THE BIOLOGICAL BULLETIN
PUBLISHED BY THE MARINE BIOLOGICAL LABORATORY

THE MARINE BIOLOGICAL LABORATORY

SIXTY-SEVENTH REPORT, FOR THE YEAR 1964—SEVENTY-SEVENTH YEAR

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II. ACT OF INCORPORATION

No. 3170

COMMONWEALTH OF MASSACHUSETTS

Be It Known, That whereas Alpheus Hyatt, William Sanford Stevens, William T. Sedgwick, Edward G. Gardiner, Susan Minns, Charles Sedgwick Minot, Samuel Wells, William G. Farlow, Anna D. Phillips, and B. H. Van Vleck have associated themselves with the intention of forming a Corporation under the name of the Marine Biological Laboratory, for the purpose of establishing and maintaining a laboratory or station for scientific study and investigation, and a school for instruction in biology and natural history, and have complied with the provisions of the statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer, and Trustees of said Corporation, duly approved by the Commissioner of Corporations, and recorded in this office;

Now, therefore, I, HENRY B. PIERCE, Secretary of the Commonwealth of Massachusetts, do hereby certify that said A. Hyatt, W. S. Stevens, W. T. Sedgwick, E. G. Gardiner, S. Minns, C. S. Minot, S. Wells, W. G. Farlow, A. D. Phillips, and B. H. Van Vleck, their associates and successors, are legally organized and established as, and are hereby made, an existing Corporation, under the name of the MARINE BIOLOGICAL LABORATORY, with the powers, rights, and privileges, and subject to the limitations, duties, and restrictions, which by law appertain thereto.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed, this twentieth day of March, in the year of our Lord One Thousand Eight Hundred and Eighty-Eight.

HENRY B. PIERCE,
Secretary of the Commonwealth.

III. BYLAWS OF THE CORPORATION OF THE MARINE BIOLOGICAL LABORATORY

(Revised August 15, 1963)

I. The members of the Corporation shall consist of persons elected by the Board of trustees.

II. The officers of the Corporation shall consist of a Chairman of the Board of Trustees, President, Director, Treasurer and Clerk.

III. The Annual Meeting of the members shall be held on the Friday following the second Tuesday in August in each year at the Laboratory in Woods Hole, Massachusetts, at 9:30 a.m., and at such meeting the members shall choose by ballot a Treasurer and a Clerk to serve one year, and eight Trustees to serve four years, and shall transact such other business as may properly come before the meeting. Special meetings of the members may be called by the Trustees to be held at such time and place as may be designated.

IV. Twenty-five members shall constitute a quorum at any meeting.

V. Any member in good standing may vote at any meeting, either in person or by proxy duly executed.

VI. Inasmuch as the time and place of the Annual Meeting of members are fixed by these bylaws, no notice of the Annual Meeting need be given. Notice of any special meeting of members, however, shall be given by the Clerk by mailing notice of the time and place and purpose of such meeting, at least fifteen (15) days before such meeting, to each member at his or her address as shown on the records of the Corporation.
VII. The Annual Meeting of the Trustees shall be held promptly after the Annual Meeting of the Corporation at the Laboratory in Woods Hole, Massachusetts. Special meetings of the Trustees shall be called by the Chairman, the President, or by any seven Trustees, to be held at such time and place as may be designated, and the Secretary shall give notice thereof by written or printed notice, mailed to each Trustee at his address as shown on the records of the Corporation, at least one (1) week before the meeting. At such special meeting only matters stated in the notice shall be considered. Seven Trustees of those eligible to vote shall constitute a quorum for the transaction of business at any meeting.

VIII. There shall be three groups of Trustees:
(A) Thirty-two Trustees chosen by the Corporation, divided into four classes, each to serve four years. After having served two consecutive terms of four years each, Trustees are ineligible for re-election until a year has elapsed. In addition, there shall be two groups of Trustees as follows:
(B) Trustees ex officio, who shall be the Chairman, the President, the Director, the Treasurer, and the Clerk.
(C) Trustees Emeriti, who shall be elected from present or former Trustees by the Corporation. Any regular Trustee who has attained the age of seventy years shall continue to serve as Trustee until the next Annual Meeting of the Corporation, whereupon his office as regular Trustee shall become vacant and be filled by election by the Corporation and he shall become eligible for election as Trustee Emeritus for life. The Trustees ex officio and Emeriti shall have all the rights of the Trustees, except that Trustees Emeriti shall not have the right to vote.

The Trustees and officers shall hold their respective offices until their successors are chosen and have qualified in their stead.

IX. The Trustees shall have the control and management of the affairs of the Corporation. They shall elect a Chairman of the Board of Trustees who shall be elected annually and shall serve until his successor is selected and qualified and who shall also preside at meetings of the Corporation. They shall elect a President of the Corporation who shall also be the Vice Chairman of the Board of Trustees and Vice Chairman of meetings of the Corporation, and who shall be elected for a term of five years and shall serve until his successor is selected and qualified, except that such term shall not run beyond the Annual Meeting of the Board following his 65th birthday; candidates over the age of 65 shall be elected on an annual basis. They shall appoint a Director of the Laboratory for a term not to exceed five years, provided the term shall not exceed one year if the candidate has attained the age of 65 years prior to the date of the appointment. They may choose such other officers and agents as they may think best. They may fix the compensation and define the duties of all the officers and agents; and may remove them, or any of them except those chosen by the members, at any time. They may fill vacancies occurring in any manner in their own number or in any of the offices. The Board of Trustees shall have the power to choose an Executive Committee from their own number, and to delegate to such Committee such of their own powers as they may deem expedient. They shall from time to time elect members to the Corporation upon such terms and conditions as they may think best.

X. The Associates of the Marine Biological Laboratory shall be an unincorporated group of persons (including associations and corporations) interested in the Laboratory and shall be organized and operated under the general supervision and authority of the Trustees.

XI. The consent of every Trustee shall be necessary to dissolution of the Marine Biological Laboratory. In case of dissolution, the property shall be disposed of in such manner and upon such terms as shall be determined by the affirmative vote of two-thirds of the Board of Trustees.
XII. The account of the Treasurer shall be audited annually by a certified public accountant.
XIII. These bylaws may be altered at any meeting of the Trustees, provided that the notice of such meeting shall state that an alteration of the bylaws will be acted upon.

RESOLUTIONS ADOPTED AT TRUSTEE MEETING AUGUST 16, 1963—EXECUTIVE COMMITTEE

I. RESOLVED:

(A) The Executive Committee is hereby designated to consist of ten members as follows: ex officio members who shall be the Chairman of the Board of Trustees, President, Director and Treasurer; six additional Trustees, two of whom shall be elected by the Board of Trustees each year, to serve for a three-year term.
(B) The President shall act as Chairman of the Executive Committee and the Chairman of the Board of Trustees as Vice Chairman. A majority of the members of the Executive Committee shall constitute a quorum and a majority of those present at any properly held meeting shall determine its action. It shall meet at such times and places and upon such notice and appoint such sub-committees as the Committee shall determine.
(C) The Executive Committee shall have and may exercise all the powers of the Board during the intervals between meetings of the Board of Trustees except those powers specifically withheld from time to time by the Board or by Law.
(D) The Executive Committee shall keep appropriate minutes of its meetings, and its actions shall be reported to the Board of Trustees.

II. RESOLVED:

The elected members of the Executive Committee shall be constituted as a standing "Committee for the Nominations of Officers," responsible for making nominations at the annual meeting of the Corporation and of the Board of Trustees, for candidates to fill each office as the respective terms of office expire. (Chairman of the Board, President, Director, Treasurer, and Clerk.)

IV. REPORT OF THE DIRECTOR

TO: THE TRUSTEES OF THE MARINE BIOLOGICAL LABORATORY

Gentlemen:

I submit herewith the report of the seventy-seventh session of the Marine Biological Laboratory.

1. Facilities Developments

During the past year a number of changes and developments in our facilities were completed under a grant provided by the National Science Foundation. Over the winter of 1963-64 the library stacks were repainted and fluorescent lighting installed which brightened up the stacks most satisfactorily. The glass floors in the stacks were overlaid with plywood, on top of which rubber tile was installed, getting away from the hazard of breaking of the glass flooring and also giving a
quiet walking surface. New quarters were provided for the library staff, directly off the card catalogue room. The reading room has been extended to include the area formerly occupied by the library staff, providing additional space for reference material as well as additional reading space.

A centralized instrument laboratory was provided by remodeling rooms 109 and 110 in the Lillie Building where large pieces of apparatus for the general use of investigators and students can be supervised by a qualified technical assistant. A suite of laboratories centrally located on the second floor of the Lillie Building has been remodeled for electron microscopy. Included is a general service laboratory, facilities for two electron microscopists, and darkrooms for loading and developing film. These laboratories and instruments are under the supervision of an expert electron microscopist.

Also, under the National Science Foundation Grant a new collecting boat, the Ciona, was constructed, a 40-foot vessel powered by 180-hp. General Motors diesel engine. This boat has proved to be exceptionally seaworthy and well adapted to the Laboratory's service. The vessel was built by the Brownell Boatyard of Mattapoisett, after a design by Eldredge-McInnis, naval architects.

The old Cayadetia dock, extending 140 feet out into Great Harbor in front of the Laboratory, was rebuilt and was used daily throughout the summer by the Capt'n Bill III, which unloaded its catch of bottom fish and squid directly into mobile sea water tanks on the dock. These facilities provided by the National Science Foundation Grant have contributed significantly to improved operations in these areas. In addition, the Laboratory made important modification of two of the boats to better adapt them for biological collecting. The cruising speed of the Limulus has been stepped up from 10 to 16 knots, extending her range. Also, a new mast and boom, operating off of a motor driven winch, has improved the operation significantly. Extensive modifications in the interior arrangements of the Limulus and Dolphin have contributed to the ease, effectiveness, and safety in the operation of these two boats.

2. Ford Foundation Grant

In 1963 the Planning Committee was instructed by the Executive Committee to explore ways of funding its long-range plans which had previously been accepted by the Executive Committee. This plan included additional housing for investigators and students, new laboratory facilities for the courses and a laboratory-equipped survey boat for the Systematics-Ecology Program. The needs of the Laboratory were spelled out in detail and a request for a grant of $2,500,000 toward this program was made to The Ford Foundation. The plan envisions an instructional building which will provide quarters for the regular courses and the Systematics-Ecology Program, a building of 65,000 square feet to be built at an estimated cost of $2,700,000. Also included in the program is a dining hall-dormitory to replace the present dining hall and the old residences currently used to house students. Included in the dormitory will be 125 double bedrooms. The estimated cost of this facility is $1,700,000. Also in the grant request was $200,000 for additional cottages in the Devil's Lane tract and $100,000 for the Systematics-Ecology biological survey boat.
We were delighted to receive notification in June of a grant of $2,500,000 by
The Ford Foundation to the Laboratory. Of this, $300,000 is an outright grant
in the amounts requested for additional cottages, particularly for younger investiga-
tors, and also funds for the Systematics-Ecology survey vessel. The remainder
of the grant, $2,200,000, covers half the estimated cost of the instructional building
and the dining hall-dormitory, so matching funds must be obtained in a like amount.

