

LONG ISLAND BIOLOGICAL ASSOCIATION

ANNUAL REPORT
OF
THE BIOLOGICAL LABORATORY

COLD SPRING HARBOR
LONG ISLAND, NEW YORK

1938

LONG ISLAND BIOLOGICAL ASSOCIATION
INCORPORATED 1924

ANNUAL REPORT
OF
THE BIOLOGICAL LABORATORY
FOUNDED 1890

FORTY-NINTH YEAR
1938

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REPORT OF THE DIRECTOR

To the Officers and Members of the Long Island Biological Association:
Ladies and Gentlemen:

I have the honor to submit my report for the year 1938.

SYMPOSIA AND RESEARCH

During the last few years the activities of the Laboratory have become more and more centered around the Symposia and the research work growing out of them, and so I shall begin my report by considering these together. This is not inappropriate, for the Symposia themselves were originally described as "an experiment in scientific procedure; a new method in biological research."

The sixth Symposium on Quantitative Biology was held from June 22nd until July 21st, the usual period of nearly five weeks. The subject this year was that of protein chemistry, nearly every aspect of which was represented by 37 papers read by 44 authors. There has been general agreement that it would be unwise to let these Symposia experience the expansion which usually goes with success, and so the number of papers read this year was smaller than the number (42) in 1937. To my mind, and I think it was a general opinion, this Symposium was the most successful one yet, perhaps because of the nature of the subject. From the beginning the Symposia have been excellent, and I feel that the stage has been reached when further improvement can scarcely be expected; looking back over the last six years, however, there are two trends which are quite apparent. The first is for an increasingly large number of the participants to remain in residence at the Laboratory for long periods of time, often for the entire Symposium period or more. This is very gratifying, for the success of the meetings depends so much on the intimate contacts which the investigators have with each other. The second trend is for an increasingly large number of visitors to attend the meetings. This results from the Symposia becoming better known each year, and this summer few papers were read to audiences of less than 50 people. I do not feel that large audiences are desirable in themselves, but when one considers that the visitors were people actively interested in protein chemistry, their attendance shows the interest which the Symposia arouse. The visitors also make most valuable contributions to the discussions.

The Symposium papers and discussions are published in Volume VI of the Cold Spring Harbor Symposia with the title "Protein Chemistry." This volume is a little smaller than Volume V, but nevertheless is quite substantial and anyone reading it will find that he has almost completely covered the field as it now stands. The sale of these Symposia volumes is very satisfactory, the receipts during 1938 being \$3,281.93. We have 450 prepublication orders, and the earlier volumes are almost sold out. The volumes are now distributed to libraries and individuals in almost every civilized country.

The subject of the Symposium to be held in 1939 is Biological Oxida-

tion, and the tentative program divides the subject up as follows: I. Fundamental Aspects, II. Components of Biological Oxidation Systems, III. Inhibitors and Activators, IV. Correlations. The subject for this Symposium has largely arisen from the discussions at the Symposium of last year; many of the investigators present seemed to think that this would be a suitable time for summarizing what is at present known about biological oxidation in its widest sense. The meetings will begin June 20th and last until July 22nd. The programs will be available for distribution about the middle of May.

Again looking back over the last six years, a disappointing aspect of the work of the Laboratory has been that comparatively little use of its research facilities has been made by visiting investigators during the summer. It was originally the idea that people taking part in the Symposia would also carry out research work and laboratory space used to be allotted to them. This plan, however, never worked out for the reason that it is almost impossible for anyone to attend the Symposium meetings, do his part in revising the many discussions, and at the same time carry out research work. In order to encourage visiting investigators to use the laboratory facilities more fully we did two things last year. First we asked the Rockefeller Foundation to increase the Symposium grant from \$7,000 to \$10,000 with the understanding that at least part of the increased appropriation would be used to encourage cooperative research work growing out of the Symposia. This increased appropriation was granted. Secondly, it was clear that part of the difficulty lay in the fact that our research accommodations were not as good as they ought to be. Extensive changes were accordingly made in our laboratory buildings, and these are referred to in my report for 1937.

These efforts appear to have been successful, for this summer our research space was in almost continual use by a larger number of people actively engaged in research than in any previous year. The way in which the plans have worked can be illustrated by considering the composition, problems and results of three groups of research workers which have been formed, partly by arrangement and partly spontaneously this summer.

1. Endocrinology Group. This group of twelve were engaged on problems essentially arising out of last year's Symposium (Internal Secretions). The problems were very various, and it is expected that the results of them will be contained in some 15 to 20 papers. The members of this group were: Professors H. O. Haterius, W. O. Nelson, Robert Gaunt, and C. D. Turner; Dr. Hermann Rahn; Messrs. C. Lloyd, M. J. Kempner, A. Edelman, W. Eversole; Misses E. Loomis, A. Fox, and E. Grossman. This group worked continuously throughout the entire summer.

2. Electrokinetic Group. Drs. H. A. Abramson, M. Gorin, L. S. Moyer, J. Daniel, and E. Ponder; Mr. R. Furchgott; Misses C. Metz, J. Porter, and L. Jennings. This very active group spent the summer carrying out investigations on the separation of proteins by the moving boundary method, the iontophoresis of substances through the skin, the electric mobilities of red cells after different forms of hemolysis, and other problems of the same type. Dr. Abramson reports that seven papers will arise from the summer's work.

3. Permeability Group. Prof. H. F. Blum, assisted by Mr. C. Hyman, spent the months of June and July at the Laboratory studying the kinetics of photodynamic hemolysis in collaboration with Dr. E. Ponder. At the same time Dr. Hugh Davson, Beit Fellow at the University of London, spent the summer continuing his investigations on permeability, again in collaboration with Dr. Ponder, and Dr. J. Danielli, also of the University of London, was the fifth member of the group, engaged in investigating photodynamic hemolysis by the Langmuir surface tray technique. Eight papers are expected from the summer's work.

The reports of the investigators will be found in full on pages 22 to 37.

The total number of investigators was 34, as many as our present space can accommodate. This number does not include the investigators engaged in field work in the later part of the summer, nor those engaged in library work and writing reviews. Much of the work done, of course, was of a more or less preliminary nature, and this is as it ought to be, for one of the most important functions of the Laboratory is that it should be a place where investigators can work out their ideas together, afterwards to take their problems home with them for completion. A fair estimate of the number of papers which will result from this summer's work is 35 to 45. In all, the dining hall books show that 143 students and investigators, excluding wives and families, were associated with the Laboratory for longer or shorter periods during the summer.

I would like to point out to the officers and members of the Association that with regard to the amount of research work turned out the Laboratory is remarkably efficient. In all, the number of papers published from the Laboratory, in first class scientific journals, is something in the neighborhood of 40 a year. This is about the number of papers published by a typical university department with a staff of about 30, or as a matter of actual record by a well-known research institution with a staff of about 50. The implications of this are clear; it means that the encouragement of cooperative summer research is a very effective means of getting things done.

INSTRUCTION

So far as the teaching activities of the Laboratory are concerned, my report is not so good. The two experimental classes held in the first part of the summer, Surgical Methods in Experimental Biology and Experimental Endocrinology, were only half registered, and the class in Plant Ecology had no registration at all. This decrease in the number of students is not due, I am certain, to any lack in the quality of the instruction, for other Laboratories experienced the same low registration. The obvious explanation is that 1938 was a depression year. A number of students applied for admission and then withdrew their applications because they had to get jobs in order to go back to school this fall. The decrease in registration made a loss of \$2,000 in Laboratory income, with the result that we finished the year with a deficit which was made up at the last moment. In contrast to the other courses, the class in Marine and Fresh Water Zoology was fully registered; the fact that six of the students held scholarships from their respective universities is probably the reason for this, and it is gratifying

to find that university departments are tending more and more to support students who are studying at the Laboratory.

