LONG ISLAND BIOLOGICAL ASSOCIATION

ANNUAL REPORT
OF
THE BIOLOGICAL LABORATORY

COLD SPRING HARBOR
LONG ISLAND, NEW YORK
1930

LONG ISLAND BIOLOGICAL ASSOCIATION

INCORPORATED 1924

ANNUAL REPORT
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THE BIOLOGICAL LABORATORY

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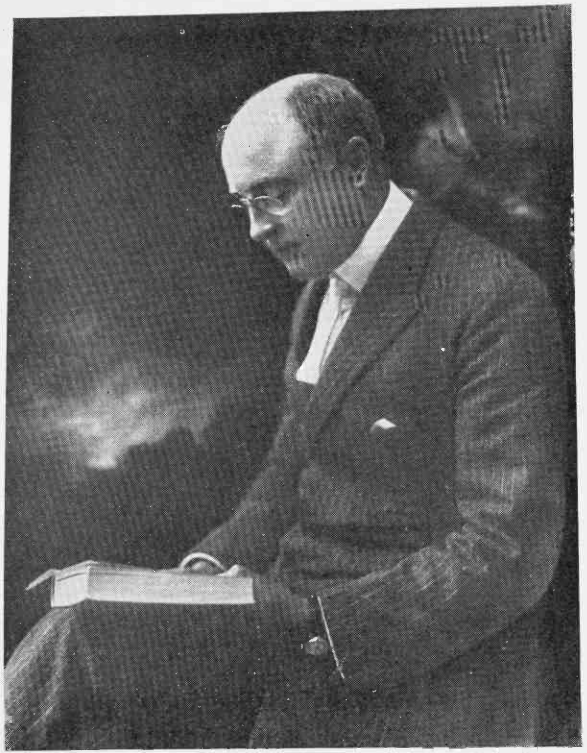

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REPORT OF THE DIRECTOR

To the officers and members of the Long Island Biological Association:

Gentlemen:

I have the honor to submit the following report for the year 1930.

The Biological Laboratory has maintained and increased its usefulness as a center for research in biology, through

1—Further equipping the Doctor Walter B. James Memorial Laboratory for biophysics, and by maintaining the work in that laboratory in a creditable manner, under the leadership of Doctor Hugo Fricke, with the aid of four technical assistants and associates, and of visiting and cooperating scientists.

2—Continuing to maintain the research of Doctor William Salant and his associates and assistants in experimental pharmacology.

3—Maintaining research, concerned with the physiology of reproduction, under the leadership of Doctor Reginald G. Harris.

4—Continuing to cooperate actively with Doctor W. W. Swingle in his work upon the adrenal cortex, through the continued loan of Doctor J. J. Pfiffner's services, and through the appointment to our Staff of Doctor Phyllis Bott and Mr. Alton R. Taylor to further aid in the work.

5—Making a grant to Doctor A. J. Grout to aid in the preparation and publication of a series of monographs upon "Moss Flora of North America, North of Mexico", and appointing Doctor Grout to our Staff.

6—Undertaking, through the appointment to our Staff, of Doctor Denis R. A. Wharton, a review and study of the possible role of cats as transmitters of disease.

7—Providing facilities for about forty research workers from other institutions to carry on experiments at the Laboratory during the summer.

8—Making further progress in improving living and working conditions for members of our Staff and for visiting biologists.

Research Workers From Other Institutions

The number of research workers from other institutions who carried on their work at the Laboratory during the summer was nearly the same as during the summer of 1929, the total number of workers, including permanent staff, at the Laboratory at any one time being limited, to about fifty to sixty, by the number of laboratories and other available facilities. This year these summer workers came from twenty-seven different institutions, including fifteen colleges and universities, ten medical schools, one museum and one governmental department.

The visiting scientists showed the same serious purpose which has characterized their coming to the Laboratory, and, almost without exception, actively conducted research covering nearly all the subdivisions of biology.

The summer workers were Doctor David Anchel, Assistant Professor of Pharmacology, New York Homeopathic Medical College and Flower Hospital; Doctor A. W. Blizzard, Professor of Biology, Coker College; Doctor J. H. Bodine, Head of Department of Zoology, University of Iowa; Mr. Keeve Brodman, Cornell Medical College; Doctor Alice L. Brown, Head of Department of Biology, Brenau College; Doctor Henry S. Conard, Head of Department of Botany, Grinnell College; Mr. Frederick Crescitelli, graduate student, Brown University; Mr. C. H. Curran, Assistant Curator, Department of Insect Life, American Museum of Natural History; Doctor William H. Cole, Professor of Physiology and Biochemistry, Rutgers University; Doctor George W. Corner, Head of Department of Anatomy, University of Rochester School of Medicine and Dentistry; Mr. George E. Daniel, School of Hygiene and Public Health, Johns Hopkins University; Mrs. M. A. Downes, College of Physicians and Surgeons, Columbia University; Doctor Harry Goldblatt, Assistant Professor of Pathology, School of Medicine, Western Reserve University; Mr. Joseph Hahn, New York Homeopathic Medical College and Flower Hospital; Miss Rebecca Halpern, New York Homeopathic Medical College and Flower Hospital; Mr. A. G. Hollander, University and Bellevue Hospital Medical College; Doctor Franklin Hollander, Assistant Professor of Physiology, New York Homeopathic Medical College and Flower Hospital; Mr. George Houston; Mr. John R. Huggins, Department of Zoology, University of Pennsylvania; Doctor Marian Irwin, Associate, Department of General Physiology, Rockefeller Institute for Medical Research; Doctor George B. Jenkins, Professor of Anatomy, Medical School, George Washington University; Doctor Jessie L. King, Chairman of Department of Physiology and Hygiene, Goucher College; Doctor I. S. Kleiner, Professor of Physiological Chemistry, New York Homeopathic Medical College and Flower Hospital; Doctor S. I. Kornhauser, Professor of Anatomy and Embryology, University of Louisville Medical School; Doctor Basile Luyet, Privat-Docent, Constitution de la Matiere, University of Geneva, Switzerland; Doctor Paul R. Needham, Instructor in Biology, University of Rochester; Mr. Edmund W. Overstreet, Medical School, Johns Hopkins University; Miss A. Louise Palmer, United States Bureau of Fisheries; Mr. W. M. Parkins, Department of Biology, Princeton University; Mr. Charles Potter, Department of Biology, Brown University; Doctor Asa A. Schaeffer, Professor of Zoology, University of Kansas; Miss Olive K. Schaeffer, University of Kansas; Mr. Julius Schwartz, Columbia University; Mr. T. L. Smith, Graduate Assistant in Zoology, Columbia University; Doctor Frederick K. Sparrow, Jr., Instructor in Evolution, Dartmouth College; Doctor W. W. Swingle, Professor of Biology, Princeton University; Doctor I. R. Taylor, Assistant Professor of Biology, Brown University; Doctor L. T. Webster, Associate Pathologist and Bacteriologist, Rockefeller Institute for Medical Research; Mr. Albert Zubow, College of the City of New York.

Outside Support Granted the Association

For the first time in its history The Biological Laboratory has received gifts from organizations other than its parent institution, Brooklyn Institute of Arts and Sciences, or corporations formed, in part at least, to look after

its welfare, the Wawepex Society and the Long Island Biological Association.

The support which has been granted from "outside sources" this year is welcomed not only on account of its financial value, but because of the significance which must be attached to such action on the part of two of the most experienced and critical organizations in the country.

Late in the summer, at the suggestion of the Chairman of our Scientific Advisory Committee, Professor J. H. Bodine, application was made to the Chairman of the Committee on the Effects of Radiation upon Living Organisms, of the National Research Council, for help in obtaining additional, much needed apparatus for the laboratory of biophysics.

About two years ago the National Research Council was invited to make an appraisal of the policy and work of The Biological Laboratory. This request was made because, (1) a new policy had recently been adopted by the Board of Directors, (2) it was believed that the Laboratory had made more progress in its work, since its transfer to the Long Island Biological Association, than was generally known among biologists, (3) this progress was rapidly involving the Association in expenses which the members could not be expected to meet without outside support. It seemed desirable to obtain the unbiased opinion of a highly competent scientific body, and the moral support which approval by such a body would of necessity bring with it. After characteristic, careful study and inquiry, the Division of Biology and Agriculture of the National Research Council, through its chairman, Doctor C. E. Allen, sent us the following statement of the Council's action.

"At the request of the officers of The Biological Laboratory of the Long Island Biological Association, the Division of Biology and Agriculture authorized the appointment of a committee to study the question of the endorsement of the Laboratory. The committee so appointed consisted of M. M. Metcalf (Chairman), E. G. Conklin, D. S. Johnson and W. J. V. Osterhout.

"The Committee, after correspondence, and after a meeting at Woods Hole which was attended by Dr. Reginald G. Harris, Director of the Laboratory, presented to the Division the following report:

" 'The Committee on The Biological Laboratory of the Long Island Biological Association has gathered information from many sources in regard to the Laboratory and its reorganization in 1924 and its present purposes. Our impression is favorable and we would cordially recommend that the Division of Biology and Agriculture endorse the endeavor of the Laboratory to secure larger financial support especially in the form of permanent endowment.'

"This report was considered by the Executive Committee of the Division at its meeting on August 14, 1929, and by the Division at its meeting on April 26, 1930. At the latter meeting the following action was taken by the Division:

" '**Moved:** That the report of the Committee be accepted and its recommendations approved, and that the endeavors of the Laboratory be endorsed by the Division of Biology and Agriculture.

Adopted.' "

Having this report at hand, Doctor W. C. Curtis, Chairman of the Committee on the Effects of Radiations upon Living Organisms, proceeded with a minimum of delay to cooperate in granting the request of the Laboratory. As a result of the excellent work which he and his Committee have already done, and as a result of his interest and cooperation in furthering research concerning the biological effects and biological applications of radiations, we have already received important gifts and promises of gifts from leading commercial companies in the country interested in such research and in apparatus pertaining to it.

This apparatus will be useful to biologists who work at the Laboratory during the summer, as well as of great value to Doctor Fricke and his associates in furthering researches which he has undertaken.

In December of this year (1930), the Board of Trustees of the Carnegie Corporation voted, upon the recommendation of its President, Mr. Frederick P. Keppel, and of its Executive Committee, to grant $15,000, payable in January, 1931, to the Laboratory for its work upon the adrenal cortex.* Application for this grant was made by our President, Arthur W. Page.

In recognition of the Association's financial support of their researches, Doctors Swingle and Pfiffner offered to give the Association royalties from their extract. This summer they signed a contract with Parke, Davis & Company, according to which, advance royalties to the extent of $10,000 per year for three years should be paid to the Association. The Association has expended all money thus received upon furthering the studies of Doctors Swingle and Pfiffner.

Research

A remarkable degree of cooperation existed between members of the all-year Staff, members of the part-time Staff, and the visiting biologists, so that it seems to be demonstrated that the permanent work, while producing results which are highly worth-while ends in themselves, makes the Laboratory more useful to those who conceive of it primarily as a clearing house for new methods and ideas.

The department of biophysics, as would be expected, offers an outstanding example of this. Six summer research workers, from six different institutions, took the opportunity to make definite and continued use of the personnel and apparatus of the biophysical laboratory, while many others occasionally benefitted directly. At the same time the work of the biophysical laboratory was, in some cases, advanced to a very appreciable extent by summer workers.

Biophysics

Doctor Fricke continued his research concerning the fundamental effects of X-rays. Among workers engaged in research upon the action of X-rays, three theories are held: (1) that the biological effects of X-rays

* In the time between the preparation and final publication of this report, Doctor Swingle made other arrangements and received a grant from another source, making the grant from the Carnegie Corporation no longer essential to the progress of his work. The Laboratory notified the Carnegie Corporation of this change. The significance of the original action of the Carnegie Corporation, however, remains.

are primarily electrical, (2) that the effects are primarily chemical, and (3) that their effects are due primarily to intense heat. Doctor Fricke's studies of the effects of X-rays upon water, upon water-solutions of sodium bichromate, potassium permanganate, potassium iodide, and ferro sulphate, strongly indicate that the effects of X-rays are due primarily to chemical action.

This work will be continued with other chemicals, with serum protein, and with cells, in order to obtain further direct proof as to whether or not chemical reactions take place in these substances as a result of irradiation.

The evidence of chemical reactions thus far obtained is in consonance with physical characteristics of X-rays, whereby they may frequently remove electrons from atoms, during bombardment, thereby bringing about immediate and direct chemical changes.

The research which Doctor Fricke is conducting upon the electric capacity of various cells and tissues drew two workers from other institutions to the Laboratory, Doctor Harry Goldblatt, Assistant Professor of Pathology at the Medical School of Western Reserve University, and Doctor Basile Luyet, Privat-Docent of la Constitution de la Matiere of the University of Geneva, Switzerland.

In the work with Doctor Goldblatt measurements were made of the electric capacity and conductivity of blood of rabbits, chickens, and turtles. It was found that the capacity of one square centimeter of red corpuscle surface is the same for all species. At the same time the size of corpuscles, and consequently the capacity of whole corpuscles, varies between species. The results indicate that the thickness of red corpuscle membrane is a universal constant. Previous work by Doctor Fricke has shown this thickness to be about 0.00000047 cm.

These results are particularly significant in view of the fact that the very existence of a corpuscle membrane had been considered hypothetical until Doctor Fricke's earlier work. The membrane cannot be seen, of course, by means of usual micriscopic technique. Still, it is now recognized, in the words of Doctor W. J. V. Osterhout, "that this surface layer is responsible for some of the most striking life phenomena such as bio-electrical effects, nervous transmissions, and selective permeability (by means of which the cell allows some substances to enter but rejects others), and it is believed that the slightest rupture of this layer, (unless instantly repaired) causes death [to the cell]."

Another discovery, made this summer by Doctors Fricke and Goldblatt, further demonstrated the possibility of detecting the presence of ultra-microscopic structures by the electric capacity method, when blood hemolyzed by a standard method, was found to still contain cell membranes.

As a result of work conducted by Doctor Basile Luyet, it was found that injury by heat, cold, alcohol or ether caused lowering of the electric resistance of plant tissues. The measure of this lowering of resistance was found to offer a very sensitive diagnosis of the beginning of tissue destruction, other indicators of death, such as the penetration of non-vital stains, for example, not showing the destruction until it was five or ten times more advanced.

Doctor Fricke is also developing techniques whereby soft X-ray photography may be rather widely applied to biological problems. Thus far the work has turned largely to photographing of insects to aid in taxonomic work and in physiological studies, which use insects as experimental material. In this work Doctor Fricke is collaborating with Mr. C. H. Curran, of the American Museum of Natural History, and with Doctor I. R. Taylor, of Brown University. During the summer, to a lesser extent, he was also able to be of service to Mr. John R. Huggins, of the University of Pennsylvania, and to Miss Louise Palmer, of the United States Bureau of Fisheries.

With the further development of technique and apparatus, it is hoped that it will be possible to make X-ray pictures of living cells, permitting, among other things, a study of the distribution of the heavier inorganic salts. Several commercial companies are cooperating by the construction of special apparatus for this, and other studies, being undertaken at the biophysical laboratory.

As a result of work accomplished in biophysics here this year, eight papers are in the process of preparation. These are listed in Doctor Fricke's report in the appendix, to which reference should be made for further details concerning this work. Details of interest are also given in the reports of Doctors Goldblatt, Luyet, and Taylor, and of Mr. Huggins.