A topographical survey of the free area of the Devil’s Lane Tract was imme-
diately made, access roads laid out and construction of cottages promptly started.
Some additional funds were obtained from individual subscribers, so that 24 cot-
tages have been completed and will be ready for summer occupancy in 1965. The
contributors included Mrs. E. Newton Harvey, Mrs. Gary N. Calkins, Mrs. Samuel
O. Mast and The Grass Foundation. Also, an extensive play area, readily accessi-
ble to both cottage colonies, has been laid out, providing recreation facilities for
children of all ages as well as adults.

Plans for the new Systematics-Ecology survey vessel have been completed and
construction will soon be started. This vessel will be 65 feet long, of steel con-
struction and equipped with the most modern equipment and gear for survey work.

Plans are being developed by the firm of Pierce, Pierce and Luykx for the
instruction building and the dining hall-dormitory. The instruction building will
be located on the north side of Center Street, east of the Apartment House. The
site for the dining hall-dormitory has not yet been selected. In the meantime the
Planning Committee is exploring various sources of additional funds to match the
grant from The Ford Foundation toward these two facilities.

3. Richard K. Mellon Foundation Grant

The Laboratory was most fortunate in receiving a grant of $50,000 from the
Richard K. Mellon Foundation, toward the cost of construction of the instruction
building. We were very much gratified by this support from one of our Woods
Hole neighbors.

4. Rand Bequest

The Laboratory was the beneficiary of a bequest this past year by the will of
Mrs. Herbert W. Rand, in memory of her husband, Professor Herbert W. Rand,
of Harvard University. Professor Rand first came to the Marine Biological Lab-
oratory in 1923, and became a member of the Corporation in 1928. He resided in
Falmouth after his retirement at Harvard in 1942 until his death.

5. Personnel

Deborah Lawrence Harlow was a member of the Library staff at the Marine
Biological Laboratory for 40 years, retiring at the end of 1964. She joined the
staff in 1925 as secretary to the Librarian. Mrs. Harlow became thoroughly
acquainted with the operation of the Library over a period of years and succeeded
Mrs. Montgomery as Librarian in 1948. During her tenure as Librarian, the
number of journals to which the Laboratory subscribed increased from 1200 to
1717, the number of volumes in the Library from 56,000 to well over 100,000.
Although these are striking increases in numbers, Mrs. Harlow will always be re-
REPORT OF THE DIRECTOR

membered for her very effective management of the Library, for her cooperativeness and for the relaxed manner in which she furthered the library work of the scientists and students at the Laboratory. Mr. Harlow, for 17 years head of the machine shop, and expert in his field, retired at the same time.

I. MEMORIALS

WINTHROP JOHN VANLEUVEN OSTERHOUT

By THEODORE SHELOVSKY

On August 2, 1871, Winthrop John Vanleuven Osterhout was born in Brooklyn, New York, the son of a Baptist minister whose ancestors came to America in the seventeenth century from the town of Osterhout in Holland. On April 9th of this year, Dr. Osterhout died in New York in his ninety-third year. In accordance with his wishes his ashes are buried in the cemetery of the Church of St. James the Less in Philadelphia, among four descendants of Benjamin Franklin, an ancestor of his widow, Marian Irwin Osterhout. Many of us who knew him personally, and the Marine Biological Laboratory, where he spent well over half the summers of his long life, mourn his death. It seems to mark the passing of an important period in the history of biological science, a period which bridged the nineteenth and twentieth centuries. At Woods Hole, as elsewhere, quantitative experimentation and important new ideas were supplementing or displacing the traditional descriptive methods of research in biology.

Here, at the Marine Biological Laboratory, a number of dedicated biologists, who were already eminent or were soon to become so, carried on their researches during the summer and influenced students—an enterprise which is happily continuing. Among these dedicated biologists we find the names of Jacques Loeb, T. H. Morgan, Frank and Ralph Lillie, E. B. Wilson, E. G. Conklin, Walter Garrey, A. P. Mathews, Ivey Lewis, and, of course, W. J. V. Osterhout. Let us examine briefly his history as a man of science.

While still an undergraduate student at Brown University, in 1892 young Osterhout came to the Marine Biological Laboratory, where W. A. Setchell introduced him to research in botany. He started work and soon found that the four spores in a red alga, Aquardhiella tenera, each of which could produce a new plant, were able to combine and form a single plant. A year later, Osterhout had received the A.B. degree from Brown (I believe he was the class poet) and was again at Woods Hole, but now as Setchell’s assistant in the Botany Course. Together, while collecting in Nobska Pond, they found Nitella, but physiological experiments on this interesting material came only considerably later.

After a year in Bonn, Germany, with the eminent plant cytologist, Eduard Strasburger (1895–6) Setchell brought Osterhout to the University of California where he earned the Ph.D. degree in 1899 and met Jacques Loeb in 1902. Learning of Loeb’s work on animal cells he began to make similar studies on plant cells and did so with considerable success. Among other things, he was much interested in Loeb’s observations on ionic antagonism, such as exists between monovalent and divalent or trivalent cations, and he used effectively the measurement of electrical conductance in such experiments with plant cells. Acquaintance with Loeb soon ripened into a great, life-long friendship. While still in California, Osterhout got to know Hugo de Vries and Svante Arrhenius. There, in those early years of the century, he doubtless participated in many discussions of matters scientific, philosophic, as well as honestly convivial.

In 1909, Osterhout left the University of California as Associate Professor and moved to Harvard as Assistant Professor, to become Professor in 1913. When Loeb,
who was a member of The Rockefeller Institute for Medical Research, died in 1924, Dr. Osterhout was invited by the Director, Dr. Flexner, to accept membership in the Institute. This invitation he accepted. At the Institute he was given a substantial department of general physiology and a small laboratory in Bermuda for work on *Valonia* and *Halicystis*. In New York he was joined by Drs. Marian Irwin, Lawrence Blinks, and, a little later, by S. E. Hill, W. Stanley and several others. Interested, as he always was, in a physico-chemical approach to biological problems he arranged for D. A. MacInnes to form a physical-chemical group, affiliated with his department. L. G. Longsworth and I soon joined that group.

After his return east from California, and while he was still at Harvard, Osterhout again became intimately associated with the Marine Biological Laboratory and remained so until just a few years ago. He had been a Trustee since 1910. Those of us who had the privilege of knowing him here at Woods Hole, in Cambridge, or in New York, will fondly recall scientific discussions with him, which often took the form of Socratic dialogues, general conversations which were seldom trivial and were usually well seasoned with wit and wisdom. We remember him as a gentleman, in the best and most accurate sense of the word, always with dignity but never with pomp or without a subtle warmth. We shall miss him; not only the scientist, botanist, physiologist, but also the mentor, the councillor, the friend. I speak not only for myself but also, I am certain, for many others.

Osterhout was a superb teacher. Although I did not have the good fortune of being one of his students at Harvard, I know that his influence in attracting young people to research in biology was great. He had a gift for devising beautiful experimental demonstrations which were presented with a persuasive but dignified enthusiasm for the subject that inspired many of his graduate students to undertake productive careers in research.

What were his main contributions to science? Here in the Marine Biological Laboratory Library, there are about 270 cards in the W. J. V. Osterhout file. These include references to his early work in cytology, salt antagonism, osmotic studies and other physico-chemical aspects of plant cells and plant cell models. Perhaps his principal work was on permeability aspects and electrical properties of single plant cells. He was very early in accounting for the active transport of ions by a molecular carrier mechanism. To show this he constructed cell models which exhibited active transport with carrier molecules passing through non-aqueous membranes. For example, aqueous trichloracetic acid and pure water, separated by a layer of guaiacol in the bottom of a U-tube, showed the water apparently moving against its chemical potential gradient. Water movement and water absorption interested him greatly and formed one of the subjects of his work with Mrs. Osterhout into the evening of his scientific life.

Beginning with his early experiments in California on the relation of electrical conductivity of plant cells and ionic antagonisms, the bio-electric phenomena in living cells had always held his active interest. This traditionally controversial field has been so from the time of Volta and Galvani, through the period of phase boundary potentials versus diffusion potentials, and even remains so today in the present era of biochemical and biophysical euphoria. Such a field is not an easy one to explore, but as Osterhout said of Loeb, "He did not select problems because they were easy, but because of their importance. His courage sprung largely from his faith in the materialistic conception..."

While at Harvard, his extensive electrical studies on *Laminaria* led in 1922 to the book, "*Injury, Recovery and Death in Relation to Conductivity and Permeability*." This book stimulated other investigators by its novelty of concept and method of interpretation involving consecutive reactions. Throughout his life, Osterhout stimulated biologists to engage in meaningful quantitative experiments, and physical chemists and physicists to consider the problems presented by the living cell.
REPORT OF THE DIRECTOR

Questions of photosynthesis, respiration, oxidation and related topics had received attention in his publications. In particular, mention may be made of his demonstration of photo induction through a striking observation with A. R. Haas (1918) in which he noted that when the marine plant, Ulva, was transferred from light to darkness the rate of photosynthesis was increased.

I have already mentioned the important concept of carrier molecules, so much invoked today. It should also be noted that Osterhout pioneered in the concept of the steady-state as against equilibrium in accounting for the kinetics of penetration of substances into living cells, and, of course, no self-respecting student of molecular biology today will deny at least some knowledge of irreversible thermodynamics. But Osterhout's influence in general physiology was even greater than the sum of his papers and of his personal contacts with other investigators and students. I refer to the Journal of General Physiology. He was, with Jacques Loeb, co-editor of this journal from its beginning. Let me quote from his own words in the "Outline of the History of the Journal of General Physiology," written in 1955: "Dr. Jacques Loeb and I realized the need for a journal to promote the study of general physiology. Dr. Flexner agreed to publish the Journal from The Rockefeller Institute for Medical Research beginning in 1918. Dr. Loeb and I were the sole editors until he died in 1924. The statement, 'Founded by Jacques Loeb' was placed on the cover of the Journal and a memorial volume was published in his honor. Dr. John H. Northrop and Dr. William J. Crozier joined the editorial board in 1924 after Loeb's death. For about twenty-two years Dr. Northrop, Dr. Crozier and I were the only editors. In 1946 Dr. Wallace O. Fenn joined us. For about thirty-seven years each editor read every paper submitted."

We shall miss Dr. Osterhout. But, for many of us, memory will often be refreshed when we see the Journal of General Physiology, when we visit the Marine Biological Laboratory, when we think of Nitella, Valonia, Halicystis, Laminaria, or when we recall the wit and wisdom which so often emanated from him to inspire us in so many ways.

ELIOT R. CLARK

By SEARS CROWELL

Dr. Eliot R. Clark was born November 13, 1881, in Shelburne, Massachusetts. He received his A.B. degree from Yale University in 1903, and the M.D. degree from The Johns Hopkins University Medical School in 1907. He was on the staff of the Department of Anatomy at The Johns Hopkins University and carried on postdoctoral studies at the Universities of Munich and Krakow. From 1914 to 1922 he was a professor at the University of Missouri, and from 1922 to 1926 at the University of Georgia. In 1926 he became Head of the Department of Anatomy at the University of Pennsylvania, a post which he held until 1947. He became Professor Emeritus in 1950 and a guest investigator at the Wistar Institute. He received an honorary Sc.D. from Washington and Jefferson College in 1940. During the past seven years a serious heart condition prevented much physical activity but he retained an alert mind and lively interest in the affairs of Woods Hole. His death came instantly on November 1, 1963 in his home in Philadelphia.

