LONG ISLAND BIOLOGICAL ASSOCIATION

INCORPORATED 1924

ANNUAL REPORT

OF

THE BIOLOGICAL LABORATORY

FOUNDED 1890

FIFTY-SEVENTH YEAR

1946

TABLE OF CONTENTS

THE LONG ISLAND BIOLOGICAL ASSOCIATION

President
Robert Cushman Murphy

Vice-President
Arthur W. Page

Secretary
E. C. MacDowell

Vice-President and Treasurer
Marshall Field

Assistant Secretary
B. P. Kaufmann

Asst. Treasurer and Auditor
William F. Dean

Director of The Biological Laboratory, M. Demerec

BOARD OF DIRECTORS

To serve until 1950

Robert Chambers.....New York University
George W. Corner.....Carnegie Institution of Washington
Th. Dobzhansky.....Columbia University
Mrs. Van S. Merle-Smith.....Oyster Bay, N. Y.
John M. Schiff.....Oyster Bay, N. Y.
Harold C. Urey .....University of Chicago
Willis D. Wood.....Huntington, N. Y.

To serve until 1949

H. A. Abramson.....Cold Spring Harbor, N. Y.
M. Demerec.....The Biological Laboratory
Henry Hicks.....Westbury, N. Y.
Dudley H. Mills.....New York, N. Y.
Stuart Mudd.....University of Pennsylvania Medical School
Robert Cushman Murphy.....American Museum of Natural History
John K. Roosevelt.....Oyster Bay, N. Y.

To serve until 1948

W. H. Cole.....Rutgers University
Mrs. George S. Franklin.....Cold Spring Harbor, N. Y.
E. C. MacDowell.....Cold Spring Harbor, N. Y.
William B. Nichols.....Syosset, N. Y.
Roland L. Redmond.....Oyster Bay, N. Y.
B. H. Willier.....Johns Hopkins University

To serve until 1947

T. Bache Bleecker.....Cold Spring Harbor, N. Y.
Marshall Field.....Huntington, N. Y.
Ross G. Harrison.....Yale University
Caryl P. Haskins.....Haskins Laboratories, New York
B. P. Kaufmann.....Carnegie Institution
Arthur W. Page.....Huntington, N. Y.
Harlow Shapley.....Harvard University

Members Emeriti

R. C. Leffingwell ..... Oyster Bay, N. Y.
Henry L. Stimson ..... Huntington, N. Y.

EXECUTIVE COMMITTEE

Mrs. G. S. Franklin
E. C. MacDowell
Robert Cushman Murphy
William B. Nichols
Arthur W. Page
John K. Roosevelt

WOMEN'S COMMITTEE

President—Mrs. George S. Franklin
Vice-President—Mrs. Van Santvoord Merle-Smith
Secretary—Mrs. Alvin Devereux
Treasurer—Mrs. George Nichols
Chairman, House Committee—Mrs. Percy H. Jennings
Chairman, Membership Committee—Mrs. John C. Hughes

FINANCE COMMITTEE

Marshall Field
William B. Nichols
Willis D. Wood

BUILDINGS AND GROUNDS

Mrs. George S. Franklin, Chairman

Mrs. Percy H. Jennings
Henry Hicks
B. P. Kaufmann
William B. Nichols

SCIENTIFIC ADVISORY COMMITTEE

George W. Corner, Chairman

L. C. Dunn
Alexander Hollaender
E. C. MacDowell
Alfred E. Mirsky

Members of the Long Island Biological Association

Contribution of at least $500

Marshall Field
Mrs. Wilton Lloyd-Smith
George Nichols
Arthur W. Page
John M. Schiff
Wawepex Society

Contribution of at least $100

Winthrop W. Aldrich
Clinton H. Crane
John W. Davis
Mrs. George S. Franklin
Childs Frick
Charles V. Graham
Mr. & Mrs. R. Graham Heiner
Mrs. Walter Jennings
Alfred L. Loomis, Jr.
Mrs. Acosta Nichols
Mrs. George Nichols
Laurence G. Noyes
Roland L. Redmond
Mrs. Roland L. Redmond
Mr. & Mrs. Charles S. Robertson
George Emlen Roosevelt
John K. Roosevelt
Willis D. Wood

Contribution of less than $100

Harold A. Abramson
Mrs. Harold A. Abramson
Mark H. Adams
Mrs. Henry Anderson
Mrs. F. Huntington Babcock
Richard F. Babcock
Mrs. Daniel Bacon
E. Farrar Bateson
Dennistoun M. Bell
Mrs. Frederick Bernheim
Edward S. Blagden
Mrs. Edward S. Blagden
Mrs. Charles Bleecker
T. Bache Bleecker
Mrs. T. Bache Bleecker
Harold F. Blum
Dietrich Bodenstein
Mrs. Herbert Bodman
George T. Bowdoin
Mrs. George E. Brower
Mrs. W. Averell Brown
Vernon Bryson
Dean Burk
Mrs. Trowbridge Callaway
McKeen Cattell
Robert Chambers
F. S. Child
Mrs. F. S. Child
C. T. Church
Mrs. C. T. Church
Mrs. Henry E. Coe, Jr.
W. H. Cole
George W. Corner
Duncan Cox
Mrs. Duncan Cox
Mrs. C. H. Crane
Mrs. Paul Cushman
William N. Davey
F. Trubee Davison
Mrs. F. Trubee Davison
Mrs. Henry P. Davison
Mrs. Henry L. de Forest
Mrs. Henry W. de Forest
Robert F. de Graff
William A. Delano
Max Delbruck
M. Demerec
Mrs. M. Demerec
Mrs. Richard Derby
Mrs. James A. de Tomasi

Mrs. Alvin Devereux
Abigail Camp Dimon
Mrs. John Foster Dulles
Jackson A. Dykman
Mrs. Jackson A. Dykman
Mrs. Walter Earle
Ferdinand Eberstadt
Mrs. Albert H. Ely, Jr.
Boris Ephrussi
Mrs. B. Tappen Fairchild
Ugo Fano
Ernst Fischer
Alexander Forbes
George S. Franklin, Jr.
Mrs. John M. Franklin
Mrs. Childs Frick
Michael Gavin
Mrs. Michael Gavin
Harvey D. Gibson
Mrs. William B. Given
H. Bentley Glass
Susan A. Green
Mrs. Arthur Gwynne
Mrs. Hamilton Hadden
Mrs. Winston Hagen
Mr. Paul Hammond
Mrs. Paul Hammond
Mrs. Montgomery Hare
William Hale Harkness
Ross G. Harrison
Mrs. Ashton Hawkins
Alexander Hollaender
Davenport Hooker
Mrs. Sarah C. W. Hoppin
Clarence A. Horn
Mrs. George Hornblower
Mrs. John C. Hughes
Oliver Iselin
Mrs. Myron Jackson
Mrs. Henry James
Percy H. Jennings
Mrs. Percy H. Jennings
Everett C. Jessup
E. Elizabeth Jones
Mrs. Otto Kahn
Martin D. Kamen
B. P. Kaufmann
Morris R. Keen
Edward L. Keyes
Mrs. Frederick R. King
Mrs. Randall J. Le Boeuff, Jr.
Mrs. Gertrude H. T. Le Boutillier
Mrs. Russell C. Leffingwell
H. T. Lindeberg
Mrs. H. T. Lindeberg
The Long Islander
S. E. Luria
E. C. MacDowell
D. A. MacInnes
John F. MacKay
John B. Marsh
Ernst Mayr
Mrs. Van S. Merle-Smith
Leo M. Meyer
Mrs. Robert B. Meyer
Alfred E. Mirsky
Louis de B. Moore
Mrs. Louis de B. Moore
Mrs. Grinnell Morris
Mrs. Ray Morris
Stuart Mudd
Robert Cushman Murphy
Mrs. Robert Cushman Murphy
James V. Neel
William B. Nichols
Mrs. John W. Nields
Juliet Nourse
Mrs. D. Chester Noyes
Mrs. D. Grinnell Noyes
Grover O'Neill
Mrs. Arthur Page
Mrs. Walter H. Page
Mrs. Paul G. Pennoyer
Isabel Peters
Francis T. P. Plimpton
Mrs. Charles Pratt
Frederic R. Pratt
Mrs. Frederic R. Pratt
Richardson Pratt
Theodore H. Price
Paul Pryibil
Mrs. Paul Pryibil
Mrs. Edward Pulling
Hale Pulsifer
Mrs. Hale Pulsifer
Otto Rahn