Doctor Fricke has been assisted in his work this year by Doctor Martha Washburn, chemist, Mr. J. J. Force, glassblower, Mr. C. Henderson, instrument maker, and Mr. D. M. Gallagher, radio engineer.

Other Work on X-Rays

Mr. T. L. Smith, John D. Jones Fellow from Columbia, treated about 950 adult fruit flies **(Drosophila obscura)** in order to study the effects of irradiation in respect to the production of mutations. He found 22 apparent mutants among the 7500 offspring from treated parents. In untreated stocks, maintained as controls, but one mutant character was isolated. This indicates that irradiation by X-rays increases the incidence of mutations, a theory which seems to be increasingly supported by experimental data.

Mr. Smith found that a dosage of 1400 r-units was optimum for his experiments, while dosage of over 2250 r-units completely sterilized both males and females.

Pharmacology

The researches in pharmacology, under the leadership of Doctor Salant, were concerned chiefly with the actions of mercury and of ergotamine, both extensively used in medicine.

Doctor Salant and his staff found, in experiments conducted upon isolated frog heart, that calcium protects the heart against the injurious action of small doses of mercury. Larger amounts of mercury, however, seem to exert their characteristic depressive action upon the heart regardless of the amount of calcium in the nutrient solution. Increasing the amount of potassium has the same effect upon the action of mercury as

decreasing the amount of calcium. This is quite consistent with many other cases in which potassium and calcium seem to have opposite physiological actions.

Similar results in respect to the effect of calcium upon the action of mercury were obtained in animals with the heart in situ. In those cases the amount of calcium was decreased by injections of sodium citrate and sodium oxalate, by removal of the parathyroid gland and by diet; and was increased by injections of calcium chloride, and by diet. There are also some indications that mercury decreases the calcium in the tissues.

Experiments are being conducted in order to learn the effect of repeated injections of sodium citrate and sodium oxalate on calcium metabolism.

Doctor Salant has found that changes in the concentration of calcium and of potassium, or in the alkalinity or acidity of the nutrient fluid may also modify the response of isolated intestine to ergotamine.

Preliminary reports embodying some of these results may be found in the publications listed in Doctor Salant's report. Working with Doctor Salant at various times during the year were: Doctor Martha Washburn, chemist, Doctor David Anchel, Messrs. William M. Parkins, Harold Nagler, Philip A. Wilchins, George Houston, and Albert Zubow.

The Hormone of the Suprarenal Cortex

Doctors Swingle and Pfiffner, and their associates, have carried their work upon the hormone of the adrenal cortex to the first step in clinical use. During the year considerable progress was made in purifying, and further fractionating the potent extract which they had last year. It will be remembered that with the aid of this extract, cats, from which both adrenal glands had been surgically removed, could be kept alive indefinitely, untreated operated animals die in from one to two weeks, and treated animals, when no longer given the extract, soon die with symptoms typical of adrenal insufficiency. Mr. Parkins, as may be seen from his report, has found that the efficacy of the extract is not limited to mammals, but that it also holds for chickens.

During the year the extract was made soluble in water, thereby permitting its use in human patients. The first person upon whom it was used was a patient suffering from Addison's disease, at the Mayo Clinic. Under the guidance of Doctors Rowntree and Greene of that Clinic, treatment with the extract met with remarkable success, further details of which may be obtained from some of the publications listed in Doctor Swingle's report.

Meanwhile, Doctor Pfiffner found a method whereby practically all of the adrenalin present in the extract could be removed without losing the potency of the extract. This steps permits intravenous injection in persons.

As this report goes to press (February, 1931), there is considerable evidence that the physiological function of the adrenal cortex has been discovered. This will probably be made public in the near future.

Working with Doctors Swingle and Pfiffner are Doctor Phyllis Bott, and Mr. Alton P. Taylor, both chemists.

Physiology of Reproduction

It may be recalled from last year's report that, with the aid of an extract of sow's corpora lutea, rats, whose ovaries were removed after the beginning of pregnancy, continued pregnant and produced normal young. The work this year has confirmed these results in further experiments in rats, while similar results have been obtained in mice.

While such successful results are not invariably obtained, they have occurred in a sufficiently large number of cases to warrant the conclusion that the corpora lutea have an important function in relation to the maintenance of pregnancy. The results obtained here with the extract prepared by Doctor Pfiffner are further substantiated by experiments conducted by Professor George E. Johnson, of Kansas State Agricultural College, who has obtained similar results with this extract, and with Doctor George W. Corner's extract, in ground squirrels and in rats. Doctor Corner has met with success in using his extract on rabbits.

In addition, in our experiments, we have found that when the extract is administered to pregnant rats whose ovaries have not been removed, pregnancy continues beyond the normal term. Such has been the case invariably, so far. Indeed, the extract, if administered continuously, often prevents even delayed birth, necessitating caesarian operation. The over-term young thus produced are considerably larger than the young produced by untreated mothers.

During the year there were seven rats which had strikingly abnormal breeding records. These animals, though living under the same conditions as other rats with normal records, did not produce young. The individual records of these animals covered from some twelve to forty matings. There was evidence that each animal had aborted at least once. Each of these animals, when treated with the extract, carried young to term. At all other times they failed to do so.

At the present time a standardizable test for potency in extracts is being sought.

Doctor Harris, aided by Miss Dorothy Newman, conducted the experiments. Doctor Pfiffner prepared the extract. Mr. Harold Bleier gave his services to the work, for a time.

Bryology

Doctor A. J. Grout is occupied with the preparation and publication of a series of monographs covering the "Moss Flora of North America North of Mexico".

During the year he has prepared manuscript covering a number of genera of mosses and some of this is now in press.

Doctor A. LeRoy Andrews has undertaken the preparation of manuscript for one group (the Bryaceae), and Mr. George N. Jones is similarly engaged with another family (the Grimmiacae).

Cats in Relation to Disease Transmission

Studies on cats in relation to disease transmission are being undertaken because of their obvious practical importance, and because of the oppor-

tunity which they afford of gaining additional information concerning the fundamental problems of host-parasite specificity.

Doctor Denis R. A. Wharton commenced these studies with a review of the scientific literature to date. From this it appears that very little is known definitely concerning the part which cats may play in the transmission of human disease. With the exception, possibly, of rabies the likelihood of cats' transmitting disease seems to be unsettled. This is true even in respect to diphtheria, where suspicion rests heavily on cats.

Doctor Wharton summarizes his review in his report. He is about to commence experiments to test the ability of cats to act as transmitters of diphtheria. It is expected that this will be followed by similar experiments concerning other diseases.

The extent to which disease-producing bacteria and parasites are adaptable to other forms of animals than those in which they are usually found is likewise a question about which there is considerable difference of opinion. This question will, of necessity, arise during the course of Doctor Wharton's experiments, and it is expected that they will provide further data for its eventual solution.

Seasonal Research

The Laboratory continues to act as a clearing house for scientific methods and ideas, at the same time furnishing the opportunity for biologist to carry on research during the summer. The number of biologists to whom the Laboratory can thus be of service has now reached a relatively constant figure at forty, fixed by present laboratory facilities and living accommodations. This number of research workers is augmented by some twelve or fifteen members of the permanent staff.

A number of the visiting investigators, their institutions and their work, are listed herewith, though others who cooperated particularly with members of the all year staff are omitted from this list as they have already appeared in the statements concerning all-year work.

The type of work carried on by visiting investigators covered, of course, a wide range of experimental biology and medicine. As the reports of individual workers are appended to this report their research will not be considered in detail here, but is merely listed under several, more or less arbitrarily chosen, headings.

Medical Biology

A large number of the research workers who make use of the Laboratory during the summer are concerned with problems in medical biology. For the most part these problems fall under the general heading of mammalian physiology. At the same time it is of interest that research in bacteriology again appeared at the Laboratory this summer, after an absence of more than a quarter of a century. During the early years, bacteriology was one of the major interests of the Laboratory, the second Director, Doctor Conn (1890-1897), being a bacteriologist.

Doctor I. S. Kleiner, Professor of Physiological Chemistry, of the New York Homeopathic Medical College and Flower Hospital, assisted by Mr. Joseph Hahn and Miss Rebecca Halpern, of the same institution, carried

further his experiments on blood sugar in diabetes. He also studied the toxicity of certain amines, attempting to correlate differences in physical structure with differences in physiological effect. During Doctor Kleiner's illness, Doctor Anchel aided in the work.

Doctor Franklin Hollander, Assistant Professor of Physiology, New York Homeopathic Medical College, continued his studies on gastric secretion, being particularly concerned with the cellular mechanism by which hydrochloric acid is formed in the stomach. He was assisted by Mr. A. G. Hollander, of University and Bellevue Hospital Medical College.

Mr. Keeve Brodman, of Cornell University Medical College, and Mr. Edmund W. Overstreet, Johns Hopkins University School of Medicine, conducted experiments designed to obtain information concerning the pathological physiology of calcium and phosphorous in the mammalian body.

Doctor George W. Corner, head of the Department of Anatomy, University of Rochester School of Medicine and Dentistry, and Doctor Jessie L. King, Chairman of the Department of Physiology and Hygiene, Goucher College, continued a series of experiments concerned with the normal mechanism of transplantation of embryos from the ovaries to the uterus.

Mr. Charles Potter, undergraduate assistant, Brown University, working under the direction of Doctor Corner, experimented with the induction of lactation by injection of alkaline extracts of the anterior pituitary.

Doctor L. T. Webster, Associate in Pathology and Bacteriology, Rockefeller Institute for Medical Research, conducted experiments concerned with the method of spread of infectious diseases of man and animals. His research during the summer was concerned with (1) infectious bronchitis of chickens, (2) Pasteurellosis of rabbits, and (3) Meningococcus meningitis.

Mr. George Daniel, assistant in the Department of Protozoology, Johns Hopkins University School of Hygiene and Public Health, conducted physiological studies on a parasitic protozoan from the domestic pig.

General Physiology

It will be seen that some of the foregoing work in mammalian physiology goes over into that modern branch of biology in which chemical methods and knowledge are used in the solution of biological problems. This promising field finds even more exponents in general physiology, a fundamental science without the aid of which the oftentimes more immediately practical science of mammalian physiology could not make the progress it is enjoying.

The work in general physiology at The Biological Laboratory has, for the most part, been conducted upon fishes, and other cold-blooded forms.

Doctor I. R. Taylor, Assistant Professor of Biology, Brown University, and Mr. Frederick Crescitelli, graduate student of the same university, continued studies of the metabolism of pupae of the bee moth **(Galleria mellonella)**, with a view to correlating changes in the oxygen consumption with changes in the organization of tissues of the pupae. They also studied chemical transformations taking place in pupae, particularly that of fat into glucose.

Mr. Julius Schwartz, instructor in Biology, DeWitt Clinton High School, New York City, working under the direction of Doctor Taylor, studied the effect of desiccation on metabolism of pupae of **Galleria mellonella.**

Doctor William H. Cole, Professor of Physiology and Biochemistry, Rutgers University, continued his researches upon chemical stimulation in animals. This summer he was particularly concerned with aliphatic aldehydes and acids.

Doctor J. H. Bodine, head of the Department of Zoology, State University of Iowa, occupied himself further with the action of pituitary extract on the melanophores of the fish, **Fundulus.**

Professor Asa A. Schaeffer, Professor of Zoology, of the University of Kansas, assisted by Miss Olive K. Schaeffer, of the same institution, continued his studies upon spiral movement, attempting to find its physical causes.

Miss Louise Palmer, of the United States Bureau of Fisheries, continued her studies on starfish control, paying particular attention to the use of copper sulphate.

Embryology

Research in embryology covered several types of embryonic development.

Doctor S. I. Kornhauser, Head of Department of Anatomy and Embryology, University of Louisville School of Medicine, continued his studies of the growth of eggs (oocytes), in the maritime earwig **(Anisolabis).** At the same time he paid particular attention to the effects of supra-vital dyes.

Doctor George B. Jenkins, Head of the Department of Anatomy, George Washington University Medical School, was interested in the correlation of physical changes with chemical processes during development in the embryo of the fish, **Fundulus heteroclitus.**

Mr. John R. Huggins, instructor in the Department of Zoology, University of Pennsylvania, studied morphological changes in the pupal stages of the fruit fly, **Drosophila melanogaster.**

Botany

Doctor Henry S. Conard, Head of the Department of Botany, Grinnell College, continued his ecological studies of plants of this region.

Doctor A. W. Blizzard, Head of the Department of Biology, Coker College, completed his work on the vegetation and plant sociology of High Hill.

Doctor Frederick K. Sparrow, Jr., Instructor in Evolution, Dartmouth College, continued his taxonomic studies of Fungi.

Other Research

Mr. C. H. Curran, Assistant Curator of Entomology, American Museum of Natural History, conducted faunistic studies of local insects, with special reference to Diptera (flies).

Doctor Paul R. Needham, Instructor in Biology, University of Rochester, aided in taxonomic work on the fresh water fauna of the region.

Resume of Seasonal Research

The foregoing lists should serve to indicate the wide range of experimental work in which The Biological Laboratory is privileged to aid. They also indicate the variety of institutions which the Laboratory serves, in addition to promoting its own research; and they set forth with what success the Laboratory is meeting its responsibility of serving as one of the major clearing houses for biologists.

Instruction

This summer, for the first time, an experiment was tried in scheduling courses. Heretofore, all courses (each of six weeks duration), began and ended at the same time. This year the schedule was so arranged that the course in Field Zoology was given the first part of the summer (June 19th through July 30th), and the course in Botany was offered during the last part of the summer (August 1st through September 11th). The other courses were given at the usual time.

The method had been tried at Woods Hole the previous year with apparent success. At the Laboratory here it has seemed to be equally satisfactory, and will be continued this year. Among its advantages are (1) Field Zoology and Botany use but one student laboratory now, whereas previously they each had a laboratory; (2) the same living quarters serve for the students of both courses, as the students in Field Zoology leave before those in Botany arrive; (this has allowed us to do away with tents, as living quarters, a previous source of some dissatisfaction); and (3) the dining hall is no longer crowded at any time during the summer, and thus the Laboratory is able to continue to welcome, in its dining hall, biologists from the Carnegie Institution, as it has for over twenty-five years.

The courses were maintained upon the advanced basis upon which they have been built of late. No courses were eliminated, and no new courses were added. There were thirty students.

The course in Field Zoology remained under the competent leadership of Dr. S. I. Kornhauser, aided by two new staff members, Dr. P. R. Needham, of the University of Rochester, specialist in fresh-water biology, and Mr. C. H. Curran, entomologist, of the American Museum of Natural History.

Dr. I. R. Taylor, a new member of our summer staff, from Brown University, ably conducted the course in General Physiology.

Dr. George W. Corner, of the School of Medicine of the University of Rochester, continued his excellent work in charge of the course in Surgical Methods in Experimental Biology.

The staff of the course in Field Botany and Plant Ecology remained unchanged, Professor Henry S. Conard, of Grinnell College, teaching with his usual success, and supported by Doctors Frederick K. Sparrow, Jr., and A. W. Blizzard. Doctor A. J. Grout, specialist in mosses, was in Europe during the summer.