It is a pleasure to comment on the excellence of these courses. Most of the students are graduates, and the standard of their work is very high. For further information about the courses I refer you to the reports of the instructors on page 20. In 1939 we propose to discontinue the course in Plant Ecology. There does not seem to be a demand for this type of work, probably because the subject is somewhat in advance of its time.

As reported last year, plans were made for a Conference on Plant and Animal Communities to be held during the first week of September. The subject of the Conference was covered by 10 papers, given by 10 authorities in the field, and the interest shown in the Conference was surprising, the audiences ranging from 30 to 60 people or more. This Conference did much to prolong the season of activity at the Laboratory into the late summer, and a detailed report of it will be found on page 18.

EVENING LECTURES

- June 28th. Dr. Harold F. Blum, University of California—
"Diseases of Animals Due to Light."
July 5th. Dr. Harold F. Blum, University of California—
"Photodynamic Action."
July 12. Dr. Hans O. Haterius, Ohio State University—
"The Hormonal Nature of Oxytocin."
July 19th. Dr. George W. Corner, University of Rochester School of
Medicine and Dentistry — "The Adventures of Dr.
Kane."
July 26th. Dr. Warren O. Nelson, Wayne University, College of Medi-
cine—"Lactation."
August 2nd. Dr. Herman T. Spieth, College of the City of New York—
"Insect Control."
August 9th. Dr. M. H. Jacobs, University of Pennsylvania—
"Species Differences in Red Cell Permeability."

LIBRARY

Again we have not had much money to spend on books, but we have continued our subscriptions to current journals in physiology, physics, and physical chemistry. Some additions have been made to our collection of reprints, which now totals more than 22,000. Indeed, the collection is now so large that we are running into difficulties about space. The Scientific Advisory Committee has again recommended that special funds be obtained to house the library in a new building and to buy back numbers, but such funds do not seem to be forthcoming. The problem of the library is a very difficult one. Every scientist realizes the importance of a ready access to the journals in his field, but as a matter of practice, the establishment of a good working library would cost not tens, but hundreds of thousands of dollars, and its upkeep would run into thousands a year. Considering that there are no less than five large libraries in New York City, it seems scarcely essential for us to do anything more ambitious than we are doing. Under

any circumstances, it is quite likely that reproduction on film will revolutionize the entire library system in the near future.

INSTITUTIONS REPRESENTED

The following 76 institutions were represented last summer, either by students, investigators, or people taking part in the Symposium, who were actually in residence at the Laboratory. The extent of the list is in some degree a measure of the extent of the influence of the Laboratory.

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Cornell University
Cornell University Medical School
De Pauw University
Duke University Medical School
Finch Junior College
General Electric Company
George Washington University Medical School
Grinnell College
Harvard College
Harvard Medical School
Institut Pasteur, Paris
Johns Hopkins University Medical School
Kerckhoff Marine Laboratory
Lederle Laboratories
Long Island College of Medicine
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McGill University
Mount Sinai Hospital, New York City
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New York University College of Medicine
New York University, Washington Square College

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Ohio State University
Oxford University, England
Packer Collegiate Institute
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University of Tennessee, Knoxville
University of Tennessee, Memphis
University of Wisconsin
Washington University
Wayne University College of Medicine
Yale University
Yale University Medical School
Yonkers General Hospital

LABORATORY BUILDINGS

It is a pleasure to be able to report that our Laboratory buildings are in excellent condition, the main desirable addition being a hot water system in the John D. Jones Laboratory. We have made considerable improvement and renovation in the George Lane Nichols Memorial building as a result of a special contribution from Mr. and Mrs. Acosta Nichols. The stockroom in the south wing of the building has proved a great convenience, and much of the valuable apparatus belonging to the Laboratory is stored there during the winter months.

In my last report I called attention to the fact that we do not have the laboratory space which we require. The John D. Jones Laboratory was in constant use this summer, visiting investigators using it during the earlier months, and the class in Marine and Fresh Water Zoology using it during the later months. The Davenport Laboratory was also used all the time (both by classes and by the various members of the endocrinology research group). The seven laboratories in the George Lane Nichols Memorial building accordingly had to house the remainder of the visiting investigators, with the result that the building was overcrowded. This situation, however, is likely to be relieved by the fact that Dr. Climenko and his staff, at present occupying the Wawepex Laboratory and employed by the Calco Chemical Company of Bound Brook, N. J., are being transferred to Stamford in June. The Wawepex Laboratory will accordingly become available for use by summer investigators. Since it contains six well equipped laboratory rooms, our space difficulty will disappear temporarily. I also called attention in my last report to the fact that we need more space for animals; the Wawepex building has a good animal building in the basement, so this problem will be solved.

During the year Mrs. Harris has been in charge of work on houses and grounds, and she gives the following report of the work which has been done during the year. "We are happy to report that this year we have painted the shutters and trim, redecorated the laboratory rooms, and refinished the floors in the George Lane Nichols Memorial building. This work was made possible through a generous gift from Mr. and Mrs. Acosta Nichols.

Hooper House has been given two coats of paint, and Williams House has an undercoat and part of a topcoat of paint. Limited funds prevented us from finishing this work and continuing this much needed painting to some of our other buildings.

Our annual redecorating of apartments and curtain making occupied, as usual, the early spring months, for our eight houses with living quarters need constant upkeep. We received a number of gifts of household furnishings, so that gradually the living conditions are improving.

Mrs. Percy Jennings, the Chairman of the House Committee, was active in helping to raise funds for the purchase of additional glass and chinaware for Symposium entertaining.

Williams House looks much neater for we have graded in the rear of that house, laid a brick walk, and constructed a low trellis for the wisteria. The hillside near the harbor, between Jones Laboratory and Wawepex Laboratory, has also been graded—a great wilderness of overgrowth was removed, the trees pruned, and the little brook, which comes from the Artesian well overflow, has been rocked in. This used to be a favorite spot with the students, and we hope they will enjoy it again next summer. All along the harbor side of our road we have pruned trees. This has greatly improved the view and will allow more circulation of air.

The hurricane felled over a hundred trees on our grounds and in our woods. All the labor we have been able to spare since then has been used in cleaning up and trying to save the fallen trees for firewood and fence posts."

The increased number of guests and visitors and the increased demands on our research space have made it necessary for us to continue to improve both our buildings and our equipment. Just as last year most of the expense went into putting the laboratory buildings into good condition, so this year we have had expenditures of roughly \$2,000 in putting our living accommodations in good order. For a scientific community such as this is in the summer, good living conditions are as necessary as good laboratories.

ACKNOWLEDGMENTS

The work of the Laboratory has been made possible only by the generous support of the Rockefeller Foundation, the William C. Whitney Foundation, the Wawepex Society, the Carnegie Corporation, the officers and members of the Women's Committee, and by the many generous contributors in the neighborhood.