His association with the Marine Biological Laboratory began in 1909 when he became a member of the Corporation and also met Eleanor Linton, who was to become his wife two years later. He served as a Trustee of the Laboratory from 1930 to 1946. Mrs. Clark's father was Dr. Edwin Linton, a distinguished parasitologist, who worked at the Bureau of Fisheries. Dr. and Mrs. Linton devoted much time and attention to the Marine Biological Laboratory Club and the Clarks carried on this tradition. Dr. Clark served as Secretary-Treasurer in 1918 and 1919, and later as President. Both of
the Clarks were active in various fund-raising affairs for the Marine Biological Laboratory Club and Tennis Club.

In the Woods Hole community the Clarks were involved with the choral group and in support of the Penzance Players. Later, as their children became sailing enthusiasts, the Clarks contributed much to the Woods Hole Yacht Club. Dr. Clark was acting Commodore during World War II, and Commodore from 1947 to 1950.

Apart from his connections with Woods Hole, Dr. Clark was most active professionally in the American Association of Anatomists, serving as their Secretary-Treasurer for the periods of 1938–1942 and 1943–1946. He was largely instrumental in building up the excellent collection of research motion pictures, now housed in the Wistar Institute. He served for many years as Chairman of the Committee on Motion Pictures of the American Association of Anatomists. He reviewed films submitted by investigators and wrote brief descriptions of each accepted. He compiled the lists of these for publication in the *Anatomical Record*.

The majority of Eliot Clark's papers, many of them with Mrs. Clark as co-author, deal with problems of the circulatory system. Although he regarded himself as an anatomist, much of his work is developmental and physiological. By about 1930 he and his associates had perfected the technique of implanting windows in the ears of rabbits. With this technique he was able to study microscopically the development of blood vessels, lymphatics, nerves, epidermis, and various implanted tissues. Older workers at the Marine Biological Laboratory will recall with pleasure the demonstrations presented by the Clarks at the scientific meetings of the Laboratory.

Dr. Clark's careful attention to detail, thoroughness, and devotion characterized both his scientific work and his services to the scientific community, the Marine Biological Laboratory, and Woods Hole.

FRANK PATTENGILL KNOWLTON

By WALTER S. ROOT

Frank P(attegill) Knowlton, the son of Charles Fox and Mary (Pattengill) Knowlton, was born in Holland Patent, New York, on June 17, 1875. He received the A.B. degree from Hamilton College in 1896 and the M.A. degree from the University of Michigan in 1897. From 1897–1900 he was an Instructor in Physiology and Embryology at the College of Medicine, Syracuse University. During this period he also studied medicine, receiving the M.D. degree in 1900. He served successively at Syracuse as Lecturer in Physiology, 1900–1906; Associate Professor, 1906–1908; Professor 1908–1946; and *Emeritus* Professor of Physiology since 1946. As student and teacher he spent 49 years at Syracuse. I remember his remarking one day as he surveyed a new class that teaching the sons of former students can be taken in one's stride, but that when the grandsons appear, one feels older.

Dr. Knowlton spent the years of 1911–1912 at Cambridge University and at University College, London. The studies carried out at this time were concerned with the relation of colloids to diuresis, the effects of stimulating the 8th and 9th spinal nerve roots upon the toad bladder, the sugar consumption of the isolated mammalian heart, the sugar consumption of the normal and diabetic heart, and the nature of pancreatic diabetes. They were published in four papers in the *Journal of Physiology*, one in the *Proceedings of the Royal Society* and one in the *Zeitschrift für Physiologie*. Of this work, perhaps the most important was the development and use of the heart-lung preparation in collaboration with the great physiologist, Ernest H. Starling. Knowlton was fortunate in having the opportunity of working in England at a time when an impressive group of men were active. Among these may be mentioned F. Gowland Hopkins, John Scott Haldane, Charles Sherrington, Joseph Barcroft, John Newport Langley, T. R.
Elliott, William Bayliss, Walter Fletcher, E. A. Sharpey-Schafer, James Mackenzie, Henry Head, Thomas Lewis and others.

Knowlton maintained a continuing interest in renal physiology, carbohydrate metabolism and diabetes mellitus. In the latter part of his professional life he was active in studying the physiology of inhibition. The published papers on this subject are concerned with reciprocal inhibition in the earthworm, peripheral inhibition in arthropods, peripheral neuromuscular augmentation in the heart of Limulus polyphemus, inhibition in the cardiac ganglia of Limulus, the dual control of crustacean muscle, and inhibition of the turtle heart, and of turtle atria.

Many of the publications in the field of comparative physiology were carried out in the Marine Biological Laboratory of which he was a Trustee from 1932 to 1946, and a Trustee Emeritus since 1946. As in his English experience, Knowlton was active in Woods Hole at a time when the Laboratory housed many distinguished scientists.

In 1902 Dr. Knowlton married Clara Avis Roberts. It was a congenial partnership, and their home was always a pleasant place to visit. They had one child, a daughter, Catherine Morilla (now Mrs. Lucius Foote), who like her father is a medical graduate of Syracuse. A grandson, Knowlton Foote, is currently a graduate student in Biochemistry at the Syracuse Medical Center.

Dr. Knowlton was a member of the Physiological Society of Great Britain, and the American Physiological Society, the annual meeting of which he attended regularly. He was active in the Western New York Section of the Society for Experimental Biology and Medicine for many years. He was also a member of a number of social and honorary societies (Delta Upsilon, Nu Sigma Nu, Sigma Xi, Alpha Omega Alpha, Phi Kappa Phi).

Dr. Knowlton was a modest man. He was always a kind and considerate companion. A mutual friend wrote to me recently that he had died on October 30, 1963, without pain or suffering. I liked the statement that his end was much as his life had been, peaceful and orderly.

IVEY FOREMAN LEWIS

By CARL C. SPEIDEL

Ivey Foreman Lewis was born on August 31, 1882, in Raleigh, North Carolina. Eighty-one years later he died in Charlottesville, Virginia, on March 16, 1964, after having been associated with the University of Virginia for nearly 50 years. He is survived by a son, Ivey Foreman Lewis, Jr., of Hampton, and a daughter, Margaret Elliott Lewis of Charlottesville.

Ivey Lewis graduated from the University of North Carolina, receiving the degrees of A.B. in 1902 and M.S. in 1903. He was awarded the Ph.D. degree by The Johns Hopkins University in 1908. For his published dissertation, entitled "The Life History of Grifflhisia borneiiana," he was given the Walker Prize by the Boston Society of Natural History. He studied abroad in 1908 at the University of Bonn and at the Naples Zoological Station. During the academic year 1905–1906 and again after returning from Naples, he was Professor of Biology at Randolph-Macon College at Ashland, Virginia. During this period he made the acquaintance of Margaret Hunter, of Ashland, who became his wife in 1909. Three years later he left Randolph-Macon College to be Assistant Professor of Botany at the University of Wisconsin. In 1914 he was made Professor of Botany at the University of Missouri. The following year he was appointed Miller Professor of Biology and Agriculture at the University of Virginia, where he served as Professor, and also as Dean from 1934 on, until his retirement in 1953.

For many years Dr. Lewis was associated with the Woods Hole Marine Biological Laboratory. He was an Instructor in Botany in 1907 and again from 1910 through
1917. From 1918 through 1927 he was in charge of botanical instruction, and also
served as Trustee and member of the Executive Committee. In 1928 he was a Carnegie
Fellow at the Dry Tortugas Laboratory and in 1929 a Professor at the Hopkins Marine
Station of Stanford University. From 1933 until 1946 he was Director of the Uni-
versity of Virginia’s newly established summer station at Mountain Lake, Virginia.

Dr. Lewis founded the Association of Virginia Biologists in 1920. This gave rise
to the Virginia Academy of Science in 1923. The following year he was elected its
first President. For eight years he was a member of the Division of Biology and Agri-
culture of the National Research Council and served as Chairman from 1933 through
1936. He was President of the American Society of Naturalists (1939), President of
the American Biological Society (1942), and President of the Botanical Society of
America (1949).

In 1947 he received an honorary degree of Doctor of Science from the University
of North Carolina. In 1959, six years after his retirement from active duty, he was the
recipient of the University of Virginia’s Thomas Jefferson Award.

Dr. Lewis’s research interests were primarily in the field of algology. In addition
to his prize-winning doctorate thesis cited above, his publications include papers dealing
with the algae of the Woods Hole and Charlottesville regions, the vegetation of Shackle-
ford Bank, North Carolina, and the pollen of the Dismal Swamp of Virginia and North
Carolina.

One of his papers, entitled “The Flora of Penikese, Fifty Years After,” published
in Rhodora in 1924, is of historic interest to the Marine Biological Laboratory. This
is a survey similar to one made in 1873 by David Starr Jordan, a member of Agassiz’s
Laboratory which was located on Penikese Island. Jordan’s results were published in
the American Naturalist in 1874. Dr. Lewis served as editor of the 1924 survey which
was made cooperatively by the students and staff of the course in Botany at the Marine
Biological Laboratory. Agassiz’s Laboratory on Penikese is regarded as a kind of fore-
runner of the Woods Hole Marine Biological Laboratory.

For recreation Dr. Lewis greatly enjoyed the numerous collecting trips made as a
part of the course in Botany. He also enjoyed the game of tennis and was an enthu-
siastic and proficient player. His figure was a familiar one on the Mess Hall court.
He always regretted that his duties in connection with the Mountain Lake Station in
Virginia made it necessary for him to terminate his regular summer attendance at
Woods Hole.

Ivey Lewis’s influence on the Marine Biological Laboratory was a beneficent one.
In the most literal sense of the expression, he was a gentleman and a scholar. Those
of us who knew him well miss him greatly.

