided with laboratories equipped for the employment of methods developed in such contributing sciences as chemistry, physics, physiology, and bacteriology.

The major problems at present studied in the Hospital are divided as follows:

1. *Acute Respiratory Diseases*—Drs. Cole, Avery, Heidelberger, Stillman, Branch, Tillett, Finkle, Reimann, Goebel, Julianelle, and Kuttner.

2. *Acute Rheumatism*—Drs. Swift, Derick, Hitchcock, and Lancefield.

3. *Cardiac Disease*—Drs. Cohn, Murray, Crawford, and Stewart.

4. *Nephritis and Blood Chemistry*—Drs. Van Slyke, Hastings, Leiter, McIntosh, and Miss Hiller.

5. *Respiration*—Drs. Binger, Faulkner, and Moore.

6. *Chicken-Pox*—Drs. Rivers and Valentine.

The Hospital employs none but graduate nurses.

## THE DEPARTMENT OF ANIMAL PATHOLOGY

THIS Department, of which Dr. Theobald Smith is Director, was organized in 1916 and the buildings were completed in 1917. The object of this undertaking was to develop a comparative pathology of animal life, which is to open the way for a study of the general processes of disease and recovery, and in virtue of the close relation exist-

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ing between the higher animals and man in the biological sense, is to throw light upon obscure details of human disease. Such a comparative pathology should be founded upon an accurate knowledge of the diseases of various groups of animals, whereas our present knowledge of these diseases is more or less incomplete and fragmentary. This is true of the economically as well as medically important diseases of our domestic animals and birds, and for this reason the resources of the department from the beginning have been largely directed towards a renewed study of these diseases.

In animal life, living agents such as bacteria, protozoa, and higher animal parasites dominate the disease processes. Bacteriology and parasitology have, therefore, up to the present formed the major lines of research. Intimately associated with these are pathological conditions due to hereditary characters, to inadequate food rations, and to toxic substances in the food. To disentangle these conditions and to assign to each one its proper place in the production of disease will be the most important work of the near future. These problems are being approached from the directions of bacteriology, parasitology, immunology, pathology, anatomy, and biochemistry.

The scientific staff of the department is made up at present as follows:

*Member*—Dr. Smith.

*Associate Members*—Drs. Jones and Lewis.

*Associates*—Drs. Glaser and Little.

*Assistants*—Miss Orcutt, Drs. Nelson, Shope, and Theiler, and Miss Loomis.

### GENERAL STATEMENT

THE three Departments of the Institute are organized for research only. Under normal conditions they give no instruction to students and thus the Institute absolves its staff from the necessity of devoting time and energy to teaching or to the consideration of subjects and problems chosen in the student's interest rather 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 theory of the Institute's organization that it can

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best serve medical science by devoting a great deal of attention to the investigation of fundamental biological, physical, and chemical subjects. Laboratories in which these aspects of science as well as those of direct clinical importance have been constantly under investigation, and laboratories in which problems of general biological interest were chosen, have largely occupied certain of the scientific staff and have used a considerable share of the Institute's annual budget. Furthermore, while the larger part of the research work of the Institute is carried on in its laboratories in New York and Princeton, from time to time field expeditions are undertaken in the United States and elsewhere for the solution of special emergency problems.

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 to them a stipend fixed with reference to their complete devotion to whatever may be their special assignments.

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

It is not the aim of the Institute to perpetuate the lines of investigation in which it may engage, or even Departments and Divisions, 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

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Directors may alter the emphasis of its work, and focus its various resources upon different aspects of complex problems.

### SERVICES AUXILIARY TO RESEARCH

THE organization of the Institute provides for the maintenance of a series of Auxiliary Divisions in which center various phases of technical service to members of the scientific staff, thus relieving the latter of such personal routine as can be wisely delegated to specially trained persons.

The following Auxiliary Divisions are now in operation in the New York laboratories: Publication, Illustration, Library, and Purchase and Supply.