The Women's Committee has contributed money and furniture, and the Laboratory is under a special debt to Mrs. Merle-Smith and the officers of the Committee for the many ways in which they have helped us to meet problems relative to the houses and grounds. The work on the study of in vivo hemolysis has been supported by a grant from the American Association for the Advancement of Science, and the work on stored blood by a grant from the Blood Donors Betterment Association. Again our special thanks are due to Dr. M. L. Crossley of the research staff of the Calco Chemical Company, and to Mr. E. H. Anthes of the Bausch & Lomb Optical Company, from whom we have received help in various ways.

Respectfully submitted,

ERIC PONDER.

CONFERENCE ON PLANT AND ANIMAL COMMUNITIES

During the week of August 29th was held what proved to be a unique ecological conference. The ten papers presented during the five-day period were prepared by well-known investigators in the respective fields. The Conference was distinguished by the breadth of its approach to the problems of the community. The speakers, of which there were four botanists and six zoologists, represented a wide diversity of interests, training, and research experience, but they had in common a deep concern with the philosophical and practical aspects of community study. From the papers and discussions developed many concepts of interest and use to those in attendance. Through the publication of the papers and discussions by *The American Midland Naturalist* (January, 1939) the results of the Conference are available to the whole ecological public. It seems likely that the Conference represents an important step toward the integration of effort among ecologists. Such integration and common understanding is difficult because of the breadth of the field of ecology, and for that reason all the more necessary.

After consideration of many aspects of the Conference problem, the following ecologists were invited to present papers:

"Plant associations on land," by H. S. Conard, Grinnell College.

"Marine animal communities," by G. E. MacGinitie, Director of the Kerckhoff Marine Laboratory of the California Institute of Technology.

"Fresh water animal communities," by F. E. Eggleton, The University of Michigan.

"The biome," by J. Richard Carpenter, Oxford University and The University of Oklahoma.

"The individualistic concept of the association," by H. A. Gleason, Curator of the New York Botanical Garden.

"The unistratal concept of plant communities," by Teodor Lipmaa, Director of the Botanical Gardens and Institute of the University of Tartu, Esthonia.

"The climax association and its complexity," by Stanley A. Cain, The Biological Laboratory and The University of Tennessee, Knoxville.

"An analysis of social organization with especial reference to birds," by N. Tinbergen, Rijks-Universiteit te Leiden, Netherlands.

"Social organization and the superorganism," by Alfred Emerson, The University of Chicago.

"Analytical population studies in relation to general ecology," by Thomas Park, The University of Chicago.

To any one familiar with the published work of these men, it is obvious that they represent as many fields of interest as there are men listed, yet they all are interested in some aspect of the community problem as a whole. This selection also indicates something of the universality of the field which commonly passes under the title of "ecology."

Space will not permit even a short review of the contents of the papers presented at the Conference, nor of the tenor of the discussions which followed each paper, but a few general remarks about each of the three groups of papers may be attempted.

In the general papers the authors made an effort briefly to survey the field and the history of work in terrestrial plant communities, and in marine and fresh water animal communities. Each author was careful to present a critical discussion of general methods and philosophies, with an interpretation of the prevailing concepts in the fields. These papers revealed much of the complexity of field problems in community study and of the cautions and training necessary for good investigations. These papers formed a good basis for the more specific discussions which followed.

The papers on the association concept represent the first recognition in the form of a Symposium of the fact that there are several concepts of the basic unit in the recognition and classification of communities. This group of papers may be compared to the rather frequent Symposia which the taxonomists have held in the past few years on the species concept. The various authors represented the four leading schools of thought relative to the association concept. Two of the speakers, Professor Lippmaa and Dr. Gleason, are the founders of the school or philosophy which they represent.

Each author explained thoroughly the factual basis for the particular concept represented and also the practical working out of the system on a field basis. The principal result of the papers and discussions was the clear presentation of the complexity of natural communities and the fact that no one method was wholly without criticism. It may be that field ecologists of the future will be able to select the portions of each method which are applicable to their particular problems and thus to develop a more consistent and satisfactory treatment of the problems of community recognition and classification. At any rate, it is very healthful for the progress of ecology that exponents of the various schools can meet together and attain a measure of understanding of what they have in common and of the reasons for the existing differences.

Also it is something of a novelty for a single program to include laboratory population studies and experimental animal psychology and social integration studies as a part of general ecology. It was proven sound that the final understanding of the social integration of the large, mixed and exceedingly complex natural communities will depend ultimately on a knowledge of the ecology and social aspects of the individuals and of the species populations which make up the community.

Finally, it is recommended to all ecologists that the Proceedings of the Conference on Plant and Animal Communities are a fertile and stimulating source of general information on community study problems and concepts.

STANLEY A. CAIN, Secretary of the Conference
THEODOR JUST, Editor of the Proceedings
ERIC PONDER, Director of the Laboratory

REPORTS OF INSTRUCTORS

SURGICAL METHODS IN EXPERIMENTAL BIOLOGY

The course in Surgical Methods in Experimental Biology had an enrollment of six, of whom one was a graduate student in zoology, one a college senior preparing for graduate work, three pre-medical students, and one a college graduate in training for advanced laboratory technical work.

Members of the class all evinced serious interest and the instruction proceeded smoothly. As in the previous year, demonstrations and other assistance were generously given by Drs. Haterius and Gaunt of the staff of the course in Endocrinology, and also by Dr. Ernest W. Blanchard of the Scientific Laboratories of Schieffelin and Company. Dr. J. P. Schooley of the Carnegie Institution of Washington provided a very instructive demonstration before the class. Dr. C. Donnell Turner of Northwestern University was a welcome visitor and participant in some of the work of the course. A visit to the operating rooms of Cornell Medical Center was made possible by the courtesy of Dr. Ralph P. Bowers.

Members of the class all attended the lectures in Endocrinology and as before the two courses ran in close cooperation.

GEORGE W. CORNER.

EXPERIMENTAL ENDOCRINOLOGY

The course program was carried out substantially as arranged for the previous year, i.e., with daily lectures and laboratory work, the former comprising a survey of the physiology of the pituitary and gonadal hormones, the adrenal cortex, and certain aspects of the endocrine role in carbohydrate metabolism. In each instance stress was laid upon the current status of the problems considered with emphasis upon original literature. Lectures were attended as well by the class in Surgical Methods.

In the laboratory students worked for the most part in teams, and opportunity was afforded for training in the more fundamental experimental procedures, including, for example, the preparation and care of animals, the technique of vaginal smear determinations, physiological and histological effects of extirpation of endocrine glands, the physiological effects of administration of gonadotropic and oestrogenic principles, the experimental control of lactation, studies on the adrenalectomized animal, viz., deficiency syndrome, hormone administration, salt therapy, water balance, and so on. Responsibility was shared by the respective teams in preparation of histological material and, by exchange, each student upon completion of the course possessed a representative set of slides:—tissues of the hypophysectomized animal, before the following restorative therapy; mammary tissue, inactive, proliferated, and lactating; and, in general, accessory organs showing the effects of various experimental procedures.

The class profited greatly through the generous cooperation of Dr. George W. Corner, who from time to time discussed certain fundamental problems related to the physiology of reproduction, and from the excellent lectures and demonstrations obligingly given by Drs. Warren O. Nelson, R. W. Bates, and Eric Ponder.

HANS O. HATERIUS
ROBERT GAUNT

MARINE AND FRESH WATER ZOOLOGY

The Marine and Fresh Water Zoology course had an enrollment of twelve students. There was about an equal number of upperclassmen and graduate students drawn from diverse parts of North America. The general scholastic ability of the group was high and this, plus the fact that the students were congenial, resulted in an effective and energetic class.