2. THE STAFF

EMBRYOLOGY

I. INSTRUCTORS

JAMES D. EBERT, Director, Department of Embryology, Carnegie Institution of Wash-
ington, in charge of course
DONALD D. BROWN, Staff Member, Department of Embryology, Carnegie Institution
of Washington
ALLISON L. BURNETT, Associate Professor of Biology, Western Reserve University
ROBERT L. DE HAAN, Staff Member, Department of Embryology, Carnegie Institution
of Washington
THOMAS J. KING, Head, Department of Embryology, Institute for Cancer Research,
Philadelphia
REPORT OF THE DIRECTOR

JAMES W. LASH, Assistant Professor of Anatomy, University of Pennsylvania
AARON A. MOSCONA, Professor of Zoology, University of Chicago

II. LABORATORY ASSISTANTS

C. B. KIMMEL, The Johns Hopkins University
DAVID E. KOHNE, Purdue University

III. LECTURES

J. D. EBERT...... Perspectives in developmental biology
T. J. KING........ Teleosts I
T. J. KING........ Teleosts II
R. L. DE HAAN.... Cell movements and morphogenesis
A. J. COULOMBRE The morphogenetic interaction of the tissues of the eye during development
E. ZWILLING...... Morphotypic diversity vs. histiotypic identity
S. SIMPSON....... Tissue interactions and morphogenesis in lizard tail regeneration
J. LASH.......... The induction of chondrogenesis in vitro
A. MOSCONA...... Sponges I
A. MOSCONA...... Sponges II
A. MOSCONA...... Tissue reconstruction from dissociated cells
H. RUBIN......... The malignant transformation of animal cells by viruses
M. ROSENBERG..... Some applications of surface physics to cell biology
P. MARCUS........ Dynamics of plasma membrane modification in virus-infected and normal cells
A. L. COLWIN..... Role of the gamete membranes in fertilization
M. STEINBERG..... Adhesive selectivity in intercellular reactions
A. BURNETT....... A model of growth for hydroids and tubules of higher organisms
A. BURNETT....... The role of neoblasts in the maintenance of form of hydroids
A. BURNETT....... Dedifferentiation and redifferentiation of somatic cells in Hydra—an analysis of polymorphism
J. D. EBERT...... Developmental aspects of immunity
J. W. LASH....... Ascidians I: General embryology
J. W. LASH....... Ascidians II: Metamorphosis
K. R. PORTER..... Developmental cytology I
K. R. PORTER..... Developmental cytology II
E. HADORN....... Developmental aspects of pleiotropic effects of genes
J. GALL.......... The nucleic acids of giant chromosomes
T. J. KING....... The developmental capacity of nuclei transplanted from advanced embryos
R. L. DE HAAN.... Comparative morphogenesis of annelids, molluscs and echinoderms
E. HADORN....... Problems of differentiation and pattern formation in Drosophila blastemas
D. D. BROWN...... Biochemistry of oogenesis and early development
P. GROSS......... Microsymposium: biochemistry of early development
A. B. Pardee  
Cell regulatory mechanisms I  

A. B. Pardee  
Cell regulatory mechanisms II  

S. Cohen  
An epidermal growth-stimulating protein  

M. Singer  
The nervous control of the regeneration of body parts in vertebrates  

V. Hamburger  
Neurogenesis and the embryology of behavior  

K. Meyer  
Keratosulfates of cornea and cartilage  

G. W. Cooper  
Induction of somite chondrogenesis by cartilage and notochord: a correlation between inductive activity and cytodifferentiation  

H. Schneiderman  
The hormonal control of insect development  

L. Weiss  
The structure of lymphatic tissue and its reaction in runt disease  

**PHYSIOLOGY**

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Merkel H. Jacobs, Professor of Physiology, University of Pennsylvania  

Arthur K. Parpart, Professor of Biology, Princeton University  

Albert Szent-Györgyi, Director, Institute for Muscle Research, Marine Biological Laboratory  

W. D. McElroy, Director, McCollum-Pratt Institute, The Johns Hopkins University  

II. Instructors  

J. Woodland Hastings, Professor of Biochemistry, University of Illinois, in charge of course  

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Harlyn Halvorson, Professor of Bacteriology, University of Wisconsin  

Shinya Inoué, Professor of Cytology, Dartmouth College  

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Fred Karush, Professor of Microbiology, University of Pennsylvania  

William F. Harrington, Professor of Biology, The Johns Hopkins University  

Hans Kornberg, Professor of Biochemistry, Leicester University, England  

III. Laboratory Assistants  

George Kissil, University of Wisconsin  

Carolyn Eberhard, University of California at Berkeley  

IV. Lectures  

Seymour Cohen  
The lethality of streptomycin and the stimulation of RNA synthesis  

A. J. Sophianopoulos  
Protein denaturation and hydrogen-ion equilibria of lysozyme  

Howard Schachman  
Macromolecular configurations  

George Wald  
Human color vision  

R. K. Clayton  
Photosynthesis II: Physical aspects  

Roger Eckert  
Excitation-response coupling: Bioelectric flash triggering in Noctiluca  

William Hagins  
Early steps in the excitation of photoreceptors
REPORT OF THE DIRECTOR

ALEX KEYNAN
The bacterial endospore and the problem of biological dormancy

H. E. HUXLEY
Fine structure of muscle

IAN GIBBONS
Studies on ciliary movement

C. VERGAR
Studies on the spectral complexes between flavo-proteins and their competitive inhibitors

RACHMIEL LEVINE
Mechanism of hormone action

ALBERT SZENT-GYÖRGYI
Growth

HANS LEO KORNBERG
Microbial metabolism I

HANS LEO KORNBERG
Microbial metabolism II

HANS LEO KORNBERG
Microbial metabolism III

FRED KARUSI
Imunochemistry I. The interactions of immunoglobulins

FRED KARUSI
Imunochemistry II. The nature of immunoglobulins

FRED KARUSI
Imunochemistry III. The biosynthesis of immunoglobulins

LAWRENCE LEVINE
Applications of immunochemistry to problems in biology

IRVIN ISENBERG
Phosphorescence properties of DNA complexes

CYRUS LEVINTHAL
Synthesis and stability of messenger RNA

R. K. CLAYTON
Transcription and translation of the bacterial chromosome

E. A. ADELBERG
Replication and transfer of bacterial DNA

K. C. ATWOOD
Some aspects of regulation of gene function

S. INOUÉ
Polarization microscopy: An approach to fine-structure analysis in living cells

S. INOUÉ
Dynamic aspects of the mitotic apparatus

S. INOUÉ
Molecular arrangement of DNA in the living sperm

HANS LEO KORNBERG
Microbial metabolism

K. E. VAN HOLDE
Protein structure III. Multichain proteins

HARLYN HALVORSON
Protein biosynthesis I: In vivo

HARLYN HALVORSON
Protein biosynthesis II: In vitro

HARLYN HALVORSON
The control and timing of enzyme synthesis

E. A. ADELBERG
The bacterial chromosome: Structure and function

E. A. ADELBERG
The bacterial chromosome: Replication

J. W. HASTINGS
Enzymatic intermediates in the bacterial bioluminescent reaction

J. W. HASTINGS
Crystalline bioluminescent particles: The Gonyaulax system

WILLIAM P. JENCKS
Some aspects of the mechanism of enzyme action

K. E. VAN HOLDE
Protein Structure I: Physical methods of investigation

K. E. VAN HOLDE
Protein Structure II: The folding of polypeptide chains

MARINE BOTANY

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RICHARD C. STARR, Professor of Botany, Indiana University

II. INSTRUCTORS

WALTER R. HERNDON, Professor of Botany, University of Tennessee, in charge of course

PHILIP W. COOK, Department of Botany, University of Vermont

H. WAYNE NICHOLS, Assistant Professor of Botany, Washington University

FRANK E. ROUND, Department of Botany, University of Bristol, England

ROBERT T. WILCE, Assistant Professor of Botany, University of Massachusetts
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ERNEST NEAL, Department of Botany, University of Tennessee

IV. COLLECTOR

MARTHA HODGE, University of Michigan

INVERTEBRATE ZOOLOGY

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LIBBIE H. HYMAN, American Museum of Natural History
CLARK P. READ, Professor of Biology, Rice University
ALFRED C. REDFIELD, Woods Hole Oceanographic Institution

II. INSTRUCTORS

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GEORGE HOLZ, Professor of Microbiology, State University of New York, Upstate Medical Center
ROGER MILKMAN, Associate Professor of Zoology, Syracuse University
IRWIN W. SHERMAN, Assistant Professor of Biology, University of California at Riverside
ALLAHVERDI FARMANFARMAIAN, Professor of General Physiology, Pahlavi University, Shiraz, Iran
ERIC L. MILLS, Assistant Professor of Biology, Queen's University, Kingston, Ontario, Canada
FRANK M. FISHER, Assistant Professor of Biology, Rice University
SEARS CROWELL, Professor of Zoology, Indiana University

III. ASSISTANTS

JOHN H. BUSSER, University of Rhode Island
W. BRUCE HUNTER, University of California at Santa Barbara

IV. LECTURES

ROGER D. MILKMAN
JOHN J. LEE
GEORGE HOLZ
GEORGE HOLZ
GEORGE HOLZ
GEORGE HOLZ
R. A. BOOLOOTIAN,
A. FARMANFARMAIAN
W. D. R. HUNTER
A. FARMANFARMAIAN

Protochordata II
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The nature of the Protozoa
Mastigophora
Rhizopoda and Actinopoda
Foraminifera
Ciliophora
Dialogue on aspects of echinoderm physiology
An approach to zoöplankton
The echinoderms I
Introduction: Crinoidea and Asteroidea
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A. FARMANFARMAIAN
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A. FARMANFARMAIAN
The echinoderms III: Echinoidea and Ophiuroidea
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Arthropoda II: Larvae, lines and limbs—further introduction to the Crustacea
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Molluscs leave the sea (physiological variation and evolution)
ERIC L. MILLS
Arthropoda III: Feeding in Crustacea—Cephalocarida, Branchiopoda, and Mystacocarida
ERIC L. MILLS
Arthropoda IV: Feeding in Crustacea—Copepoda, Cirripedia, and Malacostraca
LUIGI PROVASOLI
External metabolites in sea water
ROBERT HESSLER
Arthropoda V: Functional morphology of jaws and other things in the Crustacea
ERIC L. MILLS
Arthropoda VI: Pycnogonida and Xiphosurida
FRANK FISHER
Ectoprocta and Entoprocta
FRANK FISHER
Aschelminthes
W. D. RUSSELL HUNTER
Mollusca IV: Functional morphology in Cephalopoda and minor groups
CLARK P. READ
Physiology of parasitic flatworms
IRWIN W. SHERMAN
Annelida I: Introduction, reproduction and development
IRWIN W. SHERMAN
Annelida II: Settling of larvae, regeneration, feeding and locomotion
IRWIN W. SHERMAN
Annelida III: Respiration, osmoregulation, neuromuscular system and behavior
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FRANK FISHER
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FRANK FISHER
Platyhelminthes II: Cestoda and Rynchocoela
W. D. RUSSELL HUNTER
Mollusca I: General molluscan organization—functioning of mantle cavity in Gastropoda
W. D. RUSSELL HUNTER
Mollusca II: Gastropoda—mantle cavity and feeding mechanisms in Bivalvia
W. D. RUSSELL HUNTER
Mollusca III: Adaptations in bivalves—aspects of general physiology of Gastropods and bivalves
SEARS CROWELL
Cnidaria I: General diversity in hydroids
SEARS CROWELL
Cnidaria II: Hydroid morphogenesis
SEARS CROWELL
Cnidaria III: Other Cnidaria—physiology of Cnidaria
SEARS CROWELL
Ctenophora
ROGER D. MILKMAN
Porifera I

MARINE ECOLOGY

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MELBOURNE R. CARRIKER, Marine Biological Laboratory
BOSTWICK H. KETCHUM, Woods Hole Oceanographic Institution
EDWIN T. MOUL, Rutgers University
JOHN H. RYTER, Woods Hole Oceanographic Institution
II. INSTRUCTORS

W. Rowland Taylor, Department of Oceanography and the Chesapeake Bay Institute, The Johns Hopkins University, in charge of course

Howard L. Sanders, Woods Hole Oceanographic Institution

Lawrence B. Slobodkin, Department of Zoology, University of Michigan

Richard A. Boolootian, Department of Zoology, University of California at Los Angeles