In addition to these are the following Auxiliary Services: Section Cutting, Culture Media and Sterilization, X-Ray, Animal House, Power House, and the Machine, Instrument Making, Carpenter, and Paint Shops.

The Department of Animal Pathology at Princeton maintains a series of Auxiliary Divisions similar to these but less comprehensive in scope.

Besides these organized agencies contributing to the efficiency and convenience of research, it is the aim of the Institute, as far as is practicable, to sustain the work of the scientific staff with technicians, adequate secretarial service, and competent personal laboratory helpers.

### APPOINTMENTS TO THE SCIENTIFIC STAFF

APPOINTMENTS to the scientific staff are made by the Board of Scientific Directors, upon the recommendation of the Director of one of the Departments. The following grades are fixed by the rules of the Board: Member of the Institute, Associate Member of the Institute, Associate, Assistant, 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, Assistant Resident Physician. Appointments of Members of the Institute are made without limit of time; of Associate Members and

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Associates for a term of years; while all other appointments are made for a term not exceeding one year.

As has been stated, all appointments to the scientific staff, whether in the laboratories or in the hospital, are made with stipend and engage the full time of the incumbents. No provision is made for the enrollment of individuals or classes for formal instruction in the medical sciences or in laboratory or clinical methods. Volunteer workers are sometimes, though rarely, admitted, and then only when qualified to work upon the problems determined by the Institute.

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. 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.

### ADMISSION OF PATIENTS TO THE HOSPITAL

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.

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

## THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

### GRANTS

**B**EFORE the Institute had organized and equipped its laboratories and hospital, the Directors voted a number of grants to carry on investigations in other institutions. Latterly grants have been limited largely to the support of investigations related to studies conducted at the Institute. All applications for grants should be in the hands of the Business Manager before May 1. Grants are made for a single academic year ending June 30, unless otherwise agreed.

### DISCOVERIES AND INVENTIONS

**A**LL discoveries and inventions made by any person while receiving compensation from the Institute become the property of the Institute, to be placed freely by it at the service of humanity in accordance with the beneficent purposes of the founder.

### EXPERIMENTS ON ANIMALS

**T**HE Governing Boards of the Institute believe that the use of the lower animals for the advancement of knowledge, the prevention of disease, and the saving of life is justifiable in the interest of the general welfare both of man and animals. Contrary to the assertions of the ignorant or prejudiced, cruelties are not inflicted upon experimental animals, every effort being made to minimize discomfort or distress. The scientific staff conforms to this aim in all experiments upon animals and the chief of each laboratory is responsible for the actions of his assistants in this regard.

### BUILDINGS AND EQUIPMENT

#### NEW YORK CITY

**T**HE work of the Institute, comprised in the Departments of the General Laboratories and the Hospital, is carried on 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 insures excellent light and air, and greater quiet than could be secured in the more accessible parts of the city. The group consists of two laboratory buildings with an animal house, two hospital buildings, and a central power house, all connected by service tunnels.



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The *Central Building*, containing laboratories, library, and administration offices, was completed in 1906. It covers an area of 136 feet by 60 feet, and contains five main floors, a light basement, and a suite of surgical rooms and kennels on the roof. The second or *North Laboratory Building*, opened in 1916 and covering 150 feet by 62 feet, contains six floors and two basements. Both the above buildings are fire-proof 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. Refrigeration by means of a brine circulation is carried to central positions in these buildings, and numerous incubator rooms form part of the 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 the assembly room and quarters for the various auxiliary divisions such as publication, illustration, library, storeroom, x-ray, section cutting, and media preparation.

The *Animal House* occupies a building by itself, 77 feet by 66 feet, six stories in height, constructed as an easterly extension of the north laboratory building. In this building are kept small animals such as rabbits, guinea pigs, monkeys, etc., as well as sheep, goats, and horses. Its special equipment includes two 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 and floors are finished so that they can be washed down, and cages are suspended from ceilings on metal racks rather than being placed on the floor.