Field trips were the fundamental basis for the course. Seven fresh water and twelve marine collecting trips were conducted to various habitats. In addition, plancton catches were taken at various times to acquaint the students with various planctonic forms, and especially with the marine larvae. Lectures were given from time to time, and were supplemented during the laboratory periods by numerous individual conferences. The students also attended all of the lectures given at the Conference on Ecology, held at the Laboratory at the end of August. Besides maintaining the material collected on field trips, each student performed a number of experiments on regeneration, axial gradients, metamorphosis, and chromatophoral responses.

HERMAN T. SPIETH
WILLIAM A. CASTLE

REPORTS OF INVESTIGATORS

Dr. Harold A. Abramson's Report
College of Physicians and Surgeons, Columbia University, and the
Mount Sinai Hospital, New York

The work of the preceding years has been carried forward, and further data have been obtained which enable a more quantitative elucidation of the nature of skin reactions in allergy. This study of skin reactions has been combined with other studies in electrophoresis. During the past year the method of electrophoresis itself, especially the moving boundary method as developed by Tiselius, has become of great importance in immunology. The close connection between allergy and immunology makes it important that further advances in the field of allergy be made with the tools which have been developed by the immunologist.

At the request of the American Chemical Society a review of the polar groups of protein and amino acid surfaces in liquids, was prepared in collaboration with Drs. M. H. Gorin and L. S. Moyer. In addition, Dr. Gorin continued theoretical investigations on the relation of the size and shape of protein molecules to the potential of the protein. Dr. Gorin has fairly successfully, by this method, predicted the radii of certain protein molecules from electrokinetic data.

The quantitative study of skin reactions begun some years ago was continued with Miss Cecile Metz of the State College, Pennsylvania. Miss Metz adapted an ordinary photographic enlarger to the recording of contours of skin wheals produced by ragweed and histamine. A careful study was made of the effect of histamine concentration on the height and area of the wheals produced. Sufficient quantitative data have been obtained to direct further investigations along these lines in analyzing allergic skin reactions.

With Miss Laura Jennings and Miss Jamie Porter of Bennington College, Vermont, the first investigation was made on the electrical mobility of the biologically active constituent of ragweed pollen in solution. It had previously been found, in collaboration with A. S. Sookne and L. S. Moyer, that the substance adsorbed by quartz particles from ragweed solutions was the active constituent. At the pH of the body fluid it was found that this active constituent was negatively charged. It was necessary, however, to ascertain if this negative charge existed not only on the surface of the quartz particles, but also in solution. The fact that there was no positively charged active constituent at the pH of the body fluid is of importance in understanding the mechanism by which it is possible to drive the biologically active constituent of ragweed pollen into the skin while skin testing individuals sensitive to ragweed pollen, and who have hay fever.

As part of the investigation of skin testing by means of the electrophoresis of the biologically active constituent of ragweed pollen into the skin, four cases of hay fever were treated during the summer at the

laboratory. This is the first time, it is believed, that an allergen or antigen like ragweed protein has been introduced into the body without injection. The results in these four cases are encouraging, and it is planned to extend the method of ragweed electrophoresis, as well as the electrophoresis of biologically active constituents of other pollen, during the following summers.

Dr. Janet Daniel reconstructed the micro-electrophoresis outfit which has been in use in previous summers. At the conclusion of her period of residence at the laboratory, Mr. Robert Furchgott made a careful study of the electrical mobility of hemolysed ghosts. The results of this study will be found in his report.

An electrophoretic method has been found which gives maps of the patent pores of the living human skin.

It is a source of satisfaction to me that the quantitative study of the electrical charge of a protein may be directly applied to practical therapeutic procedures in medicine. This is an important justification of the general program which the Laboratory is pursuing.

Dr. Harold F. Blum's Report

University of California Medical School and the Washington
Biophysical Institute

Assisted by Mr. Chester Hyman, I carried out quantitative studies on the kinetics of photodynamic hemolysis, which help to elucidate the mechanism of the photodynamic process. The general picture obtained as a result of these studies is as follows: The dye molecule which serves to sensitize a cell to light, must be taken up at some point in the cell, probably on the surface, in most cases, where it produces the oxidation of cell constituents by molecular oxidation when activated by light. Because of the small quantities of dye required, sufficient to cover only a few percent of the cell surface, it seems certain that a single dye molecule may participate repeatedly in this reaction; for each quantum of light which it captures it may bring about the oxidation of a neighboring molecule of an oxidizable cell component, a process which may be likened to the action of a drill which receives successive blows from a hammer. The structure of the cell is ultimately destroyed in this way. This "quantum drill" mechanism explains the irreversibility and additiveness of the photodynamic process which the kinetic studies demonstrate, and is in accord with what is known of the photochemical action of the photodynamic dyes. These studies are fundamental to a monograph on photodynamic action and disease, which I am preparing.

Dr. David R. Climenko's Report

Pharmacological Laboratory
Calco Chemical Company

1. Chemotherapeutic agents. More than 200 drugs of the sulfanilamide type which have been synthesized by Drs. M. L. Crossley and

E. H. Northey have been examined for their chemotherapeutic properties in experimental infections with (1) *Streptococcus beta hemolyticus*, (2) *Streptococcus viridans*, (3) *Pneumococcus*, (4) influenza virus, (5) *B. tuberculosis*. The most interesting result which has been observed is the protective action of a number of these derivatives (di-sulfanilamide, 2-5-bis-sulfanilamido-benzene-sulfonate) which have been found to be effective in protecting animals from small but fatal doses of the influenza virus. This work has been published in the *Journal of the American Chemical Society* and in the *Journal of the American Medical Association*.

A considerable amount of attention has been placed on sulfanilamidopyridine. This derivative has been found to be equally efficient as sulfanilamide itself in streptococcus infections, and is considerably more potent as a therapeutic agent in the treatment of pneumococcal and staphylococcal infections.

A number of long chain derivatives such as dodecanoyl sulfanilamide, compounds having a high degree of fat solubility, are showing promising results in the treatment of experimental tuberculosis.

2. Studies on the pharmacology and toxicology of the simple cyclic compounds has progressed along the lines indicated in our previous report.

3. Examination of a series of drugs synthesized under the direction of Prof. A. J. Hill of Yale University is continued. Emphasis has been placed on sedatives and narcotics of the urethane series.

Dr. J. F. Danielli's Report
University College, London

A study was made of the action of visible light on protein films in the presence of the physiologically photodynamic dye rose bengal. After irradiation the elasticity of the initially elastic protein film is greatly reduced and the film may even be liquefied. There appear to be two factors at least involved in this liquefaction. (1) To some extent the film is probably oxidised, but the magnitude of this effect cannot be accurately estimated at present, owing to the effect of the second factor. (2) Irradiation of the dye alone produces some surface active substances which influence the film to a degree comparable with the oxidative process.

Dr. Hugh Davson's Report
University College, London

The general problem of specific ionic permeability was investigated with special reference to the permeability of erythrocytes to K^+ . The work done may be divided under four heads.