Otto Kinne, Biologische Anstalt Helgoland

III. LABORATORY ASSISTANTS

Margaret C. Lloyd, University of Michigan

BARRY M. Heatfield, University of California at Los Angeles

IV. LECTURES

W. Rowland Taylor Organisms and their environment experimental approaches

W. Rowland Taylor The marine environment, its chemistry and physics

W. Rowland Taylor Phytoplankton I: Diatoms

W. Rowland Taylor Phytoplankton II: Dinoflagellates

W. Rowland Taylor Primary productivity by phytoplankton I

W. Rowland Taylor Primary productivity by phytoplankton II

M. R. Carriker The Systematics-Ecology Program at the Marine Biological Laboratory

J. H. Rytther Geographical variations in productivity

D. Menzel Production and utilization of dissolved organic material in the oceans

W. R. Taylor Physiology of migrating littoral diatoms

B. H. Ketchum Nutrient cycles in the sea

E. R. Baylor Sea surface chemistry and the distribution of organisms

H. L. Sanders Animal-sediment relationships

H. L. Sanders A study of a marine benthic community

R. Scheltema Problems in benthic larval ecology

H. L. Sanders Salinity, hydrography and the distribution of estuarine animals

Eric L. Mills Ecology of a crustacean sibling species pair, or systematics unashamed

J. B. Pearce Temporal and spatial distribution of mytilid associations

S. A. Wainright Biology of reef corals

J. A. Hellebust Excretion of organic compounds by marine algae

Otto Kinne The effects of temperature on marine and brackish water organisms

L. Provasoli Culturing marine algae I: (Joint lecture with the Botany Course)

L. Provasoli Culturing marine algae II: (Joint lecture with the Botany Course)

Otto Kinne Effects of temperature and salinity on the hydroid, Cordylophora caspia

L. Provasoli External metabolites in sea water

Otto Kinne Effects of temperature, salinity and oxygen on the fish, Cyprinodon macularius
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**SYSTEMATICS-ECOLOGY PROGRAM**

**The Staff**

Director: Melbourne R. Carriker  
Resident Systematist: Victor A. Zullo  
Resident Ecologist: Robert H. Parker  
Visiting Investigators in Residence: Richard A. Boolootian, Louise Bush, Duane Hope, E. T. Moul  
Secretaries: San Lineaweaver, Virginia Smith  
Artists: Ruth von Arx, Diane Johnson  
Captain of Research Vessel: James P. W. Ostergard, Jr.  
Research Assistants: Kay Cram, Andrew L. Driscoll, J. Stewart Nagle, Peter J. Oldham, Peter E. Schwamb, Dirk van Zandt, Hilary M. Williams, June Thomas, Vilia Turner

**I. Seminars (winter not included)**

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<td>Victor A. Zullo</td>
<td>Keys to marine invertebrates of the Woods Hole region</td>
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Electrometric measurements of activities of ions and gases as applied to measurements in animals and of sea water
Reproduction and larval development in the spionid polychaete, *Spio setosa*
Aspects of reproductive biology of echinoderms
The biology of an amphipod crustacean sibling species pair
Some approaches to taxonomic revision in chlorophycean algae
Adaptation in a flagellate protozoan
Metabolic adaptation in a flagellate protozoan
Specific diversity in an intertidal community
Microstructure of the shell in Gastropoda
An aerial overview of the major marine habitats of the Cape Cod region
A pilgrimage to Ellerslie (P.E.I., Canada) and its surrounding benthic communities
Fossil coral thickets
The 1958–59 Downwind Expedition to Easter Island
Conodonts of the Trenton Group (Ordovician) in New York and Southern Ontario, Canada
On the origin of Metazoa
*Derocheilocaris typicus* revisited
What good is dopamine; clams; biochemical evolution?

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**Miss Jane Fessenden**, Acting Librarian
**Carl O. Schweidenback**, Manager, Supply Department
**Irvine L. Broadbent**, Office Manager

**Edward J. Bender**
**Mrs. Vivien B. Brown**
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**Mrs. Judith A. Keck**
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**Robert Adams**
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**Donald B. Lehy**
**Ralph H. Lewis**
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REPORT OF THE DIRECTOR

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Robert T. Martin, Manager, Food Service
Mrs. Elizabeth Kuil, Supervisor, Dining Room
Mrs. Ellen T. Nickelson, Supervisor, Dormitories
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3. Investigators: Lalor, Lillie and Grass Fellows; Students

Independent and Beginning Investigators, 1964

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STETTEN, MARJORIE R., Research Professor, Rutgers Medical School
SUMAK, FREDERICK N., Assistant Professor of Physiology, Albert Einstein College of Medicine
SWANSON, CARL A., William D. Gill Professor of Biology, The Johns Hopkins University
SZENT-GYÖRGYI, ANDREW G., Professor of Biophysics, Dartmouth Medical School
WAINIO, WALTER, Professor of Biochemistry, Rutgers The State University of New Jersey
WARNER, ROBERT C., Professor of Biochemistry, New York University School of Medicine
WHEELER, GEORGE E., Associate Professor of Biology, Brooklyn College
WILSON, THOMAS HASTINGS, Associate Professor of Physiology, Harvard Medical School
YNTEMA, CHESTER L., Professor of Anatomy, State University of New York, Upstate Medical Center
ZACKS, SUMNER I., Assistant Professor of Neuropathology, Pennsylvania Hospital, University of Pennsylvania
ZORZOLI, ANITA, Chairman, Professor of Physiology, Vassar College

Students, 1964

All students listed completed the formal course program, June 17—July 27. Asterisk indicates students completing Post-Course Research Program, July 28—August 31.

ECOLOGY

*ADAMS, JEAN M., Allegheny College
ALLESSIO, MARY L., University of Colorado
AVERY, PATRICIA P., Wheaton College
*BABENBECK, FRANK W., University of Connecticut
*BUCHEBAUM, VICKI M., Stanford University
*CALDER, WILLIAM ALEXANDER, Jr., Duke University
GJESSING, HELEN WITTON, College of the Virgin Islands
*HEATFIELD, BARRY MARK, University of California
JONES, MEREDITH HOWE, Boston University
JOHNS, NANCY GALR, Oberlin College
KORZER, KENNETH L., University of Rhode Island
*LLOYD, MARGARET C., Bryn Mawr College
MAYO, CHARLES A., III, Dartmouth College
QUINN, SISTER GENEVIEVE, Catholic University of America
*REA, INA K., Indiana University
*RICHARDSON, W. NORMAN, Earlham College
WHITE, JOSEPH JAMES, University of Illinois

EMBRYOLOGY

BARIL, EARL FRANCIS, University of Connecticut
BERGILL, MICHAEL, McGill University
*CONNELL, CAROLYN, Indiana University
*DICK, MIRIAM, Brandeis University
REPORT OF THE DIRECTOR

*GADE, LeROY LEWIS, Rensselaer Polytechnic Institute
*GOLDIZEN, VERNON CLAIRE, Western Reserve University
*GOULD, MEREDITH C., Stanford University
HAYASHI, MASAKI, University of Illinois
*HEIDGER, PAUL McCAY, Jr., Tulane University
*HELD, WILLIAM ALLEN, Marquette University
INSELBURG, JOSEPH, Brandeis University
KAPLAN, STANLEY, University of Miami
*KOPP, Lowell Ellis, Massachusetts Institute of Technology
*LARSEN, LYNDELL LOUISE, The Rockefeller Institute
MORTENSEN, RICHARD, Purdue University
*PERCUS, JEROME KENNETH, New York University
PRINGLE, JOHN ROBERT, Harvard University
*READ, MARGARET TYLER, Harvard University
*REIGART, JOHN R., Dartmouth Medical School
ROGERS, MARY ELIZABETH, Yale University

BOTANY

BURG, CAROL ANN, University of Connecticut
*BUTNAR, PATRICIA ANN, Seton Hill College
CONNER, CLARICE MARIE, University of Wisconsin
*HOLT, BUFORD REID, University of Tennessee
HOWELL, STEPHEN H., The Johns Hopkins University
KEVIN, SISTER M. PETRA, Fordham University
KIES, ROBERT LUDWIG, University of Erlangen, Germany
KOCHERT, GARY DEAN, Indiana University
*LEE, THOMAS F., Clark University
MCLEAN, ROBERT J., University of Connecticut
*PRINCE, JEFFREY S., University of Massachusetts
RAMUS, JOSEPH STEPHEN, University of California, Berkeley
SMITH, JOYCE EILEEN, Cornell University
STROTHER, JOHN LANCE, Washington University, St. Louis
*TRETER, ELIZABETH MABEL, Dalhousie University, Halifax, Nova Scotia
*URBAN, PAUL, Tufts University
WAER, RICHARD DENNIS, University of Arizona
*WEBER, JILL LOUISE, Vassar College
*WILCOX, ROBERT STIMSON, University of Michigan

PHYSIOLOGY

*BARBOUR, STEPHEN DAVID, Temple University
*BER, MICHAEL PETER, University of Chicago Medical School
*CAROLAN, ROBERT MILLS, Dartmouth Medical School
*CRAIG, NESSLY COILE, University of Pennsylvania
*CONVERSE, CAROLYN ANN, Brown University
*ELFBAUM, STANLEY GOODMAN, Northwestern University
*ETZLER, MARILYNNE EDDITH, Washington University, St. Louis
GAZETH, JOSEPH, Vanderbilt University
GIBERMAN, ELDAR, Massachusetts Institute of Technology
*GOLD, LAWRENCE MARSHALL, University of Connecticut
*HATLING, DONNA LYNN, Columbia University
*HAUSCHKA, PETER VOORHESS, Amherst College
HAYTLER, PETER G., E. I. duPont de Nemours & Company
*JURAS, DANUTE, Marquette University
*KUBAI, DONNA FAROLINO, University of Wisconsin
*LATTMANN, EATON EDWARD, The Johns Hopkins University
MARINE BIOLOGICAL LABORATORY

*Lloyd, David Albert, University of Illinois
*Manuel, Morton, Stanford University School of Medicine
*Nicholson, Anne, University of Pennsylvania School of Medicine
deRazumney, Celia Estel Freida, University of Pennsylvania School of Medicine
Rottemstein, Arthur Stanley, Rutgers, The State University
*Sparks, Harvey V., Harvard Medical School
Switzer, Sam, Albert Einstein College of Medicine
*Tanaka, Sister Mary Loretta, Saint Louis University
*Terrell, Kathleen Lois, Columbia University, College of Physicians and Surgeons
*Ward, John Clive, The Johns Hopkins University
*Ward, Raymond Leland, University of California, Livermore
*Wechsler, James Alan, Yale University
*Weinberg, Eric S., The Rockefeller Institute
*White, Eric S., Dartmouth Medical School