The *Hospital*, opened in 1910 and covering 165 feet by 54 feet, is an eight-story building, with two additional basement floors in the wall of the East River cliff. It is connected by a covered bridge at the level of the third floor with a four-story and basement building containing an isolation ward, laboratories, an operating room, and living quarters for Hospital personnel. The first floor of the hospital provides for the administration and reception rooms, and for the 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. The fourth and fifth are arranged for

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ward patients. On the fourth floor is situated the main diet kitchen 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 cases of pneumonia and heart disease. The hospital is planned with the idea of enabling the staff and nurses to give an unusual amount of attention to each of a small number of patients. The general wards are for only six or eight beds each. The balconies at each end of the building are large enough to permit all the beds to be rolled out in suitable weather. The sixth, seventh, and eighth floors are at present devoted to laboratories, including an electrocardiograph station.

A *Power House* built and operated by the Institute provides the buildings with heat, light, electric power, pressure, refrigeration, vacuum, and filtered water. It has ample reserve capacity for future buildings.

*Children's Gardens.* The founder of the Institute has made generous provision for its future physical growth by the gift of land lying between Avenue A and the East River water-front, which, including a recent addition, now extends from 64th to 68th Streets. Unoccupied portions of this property adjoining Avenue A, for some years have been placed at the disposal of the National Plant, Flower, and Fruit Guild, for the maintenance of Children's Gardens. In 1920, on the removal of the War Demonstration Hospital, the entire Avenue A frontage from 64th to 67th Streets was devoted to this expression of good will to the mothers and youngsters of the neighborhood. Pending the development of the work of the Institute, which may require the use of the northerly plot, between 67th and 68th Streets with its high bluff facing the river, the Trustees have arranged for its temporary assignment to such form of park and playground activities as the site and the neighborhood conditions may invite. Control, administration, and support of this playground and its equipment were assumed in June, 1921, by the Lenox Hill Neighborhood Association of New York.

### BUILDINGS OF THE DEPARTMENT OF ANIMAL PATHOLOGY NEAR PRINCETON, NEW JERSEY

IN the autumn of 1914, the Institute acquired about 400 acres of land on the east side of Carnegie Lake, opposite Princeton, in the township of Plainsboro, for the Department of Animal Pathology.

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Those general features of the building plan which have been carried out (see cut facing this page) are as follows:

1. A *Laboratory Building* which is equipped for work in pathology, bacteriology, protozoology, and biochemistry. 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 Carnegie Lake. 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 vacuum.

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. The stall partitions are removable. Provisions are made for the changing of the outer garments and footwear of attendants.

A third large building erected in 1917 for the production of curative serums to meet the urgent requirements of the war will eventually be used for experiments on a larger scale than was contemplated for the isolation units.

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

4. A *Power House* which supplies the necessary heat, electricity, refrigeration, and water from a deep driven well.

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

6. *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.

7. *Tenants' 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



THE LABORATORY AND ASSOCIATED BUILDINGS OF THE DEPARTMENT OF ANIMAL PATHOLOGY OF THE ROCKEFELLER INSTITUTE FOR  
MEDICAL RESEARCH—NEAR PRINCETON, NEW JERSEY.

The buildings stand on slightly rising ground, facing Princeton across Carnegie Lake. At the left are the laboratory and the power house; at the right, in the rear of the laboratory, are grouped the series of isolation pavilions for animals.

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and employees. An appropriate residence has also been built for the Director of the Department in a central portion of the grounds.

### PUBLICATIONS

#### SEMIANNUAL LIST

**T**HE Institute publishes a SEMIANNUAL LIST of all papers by the staff and those working under grants from the Institute, stating the title and place of publication of these reports. This, upon request, will be sent regularly to interested persons.

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Results of the investigations made under the auspices of, or with the cooperation of, or supported by The Rockefeller Institute for Medical Research, are first reported in a variety of publications. The reports are ultimately assembled in volumes designated STUDIES FROM THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH.

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THE JOURNAL OF GENERAL PHYSIOLOGY

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