Mrs. Lansing P. Reed
Mrs. Gordon Rentschler
Oscar W. Richards
Mrs. Phillip Roosevelt
Mrs. Theodore Roosevelt, Sr.
Mrs. John E. Rousmaniere
Mrs. Stanley M. Rumbough
Charles E. Sammis, Inc.
Theodore F. Savage
Mrs. Theodore F. Savage
Francis O. Schmitt
Mrs. H. L. Schwartz, Jr.
Mrs. Donald Scott
G. Herbert Semler
Harlow Shapley
Ida Sitler
Mrs. J. Barstow Smull
Sir T. Ashley & Lady Sparks
Carl C. Speidel
Mrs. Theodore E. Stebbins
J. Rich Steers, Jr.
Curt Stern
Mrs. Henry L. Stimson
Mrs. Richard Storrs
George F. Sykes
Mrs. Eugene S. Taliaferro
Harriet E. Taylor
Mrs. Henry C. Taylor
Dorothy Truesdell
Mrs. Donaldson Tucker
Isabel H. Tuthill
Harold C. Urey
Roy Waggener
Charles O. Warren
Mrs. Charles O. Warren
Mrs. Francis M. Weld
A. M. White
B. H. Willier
Mrs. Keyes Winter
W. Wilton Wood, Inc.
Mrs. Willis D. Wood
Sewall Wright
Stephen Zamenhof

Founders

Contribution of at least $5,000 in money or property

Carnegie Corporation
Mrs. Ethel Clyde
Mrs. Henry W. de Forest
Mrs. Leonard Elmhirst
Marshall Field
Mrs. Otto H. Kahn
Russell C. Leffingwell
John & Mary Markle Foundation
Mrs. Van Santvoord Merle-Smith
Mrs. Acosta Nichols
Arthur W. Page
Rockefeller Foundation
John M. Schiff
Wawepex Society

Deceased

Mrs. Eugene Blackford
Henry W. de Forest
Dr. Walter B. James
Mrs. Walter B. James
Walter Jennings
John D. Jones
Wilton Lloyd-Smith
William J. Matheson
J. P. Morgan
Acosta Nichols
Mortimer L. Schiff
William K. Vanderbilt
Col. T. S. Williams
Robert B. Woodward

SECOND POST WAR YEAR

The report of the Director indicates that while war-time activities of the Laboratory have now terminated, the influence of studies stimulated by the demands of war continues. The long-familiar fruit fly (Drosophila) remains an important organism among the tools of genetic research, and it still thrives and multiplies in its bottles at the Laboratory. The search for antibiotics, however, has led our staff to the controlled induction of mutations in organisms so much smaller than fruit flies that their physiological processes, or even their gross bulk, can be observed only by means of the enormous magnification provided by the electron microscope. For several seasons the study of hybridization and inheritance among microscopic or ultramicroscopic forms of life has occupied more and more of the attention of our investigators, and of laboratory space. The trend is one which has endowed research at Cold Spring Harbor with many original and eminently practical facets.

The Director also calls attention to social events during the year which offered our membership pleasant and profitable opportunities to learn about the Laboratory in action. Throughout several preceding seasons war conditions had deprived us of similar chances for biologists and laymen to assemble for the benefit of a common cause. We should seek to continue such meetings, and to make them more frequent, because the best assurance of popular support lies in a realization of the effectiveness of research at the Laboratory, and in the ultimate application of a proportion of the results to human welfare.

The proud history of the Laboratory, which has now entered well into its second half-century, demonstrates that there is as much truth in the "Horatio Alger" tradition as applied to institutions as to individuals. The Long Island Biological Association has never been opulent; indeed, there have been periods in which our program has had to live from hand to mouth. But the soundness of plan and economy of operation, the faith of friends who would not be discouraged, the sureness of creditable results, have won the confidence of foundations, industry and the public, no less than of our members, without in any degree compromising our complete scientific and administrative independence.

Director Demerec, by coordinating his steadfast labors for the Laboratory with those for the Carnegie Institution of Washington, serves the Association without salary. In his organization of the summer Symposia—always attuned to new and hopeful fields of quantitative biology—he is carrying forward the brilliant conception of the late Dr. Reginald Harris, and creating even brighter fame at the ends of the earth than we enjoy here at home.

The officers of the Board, the energetic Women's Committee, and other members likewise give much time and thought to Association policy, to the upkeep of our increasingly valuable property, and to the raising of funds. All we require for the attainment of success that will satisfy the most ambitious of our well-wishers is a healthily growing membership. The average annual contribution need not be large, because the hope of the future rests on the multiplicity, rather than the lavishness, of individual support.

ROBERT CUSHMAN MURPHY, President

The Long Island Biological Association, Inc.

REPORT OF THE DIRECTOR

During this second postwar year our Laboratory, in common with other similar institutions, has been passing through a readjustment period. The research initiated during the war and carried on under contract with the Medical Division of the Chemical Warfare Service was completed in September. This concluded for us a period during which we had branched out into investigations remotely related to our field of interest, had successfully mastered new techniques, had developed new methods for the use of antibiotics, and had made significant contributions for the treatment of certain infections. The experience we acquired during this period has proved a valuable asset in working out plans for our present research program.

In October we inaugurated a research program designed to investigate the potentialities of various groups of microorganisms for production of antibiotics. The strikingly successful application of penicillin and streptomycin in medicine has given an added importance to research in the relatively new field of antibiotics, and intensive work is now going on in a large number of laboratories to find new substances possessing antibiotic potency and to learn more about their biological and chemical properties. We are interested in the fundamental aspect of the biological problem; that is, we wish to obtain some understanding of what various microorganisms can do and of how widespread their capacity is for producing substances that act as antibiotics. Since our approach is a genetical one, we have ample experience for this research and our laboratory is well equipped for the work. The problem is planned on a broad basis. The presence of antibiotic capacity is determined by the induction of mutations. For this purpose, well-known mutagenic agents—X-rays and ultraviolet rays—are being put to use, and a search is also being made for chemicals that may induce mutations. This research is being supported by a grant made by Schenley Laboratories, Inc., of which Dr. E. C. Williams is the director. Drs. Vernon Bryson and Albert Kelner are in charge of the work.

Research

During the greater portion of 1946 the Laboratory was engaged in finishing up projects under its contracts with the Medical Division and the Technical Division of the Chemical Warfare Service. This research was under the supervision of Dr. V. Bryson. The experiments dealt mainly with studies of the penetration of inhaled aerosols into the lungs and of the therapeutic value of penicillin aerosol alone and in combination with certain other chemicals. A study was made also of the synergistic action against bacteria exerted by mixtures of penicillin and several other chemicals. For the Technical Division, an analysis was completed of hydrogen peroxide aerosol as a disinfecting agent for air contaminated with pathogenic and dust-borne microorganisms. In October, studies were begun on the chemical induction of mutations in bacteria, using nitrogen mustards.

As a preliminary to the study of antibiotics, Dr. A. Kelner investigated the effects produced by X-rays and ultraviolet rays on the microorganism Actinomyces. He found that the spores are relatively resistant to killing, and that heritable changes are readily induced by irradiation.

In recent years, microorganisms—viruses, bacteriophages, bacteria, protozoa, and fungi—have been receiving considerable attention among experimental biologists. Techniques have been developed for utilizing them in research on a variety of biological problems; and work with these organisms is becoming very productive in opening up new approaches to some of the outstanding questions of modern biology. At this year's symposium we brought together a group of scientists who are studying the processes of variation and heredity among living things through experiments with various microorganisms. This symposium was a logical consequence of the interest in this field that has existed in our group for a number of years. Since the summer of 1941, work with microorganisms has been conducted at the Laboratory; and at present a considerable proportion of our year-round research is focused on these experimental materials.

This summer we again had a strong group working with bacteriophages. Dr. Max Delbruck and his assistant Mr. W. T. Bailey, Jr., of Vanderbilt University, investigated phenomena that have the appearance of mutation and hybridization in this group of organisms, which are too minute to be seen with the ordinary light microscope but can be observed with the electron microscope. They found an apparent transfer of hereditary material from one bacteriophage to another when a bacterium is simultaneously infected with two different but related strains of phage.

Dr. A. H. Doermann, an associate of Dr. Delbruck, investigated the multiplication of bacteriophages. One question to which he was seeking the answer was whether each phage continues to divide—thus increasing the total number exponentially—or whether division is limited to certain individuals only.