INVERTEBRATE ZOOLOGY

Allen, Jeffrey Charles, Oberlin College
Applebaum, Richard, Columbia University
Bartizal, Frederick Joseph, Beloit College
Bennett, Judith Ann, Syracuse University
Bolender, Robert Paul, Columbia University
Boyd, Carl M., Dalhousie University, Halifax, Nova Scotia
Chang, Paula Frances, Tulane University
Coggshall, Richard Edwin, Harvard Medical School
Cotman, Carl Wayne, Wesleyan University
Denнакер, Germaine Suzanne, Morgan State College
Fischer, Barbara Ann, St. Louis University
Hall, Barbara Sue, College of St. Mary of the Springs
Hink, Charles Rink, Lafayette College
Hunter, William Bruce, University of California, Santa Barbara
Jampol, Lee Merrill, Yale University
Johnson, Kurt Edward, The Johns Hopkins University
Kaplan, Robert Gordon, Columbia University
Koenig, Marilyn J., University of Wisconsin
Koo, Helen Ping-Ching, University of Minnesota
Langebeet, Susan Grant, University of Chicago
Meadows, Robert T., Syracuse University
Nollen, Paul Marion, Purdue University
Nutt, John Gordon, Jr., Rice University
Page, Charles Henry, Yale University
Pawalek, John Mason, Brown University
Pettit, Barbara, Marquette University
Reuss, Cecilia Monica, Marquette University
Robinson, Carolyn Anne, Clark University
Rundles, Charlotte, Duke University
Stine, Deborah Clare, Wilson College
Toth, Steven Edward, Bowling Green State University
Tracy, Susan Frances, University of Massachusetts
Walcott, Benjamin, University of Oregon
Waldron, Ingrid Lore, University of California, Berkeley
Walter, Mary A., Ripon College
Walters, David Royal, Harvard University
Ward, Oscar Garien, Jr., Purdue University
Werner, Betsey Ann, Drew University
Whisnant, Betty Lynn, Duke University
Zeimen, Sister Maria Goretti, Catholic University of America
REPORT OF THE DIRECTOR

4. FELLOWSHIPS AND SCHOLARSHIPS, 1964

Lucretia Crocker Scholarship:
VICKI M. BUCHSBAUM, Ecology Course
BUFORD R. HOLT, Botany Course

Edwin Linton Memorial Endowment of the
Washington and Jefferson College:
PATRICIA ANN BYTNAR, Botany Course

Turtlex Scholarship Fund:
JOHN BUSHNELL

5. TRAINING PROGRAMS

FERTILIZATION AND GAMETE PHYSIOLOGY TRAINING PROGRAM

I. INSTRUCTORS
C. B. METZ Florida State University, in charge of program
C. R. AUSTIN Cambridge University, England
JOHN BIGGERS University of Pennsylvania
ALBERTO MONROY University of Palermo, Italy
LEONARD NELSON Emory University

II. ASSISTANTS
RACHELE MAGGIO University of Palermo, Italy

III. STUDENTS
R. BERKELEY University of Pennsylvania
J. F. FALLON Marquette University
L. E. FRANKLIN Florida State University
M. S. GOROVSKY University of Chicago
R. HALLBERG The Johns Hopkins University
G. S. HAND, JR. University of North Carolina
S. HAUSCHKA The Johns Hopkins University
D. L. HESSEL The Johns Hopkins University
B. HORWITZ Emory University
M. R. LURIE University of Miami
D. MOORE University of Pennsylvania
M. C. REPORTER Carnegie Institution of Washington
N. M. SCHULKIND New York University, School of Medicine
A. E. S. SMITH California Institute of Technology
E. L. STERN University of Chicago
D. T. SULLIVAN The Johns Hopkins University

IV. LECTURES
D. SZOLLOSI Ultrastructural Studies on Fertilization and the Gametes
R. A. BRATY Genetic Effect on Gametes
R. MAGGIO Activation of Protein Synthesis in the Sea
H. MOHRI Mitochondrial Functions of Bull Spermatozoa
P. M. BHARGAVE Ribonucleic Acid and the Amino Acid
Y. HIRAMOTO Mechanical Properties of the Protoplasm of the Sea Urchin
R. RIKMENSPERG Biophysical Approaches to Problems of Spermatozoan Motility
R. YANAGIMACHI The Hamster as a Material for the Study of Fertilization
R. C. RUSTAD Radiation Effects in Sea Urchin Gametes
L. WEISS Interactions Between Cells Making Contact
MARINE BIOLOGICAL LABORATORY

NEUROPHYSIOLOGY TRAINING PROGRAM

I. INSTRUCTORS

S. W. KUFFLER  Harvard Medical School, in charge of program
E. J. FURSHPAN  Harvard Medical School
J. G. NICHOLLS  Harvard Medical School

II. ASSISTANTS

R. Bosler  Harvard Medical School
(No lectures given—only seminars)

III. STUDENTS

J. M. CAMHI  Harvard Medical School
A. M. FRIEDLANDER  University of Pittsburgh
J. HARVEY  The Johns Hopkins University
J. S. McREYNOLDS  Harvard Medical School
R. FIPKIN  Harvard Medical School
P. STERLING  Western Reserve University
B. WICKELGREN  Massachusetts Institute of Technology

COMPARATIVE PHYSIOLOGY TRAINING PROGRAM

I. INSTRUCTORS

L. KLEINHOLZ  Reed College, in charge of program
B. C. ABBOTT  University of Illinois
A. JANOFF  New York University
G. KALEY  New York University
B. ZWEIFACH  New York University

II. ASSISTANTS

F. KIMBALL  Reed College
J. C. MUNDAY  University of Illinois

III. STUDENTS

E. A. ASHBY  University of Texas
G. M. CONNELL  Indiana University
G. A. COTTRELL  Harvard University
P. J. DOWD  Vestibular Laboratory
C. R. JONES  Fordham University
W. R. KEM  University of Illinois
M. J. PAK  University of Minnesota
P. STERN  University of Michigan

IV. LECTURES

L. KLEINHOLZ  Neurosecretion and Endocrine Physiology
G. KALEY  Cardiovascular Physiology
A. JANOFF  Comparative Aspects of Lysosome Function & Comparative Aspects of Leucocyte Physiology
B. C. ABBOTT  Excitation-Contraction Coupling and Relaxing Factor in Muscle
F. A. BROWN, JR.  A Unified Clock Theory
C. READ  Comparative Aspects of Membrane Transport
R. ALLEN  Cell Movement
G. COTTRELL  Binding of Biologically-Active Substances
### 6. Tabular View of Attendance, 1960–1964

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<tr>
<td><strong>Investigators—Total</strong></td>
<td>458</td>
<td>488</td>
<td>494</td>
<td>490</td>
<td>512</td>
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<tr>
<td>Independent</td>
<td>273</td>
<td>256</td>
<td>279</td>
<td>261</td>
<td>273</td>
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<td>Library Readers</td>
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<td>49</td>
<td>56</td>
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<td>151</td>
<td>139</td>
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<td><strong>Students—Total</strong></td>
<td>122</td>
<td>130</td>
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<tr>
<td>Invertebrate Zoology</td>
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<td>Embryology</td>
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<td>Physiology</td>
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<td>Botany</td>
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<td>Ecology</td>
<td>13</td>
<td>22</td>
<td>15</td>
<td>16</td>
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<tr>
<td><strong>Trainees—Total</strong></td>
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<td>30</td>
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<tr>
<td>Nerve-Muscle</td>
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<tr>
<td>Comparative Physiology</td>
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<td>Fertilization and Gamete</td>
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<td>16</td>
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<td><strong>Total Attendance</strong></td>
<td>580</td>
<td>586</td>
<td>615</td>
<td>614</td>
<td>668</td>
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<tr>
<td>Less persons represented in two categories</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>7</td>
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<tr>
<td>Total</td>
<td>578</td>
<td>585</td>
<td>611</td>
<td>609</td>
<td>661</td>
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</table>

#### 7. Institutions Represented, 1964

- Abbott Laboratories
- Agnes Scott College
- Albert Einstein Medical School
- Allegheny College
- American Museum of Natural History
- Amherst College
- Argonne National Laboratory
- Arizona, University of
- Beloit College
- Boston University
- Bowdoin College
- Bowling Green State University
- Brandeis University
- Brooklyn College
- Brown University
- California, University of, Los Angeles
- California, University of, Berkeley
- California, University of, Livermore
- California, University of, Santa Barbara
- Capitol Radio Engineering Institute
- Carnegie Institution of Washington
- Catholic University of America
- Chicago, University of, Medical School
- Chicago, University of
- Cincinnati, University of
- Cornell University
- Cornell University, Medical College
- Dartmouth College
- Dartmouth Medical School
- Delaware, University of
- Drew University
- Duke University
- duPont de Nemours & Company
- Earlham College
- Emory University
- Florida State University
- Florida, University of
- Fordham University
- Goucher College
- Hahnemann Medical School
- Harvard University
- Harvard University Medical School
- Haskins Laboratories
- Hawaii, University of
- Illinois, University of
- Indiana University
- Institute for Muscle Research
- Iowa State University
Jefferson Medical College  
Johns Hopkins University, The  
Johns Hopkins University School of Medicine, The  
Lafayette College  
Lerner Marine Laboratory, of the American Museum of Natural History  
Maine Vocational Technical Institute  
Marquette University  
Maryland, University of  
Massachusetts General Hospital  
Massachusetts Institute of Technology  
Massachusetts, University of  
Mellon Institute  
Miami, University of  
Michigan, University of  
Minnesota, University of  
Missouri, University of, Medical School  
Morgan State College  
Mount Holyoke College  
Mount Sinai Hospital, The  
National Institutes of Health  
New York State University, College of Medicine at Brooklyn  
New York State University, College of Medicine at Syracuse  
New York University, Bellevue Medical Center  
New York University, School of Dentistry  
New York University, Washington Square College  
North Carolina State of the University of  
North Carolina at Raleigh  
North Carolina, University of  
Northwestern University  
Notre Dame, University of  
Oak Ridge National Laboratory  
Oberlin College  
Oglethorpe University  
Oregon Regional Primate Research Center  
Oregon State University  
Oregon, University of  
Pembroke College  
Pennsylvania, University of  
Pennsylvania Medical School, University of  
Pittsburgh, University of  
Princeton University  
Purdue University  
Queens College  
Reed College  
Rensselaer Polytechnic Institute  
Rhode Island, University of  
Rice University  
Ripon College  
Rochester, University of, School of Medicine and Dentistry  
Rockefeller Institute, The  
Russell Sage College  
Rutgers, The State University  
Saint Louis University  
Seton Hill College  
Single Cell Research Foundation, Inc.  
Smith College  
South Florida College  
Stanford University  
Stanford University, School of Medicine  
State University of New York at Buffalo  
Swarthmore College  
Syracuse University  
Temple University  
Tennessee, University of  
Tufts University  
Tulane University  
Vassar College  
Vermont, University of  
Veterans Administration Hospital  
Vanderbilt University  
Virginia, University of  
Washington University, at St. Louis  
Wellesley College  
Wesleyan University  
Western Reserve University  
Western Reserve University, School of Medicine  
Wheaton College  
Wilson College  
Wisconsin, University of  
Yale University  

FOREIGN INSTITUTIONS REPRESENTED, 1964

Agricultural Research Council of Great Britain  
Anatomisches Institut, der Universität Zurich, Switzerland  
Biologische Anstalt Helgoland, Germany  
Brussels University, Brussels  
Dalhousie University, Halifax  
Erlangen, University of, Germany  
Gunma University, Japan  
Leicester University, England  
Ljubljana University, Yugoslavia  
Medical Research Council of Great Britain  
McMaster University, Canada  
Pahlavi, University of, Shiraz, Iran  
Queen's University, Ontario, Canada  
Tokyo, University of, Japan  
University College, London, England  
University of Palermo, Italy  
Utrecht, University of, Holland
REPORT OF THE DIRECTOR

SUPPORTING INSTITUTIONS, AGENCIES, AND INDIVIDUALS

Abbott Laboratories
Associates of the Marine Biological Laboratory
Atomic Energy Commission
CIBA Corporation
The Commonwealth Fund
Josephine B. Crane Foundation
Dr. William D. Curtis
The Ford Foundation
Dr. and Mrs. David W. Gaiser
The Grass Foundation
Mr. and Mrs. William H. Greer, Jr.
Dr. Ethel Browne Harvey
Mr. and Mrs. George F. Jewett, Jr.