Students

The following lists, in addition to naming the students at the Laboratory this year, give indication of their sources, trainings and experiences.

In Field Zoology: Joseph V. Anthony, St. John's College; Cazlyn G. Bookhout, A. B., St. Stephen's College, A. M., Syracuse University, Instructor in General Biology, North Carolina College for Women; R. Elizabeth Cass, scholarship from Ohio Wesleyan University; Nancy Downes, Birch Wathen School; Elizabeth Fentress, A. B., Hollins College, graduate assistant at Hollins; Judith S. Fowler, scholarship from H. Sophie Newcomb College; Robert Gaunt, A. B., University of Tulsa, M. A. Princeton University, graduate assistant at Princeton; Violet L. Harris, B. S., Georgia State College for Women, Instructor, Brenau College; Helen Hilsman, scholarship from University of Pittsburgh; D. Ralph Hostetter, A. B., Franklin and Marshall College, Ed. M., Harvard University, Instructor in Biology and Chemistry, Eastern Mennonite School; Louise G. Isfort, Swathmore College; Dorothy Mary Keppel, Briarley School; Louise McKain, University of Pittsburg.

In General Physiology: Laura B. Bent, Smith College; Frederick Crescitelli, Ph. B., Brown University, scholarship from Brown; Julius Schwartz, B. S., College of the City of New York, Instructor of Biology, De Witt Clinton High School, and graduate student Columbia University.

In Field Botany and Plant Ecology; Genevieve R. Anthony, Pennslyvania College for Women; Elizabeth Boutelle, B. E., Rhode Island College of Education, teacher elementary school, Providence, Rhode Island, teacher Nature Study, Biological Laboratory; Florence De Puy Jacobs, A. B., Goucher College, assistant in Botany and Bacteriology, Hood College; Willie A. Morgan, undergraduate assistant and B. S., Coker College; George R. Nagamatsu, B. S., University of Washington; Marian A. Parker, scholarship from Adelphi College; Josephine H. Ross, Wellesley College.

In Surgical Methods in Experimental Biology: Robert Gaunt, A. B., University of Tulsa, M. A., Princeton University, graduate assistant at Princeton; Clarence A. Horn, B. S., Pennsylvania State College, M. A., Columbia University, Professor of Biology, Albright College; Miriam E. James, B. S. and M. A., Boston University, Teacher of Biology, Gloucester, Massachusetts High School, also graduate student; Charles Potter, undergraduate assistant, Brown University; Dorothy B. Rasch, Barnard College; Eva Saper, undergraduate assistant and scholarship from Barnard College.

Eight students were also enrolled in the course of lectures only, in Endocrinology.

Evening Lectures

The public evening lectures delivered at the Laboratory this year maintained the high standard which has been set. They are listed herewith:

Dr. A. F. Blakeslee, Department of Genetics, Carnegie Institution of Washington—"Production of Variation in Jimson Weed by Extra Chromosomes".

Dr. E. A. Boyden, Professor of Anatomy, University of Alabama School of Medicine—"Some Observations on the Function of the Gall Bladder".

Dr. W. H. Cole, Professor of Physiology and Biochemistry, Rutgers University—"Chemical Stimulation in Animals".

Dr. H. S. Conard, Head of Department of Botany, Grinnell College—"Biota of Yellowstone Park".

Dr. George W. Corner, Chairman Department of Anatomy, University of Rochester School of Medicine and Dentistry—"Twelfth Century Doctors of Salerno".

Dr. George W. Corner, Chairman Department of Anatomy, University of Rochester School of Medicine and Dentistry, and Doctor Reginald G. Harris, Director, The Biological Laboratory—"The Maintenance of Pregnancy by Extract of Corpus Luteum".

Mr. C. H. Curran, Assistant Curator, Department of Insect Life, American Museum of Natural History—"Some Insects from Barro Colorado Island".

Dr. Charles B. Davenport, Director, Department of Genetics, Carnegie Institution of Washington—"Mechanism of Organic Evolution".

Dr. Hugo Fricke, Biophysics, The Biological Laboratory—"Electric Properties of Living Cells."

Dr. Franklin Hollander, Assistant Professor of Physiology, New York Homeopathic Medical College and Flower Hospital—"Gastric Secretions".

Dr. P. R. Needham, Instructor in Biology, University of Rochester—"Quantitative Studies on Aquatic Animals".

Dr. William Salant, Pharmacology, The Biological Laboratory—"The Role of Calcium and Potassium in Determining Pharmacological Action".

Dr. Asa A. Schaeffer, Professor of Zoology, University of Kansas—"Spiral Movement in Man in Relation to Blind Flying".

Dr. F. K. Sparrow, Jr., Instructor in Evolution, Dartmouth College—"Additions to the Phycomycete Flora of Cold Spring Harbor".

Dr. W. W. Swingle and Dr. J. J. Pfiffner, Princeton University and The Biological Laboratory, (lecture delivered by Doctor Swingle)—"An Active Extract of the Adrenal Cortex".

Dr. I. R. Taylor, Assistant Professor of Biology, Brown University—"Metabolism of Pupae of **Galleria mellonella** (Bee Moth)".

Dr. L. T. Webster, Rockefeller Institute for Medical Research—"Experimental Epidemiology".

Women's Auxiliary Board

The Women's Auxiliary has continued its excellent support of the work of the Biological Laboratory, notably by completing its three year pledge to the Special Research Fund.

Last year's officers were reelected as follows: Mrs. Walter B. James, President; Mrs. Russell C. Leffingwell, Vice President; Mrs. George Nich-

ols, Treasurer; Mrs. Acosta Nichols, Secretary; Mrs. Walter Jennings, Chairman of the Finance Committee; and Mrs. John H. J. Stewart, Chairman of the House Committee.

At the annual meeting held in October, plans for improving living conditions were discussed. Dr. Fricke gave a demonstration of the method of measuring the electric capacity of malignant tumors.

Classes in nature study for children were organized this year by Mrs. Ferninand Eberstadt. Twenty-three children were enrolled, and were instructed by a competent teacher, Miss Elizabth Boutelle.

Wawepex Society

The Wawepex Society, under the leadership of Charles M. Bleecker, Governor, Jesse Knight, Scribe, and Walter J. Whipple, Custodian, continues to lease certain buildings and grounds, and to give financial support to the Laboratory in the generous manner of its founder, Mr. John D. Jones. This year the Wawepex Society contributed $1500, additional to its usual grant to the Association.

Gardens Opened to The Biological Laboratory

The visiting of gardens in this vicinity continues to be a source of interest and pleasure to members of the Laboratory. Under the direction of Doctor Conard these visits are of unquestionable value. In 1930 the following persons very kindly opened their gardens to members of the Laboratory: Mr. W. R. Coe, Mrs. Henry W. deForest, Mrs. Robert W. deForest, Mr. S. A. Everitt, Mr. Anton G. Hodenpyl, Mrs. Walter B. James, Mr. Otto H. Kahn, and Mr. Louis C. Tiffany, (Art Foundation, house and gardens).

New Members

The following new members have been received in the several classes as given herewith:

Founders—Mr. Henry W. deForest and Mr. J. P. Morgan.

Patrons—Dr. James C. Ayer, Mr. Thomas Cochran, Mr. S. A. Everitt, Mr. A. G. Milbank, Mrs. George Nichols, Mr. Harold I. Pratt.

Sustaining Members—Mr. Paul Abbott, Mrs. B. R. Harris, Rev. John R. Huggins, Mrs. Francis C. Huntington, Mr. Junius S. Morgan, Jr., Dr. Paul R. Needham, Mr. Edmund W. Overstreet, Mrs. Philip J. Roosevelt, Mr. Henry C. Taylor, Dr. L. T. Webster, Mr. W. H. Vanderpoel.

Cooperating Institutions

Forty-four colleges, universities, and medical schools were represented at the Laboratory this year.

The following institutions cooperate in the work of the Laboratory by granting scholarships in their institutions applicable to The Biological Laboratory, or by a loan of equipment, or by giving financial aid to members of their institutions in residence at the Laboratory.

Adelphi College
American Museum of Natural History
Barnard College
Brown University
Coker College
Columbia University
Cornell University Medical College
Johns Hopkins University
H. Sophie Newcomb College
Long Island University
Lucius N. Littauer Foundation
New York Homeopathic Medical College and Flower Hospital
Ohio Wesleyan University
Princeton University
Rockefeller Institute for Medical Research
Rutgers University
United States Bureau of Fisheries
University of Kansas
University of Pennsylvania
University of Pittsburgh
University of Rochester School of Medicine and Dentistry
Yale University

Contributions

Contributions from members of the Long Island Biological Association continue to form the backbone of the financial support of The Biological Laboratory. This year over $50,000 were received, for current expenses, from members of the Association and of the Women's Auxiliary. In addition to this, special mention should be made of Doctor William J. Matheson's bequest of $20,000 for endowment. Contributions were received as follows—from $1,000 to $20,000: Mrs. Ethel Clyde, Thomas Cochran, Henry W. deForest, Mrs. Leonard K. Elmhirst, Marshall Field, Walter Jennings, Russell C. Leffingwell, Wilton Lloyd-Smith, Estate of Doctor William J. Matheson, Mr. and Mrs. Van Santvoord Merle-Smith, Arthur W. Page, Parke, Davis and Company, Harold I. Pratt, Mortimer L. Schiff, Louis C. Tiffany, William K. Vanderbilt, and the Wawepex Society; from $500 to $1,000: Doctor James C. Ayer, W. R. Coe, Anton G. Hodenpyl, Mrs. Otto H. Kahn, J. P. Morgan, and Acosta Nichols; from $100 to $500: Frank L. Babbott, Miss Rosina Boardman, John W. Davis, Mrs. H. P. Davison, Mrs. Henry W. deForest, Robert W. deForest, F. N. Doubleday, Mrs. E. Marshall Field, Mrs. Childs Frick, Mrs. Walter B. James, Mrs. Walter Jennings, Mrs. Russell C. Leffingwell, Gerald M. Livingston, William J. Matheson, Albert G. Milbank, Ogden L. Mills, Junius S. Morgan, Jr., Mrs. Acosta Nichols, Mrs. George Nichols, Isaac R. Oeland, Frederick B. Pratt, Louis A. Robb, Mrs. W. Emlen Roosevelt, John K. Roosevelt, S. A. Salvage, Carl J. Schmidlapp, Henry L. Stimson, Henry C. Taylor, George Whitney, Mrs. Timothy S. Williams, Mrs. Willis D. Wood, and Willis D. Wood.

Grounds and Buildings

One of the Association's lots, No. 20, was sold to Dr. Fricke early this year. His desire to build a house immediately necessitated the construction of a road, and the extension of water, light and telephone lines, thus opening for present and future use the northeastern part of our property.

Further minor improvements were made in living quarters, and all tents were eliminated from the Laboratory grounds.

The erstwhile fire house of Cold Spring Harbor village was purchased from the Fire Commissioners, and moved by barge to a site just north of the physiology laboratory. It is planned to remodel this building, so that it will be suitable for living quarters by arranging one apartment on each floor.

Living Accommodations

Since the formation of the Association the improvement of living quarters has been undertaken whenever funds were available for that purpose. Much has been accomplished, and much remains to be done. The problem has become acute as the new policy of the Laboratory has come nearer to realization. Living accommodations which were suitable in 1924, the year the Laboratory was transferred to the Association, are no longer suitable, because of the marked change in the age and habits of those using them. In 1924 the ratio of research workers to students was less than 1 to 5. Now the ratio is nearly 2 to 1 in favor of those carrying on research. The number of professors, heads of their departments, carrying on work at the Laboratory last summer was about the same as the number of undergraduate students. Our summer living accommodations must be brought up to a standard appropriate for the use of mature, established biologists.

Our winter living quarters are already more suitable and we have been happy to make them available, not only to our own staff, but to the Carnegie Institution as well. Thus of 25 people living in Laboratory houses this winter 10 are from the Biological Laboratory and 15 from the Department of Genetics of Carnegie Institution. Similarly, of 23 eating at the Laboratory this winter 8 are from the Laboratory and 15 from Carnegie Institution; last summer the figures were 88 from the Laboratory and 40 from Carnegie Institution.

Improvement in our summer living accommodations will, without doubt, bring with it a further advance toward the realization of the policy which our Board of Directors adopted three years ago, the value of which has already been demonstrated.

Library

Considerable progress has been possible in respect to library because of the fact that the library was relatively small. Mrs. Ethel Clyde has continued her support of subscriptions to certain scientific journals, and we have recently been informed of the willingness of some publishing houses to donate books on biology.

In building up our library it is our policy to work to the mutual advantage of the Laboratory and of the Carnegie Institution. With this in mind we have made it a rule, with very few exceptions, to subscribe only to journals which are not on file in the library of the Department of Genetics. This policy makes more scientific periodicals available to biologists at Cold Spring Harbor, regardless of institutional affiliations, and makes only the more desirable the building up of our library.

Recommendations

It is recommended that special consideration be given, during the coming year, to (1) the improvement of living accommodations, and (2) the building up of the library. Progress in the accomplishment of each of these recommendations cannot but place the Laboratory in a better position to fulfill its purposes of being of the greatest practicable use to biology in this country.

The procuring of a suitable endowment must be one of our major concerns. While members of the Association have, for the most part, maintained their support, in spite of the many additional demands made upon them by the exigencies of the times, it is, nevertheless, very undesirable that the fundamental work of the Association should in any way be subject to temporary financial fluctuations.

Acknowledgments

Acknowledgment is made of the valuable advice given by members of the staff and of the Scientific Advisory Committee. The Committee has had two meetings this year, one during the summer at the Laboratory, and one during the meetings of the American Association for the Advancement of Science, at Cleveland. The advice received from these sources finds expression in the policy, and in the conduct of the Laboratory, and in the recommendations offered in this report.

In the work of maintaining and supporting the Laboratory, especial thanks are due to the officers and members of the Association and of the Women's Auxiliary. Without their sustained support the accomplishments of this year would not have been possible. Finally I wish to express my appreciation of our President, Mr. Arthur W. Page, whose intelligence and courage form one of the best guarantees of the future, that any organization could have.

Reginald G. Harris.

Report of the Scientific Advisory Committee for the Year 1930

The Scientific Advisory Committee is of the opinion that the general policies and aims of the Laboratory have been greatly strengthened by the marked emphasis placed upon the research program by the Director and Board of Trustees. Increased research facilities have made possible a more comprehensive research program.

Rigid selection of students with a consequent lowering of numbers had added much to the quality of beginning research students coming to the Laboratory.

Continued financial support to make possible the proper research plans seems imperative.

J. H. Bodine,
Chairman of the Committee.

Report of Special Scientific Advisory Committee on Biophysics

The advisory scientific committee has much pleasure in reporting the work conducted in the biophysical laboratory under the direction of Doctor Hugo Fricke, who has been assisted this year by Doctor Washburn, Messrs. Force, Henderson, and Gallagher, and during the summer by Doctors Goldblatt and Luyet.

X-Rays: The chemical effect of X-rays on watery solutions of sodium bichromate, potassium permanganate, and potassium iodide, and on pure water has been measured. Work has been done on developing suitable methods for gas analysis for the purpose of studying gas exchange in chemical reactions produced by X-rays. Special X-ray tubes have been constructed for soft X-ray photography. With these tubes, a study of X-ray photography of insects has been begun. The methods for constructing the X-ray tubes have been improved.