Requirements for the growth of phages were investigated by Dr. M. H. Adams, of New York University, who found that the growth of one strain of phage (T5) depends on the presence of calcium in the medium. Studies were made by Dr. S. S. Cohen and Miss C. B. Fowler, of the University of Pennsylvania, on the interruption of the growth processes caused by addition of 5-methyl tryptophane.

Although in recent years many problems relating to heredity are being studied on microorganisms, still the fruitfly (Drosophila) remains a very important organism in genetic research. This classical material is still unequalled for work on many outstanding problems. Our Laboratory is well equipped for research with Drosophila, and every summer since 1941 we have had several scientists working with this material. Last summer Dr. E. Mayr, of the American Museum of Natural History, studied forces instrumental in the evolution of species by investigating

sexual isolation as conditioned by age differences, strain differences, and species differences. Studies of sexual isolation were carried on also by G. Streisinger, of Cornell University, who experimented with two species of Drosophila and observed that sexual isolation may be reduced by selection. Dr. B. Glass, of Goucher College, made a survey of Drosophila stocks for the presence of a suppressor of a certain gene.

Biochemical studies were carried on by Dr. E. Racker, of New York University, with enzymes; by Dr. M. Levy, also of New York University, on protein denaturation; and by Dr. L. Michaelis, of the Rockefeller Institute, with dyes.

Dr. H. A. Abramson investigated the effect of alternating currents on the transfer of drugs through the skin, as well as the passage of substances through the lungs when applied as aerosols.

Drs. I. J. Deyrup and R. Guttman, of Columbia University and Brooklyn College, studied the effect of electric current on the nerves of the horseshoe crab and the spider crab.

Dr. M. A. Rudzinska, of New York University, collected protozoa (Lacrymaria) in the Cold Spring Harbor lakes, and worked out a method for culturing them.

Several scientists utilized the time spent at the Laboratory for writing. Dr. M. D. Kamen, of Washington University, prepared the manuscript for a book on radioactive tracer isotopes in biology; Dr. B. Glass worked on a book on evolution; and Drs. M. A. Rudzinska and S. Spiegelman wrote scientific papers.

Brief statements written by these investigators about their research at the Laboratory are presented in the section of this report entitled "Reports of Investigators."

Symposium

After an interval of three years imposed on us by the war emergency, we were again able to continue with the yearly Symposia on Quantitative Biology. The topic for this year's meeting—Heredity and Variation in Microorganisms—was selected two years ago, when it was thought that a symposium could be held in the summer of 1945; the meeting had to be postponed, however, because of travel restrictions. During the last two years, research on problems connected with the genetics and physiology of microorganisms has made very remarkable progress in the laboratories of the United States. Moreover, when contact with continental Europe was reestablished we found that during the war many new discoveries in the same field had been made in France. For these reasons, the continued delay of one year was fortunate, because it gave us an opportunity to broaden considerably the scope of our program.

This was the eleventh in the series of Cold Spring Harbor Symposia on Quantitative Biology, which have become widely known throughout the scientific world since they were started in 1933. The first meeting

after the war was of special importance in bringing together workers who have had little opportunity during the last four years to hold unlimited discussion of their research, and who have until recently been completely cut off from the progress of research in other countries. The group considered the mechanisms that operate in the transmission of heredity in the smallest known living organisms—namely, bacteriophages, bacteria, fungi, and protozoa. Since it is a well-established fact that the fundamental laws of nature apply in general to all forms of life, it is sometimes easier to solve a biological problem by using simple organisms, and, if necessary, testing the validity of the solution later on more advanced organisms. The discussion included also the behavior of tumor cells and leukemia cells, which in many respects exhibit the same individuality as unicellular organisms.

Some distinguished foreign scientists who took part in the program were: Dr. N. W. Pirie, Harpenden, England; Dr. M. J. D. White, University College, London; Dr. G. Pontecorvo, Glasgow University, Scotland; Dr. Andre Lwoff, Pasteur Institute, Paris; Drs. Raymond Latarjet and Jaques Monod, of the same institute; Dr. Boris Ephrussi, University of Paris; Dr. F. Kauffman, State Serum Institute, Denmark; and Dr. T. Johnson, Winnipeg, Canada.

Some of the European scientists on the program were brought to this country by the Biological Laboratory especially for the purpose of taking part in the Symposium. Although this year it was possible for only a limited number of foreigners to be present at the meeting, it was felt that this represented a good beginning in the extremely important task of re-establishing contact and cooperation among researchers in similar fields who had been cut off from communication by six years of war. Funds for the traveling expenses of invited European participants were provided from a special grant made by the Rockefeller Foundation.

American scientists came from all parts of the country, including the states of Alabama, California, Illinois, Indiana, Maryland, Missouri, Tennessee, Texas, and Wisconsin. There was also a large attendance from the hospitals, universities, research institutes, and commercial laboratories of New York City and vicinity. Lecture-room space and living accommodations limited the number of participants, and it was not possible to accept the registrations of all who wished to attend. Of the foreign scientists taking part, four each were from Canada, England, and France, two were from Chile, and one each from Denmark and Sweden.

Course on Bacteriophages

The primary purpose of this course, introduced in the summer of 1945, is to familiarize scientists with new methods that have been developed recently and to stimulate interest in research with bacterial viruses. The course this year had a capacity registration of twelve. A majority of the registrants were established research workers, eight of them having doctors' degrees.

Lectures

Seminars and lectures were held throughout the summer, in cooperation with the Department of Genetics of the Carnegie Institution. The regular thirty-minute seminars held three times a week at the Department of Genetics were attended by members of the Laboratory. These sessions are devoted to reviews of current literature and brief reports on current research.

Technical lectures were given weekly by members of the Laboratory and of the Department of Genetics. Arrangements for these lectures were in charge of Dr. S. G. Stephens, chairman of the Seminar Committee at the Department of Genetics. A list of titles is given below:

June 5: Oscar Riddle, Department of Genetics (retired). Scientific aspects of a recent visit to South America.

June 13: Margaret R. McDonald, Department of Genetics. The preparation of crystalline hexokinase from yeast.

June 20: F. Duran-Reynals, Yale University School of Medicine. The age factor in infection of birds with neoplastic viruses.

June 27: Mark W. Woods, University of Maryland. Virus and mitochondrial diseases of plants.

July 18: M. J. D. White, University College, London. Polyploid germ lines in the Cecidomyidae (Diptera).

July 25: Curt Stern, University of Rochester. Position effect.

August 1: L. Michaelis, Rockefeller Institute for Medical Research. Ferritin and iron metabolism.

August 8: Bentley Glass, Goucher College. Suppressor genes.

August 15: Milton Levy, New York University. The effects of mustard gas on biological material.

August 22: Albert Claude, Rockefeller Institute for Medical Research. Constitution of normal and tumor cells.

August 29: Mark H. Adams, New York University. Toxin production by Clostridium welchii.

Exhibits and Dinner

During September two functions were held for the members of the Association and their friends. On the eleventh of the month Mr. Arthur W. Page organized a dinner at the Piping Rock Club, at which he acted as toastmaster. Dr. Frank B. Jewett, president of the National Academy of Sciences, discussed problems connected with private scientific research; and Mr. Roland Redmond talked about the scientific work of the laboratory from the point of view of an interested layman. An exhibit was shown, presenting some of the accomplishments of the Laboratory during the war period. About forty-five persons attended the dinner.

On Sunday, September 22, the Laboratory held open house for members of the Association, their friends, and neighbors. This was organized in collaboration with the Women's Committee, of which Mrs. George S. Franklin is president. The Laboratory buildings were open

to the visitors, so that they might see the instruments and set-up used by the staff in their experimentation. In Blackford Hall exhibits had been arranged representing high points of the research carried on at the Laboratory during the war. Research on fine mists (aerosols) was demonstrated by various instruments for generating aerosols developed at the Laboratory. These included a small aerosolizer, with a capacity of about a half-ounce of liquid per hour, and the large "Cold Spring Harbor Nozzle," which has a capacity of about five gallons per hour. The original instrument designed by Dr. Harold A. Abramson before the war for generation of extra-fine aerosols was shown. Also on exhibit were especially designed apparatus for measuring the sizes of the small droplets constituting a mist, which was used for study of the physical properties of aerosols, and a photoelectric apparatus for measuring the density of mists. The method developed at the Laboratory for application of penicillin through inhalation by the patient in the form of an aerosol was demonstrated by the nebulizers and accessories used in this treatment. An elaborate exhibit represented the method developed by Drs. V. Bryson and Edwin J. Grace for treatment of osteomyelitis with a mixture of penicillin and a detergent (wetting agent). The Airborne Instruments Laboratory sent an exhibit showing the submarine detector which was developed by them while they were using some of our buildings.