The Lalar Foundation
Mrs. Grace T. Mast
Olin Matheson Charitable Trust
National Institutes of Health
National Science Foundation
Office of Naval Research
The Rockefeller Foundation
Schering Foundation, Inc.
Scientific American, Inc.
Mr. Gerard Swope, Jr.
The Upjohn Company
Wallace Laboratories
Mr. James H. Wickersham

8. FRIDAY EVENING LECTURES, 1964

July 3
HANS LEO KORNBERG .......... Anaplerotic Sequences in Microbial Metabolism: Their Significance and Regulation
The University of Leicester

July 9, Thursday
RICARDO MILEDI .............. Localization of Acetylcholine-Receptors and Cholinesterase in Muscle Fibres, Part I
University College, London
Alexander Forbes Lecturer at the MBL

July 10
RICARDO MILEDI .............. Localization of Acetylcholine-Receptors and Cholinesterase in Muscle Fibres, Part II

July 17
IRWIN R. KÖNIGSBERG .......... Clonal Analysis of Myogenesis
Carnegie Institution of Washington

July 24
SIDNEY W. FOX ............... Experimental Geosynthesis and a Theory of Cellular Origins
The Florida State University

July 31
MELBOURNE R. CARRICKER .......... Hard Tissue Destruction by Marine Predatory Gastropods
MBL

August 7
SOL SPIEGELMAN .............. The Transcription and Translation of Genetic Messages
University of Illinois

August 14
R. ALAN BEATTY .............. The Gamete as a Microorganism
University of Edinburgh
Senior Lalor Fellow at the MBL

August 21
ERNST HADORN .............. New Patterns of Differentiation Arising in Permanent Cultures of Drosophila Cells in vitro
University of Zurich
F. R. Lillie Fellow at the MBL

August 28
KENNETH D. ROEDER .......... What a Moth's Ear Tells its Nervous System about Bats
Tufts University
9. TUESDAY EVENING SEMINARS, 1964

July 7
H. Schuel .......................... Isolation of Muscle-Relaxing Particles with the Zonal Centrifuges
L. Lorand
R. Schuel
J. S. Nagle .......................... Differential Sorting of Shells in the Swash Zone
C. C. Speidel .......................... Deviations in Motility of Developing Sea Urchins Induced by Irradiation (film)
R. H. Cheney

July 14
J. Cohen ............................ The Transfer of Melanin Granules from Melanocytes into Malpighian cells of the Mammalian Epidermis (illustrated with timelapse photography)
G. Szabó
S. Karasaki .......................... The Sites of Nuclear RNA Synthesis during Amphibian Embryogenesis
R. Alan Beatty .......................... Density Gradient Media for Spermatozoa

July 21
S. Higashino .......................... Analysis of Biological Excitable Membrane by Means of Voltage-Current-Time Characteristics
A. M. Zimmerman .......................... Further Studies on Incorporation of H³ Thymidine in Arbacia Eggs Under Hydrostatic Pressure
L. Silberman
D. Marsland .......................... High Pressure Reversal of the Anti-Mitotic Effects of Heavy Water (D₂O)

July 28
A. Janoff ............................ Production of Inflammatory Changes in the Micro-Circulation by Cationic Proteins Extracted from Lysosomes
B. Zweifach
H. Sato ............................... Condensation of the Sperm Nucleus and Orientation of DNA Molecules during Spermiogenesis in Loligo pealii
S. Inoué
P. Person ............................. Cartilage in a Marine Polychaete Eudistylia

August 4
W. E. Love .......................... Microheterogeneity in the Hemoglobin from Individual Sea Lampreys
Y. Hiramoto .......................... Further Studies on the Cell Division without Mitotic Apparatus in Sea Urchin Eggs
A. B. Novikoff .......................... GERL, its Form and Function in Neurons of Rat Spinal Ganglia

August 11
D. Bownds ............................ The Reaction of Rhodopsin and its Derivative with Sodium Borohydride
G. Wald
S. Zigman .............................. A Cold-Precipitable Protein in the Dogfish Lens
S. Lerman

August 18
W. Auclair .......................... On the Chromosome Number of Arbacia
V. Zullo ............................... Re-evaluation of the Late Cenozoic Cirriped, "Tamiosoma" Conrad
R. Parker ............................. Preliminary Quantitative Study of Small-Scale Environmental and Faunal Variability
A. Driscoll
J. S. Nagle
K. Lukas
REPORT OF THE DIRECTOR

10. MEMBERS OF THE CORPORATION, 1964

Life Members

ADOLPH, DR. EDWARD F., University of Rochester, School of Medicine & Dentistry, Rochester, New York
BRODIE, MR. DONALD, 522 Fifth Avenue, New York 18, New York
COLE, DR. ELBERT C., 2 Chipman Park, Middlebury, Vermont
COWDRY, DR. E. V., 4580 Scott Avenue, St. Louis 10, Missouri
CRANE, MRS. W. MURRAY, 820 Fifth Avenue, New York 21, New York
HES, DR. WALTER, 286 North Fairview Avenue, Spartanburg, South Carolina
HIRS, DR. F. L., Biological Laboratories, Harvard University, Cambridge 38, Massachusetts
IRVING, LAURENCE, University of Alaska, College, Alaska
JACOBS, DR. M. H., Department of Physiology, University of Pennsylvania, Philadelphia 4, Pennsylvania
LOWTHER, DR. FLORENC E., Barnard College, New York 21, New York
MACDOUGALL, DR. MARY STUART, Mt. Vernon Apartments, 423 Clairmont Avenue, Decatur, Georgia
MALONE, DR. E. F., 6610 North 11th Street, Philadelphia 26, Pennsylvania
MEANS, DR. J. H., 15 Chestnut Street, Boston Massachusetts
MEDES, DR. GRACE, 303 Abington Avenue, Philadelphia 11, Pennsylvania
MOORE, DR. J. PERCY, RD No. 1, Box 437, Chapel Hill, North Carolina
PAYNE, DR. FERNANDUS, Indiana University, Bloomington, Indiana
PLough, DR. H. H., Amherst College, Amherst, Massachusetts
PORTER, DR. H. C., University of Pennsylvania, Philadelphia 4, Pennsylvania
SCOTT, DR. ERNEST L., Columbia University, New York 21, New York
SCHRADER, DR. SALLY, Duke University, Durham, North Carolina
TURNER, DR. C. L., Northwestern University, Evanston, Illinois
WAITE, DR. F. G., 144 Locust Street, Dover, New Hampshire
WALLACE, DR. LOUISE B., 359 Lytton Avenue, Palo Alto, California
WARREN, DR. HERBERT S., 2768 Egypt Road, Audubon, Pennsylvania
WHEDON, DR. A. D., 21 Lawncrest, Danbury, Connecticut

Regular Members

ABELL, DR. RICHARD G., 55 East 2nd Avenue, New York 28, New York
ADELBERG, DR. EDWARD A., Department of Microbiology, Yale University, New Haven, Connecticut 06520
ADELMAN, DR. WILLIAM J., Department of Physiology, University of Maryland Medical School, Baltimore 1, Maryland
ALBERT, DR. ALEXANDER, Mayo Clinic, Rochester, Minnesota
ALLEN, DR. M. JEAN, Department of Biology, Wilson College, Chambersburg, Pennsylvania
ALLEN, DR. ROBERT D., Department of Biology, Princeton University, Princeton, New Jersey 08540
ALSCHER, DR. RUTH, Department of Physiology, Manhattanville College, Purchase, New York
AMATNIEK, Dr. Ernest, 34 Horner Avenue, Hastings-on-the-Hudson, New York
AMBERSON, Dr. William R., Katy Hatches Road, Falmouth, Massachusetts
ANDERSON, Dr. J. M., Department of Zoology, Cornell University, Ithaca, New York
ANDERSON, Dr. Rubert S., Medical Laboratories, Army Chemical Center, Maryland
ARMSTRONG, Dr. Philip B., Department of Anatomy, State University of New York, College of Medicine, Syracuse 10, New York
ARNOLD, Dr. John Miller, Department of Zoology, Iowa State University, Ames, Iowa 50010
ARNOLD, Dr. William A., Division of Biology, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831
ATWOOD, Dr. Kimball C., 702 West Pennsylvania Avenue, Urbana, Illinois
AUCLAIR, Dr. Walter, Department of Biological Sciences, University of Cincinnati, Cincinnati, Ohio 45221
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The summer of 1964 saw many physical changes in the Library. The older section of the stacks was repainted, new tile flooring put down on all five floors, and lighting changed completely to a fluorescent system. New lights were placed on all tables in the wing and the reserve desks now contain file cabinets. A large catalog room, three new offices for the staff, and a Xerox room were added to the existing space. Also, for the first time, all of our most valuable books were brought together in a Rare Books Room, which is lined with floor-to-ceiling paneled shelving and contains as of this date 517 volumes. This room is located within the offices and is available only while the staff is on duty.

During the year we received and serviced 844 requests on Interlibrary Loan, and we requested 137 titles for our use here. In the Fall, 1545 volumes were sent to the bindery. A very generous gift of nearly 2000 reprints was received from Dr. William Randolph Taylor. The total number of bound volumes in the Library is now approximately 100,000.

The Library holdings for this year are:

- Total Number of Serial Titles in Library: 3567
- Number Received Currently: 1917
- On Subscription: 788
- On Gift Basis: 255
- Total Number of Books in Library: 15,384
- Number Added in 1964: 462
- Received From Book Exhibit: 101
- Total Number of Reprints: 231,351
- Number Added in 1964: 3351

Jane Fessenden,
Librarian
VI. REPORT OF THE TREASURER

The market value of the General Endowment Fund and the Library Fund at December 31, 1964, amounted to $2,370,890 as against book value of $1,235,860. This compares with values of $2,155,489 and $1,242,896, respectively, at the end of the preceding year. The average yield on the Securities was 3.51\% of the market value and 6.74\% of the book value. The total uninvested principal cash in the above accounts as of December 31, 1964, was $5,595. Classification of the securities held in the Endowment Funds appears in the Auditor's report.

The market value of the pooled securities as of December 31, 1964 was $580,677 with uninvested principal cash of $2,210, the market value at December 31, 1963, being $390,026. The book value of the securities in this account was $562,547 on December 31, 1964, compared with $315,196 a year earlier. The average yield on market value was 3.6\% and 4.6\% of book value.