Electrical work: A systematic study of the electrical conductivity and capacity of various kinds of biological tissues has been undertaken. Doctor Basile Luyet of the University of Geneva made an investigation of the changes produced in the conductivity and capacity of the stems of plants when the plant was injured or killed. Doctor H. Goldblatt of Western Reserve University made a study of the conductivity and capacity of red corpuscles of various species, including rabbit, chicken and turtle. Special investigation was made of the change produced in the capacity of the red corpuscle during hemolysis. Work was also done on the conductivity and capacity of various kinds of bacteria. A special apparatus for determining the electrical conductivity and capacity at very high frequencies up to $20 \cdot 10^6$ cycles has been constructed.

A thermoelectric apparatus for measuring the temperature of various organs of living animals has been constructed. Preliminary work has also been done on apparatus for measuring gas exchange and total heat for very small living organisms.

W. J. V. Osterhout

Report of the Secretary of the Association

During the calendar year 1930 and up to February 3rd, 1931, there were held the following meetings:

Seventh Annual Meeting of the Corporation on July 29th, 1930, at which about 20 members were present. The secretary reported the deep sense of loss in the deaths of former members of the Association, two of whom had official relations to the organization; Dr. W. J. Matheson, who died in Florida, May 15, 1930, was a member of the Board of Managers of The Biological Laboratory of the Brooklyn Institute of Arts and Sciences, 1901 to 1923, and its president from 1905 to 1923. Col. Timothy S. Williams, who died in New York City, June 3, 1930, was first president of the Association from 1923 to 1926, when ill health forced him to resign. At the time of his death he was a member of the Board of Directors and of the Executive Committee. Copies of the resolutions passed by the Association, at the Executive Committee meeting, in the case of Dr. Matheson and Col. Williams are printed herewith. Mr. W. Emlen Roosevelt died in New York City, May 15, 1930, a patron of the Association. Rev. Benjamin R. Harris died in New Haven, Conn., May 29, 1930, a sustaining member of the Association since its foundation. A younger son, Reginald G. Harris, is director of the Laboratory.

Mr. Nicholas F. Brady died March, 1930. He was a patron of the Association and his advice was of much value to it. The Association also regrets the death of Mr. Edward Floyd-Jones, a nephew of John D. Jones, and a patron of the Association.

It was voted that the actions taken by the Board of Directors and the Biological Laboratory are hereby approved and ratified. The following amendment to the By-Laws, Article 3, paragraph 5, was voted, as follows: Sec. 5. Any Director, who is engaged in administration, instruction or research at The Biological Laboratory may receive such salary as shall be voted to him from time to time by the Board.

The following were unanimously elected as members of the Board of Directors, class of 1934: Herman Bumpus, George Draper, M. L. Schiff, W. W. Swingle, H. C. Taylor, Willis D. Wood, S. R. Detwiler. The Laboratory director made a report on the work of the Laboratory.

During the year there were held also four meetings of the Board of Directors and two meetings of the Executive Committee.

a. The 15th meeting of the Executive Committee was held at the office of Mr. Leffingwell, Wall and Broad Streets, New York, on March 18th, 1930. This was devoted to a discussion of the policy of the Association toward the sale of land.

b. The 16th meeting of the Executive Committee was held at the office of Mr. Leffingwell April 14th, 1930, and the form of deed of land to Dr. Fricke was approved and the president and secretary authorized to give deed. Recommendations were made to the Board of Directors for certain amendments in the By-Laws.

c. The 21st meeting of the Board of Directors was held at the office of R. C. Leffingwell April 22nd, 1930. Mr. Taylor, of the committee on buildings and lands, reported the conditions included in the proposed deed to Dr. Fricke and the sale was approved. It was voted that lots 1 to 18

on the Association's map of lands were not to be sold without special vote of the Board. Also that any deed to lot 19 shall specifically provide right of way over this lot to Lot No. 10. The following amendments to the by-laws were passed providing for additional vice-presidents (totalling 3), an assistant secretary and additional officers and providing that the vice-presidents shall perform the duties of the president in order of their seniority, in case of the absence or disability of the president. Dr. Osterhout was nominated vice president and Dr. R. G. Harris, assistant secretary. Mr. Page was authorized to appoint a committee on plans and policy and, at his discretion, a committee on ways and means to report to the Board.

d. The 22nd meeting of the Board of Directors was held at the Broad Street Club, New York City, May 15th, 1930, 15 members being present. Dr. Harris was elected director of the corporation in the vacancy created by the resignation of Col. H. L. Stimson. A more formal vote, as required in connection with the securing of leave of the Supreme Court to the sale of property to Dr. Fricke was passed. It was voted to authorize the proper officials to obtain an Act of Legislature to enable the Association to sell its land without the necessity of obtaining action of the Court in each case.

e. The 23rd meeting of the Board of Directors was held at Blackford Hall, Cold Spring Harbor, July 29th, 1930, 12 members being present. The officers of the preceding year were re-elected. The president announced two vacancies in the Executive Committee caused by the death of Col. T. S. Williams and the resignation of Mr. Leffingwell from the Executive Committee. The following members were elected to the Executive Committee: Arthur W. Page, Walter Jennings, Marshall Field, W. J. V. Osterhout, John K. Roosevelt, Acosta Nichols, C. B. Davenport. The report of the comittee on plans and scope was submitted to the Board. Dr. Swingle having communicated to the Board his purpose of transferring to the Association the royalty of $10,000 a year from Parke, Davis and Company, it was voted to apply this to the promotion of Dr. Swingle's work. The gift of Mrs. Ethel Clyde of periodicals and furnishings for the library was accepted with thanks.

f. The 24th meeting of the Board of Directors adjourned from December 30th, 1930, was held at the Broad Street Club, New York City, on February 2nd. 14 members were present. The director of the laboratory gave a summary of the report of the operations of the Laboratory and read the report of the treasurer for 1930. Mr. Page presented a statement and budget for the year 1931. It was voted to continue the summer work as hitherto; to provide for the financing of the researches of Dr. Fricke, Dr. Salant, Dr. Grout, and Dr. Wharton; to return to Dr. Swingle the $10,000 transferred by him to the Laboratory being the first installment of the royalty of $10,000 a year from the Parke, Davis and Company; and to elect Dr. James Cook Ayer, of Glen Cove, New York, to the Board of Directors, class of 1933, in place of Harold I. Pratt, resigned, and Mrs. Van Santvoord Merle-Smith to the class of 1932 in place of Col. Williams, deceased.

Charles B. Davenport,
Secretary.

During the year 1930 the Association has suffered severe losses in the deaths of two persons who were intimately connected with the development of the Laboratory and of the Association. Minutes were prepared as follows:

"The Executive Committee of the Long Island Biological Association desires hereby to express its feeling of great loss in the death of Dr. William J. Matheson, a Founder of the Laboratory, and to put on record their affection for him and appreciation of the work he did in its development. He was a member of the Board of Managers from 1901 to 1923, and its president from 1905 to 1923.

"Mr. Matheson became actively interested in the Laboratory immediately upon his taking a residence in Cold Spring Harbor. One of his outstanding achievements was the extermination of mosquitoes on the North Shore of Long Island and in this effort he found the personnel of the Laboratory of much assistance. Blackford Hall was erected during his early presidency; the architect, Mr. Gardner, wrought out Mr. Matheson's ideas and specifications, which stand embodied in it.

"Mr. Matheson, from the time of his arrival at Cold Spring Harbor, cooperated in his enthusiastic fashion with the Laboratory. He lent it the use of his yacht; he opened his gardens for its study; he entered its Board of Managers; became a Trustee of the Brooklyn Institute of Arts and Sciences to look after the Laboratory's interests and guided its policies for many years. He gave generously alike of time, thought and money to its support. Trained in science himself, he was the better qualified to appreciate the scientific work of the Laboratory.

"In recognition of these services the Executive Committee of the Association directs that this minute be entered on the records of the Association and copies be sent to members of the family."

"In the death of Timothy Shaler Williams on June 3rd, 1930, the Long Island Biological Association loses one who played the principal part in its organization in 1924, and served as its first president, until failing health made it necessary for him to resign in 1926. To his incisive legal mind and to his critical care and attention in the details of organization the highly satisfactory charter and rules of the Association are chiefly due. The structure built by him has elements of stability that ensure that it will long continue as a memorial to its architect. The loyalty of Col. Williams to the Association was shown by his generous support of and his continued attendance (with an almost perfect record) upon the meetings of the Board and Executive Committee, despite his imperfect health.

"The Executive Committee of the Association desire to record their appreciation of his devotion to the interests of the Association and their affection for him as a collaborator and friend.

"**Resolved,** that this minute be incorporated in the records of the Association and a copy sent to Mrs. Williams."

Resolutions were also passed of regret and sense of loss in the death of Mr. Nicholas F. Brady, patron of the Association.

"The directors of the Long Island Biological Association desire to

place on their records an expression of their regret and sense of loss in the death of Mr. Nicholas F. Brady. Mr. Brady's extensive, important and varied responsibilities in finance and industry did not lessen the keen interest which he always displayed in educational and humanitarian undertakings. In this respect his vision, his generous impulse and his unusually practical and intelligent comprehension made him conspicuous among the foremost of our country's business men. He was quick to perceive and estimate the nature and the importance of the work of this Association, and with both money and advice responded generously to requests for his cooperation. Not only because of his intelligent appreciation of such work as the Association is doing, but also because of his residence during a large part of the year on Long Island, not far from the Association's home and laboratory, his identification with the Association as a Patron and adviser has been much appreciated by the officers and directors, and we feel bereaved in losing him from our membership.

"RESOLVED, that a copy of this resolution be sent to Mrs. Brady."

Charles B. Davenport,
Secretary.

Partial list of papers, either by those who have worked at the Laboratory this year, or reporting research conducted here.

Dr. W. H. Cole—Stimulation in **Balanus** and **Sagartia** by Normal Primary Aliphatic Aldehydes and Acids, Anatomical Record, 1930, Vol. 47, p. 309.

Dr. E. L. Corey—Fetal and Early Post-natal Responses of Rat Gonads to Pituitary Injections, Physiological Zoology, 1930, Vol. 3, pp. 379-391.

Dr. H. S. Conard—Symposium: Glacial Relicts South of and in the Last Moraine. 5. Iowa. Presented at meeting of the American Association for the Advancement of Science.

Dr. G. W. Corner (in collaboration with W. N. Allen, University of Rochester School of Medicine)—Physiology of Corpus Luteum VII. Maintenance of Pregnancy in Rabbit After Very Early Castration. Proc. Sec. Exp. Biol. and Med., Vol. XXVII, p. 403.

Dr. A. J. Grout—Vermont Mosses Again, The Bryologist, 1929, Vol. 32, p. 105. A Fossil Form of **Drepanocladus fluitans Jeanbernati (Ren.)** Grout, ibid., 1930, Vol. 33, p. 33. The Cambridge Botanical Congress (Sub-Section on Nomenclature), ibid., 1930, Vol. 33, p. 36. A Letter from England from Doctor Grout, ibid, Vol. 33, p. 43. Report of Fifth International Botanical Congress, Section T, Taxonomy and Nomenclature. 3. Mosses, presented before the American Association for the Advancement of Science.

Dr. Franklin Hollander—Gastric Hypersecretion Following Parturition in a Dog. Proc. Soc. Exp. Biol. and Med., 1930, Vol. 27, p. 303. Gastric Juice Acidity at the End of the Secretory Period, ibid. p. 817.

Dr. I. S. Kleiner—The Effect of Insulin upon the Rate of Dialysis of Blood Sugar, Endocrinology, 1930, Vol. 14, p. 226.

Dr. B. J. Luyet—Killing of Moulds by Electric Bulb, Proc. Soc. Exp. Biol. & Med., 1930, Vol. 27, p. 668.

Dr. J. J. Pfiffner (in collaboration with W. O. Nelson, of New Yorok University)—Deciduomata Produced by Corpus Luteum Extract, Proc. Soc. Exp. Biol. & Med., Vol. 27, p. 863. An Experimental Study of the Factors Concerned in Milk Secretion, ibid., 1930, Vol. 28, p. 1. An Experimental Study of the Factors Concerned in Mammary Growth and Milk Secretion, Anatomical Record, 1930, Vol. 47, p. 317.

Dr. William Salant, and Mr. Harold Nagler—Effect of Ergotamine on Intestinal Motility, Proc. Soc. Exp. Biol. and Med., 1930, Vol. 27, p. 334. Effect of Calcium on Cardiac Reactions to Mercury, ibid., p. 859. Reversal of Action of Ergotamine by Calcium and Changes in Ch, ibid, p. 336.

Dr. Asa A. Schaeffer—Molecular Organization of the Protoplasm of Amebas, Anatomical Record, 1930, Vol. 47, p. 295.

Dr. W. W. Swingle, and Dr. J. J. Pfiffner—An Aqueous Extract of the Suprarenal Cortex Which Maintains the Life of Bilaterally Adrenalectomized Cats, Science, 1930, Vol. 71, p. 321. The Revival of Comatose Adrenalectomized Cats with an Extract of the Suprarenal Cortex, Science, Vol. 72, p. 75. Note on Modification of Original Aqueous Preparation of

Suprarenal Cortical Extract, Science, 1930, Vol. 72, p. 483. The Hormone of the Suprarenal Cortex, Anat. Rec., 1930, Vol. 47, p. 303.

Dr. I. R. Taylor—Respiratory Metabolism During Pupal Development of **Galleria mellonella,** Anat. Rec., 1930, Vol. 47, p. 316.

Dr. Martha Washburn (in collaboration with Drs. M. J. Shear and Benjamin Kramer of the Jewish Hospital, Brooklyn, New York)—Composition of Bone VII. Equilibration of Serum Solutions with Dicalcium Phosphate, Jour. Biol. Chem., 1929, Vol. 83, pp. 697-720. Serum Calcium: Undersaturation vs. Supersaturation, Amer. Jour. Physiol. 1929, Vol. 90, pp. 514-515.

Dr. L. T. Webster—The Epidemiology of Fowl Cholera, Experimental Studies. I. Introduction, Journal of Experimental Medicine, 1930, Vol. 51, p. 219. The Role of Microbic Virulence, Dosage, and Host-resistance in Determining the Spread of Bacterial Infections Among Mice. I. **Pasteurella lepiseptica** and **Pasteurella aviseptica** Infections, ibid., Vol. 52, p. 901. The Role of Microbic Virulence, Dosage, and Host-resistance in Determining the Spread of Bacterial Infections Among Mice. II. **Bacillus friedlaenderi**-like Infection, ibid., p. 909. The Role of Microbic Virulence, Dosage, and Host-resistance in Determining the Spread of Bacterial Infections Among Mice. III. **Bacillus enteritidis** Infection, ibid., p. 931.

REPORTS OF RESEARCH WORKERS

Dr. Blizzard's Report

It gives me great pleasure to report to you that the major portions of my research concerning the vegetation of High Hill, Long Island, have been embodied in a paper entitled "Plant Sociology and Vegetational Change". Through the generosity of the Cold Spring Harbor Laboratories this paper will be published in the January issue of Ecology.