(a) The Effect of Diminution of the Ionic Strength of the Suspension Medium. It is pointed out that in virtue of the ionic exchanges which follow a large diminution in the electrolyte content of the suspension medium there will be a large difference in potential across the membrane, the potential of the inside of the cell being positive in respect to the suspension medium. This P. D., by repelling positive ions, may give the latter a sufficiently great kinetic energy to allow of their passing the membrane. It is shown experimentally that an induced permeability to

cations due to diminution of the electrolyte content of the suspension medium is a general characteristic of the erythrocyte excepting those of the rabbit and pig. Experiments have been performed, designed to show whether the permeability to K^+ is indeed due to this P. D. or whether a change in the structure of the membrane is responsible. The evidence is in favor of the latter idea, the change, however, being strictly reversible. This work will be published within the next month or two.

(b) The Permeability of the Cat Erythrocyte to Cation. Some in vivo work by Robinson and Hegnauer indicates that the cat erythrocyte is permeable to K^+ to no small extent; however, as the ability to control one's experiments, and the range of variation of the conditions, are limited in these circumstances an extensive investigation into the nature of the permeability of these erythrocytes in vitro was undertaken. The work will be completed at University College; so far it appears that the cat erythrocyte is indeed permeable to K^+ and to a lesser extent to Na^+ . The process is accelerated by Ca^{++} ions and by high concentrations of narcotics and lysins.

(c) The Action of Photodynamic Dyes. It was shown that rose bengal added to erythrocytes induces a permeability to K^+ on exposure to light. This permeability cannot be reversed by cutting off the light or addition of reducing agents; it is hoped to publish this work with Dr. Eric Ponder, considering it in relation to his theory of the mechanisms of lysis.

(d) The Effect of Narcotics. It is generally assumed that an important factor in narcosis is the inhibition of the permeability of the cell to K^+ . Using the cat erythrocyte as a suitable cell it is shown that narcotics have only a very small inhibiting action on the migration of K^+ while they have a striking effect on the permeability to Na^+ , the passage of this ion being completely prevented under conditions where the passage of K^+ proceeds quite normally. This work is being extended to other systems and will be published during 1939.

Report of Drs. Hugo Fricke, Edward A. Parker and Adolf Parts The Biological Laboratory

For some years we have been interested in questions relating to the nature of the primary chemical reactions underlying the effects of X-rays on living materials. During the past year the denaturation of solutions of egg albumin by X-rays was studied in cooperation with Dr. Parker, and the influence of the concentration of the protein (from low concentration through the whole range to solid protein), pH, oxygen, and the presence of various simple types of organic chemicals was determined. An essential purpose of this work was to determine, at protein concentrations comparable to those occurring in cells (around 30 per cent), the extent to which the denaturation of the protein results from the activation of the water by the rays, and from direct excitation of the protein molecules. The contributions of the two mechanisms were found to be about equal at a protein concentration of 30 per cent. The influence of added organic

materials is interesting because of the great retarding or accelerating action which was found to be exerted by some of these substances (cyctine and phenol, for example) even when they were present as traces only. A report of some of this work, together with a review of earlier works on the denaturation of proteins by X-rays or radioactive rays with a view to determining the part which the activation of the water by the rays plays in the denaturation process was presented at the Symposium this summer and is published in Cold Spring Harbor Symposia on Quantitative Biology, Volume VI, page 164 (1938) under the title: The denaturation of proteins by high frequency radiations.

A quite comprehensive work on the chemical action of X-rays on solutions of simple organic substances was published during the year in the Journal of Chemical Physics, Volume 6, page 229 (1938) under the title: The reactions between organic compounds and X-ray activated water.

This laboratory has long been interested in the physical processes which underlie the reactions produced in living materials by electric fields. A few years ago a new dielectric phenomenon was discovered at water-dielectric interphases, which appeared to have an important bearing on this subject. Later work indicated that this phenomenon originates in the oriented water close to the interphase and studies concerned with the test of this theory and with its application to living materials have been carried out during the year. Part of this work, which dealt particularly with gelatin, has been accepted for publication in the Journal of Physical Chemistry, under the title: The dielectric properties of gelatin-water; anomalous dispersion in oriented (bound) water.

In cooperation with Dr. Parts, a study of the anomalous dispersion in solutions of amino acids was carried out and published in the Journal of Physical Chemistry, Volume 42, page 1171 (1938), under the title: The dielectric absorption and dielectric constant of solutions of aliphatic amino acids.

A few years ago we carried out a study of dielectric changes produced in the surface membrane of the erythrocyte as a result of hemolysis. This work showed that the membrane, after various mild types of hemolysis, retained a very low conductance. In such cases conductance measurements can be used to determine the volume of hemolysed erythrocytes in a suspension. This procedure forms the basis for a method of determining the dry weight of the surface membrane of the erythrocyte. The principle is to hemolyse blood by adding water, to effect a concentration of the hemolysed cells in the lower section of the hemolysed fluid by centrifugation, and then to separate this lower section from the upper section. The difference in dry weights between the two sections is determined and corrected for the content of hemoglobin and of inorganic salts. Furthermore, by conductivity measurements, the difference in the number of cells contained in the two sections is obtained. By dividing the former of these magnitudes by the latter, the dry weight of the fixed framework of the hemolysed cell is derived and thus the dry weight per unit surface of the hemolysed cell can be obtained if it is assumed that the fixed framework is exclusively a surface structure. It turns out that the surface structure has a thickness of about 120 A, if the contribution

of water is excluded. This work was carried out with Drs. Parker and Ponder, and is published in the February 1939 number of the Journal of Cellular and Comparative Physiology, under the title: The fixed framework of the hemolysed rabbit erythrocyte.

Mr. Robert F. Furchgott's Report
Northwestern University Medical School

Electrophoretic measurements were made on unlysed rabbit red blood cells and on the ghosts of rabbit red blood cells prepared by hemolysis with hypotonic saline, by freezing and thawing, with chloroform, and with saponin. The unlysed red cells and the ghosts prepared by these different methods of lysis all had the same electrophoretic mobility. This means that in lysis by these methods the outer surface of the cell either undergoes no chemical change or undergoes a change which can not be detected by electrophoretic measurements. Electrophoretic measurements were also made on oil droplets and quartz particles with saponin adsorbed onto their surfaces; and it was found that the electrophoretic mobility of saponin red cell ghosts formed by saponin lysis. This work is being published with Drs. Abramson and Ponder in the Journal of General Physiology.

Report of Dr. Robert Gaunt, Dr. W. O. Nelson and Miss Eleanor Loomis
Washington Square College, New York University
and Wayne University Medical School

I. The Effect of Crystalline Progesterone on Adrenalectomized Rats.

Gaunt and Hays found that adrenalectomized ferrets could be maintained in excellent health with crystalline progesterone, thus giving a probable explanation for the old observation that pseudopregnant adrenalectomized animals do not get adrenal insufficiency.

We found that this curious phenomenon was not species specific since young adrenalectomized rats of either sex could also be maintained on progesterone. The rat, however, was much less responsive to progesterone treatment than the ferret. The dosage necessary to maintain a 50 gm. rat was from 1.2 mg. per day, about the same as that demanded by a ferret of 10 to 20 times that body weight. This demand for high dosage in the rat probably accounts for the many previous failures to detect the cortical hormone-like action of progesterone.

II. The Effect of Sex Hormones on the Response to Intoxicating Doses of Water.

One function of the adrenal cortex concerns the regulation of electrolyte and water metabolism. Thorn and Harrop found that in intact animals both the sex and cortical hormones had a somewhat similar effect on electrolyte excretion. In adrenalectomized animals, however, the authors and others have found that the estrogenic hormones are toxic, the androgens non-beneficial, and progesterone a life-maintaining substance.