During the exhibits tea was served by members of the Women's Committee.

After tea a brief session was held in the lecture room, with Dr. Robert Cushman Murphy presiding. Dr. Vernon Bryson spoke about the contributions of biological research to medicine; Dr. Edwin J. Grace, director of the Grace Clinic in Brooklyn and Clinical Director at the Huntington Hospital, talked about his experience in collaborating in research with the Laboratory; and Dr. Otto Schmitt of the Airborne Instruments Laboratory explained the development and operation of the submarine detector "MAD."

More than a hundred persons attended this meeting.

Dining Room

The Blackford Hall dining room was put into operation again for the first time since 1942. It was opened in June, when meat rationing was approaching an end and the meat shortage was acute. However, under the very efficient management of Mrs. S. G. Stephens, satisfactory service was provided to summer residents as well as symposium guests. During the symposium period, the dining room furnished meals for over one hundred persons.

Laboratories and Equipment

No major changes were made in the laboratories. Year-round research was carried on in the George Lane Nichols Memorial Laboratory; and during the summer all research space in the other laboratory buildings was well occupied. New incubators were purchased for microbiological research and for the bacteriophage course.

Buildings and Grounds

Because of the shortage of materials, particularly lumber, only essential repairs on buildings were carried out. These consisted of reroofing the pumphouse and a portion of Williams House, repairing porches, and repainting several apartments.

Acknowledgments

It gives me great pleasure to acknowledge the support given to the Laboratory by the members of the Long Island Biological Association. It is owing primarily to their interest and generosity that the Laboratory has become an outstanding scientific center and is continuing in that status.

The Women's Committee, under the presidency of Mrs. George S. Franklin, made an important contribution towards the support of the scientific work of the Laboratory; and its House Committee, under the chairmanship of Mrs. Percy H. Jennings, collected furniture for residences and contributions for the purchase of additional furnishings. Members of the Women's Committee helped with the tea and contributed refreshments at the open-house exhibit in September.

We are grateful to Mr. Arthur W. Page, who initiated and organized the dinner at the Piping Rock Club, and to Dr. Frank B. Jewett and Mr. Roland L. Redmond, who spoke on that occasion, as well as to Drs. Edwin J. Grace and Otto Schmitt, who spoke at the open-house meeting.

Acknowledgment is also made of the contribution of the Wawepex Society towards the upkeep of buildings and grounds, of the John D. Jones Scholarship maintained by that Society, and of the special library fund contributed this year for the third time.

The Laboratory is grateful to Schenley Laboratories for funds made available for research, and to the Rockefeller Foundation for a grant to defray the expenses of foreign guests attending the symposium.

We wish to acknowledge the assistance given by the Carnegie Institution, and particularly the opportunity for close cooperation with the Department of Genetics, which is proving very helpful to the work of the Laboratory.

Abramson, Harold A., Cold Spring Harbor, N.Y.——Investigations on the effect of alternating currents on the transfer of drugs through the skin were continued from a project initiated before the war. It was found that the alternating current, contrary to simple electrical theory, can introduce drugs into the human skin.——The aerosol project, begun before the war with Dr. Demerec, was resumed with Dr. V. Bryson and Mr. H. W. Bernton. The properties of nebulizers for lung therapy in tuberculosis were scrutinized. Qualitative experiments initiated earlier in the year on the passage of substances of low molecular weight through the lungs were studied semiquantitatively. It is of some importance that the negatively charged dye phenolsulfonphthalein passes through the lungs and is predictably excreted by the kidneys. It is anticipated that a test of lung function will evolve out of these measurements.

Adams, Mark H., New York University College of Medicine, New York, N.Y.——It seemed possible that the growth of the host bacterium in different nutrient media might result in quantitative differences in phage yield. A brief survey of the available phages indicated that E. coli grown on nutrient broth would yield 350 T5 phage particles per infected bacterium, whereas the same organism grown on a chemically defined ammonium lactate medium ("F") yielded no phage at all. It was eventually found that the growth of T5 depended on the presence of calcium ion in the medium, and with the addition of calcium to the "F" medium the yield of phage was between 50 and 100 infectious particles per infected bacterium. The other factors present in nutrient broth which contribute to high yields of T5 phage are still under investigation.

Bryson, Vernon, Biological Laboratory, Cold Spring Harbor, N.Y.——During the past year our research program has undergone a marked change in orientation. One phase of investigation brought to a close the series of studies conducted for the Technical and Medical Divisions of the Chemical Warfare Service. In this capacity further information was obtained on the comparative value of varied routes for administering penicillin, including inhalational, intramuscular, and subcutaneous administration. The most effective time schedule for treating experimental pneumonia in mice was determined, as was the effect of penicillin, when aerosolized in a solution of the cationic germicidal detergent, Zephiran. Penicillin-detergent aerosols were found to reduce mortality of mice with pneumococcal infection, as compared with penicillin-saline controls.——In cooperation with Horace Bernton we investigated the fate of inhaled phenolsulfonphthalein dye, as a measure of the relative efficency of conventional methods of aerosol therapy. This dye was further used to test the degrees of concentration of nebulized solutions as a function of the relative humidity of air employed to operate the nebulizing apparatus. As a result we were able to propose procedures intended to increase effectiveness of aerosol therapy. By means of radiosodium it

was possible to check quantitatively the amount of nebulized material that is retained in the bodies of test subjects. Mice were exposed to aerosol containing radioactive sodium chloride, using dead animals as control indices of the extent of surface contamination. All specimens were subsequently skinned and the carcasses tested in a Geiger counter with scaling circuit by the Department of Radiology, Columbia University. Close agreement was obtained between observed and estimated dosage. The information derived from this experiment was of aid in determining more exactly the quantity of Type I capsular polysaccharide aerosol required to immunize mice against the corresponding pneumococcus.——With the termination of research for the War Department, work was begun on the induction of mutations in microorganisms. Results achieved by purely physical means are described elsewhere in the Annual Report by our colleague, Dr. Albert Kelner, who has been aided by Miss Rachel Arbogast. My own attention, together with that of Miss Maryda Swanstrom, has been directed to the use of chemicals in inducing mutation of Escherichia coli to bacteriophage-resistance. The major part of this work has been done with nitrogen mustard (methyl-bis betachloroethylamine hydrochloride). More recently, a surface-active mixture of alkyl dimethyl benzyl ammonium chlorides has been used. Although it would be premature to discuss this work in more than general terms, it may be said that either of the chemical agents noted is active as a mutagenic material. This should occasion no surprise in the case of nitrogen mustard, as other workers have established its capacity to alter genetic properties of diverse organisms. In distinction, the surface-active chemical has not hitherto been described as mutagenic. Its inclusion as an agent capable of inducing heritable change to bacteriophage-resistance lengthens the list of chemicals already defined as modifiers of bacterial genotype by Dr. E. M. Witkin at the neighboring Carnegie Institution. It is anticipated that during the coming year the list may be sufficiently extended to afford some clue to the mechanism of induction.

Cohen, Seymour S., and Fowler, Catherine B., University of Pennsylvania School of Medicine, Philadelphia, Pa.——In studies to appear in press shortly, it was demonstrated by Cohen and Anderson that 5-methyl tryptophane was bacteriostatic for E. coli. B without affecting the O_2 consumption or respiratory quotient of the inhibited organisms. Under the influence of this compound, B adsorbed the bacterial viruses T2 and T4 but was unable to liberate either virus in a burst. It was noted, however, that plaques were produced when mixtures of the infected bacteria and 5-methyl tryptophane were plated in media containing tryptophane. Hence the inhibition was reversible. It seemed of interest to examine the conditions of reversibility more closely in chemically defined tryptophane-free media. Young cultures of E. coli B infected with T2 in a chemically defined lactate medium liberate 25-30 T2

particles per infected bacterium, after a latent period of 21 minutes. With B derived from more crowded cultures, the burst size is reduced and the latent period is lengthened. The liberation of virus is completely inhibited when 5-methyl tryptophane is added to the medium at 0, 6, and 12 minutes after infection. When the inhibited infected B were transferred to media containing tryptophane, normal virus liberation occurred after 21, ca. 15, and ca. 9 minutes, respectively, with undiminished burst size——From these preliminary experiments, it appears that 5-methyl tryptophane can interrupt T2 multiplication until relatively late in the latent period. After periods of inhibition of at least 30 minutes, the residual latent period may resume under the influence of added tryptophane.