The salient features of the paper are as follows:

1. The biotic (human) factors disturbing the vegetation, especially the grassland on High Hill, have mostly or entirely ceased to operate. This gives the habitat and vegetation an opportunity of adjustment—to give expression to ecological and sociological constructiveness, by the production of vegetational changes, culminating finally in an edaphic as well as climatic change.

In the first place, the physiognomy of the vegetation on High Hill is changing. The prevailing or dominant vegetation (grassland)) is being altered. This means the substitution of one dynamic-genetic unit by another of sociological importance.

2. The grassland which covers a portion of High Hill, Long Island, represents a stage—**Andropogonetum scoparii**—in a secondary succession.

3. The **Andropogon scoparius** association has existed on High Hill for a century and a half—probably much longer.

4. The grassland was able to hold out against invasion by other plants primarily because of the equilibrium established by the socializing plant forms: **Andropogon scoparius,** two lichens, and one moss. The former functions as a consolidating force in the association; the two latter contribute mineral nutrient and formation of soil.

5. **Myrica carolinensis** possesses highly dynamic-genetic potentialities of sociological importance: destructive as well as constructive to the plant community.

a. It is capable of invading the **Andropogonetum scoparii** and becoming established.

b. It changes the habitat so that a trail of secondary invaders comes in; these become established and through competition and succession make it possible for

c. Trees of the surrounding forest to come in, and in turn, become established.

d. Thus through the mediation of **Myrica carolinensis** the forest is able to invade the grassland.

6. Because of the demonstrated qualities of the sociological constructiveness of **Myrica carolinensis** it is recommended as a means of bringing denuded, abandoned, or other land to forest in the eastern and northeastern United States.

7. The vegetation of High Hill is separated into well defined belts, viz., grassland, shrubs, and forest.

8. The ecotones and successions have been established by means of permanent quadrats located in relation to a United States Geodetic and Coastal Survey Triangulation Station. Thus they are always accessible.

9. A partial list of the plant species on High Hill is reported.

The paper is further illustrated by photographs, tables, and maps.

In the vicinity of Cold Spring Harbor there is a great wealth of material for study from the point of view of Plant Sociology. I hope to continue the study of some of these problems.

Dr. Bodine's Report

My work at the Laboratory last summer had to do with the completing of work on the action of pituitary extracts on the melanophores of **Fundulus.**

Report of Mr. Broadman's and Mr. Overstreet's Research

by Mr. Broadman

The experiments performed at the Laboratory this past summer were part of a series planned to bring to light some new facts concerning the changes that calcium and phosphorus go through in the mammalian body. These elements have an interest not only for the physiologist and the biological chemist, but also from the point of view of the physician, in relation to such pathological processes as infantile tetany, arteriosclerosis, osteomalacia, and rickets, and to the normal process of pregnancy. It is a well recognized fact—for instance the discovery of vitamines and their use in the treatment of disease—that animal studies often bring to light important information subsequently used in the treatment of disease. The experiments, though in general of a theoretical nature, were chosen to aid in a better understanding of the pathological physiology of calcium and phosphorus. This last summer Mr. Overstreet and I concentrated our attention on the determination of the rate of elimination from the circulation of intravenously injected calcium, in normal and parathyroidectomized dogs and in normal cats and rabbits. We also studied the effects of hemorrhage on the serum calcium and phosphorus of normal cats, dogs, and rabbits.

Calcium, on being injected into the circulation, disappears rapidly into some organ or organs. It takes a comparatively long time for it to be eliminated from the body. The exact rate at which the calcium leaves the circulation has never been determined. This rapid elimination from the circulation forms the basis of explanations as to why calcium injected intravenously is such a temporary remedy for the symptoms of tetanea parathyropriva. The curves of elimination from the circulation of calcium introduced intravenously were determined in normal and parathyroidectomized animals. An analysis of these curves showed that the important factor in determining this elimination is not the level of calcium at any one particular moment, but the magnitude of the dose of calcium injected. The mammalian animal can take care of surprising doses of calcium if the element is introduced slowly enough; a rapid intravenous injection of large amounts often results fatally. Parathyroidectomized animals do not seem to be able to take care of larger doses than normals, nor, on the other hand, do they show the effects of overdosage sooner. The factors involved in the regulation of tissue calcium are in many ways different from those that control the calcium level of the blood.

The effects of hemorrhage on the calcium and phosphorus content of

the serum vary with the animal used. Thus, in the cat and dog, very little change takes place in the concentration of serum calcium even when the hemorrhage is severe; in the rabbit, on the other hand, there is a marked fall in the concentration of this element even with slight bloodletting. The exact significance of this fall has not been explained, but we have found a tendency for the calcium level to return to normal, especially if there is a readily available source of calcium. The changes that took place in the blood due to hemorrhage were studied by means of making hemoglobin determinations, red blood cell count, and hematocrit readings. It was found that the mechanism for keeping the blood volume constant in a very perfect one. Even though as much as one-third of the blood contained in the body is removed, there is an influx of fluid that, though it dilutes the blood, brings the volume to within a few percent of normal. As indicated above, in the cat and dog there is very little change in the concentration of serum calcium after hemorrhage. This, when correlated with the changes in hemoglobin concentration and the constancy of blood volume, means that either the fluid entering the circulation to make up for lost blood has exactly the same concentration of calcium as the serum lost, or else that the factors that keep a certain amount of calcium dissolved in the blood are in very delicate equilibrium with each other. This question is now being studied.

Dr. Cole's Report

Stimulation in **Balanus balanoides** and **Sagartia luciae** by normal primary aliphatic aldehydes and acids

As a part of a study on chemical stimulation in animals the experiments during the summer of 1930 were done on the normal primary aliphatic aldehydes and acids. One series of tests was made with the first four acids on the common intertidal rock-barnacle, **Balanus balanoides.** For all the other experiments the small anemone, **Sagartia luciae** was used.

The experimental technique was such that all simultaneous and interfering stimulation was reduced to a minimum. Constant temperature (20.5 plus or minus 0.3° C.), constant illumination (25w Mazda with reflector at 50 mm distance), constant flow of sea water and experimental solution (250cc per minute) and insulation against vibrations were features of the arrangement. During the flow of sea water over the animals rhythmic movements of the cirri of the barnacles, and expansion of the column and tentacles of the anemone were criteria of the non-stimulated animal. During the flow of experimental solutions any irregularity in the cirral movements and contraction of the column or tentacles of the anemone were evidences of stimulation by the solution being used.

Threshold stimulating concentrations of the aldehydes and acids were determined on several different groups of animals on at least two different days. The hydrogen ion concentration of the sea water and of the experimental solutions was determined daily by the colorimetric method. The lowest pH of the solutions used was 6.1 (uncorrected for salt errors), as compared to 7.7 for sea water. To determine any effect of such a change in pH, carefully prepared solutions of HCl and H_2SO_4 at pH 6.1 were tried. In no case were any evidences of stimulation by these mineral acids

obtained. The stimulating effect of the other acids and the aldehydes must therefore have been produced by factors other than the hydrogen ion concentration.

For the barnacle the threshold stimulating concentrations of the first four acids (formic, acetic, proprionic and butyric) were found to be 0.001 molar, and for the anemone, 0.0015 molar. In other words, there was no evidence of increasing stimulatory effect with increase in length of carbon chain in those acids. For **Sagartia** the next five acids were tested and were found to show increasing effect with increase in length of carbon chain in the ratio of 1.5 to 1.0. The actual concentrations were as follows:

Valeric	0.001	M
Caproic	0.00066	
Heptylic	0.00044	
Caprylic	0.00029	
Pelargonic	0.00019	

Using the first five members of the aldehyde series on **Sagartia** the theshold concentrations were found to be as follows:

Formaldehyde	0.016	M
Acetaldehyde	0.007	
Proprionaldehyde	0.00233	
Butraldehyde	0.000225	
Valeraldehyde	0.000259	

In no case did the hydrogen ion concentration of the aldehydes go higher than pH 7.3. Omitting formaldehyde and butraldehyde, it is evident that the ratio of successive concentrations is 3 to 1; i. e., the relative concentrations of acetaldehyde, proprionaldehyde and valeraldehyde were 27, 9 and 1. On theoretical grounds it was expected that formaldehyde might be an exception to the usual 3 to 1 ratio. The failure of butraldehyde to conform to expectaton was perhaps due to the high degree of polymerization which had occurred. It is known that butraldehyde polymerizes on standing to a greater degree than the other aldehydes, and it is expected that a polymerized product would be more stimulating than pure butraldehyde. This tentative explanation for the behavior of butraldehyde will be subjected to experimental test.

A theoretical interpretation of the results on acids and aldehydes in conformity with the generalized principles on chemical stimulation by organic compounds already announced is possible, and will be published later.

Dr. Conard's Report

Dr. Conard and Dr. Sparrow spent much time reorganizing the Botany Course with a view to making fuller use of the abundant and remarkably varied flora of the region. Plant lists made at the Laboratory in the past thirty years were partly checked by reference to recent collections. Tentative practical keys for the identification of the species of the local flora were prepared and tested by use. Profiting by the exhaustive study of mosses made by Dr. Grout and others in 1929, a reasonably complete key to local mosses was prepared. This was planned to enable the student to

identfy species either with or without capsules. Such a key presupposes an adequate manual, in this case Dr. Grout's "Mosses with Hand Lens and Microscope", and his forthcoming "Moss Flora of North America".

Dr. Conard was occupied for the first two weeks in proof-reading a laboratory manual of botany by Dr. Paul K. Y. Lu, of Peking, China, whose college textbook of botany, the first of its kind in Chinese, has just come from the press (Sept. 1930).

Most of the remainder of Dr. Conard's time was devoted to finishing the manuscript of a translation of Braun-Blanquet's Pflanzensoziologie, begun at the Laboratory the previous summer. The book will be published some time in 1931. This book presents the fundamental concepts which have been followed in the work in plant ecology which has been done at the Laboratory during the past three summers. It seems to be much needed in the English-speaking world, particularly in North America.

Finally, a careful re-check of the "Denuded Area" was made, preparatory to a third paper on the re-vegetation of this tract of land (Cf. Botanical Gazette vol. 55, 1913; vol. 75, 1923). These papers record the changing "personnel" in the plant covering of a stretch of sand and gravel laid bare in 1911 west of Cold Spring Harbor Station, under approximately natural conditions. The development of soil, and "plant succession" are the points especially under observation. Leaf mold and genuine soil are already well developed in parts of the area. The **Andropogon scoparius** association, and **Myrica carolinensis** clumps show correlations with Dr. Blizzard's work on High Hill.

Dr. Corner's Report

Dr. George W. Corner of the University of Rochester, School of Medicine and Dentistry, and Dr. Jessie L. King of Goucher College, continued in the summer of 1930 a series of experiments begun at Rochester and carried on at Cold Spring Harbor in 1929. These experiments were based in the observation that cauterization (under anaesthesia) of the ovaries of rabbits, within a few hours after discharge and fertilization of the ova, leads to a failure of the early embryos to appear in the uterus at the usual time. It was hoped that by tracing the movements of the embryo under these experimental conditions, some light might be thrown upon the normal mechanism of transportation of the embryos from the ovaries to the uterus. Owing to experimental difficulties, however, the work of the past two summers amounts only to a preliminary survey of the question and further work will be necessary.

Mr. Curran's Report

Research work at the Biological Laboratory during 1930 was divided into two divisions (a) Preliminary Life History Studies of **Lema trilineata** and (b) Faunistic Studies of Insects with Especial Reference to Diptera.

(a) **Lema trilineata** is a beetle belonging to the family Chrysomelidae. It has proved to be a very serious menace to Datura plants and large numbers of the plants grown for experimental purposes have been destroyed by the pest. The larvae and adults may be destroyed by the use of poison

sprays. The initial problem was the determination of the length of the life cycle of the beetle in order that the sprays might be applied at the proper time in order to give a satisfactory "commercial" control with the minimum expenditure of labor and materials. The problem is complicated because of an overlapping of generations and the rapid growth of the plants resulting in the production of unsprayed foliage. Nevertheless, a suitable basis for spraying has been determined. This phase of the investigation can be regarded only as of a preliminary nature and does not take into consideration many natural and artificial conditions which might seriously affect the normal development of the insect. Some of these may be mentioned.

(1) Drought. The effect of drought on the development of the larvae and pupae. Does dry soil lengthen or shorten the pupal stage? Indications are that the condition of the soil has considerable effect upon the duration of the pupal stage. The same condition interlocks with

(2) Drying off of the plants. Drought condition result in a hardening of the plants and a very great reduction in growth. Observations indicate that this condition is most unfavorable for the larvae and will frequently result in their starvation. It is also favorable for spraying since the small amount of new growth limits the food to poisoned leaves.

(3) Soil. What is the effect of soil on the pupae in regard to the duration of the pupal stage? Apparently the type of soil has considerable effect and investigations along these lines may prove of great importance. An interesting point is whether or not the emerging beetles could work their way through baked clay to the surface and whether or not pupation, if forced on the surface of the soil, due to this same cause, would result in a high mortality in the pupal stage.

It will be noted that each of the three main lines of investigation is in itself a complex one and also that the three are closely connected.

Research in connection with this insect cannot be considered as of local interest inasmuch as the results of investigations will apply in large measure to all beetles having similar habits. Conditions for such research at the Laboratory are ideal since the materials with which to work are so readily available. It is hoped that investigations along the lines suggested may be continued in 1931.

(b) The study of a fauna of a region requires a great deal of observation in the field and study in the Laboratory. We are wont to consider a list of species as constituting the fauna, but such a conception falls far short of the actuality. The occurrence of a species in a region is determined by environmental conditions which may be, and are, both physical and zoological. This, of course, comes under the field of Ecology, but in order to understand the fauna, determine the reasons for the abundance or scarcity of any species from a faunistic standpoint it must be considered. A report on a very short survey made during 1930 must await the final determination of the insects captured and a correlation of the identifications with the conditions under which they occur. Much more satisfactory results would be obtained by spreading the investigation over several years and various seasons, since there is a continual change in the insect fauna from spring to autumn.

Mr. Daniel's Report

The experiments of Hegner (1922), Ratcliffe (1928-1929), and Schumaker (1930), show that the diet of the host plays a very important part in determining the numbers of individuals of several species of intestinal protozoa found in the digestive tract of the host.

Schumaker found that if rats were fed a diet containing 93.5% whole-wheat flour, these animals could be infected with **Balantidium coli** from the domestic pig.

This is an extremely high carbohydrate diet and it was thought that the carbohydrate might be the chief food material of the organisms.

The summer was spent in making preliminary studies on the respiratory quotient of the parasite. Because of their small size, the composition of the culture media and the contaminating bacteria, it is very difficult to measure gas exchanges. A method using barium hydrate to absorb the carbon dioxide and a volumetric measurement of the oxygen, was devised and promises to give very satisfactory results.

Dr. Fricke's Report

The work may be classified under the following three headings: (1) X-rays, (2) electrical work, (3) other researches.

X-Rays. The equipment for evacuating the tubes has been steadily improved and enlarged. Special electric ovens for heating the tubes during evacuation and designed for different types of tubes have been constructed. A quartz oven for preheating all the metal parts of the tube up to 1000° C. in a vacuum and furnished with a recording electric thermometer has also been completed. Four evacuation systems are in use, two for finishing the tubes and two for leakage tests and pre-evacuation with preheating. The speed of working has therefore been greatly increased. With this improved equipment investigations on X-ray tube construction have been going on steadily during the year, especially from the point of view of constructing tubes with the largest possible current capacity.