Adrenalectomized animals are highly susceptible to the intoxicating effects of excess water, administered by stomach tube. They can be readily protected by cortical hormone. We considered it probable, therefore, that

the sex hormones would likewise modify the response to excess water in either normal or adrenalectomized animals or both.

We were unable to find, however, any action of estrogens, androgens or progesterone on the above phenomena in any type of rat used. This was particularly surprising in the case of progesterone, a substance which can substitute for the adrenal cortex in the vital function of maintaining life. The results indicate either a qualitative difference in the action of progesterone and cortical hormones or a marked difference in the rate of their effective actions.

III. Role of the Adrenal Cortex in Diabetes insipidus.

It has been well demonstrated that the presence of functional anterior lobe tissue together with the lack of function of posterior lobe tissue is essential for the development of a permanent diabetes insipidus (excess loss of water through the kidney). The anterior lobe principles involved in the maintenance of this polyuric state have not been identified.

We attempted, therefore, to determine if a more severe polyuria could be maintained in hypophysectomized animals by giving adrenotropic hormone and thus preventing the post-hypophysectomy atrophy of the adrenal cortex. While this work was in progress, Silvette and Britton elucidated the hypothesis, on the basis of indirect evidence, that the transitory nature of the diabetes insipidus following hypophysectomy was, in fact, due to the atrophy of the adrenal cortex. Our observations indicated not only that this hypothesis was incorrect, but that a stimulated adrenal cortex actually acts as an anti-diuretic rather than a diuretic influence in hypophysectomized rats.

A purified adrenotropic-lactogenic hormone preparation given in large doses to hypophysectomized rats, beginning at the time of operation, failed to prevent the cessation of diabetes insipidus.

After diabetes insipidus had abated the subsequent repair of the adrenal cortex by adrenotropic hormone reduced rather than increased the urine output. Cortical extract, likewise, failed to re-establish diabetes insipidus after it had once subsided.

Report of Dr. Robert Gaunt and Mr. Abraham Edelman
Washington Square College, New York University
and Johns Hopkins University

Factors Involved in the Secretion of Lactogenic Hormone.

In view of certain confusing reports in the literature, a study was begun of the identity and mode of action of certain substances reputed to inhibit the secretion of lactogenic hormone. This work was necessarily of long duration and is being completed at Washington Square College.

Report of Dr. Robert Gaunt and Miss Edith Grossman
Washington Square College, New York University

Effects of Sodium and Potassium Salts on the Response to Excess Water.

Adrenal insufficiency can be prevented in part by sodium salt treat-

ment, and augmented by potassium salts. Adrenalectomy increases the susceptibility of animals to the intoxicating effects of excess water. We studied, therefore, the effects of sodium and potassium salts on the response to excess water in normal animals, particularly to see if potassium would induce changes like those of adrenalectomy.

The definite protective action of sodium salts, as previously known for other forms, was established for the rat. The action of potassium salts was more complicated, and conclusions must await the completion of a few more experiments at Washington Square College this fall.

Report of Dr. Robert Gaunt and Mrs. Jennie Shapiro
Washington Square College, New York University

Response of Adrenalectomized Rats to Pregnancy Urine Extracts.

A report in the literature that there was a qualitative difference in the ovarian response to pregnancy urine prolan following adrenalectomy was investigated. Our experiments were designed to repeat and test this hypothesis, but they failed completely to confirm it.

Dr. A. J. Grout's Report
Biological Laboratory

Volume I, pt. 3 of *The Moss Flora of North America* was issued October 25th last. Dr. Seville Flowers of the University of Utah, Dr. William C. Steere of the University of Michigan, and Mrs. Inez M. Haring, unofficially working at Vassar College, contributed. Manuscript for Vol. II, pt. 4 and Vol. I, pt. 4, completing the series, is now in preparation and will be ready in 1939, publication depending on available funds.

Mrs. Inez M. Haring was the only student at Newfane this summer. She was doing taxonomic work on her collections.

Miss Mildred L. Wickes, a student at Newfane in 1937, spent this summer vacation collecting mosses in Labrador. Her collection of more than 100 numbers, including one species new to science, were named by me with assistance from specialists in various genera, and will be distributed in sets in 1939. Miss Wickes intends to spend the summer of 1939 continuing the bryological exploration of Labrador and Newfoundland.

Several hundred specimens have been named for various colleges and private students, including at least two species new to the United States.

Numbers 326-350, *N. American Musci Perfecti*, have been issued. Articles for the *Annales Bryologici* and the *Bryologist* have been accepted and published.

Dr. Hans O. Haterius' Report
Ohio State University

Work was begun during the past summer upon the hormonal factors

involved in regulation of water diuresis in the experimental animal, and a technique was evolved which has been employed since that time. The work is in too early a stage as yet to permit of a detailed report at this time. In addition to the above, Mr. M. J. Kempner, a former student in the Experimental Endocrinology course, and I began a series of experiments bearing upon the problem of maintenance of pregnancy in the oophorectomized rat. Excellent progress was made in this work, and evidence was obtained which would indicate that under suitable conditions uterine distension will of itself maintain an experimentally monocious pregnancy in the spayed female; this observation is of importance since it bears directly upon certain puzzling aspects of the physiology of pregnancy. Our observations have been extended during the past few months and will be ready soon for publication.

Mr. Mortimer Jay Kempner's Report
Long Island College of Medicine

The following work was undertaken at the suggestion of Dr. H. O. Haterius to test a hypothesis of S. R. M. Reynolds (1937). He had suggested that there might be a mechanical factor in pregnancy; i.e. distention of the uterus, which might take the place of or act in conjunction with the corpus luteum hormone in the maintenance of gestation.

Three rats at the 14th day of gestation and two at the 15th day of gestation were operated on in two stages. At the first stage, one ovary was removed and all but one of the foetuses "shelled" out by one incision in each uterine horn. All placentae (except that of the remaining foetus) were also carefully removed. In two of the animals paraffin (temp. 44-48° C. at the time of injection; melting point 42-44°C.) was injected into both uterine horns. In the other three animals the paraffin was injected only into the horn not containing the foetus. The distention in any case was not larger than the size of the 15 day old conceptus. Two days later the remaining ovary was removed. At the 22nd day the animals were opened. Four of the foetuses appeared perfectly normal and weighed 3.48, 4.98, 5.35 and 5.36 gms. The other foetus had a slight haematoma but weighed 3.6 gms. Two other animals operated on in a similar manner dropped their foetuses.

One rat taken at the 14th day of gestation was operated on in a similar fashion, except that both ovaries were removed at the same time. Abortion followed within 36 hours. Other animals taken at 11-13 days and 17-18 days of gestation also aborted within 36 hours of the second stage of the operation. Those animals of 11-13 days may possibly have been lost as a result of the manipulations of the tissues involved, caused by the difficulty in "shelling" out the foetuses of this age.

Mr. Charles E. Lloyd's Report
(Temple Prime Scholar)

University of Rochester School of Medicine and Dentistry

Mr. Charles Lloyd undertook, at my suggestion, to repeat the recent work of Freed and Soskin (Proc. Soc. Exp. Biol. and Med., vol. 38, p 391,

1938), indicating the existence of an ovarian factor in the rat which inhibits the uterine response to estrin, and which is believed not to be the corpus luteum hormone, progesterin. The project involved attempting to repeat the experiments with crystalline progesterone rather than making use of the secretions of the animals own ovaries.