Delbruck, M., and Bailey, M. T., Jr., Vanderbilt University, Nashville, Tenn.——Our research was concerned with further studies on "Induced Mutations in Bacterial Viruses," the subject on which we presented a paper at this year's Symposium. The phenomenon consists in an apparent transfer of hereditary material from one virus to another when a bacterium is simultaneously infected with two different but related strains of virus. As a result, new types of virus appear in the viral progeny of mixedly infected bacteria. The infecting types used in these experiments are pairs of related varieties—T2, T4, and T6—which are distinguishable serologically and by host range. Each of these types is capable of mutations affecting the type of plaque, and it is the transfer of this genetic factor affecting the type of plaque which is observed in the experiments. This set-up may be likened to the one in the original experiments of Mendel, who crossed varieties of plants which differed in one conspicuous genetic marker. Actually, these varieties probably differed in many minor factors besides the conspicuous one. Such differences in genetic background will generally lead to exchanges of genetic material which may strongly affect the expression of the phenotype to be studied and which may confuse the picture. Similar minor genetic differences between the strains T2, T4, and T6 may be expected, and we had indications that they do, in some respects, confuse the picture. We were attempting, therefore, to develop methods for the equalization of genetic background, by an arrangement analogous to repeated backcrosses.——It was also thought that further progress in this field would be much helped if it were possible to find "biochemical" mutations, analogous to those which have been employed so successfully in work with the mold, Neurospora crassa. T. F. Anderson discovered that the wild-type strains, T4 and T6, are "tryptophane-deficient," i.e., they require tryptophane as a cofactor for adsorption on the sensitive host. It did not seem unreasonable to expect that other deficiencies might occur, and that these might be induced by iradiation with ultraviolet light. Therefore, a technique analogous to that employed in Neurospora work for detection of biochemical mutants was developed and applied to UV-treated stocks of T2. To date, 258 isolates have been tested, but no mutants found.——In these experiments with ultraviolet light

acting on T2, a peculiar phenomenon was encountered. Heavily irradiated phage preparations gave plaque counts that were not proportional to the dilution. When serial tenfold dilutions were plated, the plaque counts might differ by more than a factor of one hundred. The irradiated preparations behave as if they contained, besides phage, another substance, X, which acts as a cofactor. The plaque counts depend on the concentration of the samples brought into contact with the bacteria. These phenomena are much less pronounced when the irradiated samples are plated one or two days after irradiation.

Deyrup, Ingrith J., and Guttman, Rita, College of Physicians and Surgeons, Columbia University, New York, N.Y., and Brooklyn College, Brooklyn, N.Y.——We carried out experiments on resistance characteristics of the rectifier element in nerve. A number of preliminary experiments were done on the optic nerve of the horseshoe crab and the walking-leg nerve of the spider crab.——A specially designed resistance-characteristic instrument was used. This instrument produces a plot of voltage vs. current on an oscilloscope screen, the presence of rectification being indicated by curvature of the trace.——The sensitivity of the apparatus was of the order of three per cent rectification. Under the conditions of these experiments, the rectification of the nerves was less than this amount, so that no curvature was detected.

Doermann, A. H., Vanderbilt University, Nashville, Tenn.——One of the basic problems of bacteriophage research is to answer the question: according to what sort of a mathematical progression do the bacterial viruses multiply? Is their multiplication an arithmetic progression, is it exponential, or is it neither of these? The summer's experiments were devoted to preliminary attempts to find a technique for answering this question.——A possible procedure was suggested by previous results. It is known that T4-infected bacteria will lyse about 23 minutes after addition of the phage to the bacterial suspension. However, it had been noted that such cultures, secondarily infected at 12-15 minutes with high multiplicities of T6r+, would on some occasions show partial lysis with liberation of T4 as early as 16-17 minutes after the primary infection. Delbruck, in 1940, described the phenomenon of lysis from without, in which bacteriophage is capable of initiating lysis immediately on contact with uninfected bacteria if the ratio of virus to bacteria is high enough. It was assumed that the T4 liberation described above is another example of lysis from without. If this assumption proves to be correct, and if a secondary infection can release virus before the end of the latent period of the primary infection, then it might be developed into a method of obtaining an answer to the question posed above.——To this end, various phage stocks were tested for their ability to lyse uninfected bacteria immediately after their addition to the culture. This was tested turbidimetrically with a nephelometer recently designed by Dr. Newton Underwood of Vanderbilt University. Lysis from without was found to occur with T2, T4, and T6. No apparent

correlation was found between phage titer and lysing ability of various stocks of the same phage. It appeared that some stocks of a given phage were more effective lysing agents than other stocks of the same phage at similar ratios of phage to bacteria. Of the stocks tested, a T6r+ stock appeared to be the best lysing agent. In view of this fact, and since host-range mutants of T6 are not known, it was selected for this purpose.——For primary infection T5 was selected, since it has a latent period of about 40 minutes, the longest of the phages of the T system. A high-titer stock of T5 was available, insuring rapid infection of a high proportion of the bacteria; and antiserum for specific removal of free T5 was also available.——The procedure devised for these experiments was as follows. To a bacterial culture in the exponential growth phase, T5 was added to the extent of 40 phage particles per bacterium. Although T5 is poorly adsorbed, this high multiplicity insures that most of the bacteria will be infected within 5 minutes after addition of the phage. At 5 minutes a dilution by a factor 20 was made into anti-T5 serum properly diluted in broth so that nearly 100% of the unadsorbed phage particles would be inactivated. After allowing 5 to 8 minutes for serum action a subsequent dilution by a factor 50 was made in broth. From the latter dilution a final dilution was made into broth on the one hand and into properly diluted T6 on the other. The dilutions into T6 were made at three different times: in one experiment dilutions were made at 15 and at 20 minutes after the primary infection; in a second experiment the final dilution into T6 was made at 25 minutes after the primary infection. The results obtained may be expressed in terms of the average yield of T5 per infected bacterium. The total yield is estimated from platings against B/6 at frequent intervals during the experiments. From these values the average yield is calculated by dividing the total yield at a given time by the number of infected bacteria. The latter is determined from the mean of the preburst control platings. Four such control platings divided their average were 0.9, 1.0, 1.0, and 1.1 in one of these experiments. In the control, this value remained at about one until 37-38 minutes, when a rapid rise indicated the beginning of lysis. By 45 minutes the figure had risen to 102, and by 55 minutes to its maximum of about 300. The experimental results from the dilutions into T6 at 15 minutes came to a maximum of 1.8 at 33 minutes, with an average of 1.6 for the platings at 30, 33, and 36 minutes. This average was not exceeded in four platings later than 45 minutes. The dilution into T6 at 20 minutes reached a maximum of 14 by 35 minutes. Five subsequent platings did not exceed this figure. Dilution into T6 at 25 minutes gave a maximum of 74 at 35 minutes.——Certain tentative conclusions may be drawn from these results, but it must be remembered that they are based on preliminary experiments only. It seems clear that mature new phage particles are present in the bacteria as early as 30 minutes after infection, and probably earlier. This rules out the possibility that no mature phage particles are present in the bacteria until the end of the latent period. On the other hand the results indicate that

few or no mature phage particles are present in T5-infected bacteria at 15 minutes. It also seems indicated that further refinements of the procedure described may result in a method for analyzing the quantitative aspects of bacteriophage multiplication during the latent period.

Glass, Bentley, Goucher College, Baltimore, Md.——The summer was spent chiefly in working on a book on the subject of evolution, and in making a study of the genetic and evolutionary thought of Pierre Louis Moreau de Maupertuis, a great eighteenth-century precursor of Darwin and Mendel.——In continuation of the work on the erupt-suppressor-erupt gene system discovered in Drosophila melanogaster during a previous stay at the Biological Laboratory (summer, 1942), I commenced a survey of the available wild-type stocks of D. melanogaster, in order to ascertain whether or not they carry either or both of these genes. This experiment was carried to completion after leaving Cold Spring Harbor.

Kelner, Albert, Biological Laboratory, Cold Spring Harbor, N.Y. ——During an investigation of X-ray-induced mutations of microorganisms, a representative saprophytic actinomycete species. Actinomycese flaveolus, was subjected to X-rays. Suspensions of the conidia in saline were treated with doses ranging from 25,000 to 300,000 roentgen units. The conidia proved relatively resistant to the killing effect of X-rays; in one experiment 6 per cent survived 100,000 r units, and 0.03 per cent 300,000 r units. The survival rate was inversely proportional to the dose. Among the survivors of irradiated suspensions were found the following types of mutants: biochemically deficient strains, which grew on nutrient agar, but very poorly or not at all on asparagin dextrose agar; strains with more intense or with different pigmentation from the wild type; and asporogenous strains. The percentage of such mutants among the survivors increased as the X-ray dose was increased. About 24 per cent of the survivors of the suspension treated with 200,000 r units were morphological mutants.