The action of X-rays on solutions of sodium bichromate, potassium permanganate, and potassium iodide, and on pure water, has been measured. Considerable work has been done on developing suitable methods for gas analysis for the purpose of studying the gas exchange in chemical reactions produced by X-rays. Various methods which seemed advantageous have been worked through.

Special X-ray tubes have been constructed for soft X-ray photography. These tubes have windows about 10mu thick for the exit of the soft rays. With these tubes, in cooperation with Dr. I. R. Taylor of Brown University, X-ray pictures of the pupae of **Galleria mellonella** were taken, covering the complete life cycle of the pupae. Dr. Taylor is at present making microscopic sections of this material, whereafter an analytical study of the X-ray pictures may be undertaken. A similar, although not so complete, study was made of pupae of **Drosophila melanogaster,** in cooperation with Mr. J. R. Huggins of the University of Pennsylvania. A study of insects was also started during the summer and is continued in cooperation with Mr. C. H. Curran of the American Museum of Natural History. A description has been prepared of the technique employed and with represen-

tative pictures to indicate the possibilities, while various promising applications of this method will be taken up next summer. For the classification of insects the method should provide a most useful tool. It may be useful in parasitic studies. Furthermore, it should be recalled that the shadows shown in an X-ray photograph are not alone indicative of the various densities but also of the distribution of the heavier chemical elements such as Na, K, Ca, Cl; it is possible, therefore, that the pictures may furnish information about the distribution of these elements in insects. The pictures were made on special, fine grained, photographic plates, prepared for us by the research laboratory of the Eastman Kodak Company. These plates may be studied at a magnification of 50 diameters without the grains' being visible. Some preliminary work has been carried on toward solving the problem of obtaining X-ray pictures of single cells. Such photographs would picture the distribution of inorganic salts inside the cell. It would be a matter of the greatest interest if sich pictures could be made, but considerable technical difficulties will have to be overcome.

Electrical Work. The high frequency bridge constructed during the fall of 1929 was greatly improved during the spring of 1930. A number of various types of electrolytic cells suitable for different kinds of biological materials were constructed and work done with them. A systematic study of the electrical conductivity and capacity of plant tissues was undertaken, fruits, roots, stems, leaves and so forth, of various plants being measured. The results have been used in a theoretical study of the subject. Some of this work was done in cooperation with Dr. Basile Luyet of the University of Geneva. Dr. Luyet also made an investigation of the change produced by death in the conductivity and capacity of plant tissues. According to his findings, the change in these electrical constants furnishes a much more sensitive indication of death than the usual colorimetric method. Dr. Luyet gives below a report of this work. In cooperation with Dr. Harry Goldblatt, Associate Professor of Pathology at Western Reserve University, measurements of the capacity and conductivity of blood of rabbits, chickens and turtles were made. Because of the increase of the size of the red corpuscles of these species in the order stated, the directly measured capacities increased in the same order. Using a formula earlier derived, which states the relationship between the directly measured capacity and the size of the cells, it could be shown that the capacity of one square centimeter of red corpuscle surface is the same for all the species. If we assume that the capacity is derived from the static capacity of the red corpuscle membrane, this fact indicates that the thickness of the red corpuscle membrane is a universal constant. An interesting observation was made during this work which may be recorded here. A centrifugal mass of red corpuscles was hemolyzed by freezing (with carbon dioxide snow) and subsequent thawing, the process being repeated seven times. This method is considered a standard method of hemolyzing red corpuscles. However, the resulting mass was found to possess a very high capacity, higher, as a matter of fact, than the original suspension. This proved that cells, or at least cell membranes, were still present. Nevertheless, no evidence of the presence of cells could be obtained by a microscopical examination. It is possible that the corpuscles in the frozen and

thawed mass have undergone swelling or some other process, whereby they have become invisible. Dr. Goldblatt is at present making further studies of this phenomenon with the best microscopical methods. The observation was of interest, especially to us here, because it gave an instance of the value of the capacity method for demonstrating the presence of cells not, or not easily, demonstrable by microscopical methods.

Suspensions of **Bacillus coli** and of **Bacillus mucosus capsulatus** were also measured in cooperation with Dr. Goldblatt. Bacteria were found to behave very differently from any other cells with which we have worked, in that their membranes seemed quite permeable, the bacteria adjusting their conductivity to equal that of the surrounding medium.

It is proposed to make an extensive study of the red corpuscle by the conductivity method. The low frequency conductivity of a suspension of red corpuscles is a measure of the conductivity of the suspending medium, the conductivity at very high frequencies is a measure of the conductivity of the interior of the corpuscle. Thus, by this method, a continuous record could be made of the interchange of electrolytes across the red corpuscle membrane, a problem of considerable theoretical interest. The high frequency required is, however, beyond what can be used with the bridge method, at least ten million cycles per second being needed. In earlier work, extrapolation from a series of measurements at lower frequencies was made, but this method is inaccurate and prevents a record of faster changes from being made.

For this reason, a new type of apparatus for measuring the conductivity and capacity at very high frequencies has been designed and constructed. The principle consists in placing the electrolytic cell in a tuned resonance circuit, in which the amplitude of the oscillating current is measured with a tube voltmeter. With this apparatus, measurements of blood have been made up to sixteen million cycles; at this frequency the resistance offered to the electric current by the red corpuscle membrane is negligible.

Other Researches. Following an adopted plan, the various kinds of apparatus most useful in general biophysical research are from time to time constructed or purchased and installed ready to be used. It is our idea that scientists coming here during the summer can find the fundamental biophysical apparatus at the laboratory ready for use. Some of this apparatus was constructed during the year. A thermoelectric apparatus for temperature measurement, furnished with a semi-automatic recording device, has been constructed. With this apparatus, temperatures can be recorded of the various organs of animals to an accuracy of one one-thousandth degree C. Preliminary work has also been done on apparatus for measuring gas exchange and total heat for very small living organisms.

The following papers are under preparation:

1. The effect of X-rays on solutions of Sodium bichromate.
2. The production of Hydrogen and Oxygen by irradiation of water with X-rays.
3. X-ray photography of insects.
4. X-ray photographs of pupae of **Galleria mellonella** in different stages of development.

5. The electric capacity and conductivity of red corpuscles of animals of various species.

6. The electric capacity and conductivity of various types of plant tissues at different frequencies.

7. A new apparatus for measuring the electric capacity and conductivity of biological cells.

8. The electric capacity and conductivity of red corpuscles or rabbit for frequencies between 500 and $16 \cdot 10^6$ cycles.

Dr. Goldblatt's Report

During the few weeks I spent at the Biological Station in Cold Spring Harbor I worked in the biophysics laboratory with Dr. Hugo Fricke. We studied the electrical conductivity and capacity of red blood corpuscles, with and without nucleus, of various species of animals. Some of the studies were completed during my stay and are now being written up for publication. Some of the studies we made require further work, which Dr. Fricke intends to complete. Some interesting fresh problems have presented themselves as a result of the work we did together. For me the time spent at the Biological Station proved very profitable. It afforded me an opportunity to become acquainted at first hand with some physical methods that can be applied to biological investigations and I was privileged to work under the careful guidance and stimulation of a master in this field.

Dr. Grout's Report

I am submitting the following preliminary report on my work as a member of our staff from February, 1930.

I spent two months in England, June 22 to August 23, devoting most of my time to a critical field comparison of the British and North American moss flora.

For nearly a month I was accompanied by the Rev. C. H. Binstead, a former president of the British Bryological Society and one of the keenest and best informed field botanists I have ever met. For two weeks in August I was shown the moss flora of the Wye valley in Herefordshire by Miss Elenora Armitage, also a prominent member of the British Bryological Society.

The material and information thus acquired will prove of the utmost value in my work on the North American Moss Flora.

I attended the international Botanical Congress at Cambridge as member of your staff and also as a member of the international sub-committee on bryological nomenclature, taking an active part in all the activities of this committee and in general sessions of the section of Taxonomy.

I was appointed on an international committee to arrange for a new index of bryological nomenclature on the plan of the Paris Index but greatly enlarged and improved. Much of the material for this work already exists in Ms form in the herbarium of the Berlin-Dahlem Museum and Dr. Diehls, director of that institution assured us of his hearty cooperation.

The rest of my time has been devoted to preparing the manuscript for the next part of the Moss Flora of North America. Manuscript covering the genera **Leptodictyum, Hygroamblystegium, Amblystegium, Sciaromium, Campylium, Cratoneuron, Calliergon, Calliergonella, Scorpidium** and **Hygrahypnum** is practically finished.

The illustrations for the first three genera named are completed and the cuts made. The manuscript for these three genera has been examined by the editorial board and valuable suggestions have been given by them.

Dr. A. LeRoy Andrews, who did the Sphagnaceae for the Britton North American Flora, has undertaken the treatment of the Bryaceae for our work and reports good progress. Dr. Andrews has for years been an authority on this difficult group.

Mr. George N. Jones of the State College of Washington, a young but capable and enthusiastic bryologist, is preparing the manuscript for the Grimmiacae. Thus there is reason to expect three new parts of the work within a year or two.

Dr. Harris' Report

See Physiology of Reproduction, page 18

Dr. Hollander's Report

The work of the past summer was a continuation of the investigation which has been under way for several years. The general problem deals with the cellular mechanism by which the hydrochloric acid is formed in the mammalian stomach. More specifically, however, I have been concerned with the collection of evidence which will throw some light on the applicability of a relatively simple physico-chemical picture for the formation of this acid. This hypothesis is based on the hydrolysis of a neutral salt solution by means of a membrane, with separation of the acid and retention of the alkali.

Experimental work has been directed primarily toward a study of variations in composition of the gastric juice, obtained from Pavlov pouch dogs, with changes in rate of secretion and therefore in intensity of stimulation. Attention has been centered on the concentration of hydrochloric acid and of neutral chlorides. In general, it has been found that under properly controlled conditions, the acid concentration is practically independent of the secretory rate, and is characteristic of the osmotic equilibrium of the organism. The concentration of neutral chlorides is so small as to suggest that its presence may be due solely to contamination of the parietal fluid with one or more other liquids from the mucous membrane.

Mr. Huggins' Report

The investigation of the morphological changes in the pupal stage of **Drosophila melanogaster** was continued during the summer of 1930. Much of the time was taken up with the preparation of material for future study. The evagination of the imaginal discs of the legs, wings, antennae,

eyes, integument, etc., during the first two days of the pupal period was investigated. In collaboration with Dr. Fricke, X-ray photographs of living pupa were taken at intervals of a few hours during the entire pupal period, and interesting results were obtained.

Dr. Jenkin's Report

Extract from notes on summer work, 1930

Studies are being made of selected stages of development in the effort to ascertain more about the principles underlying these phenomena. To this end attempts are being made to correlate physical changes with the chemical processes which are the bases of these observed grosser features. The most important single method that can at present be employed is the determination of the oxygen consumption of the developing embryo and three stages have been chosn because of their outstanding importance as landmarks in the peculiar developmental history of the fish embryo, **Fundulus heteroclitus.**

These stages are (1) the egg from fertilization to the time of appearance of the heart, which is a relatively late occurrence; (2) the embryo from the appearance of the heart to hatching; and (3) the fish from hatching to definitive gill development. This latter is also curiously long in reaching completion.

With this data in hand it is felt that a better understanding can be had of some of the observed physical phenomena and perhaps other methods devised which will give us a clearer insight into the chemical processes of these active metabolic changes.

Dr. Kleiner's Report

My plans were to proceed along two lines. For one of them I had the financial aid of The Littauer Foundation. This was for research in blood-sugar. The other line of work was the study of the toxicity of certain amines, this being an attempt to correlate differences of chemical structure with physiological effect.

As you are aware, I was taken ill about the middle of July and was unable to do any active work for the remainder of the summer. My two assistants, however, carried on very efficiently. They were Miss Rebecca Halpern, working on the blood-sugar problem and Mr. Joseph Hahn on the toxicological problem. To them I wish to express by sincere thanks for their splendid work under great difficulties. My thanks are also due to Dr. David Anchel, of Dr. Salant's staff, who performed the surgical operations very skillfully.

The toxicological experiments were of necessity preliminary in character. We determined on white rats the relative toxicity of a short series of compounds. At the same time we attempted to obtain a definite skin or eye reaction on rabbits which would be more convenient than the determination of the minimal lethal dose. Although we were not successful in the latter type of work, the experiments done there will undoubtedly serve as controls for more successful tests which were carried out later. The work is still going on and I hope to report details at some future time.

In the blood sugar experiments I continued to study the previously reported phenomenon that violent fluctuations of diabetic blood-sugar values occur after the blood is subjected to a short period of dialysis. We varied the conditions in several directions and are now nearly ready to report our results. There seems to be present in diabetic and even in normal blood an enzyme which increases the reducing power at times. This may be (1) a reverse phase of the glycolytic enzyme, (2) an entirely different enzyme which forms sugar from some substrate, or (3) an enzyme which releases some non-sugar reducing substance.

There has just appeared in "Endocrinology", (July-August), an article partly based on work done in the Biological Laboratory last summer.

Dr. Kornhauser's Report

After the close of the course in Field Zoology in which the writer gave most of his time to instruction and direction of field problems, he undertook a continuation of his work on the oocytes of **Anisolabis maritima Bonn,** the seaside earwig. It was specially planned to get a good photographic record of progress made to date in the study of supra-vitally stained ovarioles, and also to extend the observations to include dyes not used previously.

Most excellent results were obtained by using Brilliant Cresyl Blue and Toluidine Blue. These dyes used in modified Ringers Solution brought out many details of the ovarial sheaths, the amoebocytes and oocytes. These stained ovarioles were narcotized to prevent movement under the microscope and satisfactory photographs obtained. The technical difficulty involved in photographing these rather large cells in hanging drops is far greater than is encountered in taking photomicrographs of thin sections.

The pictures obtained will be exhibited with explanatory notes at the Cleveland meeting of the American Society of Zoologists.

Dr. Luyet's Report

(a). This summer I carried on two researches. One in collaboration with Dr. Fricke, consisted of measuring the resistance and the capacity of different types of plant tissue for frequencies of from 500 to 1,024,000 cycles per second. Dr. Fricke is preparing a general study on the resistance and capacity of tissues, for which he needs the collaboration of different biologists, bacteriologists, physiologists, botanists, etc. I measured, for him, the resistance and capacity (1) of tissue constituting the stem of plants **(Senecio);** (2) roots (beets); (3) fruits (apple); (4) yeast; (5) mushrooms (bacidimycetes). The results will be published later by Dr. Fricke. The general conclusion is that all these tissues present analogous curves of resistance and of capacity, except mushroom tissue, in which the curve has a particular form which Dr. Fricke will discuss.

My second research is upon the resistance and the capacity of a dying tissue.

(b). Electric resistance and capacity, in an alternating current of high frequencies, of a dying plant tissue.

A piece of growing stem, pure meristem, is treated (1) by heat, by immersion in physiological salt solution at 50°, 60°, 70°, 80°, 90° and 100° C, for different lengths of time; (2) by cold, by inclusion in solid CO_2; (3) by poisoning by alcohol; (4) by anaesthetization in ether; it is then placed in the bridge, specially constructed by Dr. Fricke, for measuring such resistances. The conclusions drawn from the measurements are:

(1) that the resistance of the tissue diminishes more, for a given frequency, the more the treatment has been prolonged, until a limit of value has been reached, after which the resistance remains invariable even when the destructive action is continued until death results.