The summer was spent in the endeavor to repeat the original experiments. It was intended to continue at Rochester during the fall, but the illness of Mr. Lloyd has caused the project to be put aside temporarily.

GEORGE W. CORNER.

Dr. Vincent E. Morgan's Report
Harvard Medical School

My research work at the Biological Laboratory during the summer of 1938 consisted in an attempt to obtain crystalline myoglobin from fish muscle. The fish used was the common mackerel (I believe this is called the "Boston" mackerel). The pigment was extracted from the red lateral muscles of the fish by water and the crystallization of the myoglobin was attempted by various methods on the solution so obtained. Unfortunately none of the methods tried yielded crystals detectable under the microscope. The spectrum of the solution at various stages in the procedure was followed with a Hortridge Reversion Spectroscope. No appreciable shift was noted during the attempted purification.

It seems quite certain that myoglobin is present in the lateral muscles of this fish because of their deep red color. However, the problems of purification and crystallization have not yet been solved.

Dr. Eric Ponder's Report
The Biological Laboratory

The investigations carried out by myself and my collaborators are best reported under the titles of the papers in which they are being published.

1. The fixed framework of the rabbit red cell. An investigation by Fricke in 1925, using conductivity and capacity determinations, indicated that the thickness of the red cell membrane is about 30 A, but since that time many of the assumptions originally made in the calculations have been revised. We therefore attempted to find the amount of material available to form a surface membrane by a method which would give unequivocal results. A suspension of red cells, of known volume concentration, is hemolysed by 6 volumes of water: "reversal of hemolysis" is produced by adding NaCl, and the ghosts are thrown down. The volume concentration of the upper fluid, and the lower layer containing the ghosts, is found by conductivity; from these the difference in volume concentration of the ghosts in the two layers is obtained. The dry weight per unit volume of the two layers is determined, and by dividing the difference between the dry weights by the difference in volume concentration, the weight of the non-diffusible components of the red cell, or "fixed framework",

per unit volume, is found. The average value of the weight of the fixed framework per unit of cell surface is 120×10^8 gm./cm². If all the material were distributed at the cell surface, the thickness of the surface structure, excluding any contribution of water, would be about 120 A. This would be compatible with the results of capacity measurements if a dielectric constant of about 14, instead of 3, were used, and the former figure is much more likely to be the right one. If we add a 50 p. c. contribution to the thickness of the membrane because of contained water, we end up with a membrane thickness in the neighborhood of 180 A. (Fricke, Parker and Ponder, *J. Cellular and Comparative Physiology*, Vol. 13, page 69, 1939).

2. Electrical mobility of red cells and ghosts. Measurements of the electrical mobility of washed rabbit red cells and ghosts produced by hypotonic solutions, freezing-and-thawing, chloroform, and saponin, were made in the Abramson micro-electrophoresis cell. These different forms of lysis, involving a variety of different degrees of injury to the red cell, were found to be unaccompanied by changes in electrical mobility. This entirely unexpected result may be explained in one of at least two ways. The first is to invoke Abramson's "key spot" hypothesis, which suggests that lysis results from certain key spots in the membrane breaking down, the greater part of the surface, however, being unaffected. The second possibility is suggested by the particular form of the membrane ultrastructure as we now conceive it to be: an outer, tangentially arranged, protein layer, a few molecules thick, a second radially arranged, lipid layer, also only a few molecules thick, and an inner protein layer, probably connected with the stromatin which forms the cell interior. It is possible that the outer protein layer, with its many polar groups, is responsible for the mobility, while lysis results from the destruction or disorientation of the more deeply seated lipid layers, whose non-polar groups contribute little to the surface charge. The paper will be published in the *Journal of General Physiology*. (Abramson, Furchgott, and Ponder, March issue).

3. Stored blood. There has recently been a movement to establish "blood banks" in hospitals, in order to avoid the delay in getting suitable donors for transfusions, but there has been some doubt as to whether the stored blood in these banks was as good as freshly transfused blood. I was asked by the Blood Transfusion Betterment Association to investigate certain aspects of the matter, and the Association made a very generous grant for the purpose. In general, blood was taken from an arm vein, and mixed with one-tenth of its volume of 2 p. c. sodium citrate. The blood was transferred to a sterilized bottle, and kept at from 2° to 4° C. in a refrigerator. From time to time a small amount of the blood was withdrawn for tests, and the samples were examined for (a) hemolysis, (b) changes in the appearance of the cells, (c) changes in fragility, and (d) changes in oxygen consumption of the washed cells.

The results fell into three categories. (1) In most cases the blood appeared to keep perfectly well in the refrigerator for at least 3 weeks, and the oxygen consumption was unchanged within the limits of error. In some cases we were able to keep the stored blood for 4 weeks without

apparent deterioration. (2) In some cases we found hemolysis in the supernatant plasma, without any change in oxygen consumption of the cells. This is due to agitation of the blood, and is a form of "contact hemolysis", due to the red cells being shaken against the glass wall of the bottle. It has been giving considerable trouble in hospitals where blood banks are installed, and can be obviated by simply leaving the blood alone. (3) In a few cases we would find that the blood would keep well for a few days, and that then the oxygen consumption would rise enormously. This is due to contamination by bacteria. At first sight this seems to be something which ought to be avoided, but it has significance nevertheless. Except for an oxygen consumption measurement or a fermentation test, one would never suspect that these samples of blood were contaminated; it does not seem to be an invariable practice of hospitals where blood banks are used to test the specimens for sterility before transfusions are made, and in my experience absence of lysis and a generally satisfactory appearance of the blood is no criterion that it is not contaminated.

In conclusion, it seems that blood can be stored for as long as 3 weeks without the red cells undergoing any apparent change, but one has to observe certain precautions against contamination and contact hemolysis. This work is being continued.

4. *In vivo* hemolysis. Under a grant from the American Association for the Advancement of Science, I have been studying the relation between the kinetics of hemolysis *in vitro* and hemolysis *in vivo*. In the former type of experiment, one uses a dilute suspension of washed cells in saline, whereas when lysis occurs in the blood stream there is a very concentrated suspension of cells in plasma, which contains powerful inhibitors (and possibly accelerators) of hemolysis. Further, some of the lysin probably reacts with cells other than red cells, and so is ineffective for hemolysis.

So far, the investigation has fallen into two categories, the first mathematical, and the second experimental. The equations for the kinetics of lysis *in vivo* have been worked out, corresponding to the equations for the kinetics *in vitro*. The two sets of kinetic behavior show some interesting differences, the most interesting being that a lysin *in vitro* is at least ten, and maybe a hundred, times as effective as *in vivo*. This is interesting in view of the many attempts which have been made to extract lysins from blood and tissues; the weakly lytic substances so far obtained could not possibly produce any appreciable hemolysis in the animal's own blood stream.

The experimental approach is still being continued. It consists of finding how lysis depends on cell concentration and serum concentration, a laborious business. The investigation of the extent to which lysins are taken up by organs through which they are perfused promises to be more interesting, but is still in its early stages.

A peculiar difficulty arose in connection with this investigation. At first I could find no way of determining the end-point of hemolysis when whole blood was used. Colorimetric methods and conductivity methods

are not practical, because of the time consumed in making a time-dilution curve, and it is impossible to use the usual technique with whole blood, because, even at the end-point, the system is too opaque. The difficulty is simply overcome, by placing a piece of glass tubing, 3 mm. in diameter, into each of the tubes containing the hemolytic systems. By capillarity, the blood rises up the little tube, which is so narrow that the end-points can be determined with ease.