Levy, Milton, New York University College of Medicine, New York, N.Y.——For the summer of 1946, the writer undertook a systematic study of the influence of pH and temperature on the rate of denaturation of beta-lactoglobulin. Beta-lactoglobulin is a well-characterized crystalline protein which at the time was regarded as homogeneous but has since been shown to be split into electrophoretically distinguishable components at pH values somewhat removed from the isoelectric point. This may have been the source of the disturbing finding that the rate of denaturation was not first order but fell off more rapidly than expected. Some time was spent in exploration of the analytical method and the conditions used for precipitation of the denatured material, in an attempt to find a source of error. None was found. The rate seems to fall between the second and third order. On the alkaline side, it increases rapidly with pH; at 50° C. the acceleration indicates a dependence on the fourth or fifth power of the hydroxyl ion concentration. The effect of acidity is not nearly so great, denaturation being hardly

detectable at pH 2 after several hours at 50° C.——Systematic studies of protein denaturation as effected by temperature and pH have been very few in number. It is hoped that a protein can be found which will follow simpler kinetics and whose denaturation can be studied over a wide range of these factors. Important indications of the structure of proteins should arise from such studies. The very great use which has been made of the data of Steinhardt on pepsin indicates this. His data cover only a few units of pH at one temperature. Their value lies in the careful attention to pH and kinetic measurements. Much more of this kind of measurement should be useful to biologists and biochemists interested in the nature of proteins.

Mayr, E., American Museum of Natural History, New York, N.Y.——Additional work was done this summer on problems of sexual isolation in Drosophila. Exploratory experiments were made of a number of problems.——Previous observations had suggested that a higher percentage of older females are inseminated if males of D. pseudoobscura are given a choice of older and younger females. Experiments reported in Table I do not confirm this.

Table I

MALES	OLDER FEMALES			YOUNGER FEMALES		
Age in days	Age in days	Insemination		Age in days	Insemination	
		+	—		+	—
6	6	10	2	2	2	6
6	6	7	2	2	4	6
2	6	5	3	2	3	6
2	6	2	6	2	2	7
6	16	9	3	5	7	5
4	8	9	1	4	8	2
4	8	5	4	4	7	2

The difference appears significant only if the younger females are two days old and not yet fully mature. The exact determination of the age factor is important, because in the experiments on conditioning (Mayr and Dobzhansky, 1945) the age factor was not rigidly controlled.—— Preliminary experiments indicate that being kept in light or in the dark has no effect on the mating preference of yellow males of D. melanogaster. ——In experiments on interspecific courtship, it was observed that males of D. melanogaster display freely to females of D. pseudoobscura, but in one set of experiments courtship broke off at the licking stage. Again and again a male approached a female, vibrated the wings, licked and simultaneously bent the abdomen, but did not complete copulation. In another set of experiments a number of males mounted the female during an observed period of thirty minutes, but seemed to be unable to take proper hold and fell off within a few seconds. This observation suggested that even in these distantly related species copulations might be successful if opportunity were provided for sufficient contacts between males and females in the absence of conspecific females. Twenty-five female pseudoobscura (seven days old) were therefore placed in a food vial with

twenty-six male melanogaster (Swedish wild type, eleven days old). After thirty-seven hours at 24.5° C. the females were killed and dissected. Six (twenty-four per cent) of the females were found to have been inseminated. The sperm was dead and clumped in five, and moribund in the sixth (probably the most recently inseminated) fly. There was no indication of an insemination reaction such as that recently described by Patterson for other species of Drosophila.——In a few reciprocal experiments (male D. pseudoobscura, female melanogaster), no displays were observed. In a few instances males displayed to each other but not to the females of the other species.

Michaelis, L., The Rockefeller Institute for Medical Research, New York, N.Y.——Work has been done at Cold Spring Harbor on the mechanism of histological staining, in continuation of the work published in the Journal of the American Chemical Society, 67: 1212 (1945). The special topic was the spectroscopic behavior of basic dyestuffs when adsorbed by various histologically important substrates, especially nuclei on the one hand and metachromatically staining elements such as basophilic granulae cartilege, mucus. The goal of this research is elucidation of the structure of those morphological elements of the cell, and also of the theory of the staining process. The studies are to be continued next summer.

Racker, E., New York University, New York, N.Y.——The study of a spectrophotometric method for the determination of hexokinase and phosphohexokinase activity was contined. The enzyme alpha-glycerophosphate dehydrogenase is used for the main reaction. When dihydroxyacetone phosphate is reduced by this enzyme to alpha-glycerophosphate, oxidation of reduced diphosphopyridine nucleotide occurs. Since reduced diphosphopyridine nucleotide has a high absorption at wave length 340, which disappears on oxidation, this change can be readily measured spectrophotometrically. It was found that when aldolase—the enzyme which splits hexose diphosphate into dihydroxyacetone phosphate and glyceraldehyde phosphate—was added, hexose diphosphate utilization could be measured. When both enzymes—aldolase and alpha-glycerophosphate dehydrogenase—were present in excess, it was possible to measure the phosphorylating enzymes hexokinase and phosphohexokinase, which are responsible for the transformation of glucose into hexose diphosphate. Thus, all enzymes leading to the formation of hexosediphosphate can be measured by the rate of a zero order reaction if added as limiting factors of the over-all reaction.

Rudzinska, Maria Ann, New York University, New York, N.Y.—— I had intended, during the four-week period spent at Cold Spring Harbor, to reconstruct my paper on the nutrition of Tokophrya (Suctoria), which was lost during the war. However, after completing the literature and preparing fixatives, stains, etc., I found that it was impossible to obtain Suctoria. The Cold Spring Harbor lakes, streams, and seawater were examined without success. The Marine Biological Laboratory at

Woods Hole sent some material, but it was dead on arrival.——After abandoning this project, I found some very good specimens of Lacrymaria olor in the lakes, and attempted to prepare the best medium for a pure culture of this species. Using different concentrations of hay infusion, I found that the best is a dilute hay infusion of 0.3 per cent, made by boiling in tap water for 5 to 10 minutes.

Streisinger, George, Cornell University, Ithaca, N.Y.——An attack on the problem of sexual isolation was made with the aid of the technique of direct observation developed by Drs. E. Mayr and Th. Dobzhansky. These workers, using Drosophila pseudoobscura and D. persimilis, noted that whenever females of one species were placed together with males of the other species, the males courted very actively and attempted copulation. The copulation, however, was only very rarely successful. It was noted by the present writer that when a large number of heterogamic matings was arranged singly in a series of shell vials, a small percentage of flies copulated almost immediately after being placed together, while a large majority copulated only after several hours if at all. This apparent lack of sexual isolation in the flies which successfully copulated might be due, in at least some cases, to genetic differences among the flies. If so, it should be possible to select strains of flies which would show relatively little sexual isolation.——Six D. persimilis males were selected by the above technique and mated to single females of their own species. The sons of one of the males showed a weakening of the sexual isolation and readily mated with D. pseudoobscura females. Attempts to select females of this species showing weaker then normal sexual isolation, as well as males and females of D. pseudoobscura, were unsuccessful; but this was probably due to the limited number of experiments. It is hoped to continue these experiments in the future.——In collaboration with Dr. E. Mayr, the effect of age of Drosophila on sexual preferences was studied. This factor is of great importance in experiments on sexual isolation, since differences in physiological age may greatly alter the significance of some results. It was found that in matings of fully mature flies of five, ten, or fifteen days, copulations are at random, although older flies are preferred to those having just reached maturity.

COURSE ON BACTERIOPHAGES

July 15 — August 2, 1946

Instructor: M. Delbruck, Vanderbilt University, Nashville, Tennessee.
Assistant: W. T. Bailey, Jr., Vanderbilt University, Nashville, Tennessee.

As in the preceding year, a short but intensive laboratory course in the techniques and problems of research on bacterial viruses was offered. The number of students enrolled this year was twelve, as against six of last year. To economize on materials, it was necessary for the students to work in pairs. Since several of the students were persons having highest qualifications for bacteriological research, the pairing arrangement turned out to be of great benefit to all, as it increased the amount of mutual instruction. The quality of performance was much higher than in the preceding year, and several more advanced experiments could be added to the schedule.