(2) The measure of the fall of the resistance is a very sensitive diagnosis of the beginning of destruction. The other indicators of death, the penetration of dyes, for example, act only when the destruction is 5 or 10 times more advanced.

(3) The capacity disappears with the destruction of the tissue at all frequencies, as it disappears at high frequency when the tissue is living; which can be explained by the theory which likens a living tissue to a resistance in parallel with a capacity, both being in series with another resistance (Philippson, Fricke). For a given frequency the capacity diminishes more, the more the tissue is maltreated.

(4) The curves of resistance and of capacity have the same form, whether the destruction is produced by heat, cold, alcohol or ether.

(5) Most of the preceding phenomena may be explained by a certain destruction of the semi-permeability of the membranes under the action of the applied agents.

Dr. Needham's Report

Devoted the three weeks following the course in Field Zoology to writing up a paper entitled "Studies on the Seasonal Foods of Brook Trout". This was presented at the annual meeting of the American Fisheries Society in Toronto, August 27, 1930. It seemed better to prepare this paper for publication than to undertake new work as my time was short following the field course.

Miss Palmer's Report

During the summer of 1929 work was started by The United States Bureau of Fisheries with the purpose in view of finding some chemical by which the starfish which infect the oyster beds of Long Island Sound might be killed. It was found that starfish are singularly sensitive to minute traces of copper salts in the sea water. As a result of the discovery of this sensitivity, experiments were further organized in 1930, to determine the toxic effect of various concentrations of copper salts, particularly copper sulphate, on the starfish of different age groups.

These experiments showed that the lethal concentration of copper sulphate is dependent on salinity, hydrogen ion concentration and the temperature of the sea water. The results of these experiments showed, however, that not only these physical factors but physiological conditions of

the animals also were determining factors. Age, metabolic rate, size, and phase of the sexual cycle in starfish modified or entirely changed the concentration of copper sulphate necessary to cause death.

Despite the difficulty of controlling the above factors the results show that there is a possibility of using copper sulphate as an effective means of killing the starfish without seriously injuring the oyster or other food fish. Practical applications of copper sulphate on the infested areas resulted in death to great numbers of starfish and it is hoped that future applications will solve the remaining difficulties so that this method may be used as an effective control for starfish.

Mr. Parkins' Report

A Study of the Suprarenal Glands of the White Leghorn Fowl

The suprarenal glands of the domestic fowl **(Gallus domesticus)** are located in an extremely vasculated area, lying adjacent to the aorta abdominalis and the posterior vena cava, and between the anterior margin of the kidney and the diaphragm. Due perhaps to certain technical difficulties, complete bilateral suprarenalectomy has, to the knowledge of the writer, for the first time been succesful in birds. Hemorrhages are most difficult to avoid.

By the application of many exceedingly helpful suggestions made by Doctor Swingle, complete removal of both the right and left gland has been accomplished in eight out of twenty-six male fowls considered in four series. In the last series the removal was complete in 66 per cent of the six individuals of the group. Nine of the twelve unilateral operations were successful, three being incomplete due to the fact that a minute piece of the right gland was left attached to the wall of the posterior vena cava, just medial to the testis. A very minute piece of the gland left attached at the first unilateral operation will have hypertrophied in seven days, when the remaining gland is removed from the left side, to a size sufficient to maintain an adequate supply of the cortical hormone.

The object in view at the outset of this investigation, after working out a successful technique of operation, was to determine the life span of bilaterally suprarenalectomized fowls, the symptoms under varying conditions and degrees of adrenal insufficiency, and to test the non-specific action of the suprarenal cortical extract of Drs. Swingle and Pfiffner, and continue the study with a series of blood determinations and, incidentally, autoplastic grafts, in this group.

In ten cases of total bilateral suprarenalectomy, the survival periods following the removal of the second gland varied from 52 to 119 hours, the average being 84 hours. The train of symptoms resembles quite closely those of the suprarenalectomized cat and dog, but occurs in the fowl during a much shorter period of time.

The fowls show remarkable recovery from the operation, and within 1 to 3 hours after the operation were unrecognizable from normal fowl. They continue to be so, following the removal of the second gland, eating, scratching, running about, and even fighting with other cocks for a period of 24 to 56 hours, or in some cases, three days or more, after which time

they begin to show signs of listlessness and weakness, being easily fatigued when disturbed. They develop weakness, particularly in the legs, a condition of lassitude, and a loss of interest in other fowls. The comb becomes darker and somewhat drooped to one side. The skin is dry, causing the fowls to peck the skin and ruffle their feathers. Later they become very weak and lethargic, refuse food, but drink much water. Still later they refuse to rise to their feet, and in the more advanced stages of adrenal insufficiency, are unable to stand when lifted upon their feet. The comb at this point is a much darker red, and usually more drooped. The eyelids show a marked tendency to blink or stay closed, and the head is often down under the crop. In the terminal stages the mouth is in some cases held open, and more rapid and deeper respiration is noted. The fowls are soon found in a comatose condition, lying on their sides, and showing a slight tremor, which increases in magnitude until violent convulsions set in, followed by death in a few minutes, with the neck and limbs in extreme extensor rigidity. The comb is a bluish purple in the comatose stage. Autopsies showed a probable liver congestion, a darkened spleen, and some indications of an enlarged gall bladder.

One of the fowls of the last series was showing very severe symptoms at 39 hours after removal of the second gland, and judging from the survival of previous cases showing comparably the same symptoms, would have lived from 2 to 4 hours. He was very weak, lethargic, unable to stand, and the comb was drooped, and dark red to purple in color, when 2 c. c. of the cortical extract of Drs. Swingle and Pfiffner was injected intravenously through the wing vein. In six to eight hours this cock could stand alone, showing considerable general improvement. In twelve hours after the first injection, a second 2 c. c. injection was given. The cock, at this point, was walking around, eating wheat, corn, and oats, and drinking; the comb had lightened in color considerably, and the eye sign had disappeared, and at the end of twenty-four hours after the first injection the animal had, to all appearances, completely recovered.

Further tests of the action of the cortical extract, together with a series of blood determinations, are at present being undertaken at this Laboratory. A detailed account of the technique of the operation, as well as a detailed description of the anatomy and blood supply of the glands, will appear in the near future, as will also the results of the previously mentioned study.

Mr. Potter's Report

The following is a report of the work performed by me during the summer 1930 at the Biological Laboratory:

My work was an extension of that done by Dr. G. W. Corner on the rabbit (since published), in which he induced lactation by the injection of alkaline extracts of the anterior pituitary. A similar procedure was followed, using the guinea pig and the rat, in order to study the effect in these animals. It was found that the rat is not a suitable animal for such experiments, but positive results were secured for the guinea pig.

Dr. Salant's Report

Studies on the action of mercury were continued, and the following results were obtained:

I. Experiments on the Isolated Frog Heart.

It was found that in the presence of deficient amounts of calcium in the nutrient solution (Ringer) small and medium amounts of mercury produced stimulation, whereas the same concentration of mercury in normal Ringer's solution either produced no effect, or produced depression. Concentrations of calcium chloride above normal rendered mercury less toxic, but did not transform it into a stimulant. Calcium thus protects the heart against the injurious action, and, as we have reason to believe from observations made in the laboratory, probably also protects against other poisons. The effects of larger amounts of mercury were not influenced, however, by increased concentrations of calcium, as they caused cardiac depression and irregularity even when calcium was greatly increased. When the concentration of potassium chloride was increased 50-100 per cent above normal, the effect of mercury was similar to that produced by it when calcium was low. (Manuscript in press).

II. The Relation of Calcium to the Action of Mercury in Intact Animals.

1. A marked decrease in the resistance to mercury occurred in cats that had received subcutaneous injections of sodium citrate and sodium oxalate daily for from one to about six or seven weeks.

2. Decreased resistance to mercury was also obtained in cats after removal of the parathyroid, and consequent fall of blood calcium.

3. But after the intravenous injection of calcium chloride, mercury was distinctly less toxic.

4. In a large number of experiments on cats kept on different diets, it was observed that diet is unquestionably a factor in determining the resistance to mercury. Its toxicity varied inversely as the amount of calcium in the food. That some relation exists between the action of mercury and the amount of calcium present was further indicated by the results of analysis for calcium in the hearts of cats which have been poisoned by mercury, for it was found that the calcium content was greatly decreased in the animals which received mercury. The manuscript including the results of the above studies on mercury is in preparation.

III. Studies have also been conducted on the blood calcium after the administration of mercury. This investigation is not quite finished. The results thus far obtained show that moderate amounts of mercury, given in various ways, do not affect the blood calcium, but, as stated above, decrease tissue calcium in cats. Incidentally, it was found that hemorrhage was without effect on blood calcium in cats, but decreased the blood calcium in rabbits, thus corroborating the results of previous investigation of this subject. It is hoped that the results of experiments dealing with the effect of mercury on calcium metabolism will be completed in the near future.

IV. Investigations have also been made on the effect of repeated injections of sodium citrate and sodium oxalate on calcium metabolism.

The interesting observation was made that, notwithstanding prolonged treatment of six to seven weeks with effective doses of these salts, the concentration of total calcium in the blood remained unchanged. Blood calcium was decreased, however, by intravenous injection of sodium oxalate in acute experiments, provided about 30-40 mgs. per kilo had been given, in divided doses. The determination of the amounts of calcium eliminated by the intestines and by the kidney after prolonged treatment with sodium oxalate and sodium citrate are still in progress, but the feeding experiments have been completed. The results will form the subject of a separate communication.

V. Extensive studies have also been made during the past year on the effect of ergotamine on intestinal motility. The results are as follows: Small doses of ergotamine stimulate the movements of the isolated intestine of different animals, whereas larger doses usually cause depression. Changes in the ionic content of the nutrient fluid, that is, changes in alkalinity and acidity, concentration of calcium and potassium, may modify the response of the intestine to ergotamine. When injected intravenously ergotamine stimulated movements of the intestine, which were promptly abolished by atropine. The manuscript giving the results of these studies is in preparation.

Publications

Preliminary reports were made before the Society for Experimental Biology and Medicine as follows:

1. The Reversal of Action of Ergotamine by Calcium and Potassium, Proc. Soc. Exp. Biol. and Med., 1930, XXVII, 333.

2. The Effect of Ergotamine on Intestinal Motility, Proc. Soc. Exp. Biol. and Med., 1930, XXVII, 334.

3. Effect of Calcium on Cardiac Resistance to Mercury, Proc. Soc. Exp. Biol. and Med., 1930, XXVII, 859.

Dr. Schaeffer's Report

We made a series of observations on extracts of muscles and other tissues of molluscs with the polarimeter in order to extend our knowledge, if possible, on the shape of the molecules concerned in the general structure of the organism. The special point towards which the research was directed is the possibility of a correlation between the shape of the molecule and the spiral structure of the body, such as is seen in snails.

Since no detailed evidence has yet been published concerning the shape and other characteristics of the molecule in living tissue as deduced from the gross structure or movement of the organism, it may be well to set forth what has already been accomplished in earlier work in this special field. Such a summary will, at the same time, indicate the connection this work has with other lines of investigation.

In the first place, it has been observed that all motile organisms whatsoever go in some sort of spiral path when eyes or other guiding senses and not functioning. Bacteria, all kinds of one-celled animals and plants;

the larvae of jelly fish, worms, sea-stars; blindfolded mice, dogs and men while swimming; blindfolded birds and aviators, all go in spirals. Special experiments on some of these forms have proved that the mechanism behind this spiraling tendency is small, beyond the power of the microscope to see. Some organisms go in a right spiral, some in a left, while others again change from a right to a left and vice versa, after a varying number of spiral turns.

Now it has been seen that in the amebas, which belong to the group that alternate from right to left, the number of right turns can be greatly increased by changing the light intensity. It has also been found that very large amebas of any given species are predominantly right-turning, as are also those that have, thirty minutes previously, eaten a large and easily digested food body.

Amebas also have definite points or nodes at which they change to a new direction of movement, as from right to left, for example. Thus, of four species investigated, one moves 1-4 of the way around a glass rod of a given size, another 1-3, another 1-2, and the other all the way around before another node occurs at which the direction may be changed. This was brought out by arranging all the sections of the various lengths in a frequency series for each species. Such series were found to be represented by the exponential series:

$$\frac{1}{2^{\frac{y-1}{2}}},\ \frac{1}{2^{y-\frac{1}{2}}},\ \frac{1}{3^{y-\frac{1}{3}}},\ \frac{1}{4^{y-\frac{1}{4}}}$$

in which "y" represents the length of any section.

Now it is a very interesting thing that the most common arrangements of leaves on the stems of plants from the mosses on up, are the same as the bases of the last three series above. In the case of the plants the leaves represent the nodes.

We have a mechanism, therefore, which is characterized by: 1, submicroscopic size; 2, practical universality in plants and animals; 3, correlation between spiral movement and spiral structure (from other data); 4, a definite periodicity; 5, specific differences definitely expressible by integers; 6, a tendency of the number of body lengths per spiral turn to approach a constant; 7, sensitivity to light. Now the only mechanism known which operates under all these conditions is the molecule, and our underlying hypothesis is that the molecule which is responsible for the general structure and movements of the organism, exists in two stereo-isomeric forms, right-turning and left-turning, which organize themselves into definite patterns with attendant formation of fields.

The stereo-isomers which are known in chemistry may be divided into two groups: 1, optical isomers, and 2, optically inactive isomers. The chemical properties of the right and left varieties of the optical isomers are very nearly alike and in some cases no difference at all in chemical properties has been discovered. In the inactive isomers, however, the differences between the right and left varieties are definite and measurable, and in many cases pronounced.

To return again to our work of the past summer: We attempted to find differences in the optical activity, if any exist, between the extracts

of right species and left species of snails. We found no such differences. If our method was the correct one, this result may mean that the isomers are of the inactive variety, signifying greater chemical difference than if they were optically active. This is negative evidence but it is consistent with the other data summarized above. That heavy feeding temporarily changes the left-right ratio in amebas may also indicate a definite chemical difference between the two isomers and therefore their optical inactivity.

We also examined many thousands of snails of different species for variants in the direction of turn of shell in order to test this idea further, but we failed to find any. The final step in this particular sub-division of stereobiology, therefore, still remains to be worked out.

Mr. Schwartz's Report

Work was begun on the effect of dessication on the metabolism of pupae of Galleria mellonella. No specific conclusions are justified as yet.

Mr. Smith's Report

Summary of X-Ray Work on **Drosophila obscura**—Race "B" (Lancefield)

About 950 adults were treated with dosage ranging from 100 r-units to 5500 r-units. Individuals were placed in groups of 10 to 12 in celluloid vials in which were placed pieces of paper toweling, moistened with fermented banana juice.

Dosages of over 2250 r-units completely sterilized both males and females. The optimum dosage was around 1400 r-units of x-rays. After treatment there was a period of from four to eighteen days sterility, depending upon the intensity of the treatment.

The number of offspring from treated parents ranged from 2 to 180. The higher dosages causing the more reduced number of offspring. The stocks were raised in 1x4 inch vials, with cotton plug stoppers.