5. Potentials in the intact frog skin. See Dr. Steggerda's Report.

6. Shape changes in ovalocytes. In the rare hereditary condition of ovalocytosis, the red cells are oval and biconcave instead of round and biconcave. Having access to a family with this condition, I investigated the shape changes which occur with slide and coverglass, lecithin, rose bengal, etc., to see if they were the same as the changes which occur with normal red cells. No difference was found, despite the abnormal shape which the cells had originally. It seems that the oval shape is fully assumed only after the cell has lost its nucleus and reticulum, a fact very difficult to explain on existing theories of red cell structure. (Published in the *J. Physiology*, February, 1939).

Dr. Hermann Rahn's Report
(John D. Jones Scholar)
University of Rochester

It was undertaken to study in more detail the placenta and the ovarian corpora lutea of viviparous snakes and to ascertain the possible function of these corpora during gestation. Both of these structures were found at the laboratory the previous summer and are, as far as I am aware, described here for the first time for North American reptiles.

1. Placentation in Viviparous Snakes. In the genera *Storeria*, *Potamophis*, and *Thamnophis* the relatively large, yolky eggs, lacking an egg-shell and albumen, are suspended in an extremely thin uterus which constricts around each individual egg. During the early embryonic development the area of the ectodermal chorion covering the most ventral pole of the yolk-sac proliferates to form large cuboidal cells. Likewise the opposing uterine epithelium reacts to form a similar tissue. Thus in the ventral pole of the developing egg a yolk-sac placentation is established consisting of an elliptical region of two closely applied, highly proliferated epithelia, one of foetal, the other of maternal, origin. Outside of this placenta the chorioallantois makes intimate contact with the uterine epithelium. The latter is highly vascularized and in *Storeria* the epithelium is partly eroded allowing the maternal capillaries to make direct contact with the chorio-allantois. This may be regarded as a primitive beginning of an allanto-placenta.

2. The Corpus Luteum. Post-ovulatory changes in the ovary have been most extensively studied in the genera *Potamophis* and *Thamnophis*. After ovulation the Graafian follicle collapses and leaves within its cavity a detached layer of granulosa cells. Before these have even reestablished their contact with the theca, they proliferate and begin to fill the cavity

of the follicle. This luteal tissue is later invaded by supporting fibres and finally by blood vessels and capillaries. The fully differentiated organ resembles closely that of the mammal. Degeneration processes set in after parturition.

3. Function of the Corpus Luteum. The brief report of Clausen (1935) that castration in snakes during early and middle pregnancy is followed by resorption of embryos, and my finding of well developed corpora lutea during pregnancy, suggested that this organ was responsible for the maintenance of the intrauterine embryos. Consequently a series of experiments was set up to see whether by appropriate injections of theelin and progesterone into pregnant, castrated animals the embryos could be maintained.* For the experiment *Thamnophis* and *Natrix* were castrated during early pregnancy. One group served as control, the other was injected daily with a theelin-progesterone mixture. Biopsy and autopsy at intervals up to three weeks after the operation showed that the untreated controls as well as the injected animals had normal, living young. Thus it would seem that castration during early pregnancy is not necessarily followed by resorption and that the corpus luteum hormone is not essential for maintaining young. However, before definite conclusions may be drawn and in view of the contrary findings of Clausen, these experiments are to be repeated on a larger scale in order to determine the role of the ovary during gestation.

In spite of these negative results it seems very probable that these organs have an important function in the endocrine control and regulation of pregnancy of reptiles.

Dr. F. R. Steggerda's Report
(John D. Jones Scholar)
University of Illinois

Although much has been written concerning different factors influencing the potential across the isolated skin of the frog, to my knowledge no attempt has been made to record changes across the skin of the intact animal.

Three types of experiments were done; first, records were made of the percentage change in potential following brain destruction (single pithing) and spinal cord destruction (double pithing) respectively; this was followed by a study of the potential across the skin following its removal from the body. The second approach consisted in taking potentials after destroying the nerve supply to the skin and then later the brain (single pithing). In the third set of experiments, potential readings were taken after the injection of small doses of strychnine sulphate. This was done because of its well established effect of increasing nervous excitability. The results of these experiments indicate that there is a sudden fall of about 25 p.c. in skin potential following single pithing, with an additional 25 p.c. fall after double pithing. After removal of the skin the potential fall makes a more progressive decline, an observation made

* The author is greatly indebted to the Schering Corporation for their generous aid in supplying progesterone for the experiment.

by many investigators (see Table I). After denervation of the skin, a definite potential fall is noted which is not appreciably changed after brain destruction (see Table II). As would be expected, if the potential is influenced by the nervous system, the effects of strychnine should increase the potential above normal. This was readily observed, as can be seen in Table III.

These results indicate that the skin potential is related to the tonic activity of the nervous system.

Mention should also be made of a few experiments which were made to test the effects of destruction of the circulatory system on skin potential in the intact animal. The procedure was to single pith the animal, and then, while recording the potential, to remove the heart of the frog. On examination of the data (Table IV) it will be noticed that no sudden fall of potential is recorded after removal of the heart. At present we have no data available as to the extent of time necessary for circulatory failure to register potential changes.

Table I

The percentage change in skin potential in the intact frog following single and double pithing, respectively, and the progressive fall in skin potential after removal from the frog.

Number of experiment	Actual millivolts at beginning of experiment	Single pithing				Double pithing				Removed skin			
		Time intervals in minutes											
		3	6	9	12	3	6	9	12	3	6	9	12
Frog I	111	72	86	85	74	35	36	35	34	25	26	23	20
Frog II	41	54	61	66	66	46	49	49	49	24	18	12	10
Frog III	77	84	70	69	69	52	49	49	48	42	38	32	27
Frog IV	52	98	92	82	84	61	58	58	56	38	33	25	19
Frog V	33	76	73	70	70	51	51	48	45	33	26	24	23
	average	77	78	74	71	49	47	48	46	32	28	23	20

Table II

The percentage change in skin potential in the intact frog following denervation of skin and single pithing, respectively.

Number of experiment	Actual milli-volts at beginning of experiment	Denervation				Single pithing			
		Time intervals in minutes				Time intervals in minutes			
		3	6	9	12	3	6	9	12
Frog I	41	80	73	72	73	85	73	73	73
Frog II	97	68	67	63	67	98	75	76	76
Frog III	32	67	67	67	67	63	60	54	
	average	72	69	67	69	82	69	68	

Table III

The percentage change in skin potential in the intact frog, following injection of strychnine.

Number of experiment	Actual milli-volts at beginning of experiment	Injected strychnine							
		Time intervals in minutes							
		3	6	9	12	15	18	21	24
Frog I	47	138	138	157	178	144	108	87	83
Frog II	57	107	106	112	77	79	81		
Frog III	52	106	114	125	123	116	104	98	98
	average	117	119	131	126	113	98	93	91

Table IV

The percentage change in skin potential in the single pithed frog, before and after removal of the heart.

Number of experiment	Actual milli-volts at beginning of experiment	Before removing heart				After removing heart			
		Time intervals in minutes				Time intervals in minutes			
		3	6	9	12	3	6	9	12
Frog I	35	60	60	60	60	60	60	60	60
Frog II	28	79	84	84	82	79	79	79	79
Frog III	41	73	73	72	73	76	76	78	79
	average	71	72	72	72	72	72	72	73

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