Following is a list of the students enrolled in the course:

Dr. E. A. Evans, Jr., Professor of Biochemistry, Chicago University
Dr. B. Vennesland, Assistant Professor of Biochemistry, Chicago University

David Perkins, Graduate Student, Columbia University
Elizabeth Miller, Research Assistant, Rockefeller Institute for Medical Research

Dr. V. Bryson, Research Biologist, Biological Laboratory
Dr. H. B. Newcombe, Research Associate, Department of Genetics, Carnegie Institution

Dr. H. Gaffron, Associate Professor of Biochemistry, Chicago University
Dr. Harriet Taylor, Research Assistant, Rockefeller Institute for Medical Research

Dr. Seymour Cohen, Department of Biochemistry, University of Pennsylvania Medical School

Catherine Fowler, Research Assistant, Department of Biochemistry, University of Pennsylvania Medical School

Dr. M. Adams, Associate Professor of Bacteriology, New York University Medical School

R. Kutsky, Graduate Student, Princeton University

The course lasted three weeks. Several of the students stayed on during the remainder of the summer and undertook minor research projects on bacterial viruses. These projects are reported on separately by the respective investigators.

The course and the research work were housed in the Davenport Laboratory.

SUMMER RESEARCH INVESTIGATORS

Abramson, Harold A.—Cold Spring Harbor, N. Y.

Adams, Mark H.—New York University College of Medicine, New York, N. Y.

Bailey, W. T., Jr.,—Vanderbilt University, Nashville, Tenn.

Bernton, Horace—Harvard University, Cambridge, Mass.

Cohen, Seymour S.—University of Pennsylvania School of Medicine, Philadelphia, Pa.

Delbruck, Max—Vanderbilt University, Nashville, Tenn.

Deyrup, Ingrith J.—College of Physicians & Surgeons, Columbia University, New York, N. Y.

Doermann, A. H.—Vanderbilt University, Nashville, Tenn.

Fowler, Catherine B.—University of Pennsylvania School of Medicine, Philadelphia, Pa.

Glass, Bentley—Goucher College, Baltimore, Md.

Guttman, Rita—Brooklyn College, Brooklyn, N. Y.

Hotchkiss, Rollin D.—The Rockefeller Institute for Medical Research, New York, N. Y.

Kamen, Martin D.—Washington University School of Medicine, St. Louis, Mo.

Levy, Milton—New York University College of Medicine, New York, N. Y.

Mayr, Ernst—American Museum of Natural History, New York, N. Y.

Michaelis, L.—The Rockefeller Institute for Medical Research, New York, N. Y.

Perkins David—Columbia University, New York, N. Y.

Phillips, Faith—Vanderbilt University, Nashville, Tenn.

Pittendrigh, Collin—Columbia University, New York, N. Y.

Racker, E.—New York University College of Medicine, New York, N .Y.

Rudkin, George—Lankenau Hospital Research Institute, Philadelphia, Pa.

Rudzinska, Maria Anna—New York University, New York, N. Y.

Schultz, Jack—Lankenau Hospital Research Institute, Philadelphia, Pa.

Spiegelman, S.—Washington University School of Medicine, St. Louis, Mo.

Stern, Curt—University of Rochester, Rochester, N. Y.

Streisinger, George—Cornell University, Ithaca, N. Y.

White, M. J. D.—University College, London, England.

COLD SPRING HARBOR SYMPOSIA ON QUANTITATIVE BIOLOGY

List of Published Volumes

*Vol. I (1933) Surface Phenomena 239 pp.

*Vol. II (1934) Growth 284 pp.

Vol. III (1935) Photochemical Reactions 359 pp.

Vol. IV (1936) Excitation 376 pp.

*Vol. V (1937) Internal Secretions 433 pp

*Vol. VI (1938) Protein Chemistry 395 pp.

Vol. VII (1939) Biological Oxidations 463 pp

Vol. VIII (1940) Permeability and the Nature of Cell Membranes 285 pp.

*Vol. IX (1941) Genes and Chromosomes 315 pp.

Vol. X (1942) The Relation of Harmones to Development 160 pp.

Vol. XI (1946) Heredity and Variation in Microorganisms 314 pp.

*Out of print

LABORATORY STAFF

Arbogast, Rachel—Research Assistant

Bryson, Vernon—Research Biologist

Demerec, M.—Director

Dorsey, Henry—Laborer

Farrington, Margaret—Technical Assistant

Holmes, Joseph—Outside Handyman

Kelner, Albert—Bacteriologist

Klem, Dorothy V.—Secretary

Kriger, David—Technical Assistant

Reddy, William—Laborer

Reiss, Albert M.—Bacteriologist

Reshetiloff, Cyril—Technical Assistant

Robbins, Elizabeth—Clerical Assistant

Swanstrom, Maryda—Research Assistant

REPORT OF THE SECRETARY

The 51st meeting of the Board of Directors of the Association was held on January 31, 1946, at the Down Town Association in New York City, with thirteen members present. The report of the Director of the Laboratory dealt first with plans for the 1946 symposium, on Heredity and Variation in Microorganisms, which had undergone some changes since they were last discussed by the Board. Several foreign scientists had been invited to participate, and a special grant of $2500 received from the Rockefeller Foundation for their traveling expenses. Dr. Demerec spoke also of the course in bacteriophage research, introduced last summer. He then turned to a consideration of the full-time research program of the Laboratory, which at the time consisted of a continuation and expansion of work under contract with the War Department. Dr. Demerec advocated serious consideration by the Board and the Scientific Advisory Committee of possibilities for a long-term research program for the Laboratory. He proposed that a long-range program in the field of the Laboratory's present interest could be supported for $15,000 a year, which might be expanded by securing additional funds for special projects. Possible sources of such funds were discussed by members of the Board. Dr. Demerec reported on the physical condition of the Laboratory, mentioning the many improvements that had been made in connection with war research projects, and citing the need for better living quarters for summer guests as one of the out-standing requirements for the future. It was suggested that a gift of $5000 made recently by Mrs. Acosta Nichols might be used for building a summer cottage, to be named in memory of Mr. Acosta Nichols. The report of the Director was voted approved. The financial report for the year 1945 was circulated, discussed, and approved. The proposed budget for 1946 was discussed and approved. General discussion was held on the subjects of the pending New York State anti-vivisection legislation and the bill currently before Congress for the establishment of a National Science Foundation.

On July 30, 1946, the 23rd Annual Meeting of the Association was held at Blackford Hall. In opening the meeting President Murphy spoke of plans for a special celebration to be held in September to mark the return of the Laboratory to a more normal peace-time program. Dr. Demerec reported on the success of the eleventh Cold Spring Harbor Symposium, just held, and briefly reviewed the other current activities of the Laboratory. He spoke of the need for improvements in the physical plant; in particular, a more suitable lecture room for the symposia, modernization of the kitchen, and additional summer accommodations for families. At the conclusion of the Director's report, President Murphy commented on the high scientific honor conferred on Dr. Demerec this year in his election to the National Academy of Sciences. The

financial report for the year 1946 was examined, discussed, and approved. The following members were re-elected to the Board of Directors, Class of 1950: Robert Chambers, George W. Corner, Th. Dobzhansky, Mrs. Van S. Merle-Smith, John M. Schiff, Harold C. Urey, and Willis D. Wood. Mr. T. Bache Bleecker, and Dr. Caryl P. Haskins were elected as new members in the Class of 1947.

The 52nd meeting of the Board of Directors was held on July 30, following the Annual Meeting, with eleven members present. The interim financial report for the first six months of 1946 was distributed. Dr. Demerec proposed a research program for the coming year, consisting of a basic study of the distribution among microorganisms of potentialities for the production of antibiotics—this program to be financed by funds from Schenley Laboratories, Inc. Different aspects of this proposal were discussed at length; and the Director was instructed to investigate the matter further and report before final action. The Executive Committee as previously constituted was re-elected to serve for the coming year; Mrs. G. S. Franklin, E. Carleton MacDowell, Robert Cushman Murphy, William B. Nichols, Arthur W. Page, and John K. Roosevelt. The question of selling the property known as Stewart Cottage was brought up and referred to the Committee on Buildings and Grounds for consideration. A vote was recorded to express the appreciation of the Board for the effective management of Dr. Demerec as director of the laboratory.

A meeting of the Executive Committee of the Board of Directors was held on October 25, 1946, at the Down Town Association, to consider details of the agreement between Schenley Laboratories, Inc. and the Long Island Biological Association. It was voted to approve the execution of this agreement, provided that a mutual understanding was reached between Dr. Williams, Director of the Schenley Laboratories, and Dr. Demerec of the Biological Laboratory concerning the interpretation of certain provisions of the agreement. Mr. Dudley H. Mills was elected a member of the Board of Directors to fill a vacancy in the Class of 1949. Mr. Page reported on the dinner and the exhibits that had been held to arouse interest in the Laboratory.