Among the 7500 offspring from treated parents up to September 15th, there appeared twenty-two apparent mutants. A few of these have grown sterile or died. The remainder are being inbred in an attempt to purify and establish a strain homozygous for the character.

The F1 offspring of treated parents are being inbred to detect any further unobserved mutants. Some of these are not hatching.

A wild untreated stock was maintained as a control. In these untreated stocks one mutant character has been isolated.

Dr. Sparrow's Report

The mycological work of the last season was confined mostly to the assembling and minute examination of material and data of past years, and preparing it for purposes of publication. Numerous drawings of various species were made.

However, collecting was not discontinued, a number of familiar forms being found as well as two apparently new to this country, namely, **Rhizophidium lagenula (A. Braun) Fischer,** a parasite of Diatoms, and **Olpidiopsis minor Fischer,** a parasite of **Achlya,** were found.

An as yet incomplete summary of submerged Phycomycetes of the Cold Spring Harbor region reveals the following data:

Number of different species collected	44
Species unreported from the U. S.	16
Species new to science	2 at least

In addition, there are at least 6 species which have not been reported in this country for over 35 years.

Dr. Swingle's Report

The Hormone of the Suprarenal Cortex

Work on the hormone of the suprarenal cortex is still in progress. A water soluble relatively pure fraction has been obtained which is free from all protein, liquids and other contaminating substances. This fraction is highly active and is suitable for intravenous use in human beings. The material is non-toxic and can be administered in large doses with no untoward effect.

Experimental work on the cortical hormone has brought to light the following facts, all of which are new and have not been demonstrated heretofore:

1. Completely adrenalectomized animals can be kept alive indefinitely by administering small doses of the extract once daily subcutaneously. Following cessation of the extract treatment such animals soon die with typical symptoms of adrenal insufficiency. The treated animals are normal in every way and cannot be distinguished from normal unoperated animals.

2. Animals prostrate from adrenal insufficiency and on the verge of death can be restored to normal condition within 48 to 72 hours by injections of small quantities of the cortical hormone. When the animals have returned to normal they can be maintained so, for any length of time desired by a single daily subcutaneous injection of the extract. Following withdrawal of the extract the treated animals promptly die of adrenal insufficiency.

3. The extract has been used successfully in the crisis of Addison's disease by competent clinical investigators. Prostrate individuals can be revived and destored to normal activity by intravenous injections. They remain normal for 8 to 10 days and then again develop symptoms unless the extract is again administered.

A cooperative scheme for investigating the clinical and physiological possibilities of the cortical hormone is now under way. The cooperating clinics are the Mayo Clinic and the Johns Hopkins Hospital.

The extract will very shortly be available for all workers and clinicians who care to use it.

Biochemical and physiological studies are now under way at Princeton, but the results cannot be discussed at this time.

Publications

Brief reports were published as follows:

Swingle and Pfiffner—An Aqueous Extract of the Suprarenal Cortex

which Maintains the Life of Bilaterally Adrenalectomized Animals. Science, March 21, 1930, Vol. LXI, p. 321.

Swingle and Pfiffner—The Revival of Comatose Adrenalectomized Cats with an Extract of the Suprarenal Cortex. Science, July 19, 1930, Vol. LXXII, p. 75.

Swingle and Pfiffner: Rowntree and Greene—The Treatment of Patients with Addison's Disease with the Cortical Hormone of Swingle and Pfiffner. Science, November 7, 1930, Vol. LXXII, p. 482.

Dr. Taylor's Report

The following is a report of the work in which Mr. Crescitelli and I were engaged during the summer of 1930.

We continued at the Laboratory our study of the metabolism of the pupae of **Galleria mellonella** (bee moth). Earlier we had found that the rates of oxygen consumption are not constant throughout the metamorphosis of this species but that the rates in the pupae are high at first, decrease to a minimum then increase to a maximum and finally decrease just before emergence. These changes in rates are not due to body movements, but are probably associated with the marked reorganization of the larval tissue into that of the moth. The object of the experiments this summer was to correlate the changes in the rates of oxygen consumption with changes in the organization during histolysis and histogenesis of the tissues of the pupae. It was thought desirable to determine, for example, what tissues and organs are present when the minimum and the maximum rates of oxygen consumption are exhibited. Accordingly, I made measurements of oxygen consumption using different pupae for different stages of metamorphosis. In the case of each pupa the period of measurement of oxygen consumption was long enough to show the stage of development reached with reference to the established oxygen curve. These measurements were made on individual pupae and in each case as soon as completed an X-ray photograph was made. This was followed at once by fixation for microscopical examination of tissue organization. The securing of the X-ray pictures was made possible by the facilities of the biophysics laboratory and the much appreciated cooperation of Dr. Hugo Fricke. The results of this work will be reported later.

This general problem involves an investigation of the chemical transformations taking place during metamorphosis. A paper is in preparation in which Mr. Steinbach and I will report the values of the respiratory quotients and also the occurrence of a definite sex difference in the rates of oxygen consumption and carbon dioxide output during part of metamorphosis. The values of the respiratory quotients seem to indicate a considerable transformation of fat into glucose. In order to obtain further information regarding the possibility of the occurrence of this transformation, Mr. Crescitelli during the summer made determinations of the glucose and glycogen content of the pupae at different periods of development. He is continuing this work throughout the year and analyses are to be made of additional constituents.

Dr. Webster's Report

The facilities of the Cold Spring Harbor Biological Laboratory were used during the summer of 1930 to carry on three lines of investigation. Each of these is a part of a program to determine the method of spread of infectious diseases in man and animals.

One of the diseases under observation was infectious bronchitis of chickens. Efforts were made during the past winter at the Rockefeller Institute for Medical Research to determine the nature of the etiological agent, its portal of entry, and reactions of the host. Sections of tissue from seventy spontaneous, non-experimental cases were studied histologically at the summer laboratory. The chief findings were the absence of stainable bacteria or other visible parasites, hyperplasia and hypertrophy of tracheal epithelium, extravasation of red blood cells and dilatation of capillaries and small vessels in the submucosa. No intranuclear inclusions were observed.

The second infectious disease under observation was pasteurellosis of rabbits. During the summer we were able to determine the effect of local chemotherapy on the growth of **Pasteurella** in the nasal passages and the effect of open air, partial sunshine, and fresh, green food on this carrier state. Mild oxidizing agents and weak copper solutions increased the numbers of **Pasteurella** growing in the nasal passages; conditions of open air, partial sunlight, and fresh, green diet were accompanied by a clearing up of clinical symptoms and disappearance of **Pasteurella** from the nasal passages.

The third infectious disease studied was meningococcus meningitis. Serum strains were obtained from the State Board of Health at Albany, together with three fresh cultures. A comparison of these strains revealed no significant differences in acid agglutination zones, and no permanent differences in colony morphology. The following attempts were made to infect mice by way of the normal portal of entry, i. e., through nasal passages; Test 1, adult mice of each of five special inbred strains; Test 2, similar mice, one to seven days of age; Test 3, similar mice one to seven days of age submitted to unfavorable environmental conditions of temperature; Test 4, similar mice tested after injury of nasal passages with formaldehyde, mercuric bichloride, potassium permanganate, 95 per cent alcohol. In none of these tests was a true infection established.

Dr. Wharton's Report

The Cat in Relation to Disease Transmission: Abstract of a Review

It is pointed out that the cat has not been studied with the thoroughness which its close assocation with man should warrant, and that in view of this relation it is an appropriate animal for studying the comparative behavior of certain organisms and from which a wider knowledge of the sources of infection for man may be derived.

Diphtheria is a case in point which merits investigation. The findings have been contradictory both with regard to the cat's susceptibility to the disease and its capacity to harbor the organism, although there are

indications that the cat has been connected with a number of cases of diphtheria.

Extensive and dependable data relating to tuberculosis in the cat exist and show that both bovine and human strains are found. The relative occurrence of these forms has only been investigated in a few cases. It is probable that the bovine strain occurs more frequently; nevertheless, the location of the lesions in the cat makes this animal a menace under certain conditions.

Infection from streptococci, plague, tularemia, the haemophilia and Salmonella groups, rabies, foot-and-mouth disease and other filterable virus diseases and rat-bite fever is also considered in the light of existing data on the incidence and epidemiology of these diseases, and attention is drawn to problems which could be undertaken profitably.

Amoebic dysentery, Chaga's disease and kala-azar are among the few protozoan infections of man with which the cat is apt to be associated. Except in the case of Chaga's disease, however, the cat cannot be considered as a danger, although a great deal of work can be done with amoebic dysentery in the cat with a view to establishing this animal's ability to harbor and spread the infection.

Consideration is given to the helminth parasites for which the cat may act as an important reservoir host. Among the trematodes, **Clonorchis sinensis, Heterophyes heterophyes, Paragonimus westermani** and **Schistosomum japonica** are the most important. In the Uited States **P. westermani** deserves particular attention, more, perhaps, from the economic point of view than that of human infection.

The cestode parasites of the cat are of minor concern to man, except insofar as the cat may play a not insignificant part in spreading **Diphyllobothrium latum** among fish.

Ancylostoma brasiliense, Strongyloides stercoralis and certain other nematodes have a relation of more or less importance to man. **A. brasiliense** is associated with creeping eruption, which is found to occur in many parts of the world. The worm is common to the dog and cat. While the dog strain has been shown to cause creeping eruption, the data relating to the ability of the cat strain to do so are, at present, only circumstantial. The cat is assumed, however, to be one of the main sources of infection. **A. brasiliense** affords a suitable example for studying the development of parasitism and the influences which affect it.

Strongyloides stercoralis has recently been found in a high percentage of cats in India; a fact which offers an interesting opportunity for investigating the parasitism of this worm in the cat and its relation to the human form.

The sarcoptic and fungous parasites are given brief mention.

Persons in Residence at the Laboratory in 1930

In Addition to Members of the Staff

Name	Registration	Institution	Status
David Anchel		R. N. Y. Homeo. Med. Col. and Flower Hosp.	Instructor
Genevieve R. Anthony	F. B.	Pa. College for Women	Undergraduate
Joseph V. Anthony	F. Z.	St. John's College	Undergraduate
Laura B. Bent	G. P.	Smith College	Undergraduate
Cazlyn G. Bookhout	F. Z.	N. C. College for Women	Instructor
Elizabeth Boutelle	F. B.	R. I. Col. of Education	Graduate
Keeve Brodman	R.	Cornell Medical College	Undergraduate
Alice L. Brown		Brenau College	Professor
R. Elizabeth Cass	F. Z.	Ohio Wesleyan Univ.	Undergraduate
William H. Cole	R.	Rutgers University	Professor
Frederick Crescitelli	G. P., R.	Brown University	Graduate
G. C. D'Arcangelo	G. P.	Columbia University	Graduate
Marion A. Downes	R.	Presbyterian Hosp., N. Y. C.	Technician
Nancy Downes	F. Z., E.		Undergraduate
Elizabeth Fentress	F. Z., E.	Hollins College	Graduate Asst.
Judith S. Fowler	F. Z.	H. Sophie Newcomb Col.	Undergraduate
Robert Gaunt	F. Z., S. M., E.	Princeton University	Graduate Asst.
Harry Goldblatt	R.	Western Reserve Univer.	Asst. Professor
Joseph Hahn	R.	N. Y. Homeo. Med. Col. and Flower Hosp.	Undergraduate
Rebecca Halpern	R.	N. Y. Homeo. Med. Col. and Flower Hosp.	Undergraduate
Violet L. Harris	F. Z.	Brenau College	Instructor
Helen Hilsman	F. Z.	University of Pittsburgh	Undergraduate
A. G. Hollander	R.	Univ. and Bellevue Hosp. Medical College	Undergraduate
Clarence A. Horn	S. M., E.	Albright College	Professor
D. R. Hostetter	F. Z., E.	Lebanon Valley College	Instructor
George Houston	R.		Undergraduate
John R. Huggins	R.	Univ. of Pennsylvania	Graduate
Marian Irwin	R.	Rockefeller Inst. for Med. Research	Associate
Louise G. Isfort	F. Z.	Swathmore College	Undergraduate
Florence DeP. Jacobs	F. B.	Hood College	Assistant
Miriam E. James	S. M., E.	Boston University	Grad. Student
George B. Jenkins	R.	Geo. Washington Univ.	Professor
Dorothy Mary Keppel	F. Z.		Undergraduate
Jessie L. King	R.	Goucher College	Professor
Basile Luyet	R.	Rockefeller Inst. for Med. Research	Fellow

E.: Endocrinology.
F. B.: Field Botany and Plant Ecology.
F. Z.: Field Zoology.
G. P. General Physiology.
S. M.: Surgical Methods in Experimental Biology.
R.: Research.

Name	Registration	Institution	Status
Mrs. Martin	R.	Rockefeller Inst. for Med. Research	Technician
Louise McKain	F. Z.	University of Pittsburgh	Undergraduate
Willie A. Morgan	F. B.	Coker College	Graduate Asst.
Geo. R. Nagamatsu	F. B.	N. Y. Homeo. Med. Col.	Undergraduate
Edmund W. Overstreet	R.	John Hopkins Univ. Med. School	Undergraduate
A. Louise Palmer	R.	Univ. of Penn. and U. S. Bureau of Fisheries	Graduate
Marian A. Parker	F. B.	Adelphi College	Undergraduate
William M. Parkins	R.	Princeton University	Graduate Asst.
Chas. Potter	S. M., E., R.	Brown University	Undergrad. As.
Dorothy B. Rasch	S. M.	Barnard College	Undergraduate
Josephine H. Ross	F. B.	Wellesley College	Undergraduate
Eva Saper	S. M.	Barnard College	Undergrad. As.
Julius Schwartz	G. P., R.	College of City of N. Y.	Graduate
Olive K. Schaeffer	R.	University of Kansas	Undergraduate
Marian E. Smith	E.	Adelphi College	Graduate
T. L. Smith	R.	Columbia University	Graduate Asst.
L. T. Webster	R.	Rockefeller Inst. of Medical Research	Associate
Albert Zubow	R.	College of City of N. Y.	Undergraduate

E.: Endocrinology
F. B.: Field Botany and Plant Ecology
F. Z.: Field Zoology
G. P.: General Physiology.
S. M.: Surgical Methods in Experimental Biology.
R.: Research.

THE LABORATORY STAFF

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*Hugo Fricke ..... The Biological Laboratory
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*William Salant ..... The Biological Laboratory
Pharmacology

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Research in Physiology

Christianna Smith, Associate Professor of Zoology, Mount Holyoke College
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Research in Physiological Chemistry

*In residence throughout the year.

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Associate in Field Zoology

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*William M. Parkins ..... The Biological Laboratory
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*Harold Nagler ..... The Biological Laboratory
Technician

Philip Wilchins ..... The Biological Laboratory
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George E. Daniel ..... School of Hygiene and Public Health
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Carnegie Institution of Washington
Lecturer

*Catherine H. Robertson ..... Executive Secretary
*Catherine Brown ..... Secretary
*Frank Allen ..... Carpenter and Boatman
*Thomas Wheeler ..... Collector and Caretaker
*J. J. Force ..... Glass-Blower
*Christopher Henderson ..... Instrument-Maker
*D. M. Gallagher ..... Radio Engineer
*Henry Jordan ..... Animal Caretaker

*In residence throughout the year.

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