E. Carleton MacDowell
Secretary

REPORT OF THE TREASURER

The Treasurer reports total income for the year of $75,994.18 and disbursements of $43,832.99.

The Women's Committee, under the leadership of Mrs. George S. Franklin, President; Mrs. Van Santvoord Merle-Smith, Vice-President; Mrs. Alvin Devereux, Secretary; Mrs. George Nichols, Treasurer; Mrs. Percy H. Jennings, Chairman of the House Commiitee; and Mrs. John C. Hughes, Chairman of the Membership Committee, contributed $1,547.00.

The Wawepex Society continued its annual grant, this year of $1,250.00 plus $250.00 for the John D. Jones Scholarship and $200.00 for Library Expenses.. Officers of the Wawepex Sociity are: T. Bache Bleecker, Governor; John Hewlett, Scribe; and Howland B. Stoddard, Custodian. In addition to its annual financial support, the Wawepex Society leases certain lands and buildings to the Association, free of rent, and carries the insurance on these buildings.

Mr. William F. Dean audited the books for the year. The balance sheet and income-and-expense accounts of the Association follow herewith:

BALANCE SHEET

ASSETS

Current:		
Cash in banks	48,825.46	
Accounts Receivable	5,090.71	
		53,916.17
Securities held by Bankers Trust Co:		
U. S. Savings Bonds Series G	14,000.00	
Other Securities	8,856.00	
Bonds	6,600.00	
		29,456.00
Land:		
Land Purchased	69,590.52	
Land on 50 year lease	13,500.00	
Henry W. de Forest Gift	12,000.00	
Land (Improvements)	2,898.01	
Land (Airslie)	5,000.00	
		102,988.53
Buildings:		
Blackford Hall*	19,000.00	
Jones Laboratory*	10,000.00	
Davenport Laboratory	8,500.00	
George L. Nichols Memorial Laboratory	13,700.00	
Williams House	11,300.00	
Stewart Cottage	3,000.00	
Hooper House*	13,200.00	
Wawepex Laboratory*	7,500.00	
Osterhout Cottage*	5,500.00	
Dr. Walter B. James Laboratory	13,500.00	
Reginald G. Harris House	8,500.00	
Urey & Cole Cottages	4,765.00	
Henry W. de Forest Building	15,000.00	
Machine Shop and Garage	2,000.00	
Airslie	5,000.00	
		140,465.00
Equipment:		
General	38,577.27	
Biophysics	16,849.90	
Physiology	2,513.15	
		57,940.32
		384,766.02

* Situated on property on 50 years' lease from Wawepex Society

LIABILITIES

Current:		
Accounts Payable	901.68	
Library Fund	321.95	
Charles B. Davenport Memorial Fund	4,924.75	
Mrs. Acosta Nichols	5,000.00	
Schenley Laboratories, Inc.	16,216.90	
H. A. Abramson Research	2,276.15	
		29,641.43
Special Funds:		
Blackford Memorial Fund	5,000.00	
Temple Prime Scholarship Fund	2,500.00	
Dorothy Frances Rice Fund	2,000.00	
Dr. William J. Matheson Fund	20,000.00	
Rockefeller Symposia Fund	12,000.00	
		41,500.00
Balance:		
Long Island Biological Association	152,950.32	
Value of Leasehold — Wawepex Society	39,153.74	
January 1, 1946	109,623.04	
Gain in Capital — December 31, 1946	11,897.49	
		313,624.59
		384,766.02

The Biological Laboratory
Income and Outgo — Year Ended December 31, 1946

	TOTAL		NET	
	Received	Paid	Received	Paid
Balance Forward from 1945:				
Cash in Banks	17,994.03			
Payables & Receivables	4,140.51	1,281.24		
	22,134.54	1,281.24	20,853.30	
Deduct: Special Funds			7,876.05	
			12,977.25	
Current Accounts:				
Dues & Contributions	5,411.65		5,411.65	
Women's Committee	1,547.00		1,547.00	
Wawepex Society	1,250.00		1,250.00	
Income of W. B. James Trust	118.56		118.56	
W. J. Matheson Bequest	575.00		575.00	
Research	4,311.00	116.03	4,194.97	
Sale of Books	2,789.61		2,789.61	
Symposia Fund Interest	300.00		300.00	
Symposia Expense		1,353.95		1,353.95
John D. Jones Scholarship	250.00	250.00		
Dorothy F. Rice Scholarship	75.00	75.00		
Temple Prime Scholarship	75.00	75.00		
Summer Course	330.00	122.62	207.38	
Insurance	4.17		4.17	
Rooms & Apartments	6,245.13	1,978.62	4,266.51	
Buildings & Grounds Salaries		4,075.80		4,075.80
Buildings & Grounds Supplies		2,098.09		2,098.09
Heat, Light & Water		1,194.08		1,194.08
De Forest Property Taxes	690.84		690.84	
Dining Hall	7,919.92	7,709.63	210.29	
General Expenses:				
Administration Salaries		447.84		447.84

Administration Expenses		519.70		519.70
Telephone & Stamps		203.77		203.77
Printing & Stationery		106.60		106.60
Macy Foundation Contract		579.25		579.25
Medical Division Contract	16,401.30	18,814.06		2,412.76
Capital & Special Accounts:				
Library	200.00	6.00	194.00	
H. A. Abramson Research	2,500.00	223.85	2,276.15	
Schenley Laboratories, Inc.	20,000.00	3,783.10	16,216.90	
Special Contribution	5,000.00		5,000.00	
Receivables		100.00		100.00
	75,994.18	43,832.99	45,253.03	13,091.84
Deduct Payments			13,091.84	
			32,161.19	
Add — Balance of 1945			20,853.30	
Balance — December 31, 1946	48,825.46			
Payables & Receivables	5,090.71	901.68		
	53,916.17	901.68	53,014.49	
Less: Special Funds			40,139.75	
Net Balance			12,874.74	

Special Funds:	
Library	321.95
C. B. Davenport Memorial Fund ($600 in Bonds)	4,324.75
H. A. Abramson Research	2,276.15
Schenley Laboratories, Inc.	16,216.90
Mrs. Acosta Nichols	5,000.00
Reserve Fund	12,000.00
	40,139.75

SPECIAL FUNDS

TEMPLE PRIME SCHOLARSHIP FUND

Donor: Cornelia Prime. Original Principal, $2,500. (1913)

"In memory of my brother, Temple Prime, the entire annual income to be expended each year for the payment of the tuition and other expenses of a male, or female student in biology, who is working at the Laboratory at Cold Spring Harbor, New York, during that year."

Allocated, 1946	$75.00
Scholarship, support of research	75.00

BLACKFORD MEMORIAL FUND

Bequest of Frances L. Blackford. Principal, $5,000. (1924)

" . . . to be used in the maintenance of the Blackford Memorial at Cold Spring Harbor, Long Island, as the trustees may deem to be for the best interest of said Memorial."

No income, 1946.

DOROTHY FRANCES RICE FUND

Donor: Oran W. Rice. Original Principal $2,000. (1926)

Income to be applied as follows: (1) one-sixth to be added annually to principal of fund, (2) remaining five-sixths to be paid over each year to a woman student, preference of selection being given to students working in art botanical sciences and particularly worthy of such recognition.

Allocated, 1946	$75.00
Scholarship, support of research	75.00

DR. WALTER B. JAMES FUND

Bequest, in trust, of Dr. Walter B. James. Principal, $5,000.

"By his will, Walter B. James, who died in 1927, bequeathed $5,000. to Equitable Trust Company in trust in accordance with the Resolution and Declaration of Trust creating The New York Community Trust and expressed the desire that the net income thereof be devoted to the support of the Long Island Biological Association of Cold Spring Harbor, Long Island.

Income received, 1946	$118.56
Transferred to Income Account	118.56

DR. WALTER J. MATHESON FUND

Bequest of Dr. William J. Matheson. Bequest $20,000.
Cost of securities $20,116.18 (1931)

"I give and bequeath to Biological Laboratory, of Cold Spring Harbor, Long Island, for its endowment fund, the sum of Twenty Thousand Dollars."

Interest, 1946	$575.00
Transferred to Income Account	575.00

Marshall Field, Treasurer
William F. Dean, Assistant Treasurer and Auditor