The proportionate interest in the Pool Fund Account of the various Funds as of December 31, 1964, is as follows:

<table>
<thead>
<tr>
<th>Pension Funds</th>
<th>General Laboratory Investment</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.098%</td>
<td>32.264%</td>
<td></td>
</tr>
<tr>
<td>Bio Club Scholarship Fund</td>
<td>0.923%</td>
<td></td>
</tr>
<tr>
<td>Rev. Arsenius Boyer Scholarship Fund</td>
<td>1.130%</td>
<td></td>
</tr>
<tr>
<td>Gary N. Calkins Fund</td>
<td>1.059%</td>
<td></td>
</tr>
<tr>
<td>Allen R. Memhard Fund</td>
<td>0.206%</td>
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</tr>
<tr>
<td>F. R. Lillie Memorial Fund</td>
<td>3.566%</td>
<td></td>
</tr>
<tr>
<td>Lucretia Crocker Fund</td>
<td>3.800%</td>
<td></td>
</tr>
<tr>
<td>E. G. Conklin Fund</td>
<td>0.652%</td>
<td></td>
</tr>
<tr>
<td>Jewett Memorial Fund</td>
<td>0.343%</td>
<td></td>
</tr>
<tr>
<td>M. H. Jacobs Scholarship Fund</td>
<td>0.465%</td>
<td></td>
</tr>
<tr>
<td>Anonymous Gift</td>
<td>1.221%</td>
<td></td>
</tr>
<tr>
<td>Herbert W. Rand Fellowship</td>
<td>23.326%</td>
<td></td>
</tr>
<tr>
<td>Mellon Foundation</td>
<td>7.887%</td>
<td></td>
</tr>
</tbody>
</table>

Donations from the MBL Associates for 1964 were $4,830.00 as compared with $4,295.00 for 1963. Unrestricted gifts from foundations, societies and companies amounted to $14,575.

During the year, we administered the following grants:

<table>
<thead>
<tr>
<th>Investigators</th>
<th>Training</th>
<th>MBL Institutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 NIH</td>
<td>3 NIH</td>
<td>4 NIH</td>
</tr>
<tr>
<td>3 NSF</td>
<td>2 NSF</td>
<td>3 NSF</td>
</tr>
<tr>
<td>1 Ford</td>
<td></td>
<td>3 ONR</td>
</tr>
<tr>
<td>1 ONR</td>
<td></td>
<td>1 AEC</td>
</tr>
<tr>
<td>1 Commonwealth</td>
<td></td>
<td>1 Ford</td>
</tr>
</tbody>
</table>

19          | 5        | 12
The rate of overhead on grants to investigators is 20%, based on the amount expended. The overhead on these grants for this year amounted to $81,239 as compared with $56,494 for the preceding year.

The Lillie Fellowship Fund, with a market value of $114,293 and a book value of $92,893, as well as the investment in General Biological Supply House with book value of $12,700, is carried in the Balance Sheet item “Other Investments.”


In the fiscal year 1964 the Marine Biological Laboratory received dividends from the General Biological Supply House of $63,500 as against $42,164 in 1963, $38,100 in 1962, $33,020 in 1961, and $30,480 in 1960.

Following is a statement of the auditors:

To the Trustees of Marine Biological Laboratory, Woods Hole, Massachusetts:

We have examined the balance sheet of Marine Biological Laboratory as at December 31, 1964, the related statement of operating expenditures, income and current fund and statement of funds for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We examined and have reported on financial statements of the Laboratory for the year ended December 31, 1964.

In our opinion, the accompanying financial statements present fairly the assets, liabilities and funds of Marine Biological Laboratory at December 31, 1964 and 1963 and the results of its operation for the years then ended on a consistent basis.

The supplementary schedules included in this report were obtained from the Laboratory’s records in the course of our examination and in our opinion, are fairly stated in all material respects in relation to the financial statements, taken as a whole.

Boston, Massachusetts
March 26, 1965

Lybrand, Ross Bros. & Montgomery
James H. Wickersham,
Treasurer
REPORT OF THE TREASURER

MARINE BIOLOGICAL LABORATORY

BALANCE SHEETS

December 31, 1964 and 1963

<table>
<thead>
<tr>
<th>Investments</th>
<th>1964</th>
<th>1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investments held by Trustee:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Securities, at cost (approximate market quotation 1964—$2,370,890)</td>
<td>$1,235,860</td>
<td>$1,242,896</td>
</tr>
<tr>
<td>Cash</td>
<td>5,595</td>
<td>431</td>
</tr>
<tr>
<td></td>
<td>1,241,455</td>
<td>1,243,327</td>
</tr>
<tr>
<td>Investments of other endowment and unrestricted funds:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled investments, at cost (approximate market quotation 1964—$579,161) less $5,728 temporary investment of current fund cash</td>
<td>479,344</td>
<td>309,468</td>
</tr>
<tr>
<td>Other investments</td>
<td>118,888</td>
<td>120,424</td>
</tr>
<tr>
<td>Cash</td>
<td>39,522</td>
<td>14,083</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>10,664</td>
<td>21,131</td>
</tr>
<tr>
<td></td>
<td>$1,889,873</td>
<td>$1,708,433</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant Assets</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Land, buildings, Library and equipment (note)</td>
<td>5,136,289</td>
<td>4,931,472</td>
</tr>
<tr>
<td>Less allowance for depreciation (note)</td>
<td>1,378,887</td>
<td>1,313,162</td>
</tr>
<tr>
<td></td>
<td>3,757,402</td>
<td>3,618,310</td>
</tr>
<tr>
<td>Construction in progress</td>
<td>109,215</td>
<td></td>
</tr>
<tr>
<td>Short-term investments, at cost</td>
<td>192,360</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4,058,977</td>
<td>$3,618,310</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current Assets</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>79,637</td>
<td>100,991</td>
</tr>
<tr>
<td>Temporary investment in pooled securities</td>
<td>5,728</td>
<td>5,728</td>
</tr>
<tr>
<td>U. S. Treasury bills, at cost</td>
<td>96,045</td>
<td>74,324</td>
</tr>
<tr>
<td>Accounts receivable (U. S. Government, 1964—$84,793; 1963—$95,142)</td>
<td>138,489</td>
<td>140,825</td>
</tr>
<tr>
<td>Inventories of specimens and Bulletins</td>
<td>33,401</td>
<td>45,288</td>
</tr>
<tr>
<td>Prepaid insurance and other</td>
<td>6,844</td>
<td>7,062</td>
</tr>
<tr>
<td></td>
<td>$360,144</td>
<td>$374,218</td>
</tr>
</tbody>
</table>
## Balance Sheets

**December 31, 1964 and 1963**

### Endowment Funds

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endowment funds given in trust for benefit of the Marine Biological Laboratory</td>
<td>$1,241,455</td>
<td>$1,243,327</td>
</tr>
<tr>
<td>Endowment funds for awards and scholarships:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principal</td>
<td>295,710</td>
<td>126,980</td>
</tr>
<tr>
<td>Unexpended income</td>
<td>14,289</td>
<td>12,077</td>
</tr>
<tr>
<td></td>
<td>309,999</td>
<td>139,057</td>
</tr>
<tr>
<td>Unrestricted funds functioning as endowment</td>
<td>206,378</td>
<td>206,378</td>
</tr>
<tr>
<td>Retirement fund</td>
<td>123,298</td>
<td>108,481</td>
</tr>
<tr>
<td>Pooled investments—accumulated gain</td>
<td>8,743</td>
<td>11,190</td>
</tr>
<tr>
<td><strong>Total Endowment Funds</strong></td>
<td><strong>$1,889,873</strong></td>
<td><strong>$1,708,433</strong></td>
</tr>
</tbody>
</table>

### Plant Funds

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funds expended for plant, less retirements</td>
<td>5,245,504</td>
<td>4,931,472</td>
</tr>
<tr>
<td>Less allowance for depreciation charged thereto</td>
<td>1,378,887</td>
<td>1,313,162</td>
</tr>
<tr>
<td><strong>Total Unexpended Plant Funds</strong></td>
<td><strong>3,866,617</strong></td>
<td><strong>3,618,310</strong></td>
</tr>
</tbody>
</table>

### Current Liabilities and Funds

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts payable and accrued expenses</td>
<td>33,315</td>
<td>62,763</td>
</tr>
<tr>
<td>Advance subscriptions</td>
<td>10,926</td>
<td>10,362</td>
</tr>
<tr>
<td>Unexpended grants—research</td>
<td>99,000</td>
<td>110,433</td>
</tr>
<tr>
<td>Unexpended balances of gifts for designated purposes</td>
<td>17,995</td>
<td>13,531</td>
</tr>
<tr>
<td>Current fund</td>
<td>198,908</td>
<td>177,129</td>
</tr>
<tr>
<td><strong>Total Current Liabilities and Funds</strong></td>
<td><strong>$360,144</strong></td>
<td><strong>$374,218</strong></td>
</tr>
</tbody>
</table>

Note.—The Laboratory has since January 1, 1916, provided for reduction of book amounts of plant assets and funds invested in plant at annual rates ranging from 1% to 5% of the original cost of the assets.
REPORT OF THE TREASURER

MARINE BIOLOGICAL LABORATORY

STATEMENTS OF OPERATING EXPENDITURES, INCOME AND CURRENT FUND

Years Ended December 31, 1964 and 1963

<table>
<thead>
<tr>
<th>Operating Expenditures</th>
<th>1964</th>
<th>1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and accessory services</td>
<td>$293,396</td>
<td>$273,333</td>
</tr>
<tr>
<td>Instruction</td>
<td>160,820</td>
<td>147,163</td>
</tr>
<tr>
<td>Library and publications (including book purchases—1964, $24,304; 1963, $25,628)</td>
<td>80,416</td>
<td>77,922</td>
</tr>
<tr>
<td>Direct costs on research grants</td>
<td>493,890</td>
<td>484,640</td>
</tr>
<tr>
<td>Direct costs on institution support grants</td>
<td>150,450</td>
<td>129,642</td>
</tr>
<tr>
<td>Administration and general</td>
<td>112,453</td>
<td>97,339</td>
</tr>
<tr>
<td>Plant operation and maintenance</td>
<td>139,684</td>
<td>111,441</td>
</tr>
<tr>
<td>Dormitories and dining</td>
<td>175,696</td>
<td>174,030</td>
</tr>
<tr>
<td>Additions to plant from current income</td>
<td>5,045</td>
<td>7,793</td>
</tr>
<tr>
<td><strong>Less depreciation included in plant operation and dormitories and dining above but charged to plant funds</strong></td>
<td>67,437</td>
<td>67,472</td>
</tr>
<tr>
<td><strong>Total Operating Expenditures</strong></td>
<td>1,544,413</td>
<td>1,435,831</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income</th>
<th>1964</th>
<th>1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research fees</td>
<td>88,240</td>
<td>113,024</td>
</tr>
<tr>
<td>Accessory services (including sales of biological specimens—1964, $42,051; 1963, $38,019)</td>
<td>114,181</td>
<td>103,398</td>
</tr>
<tr>
<td>Instruction fees</td>
<td>28,470</td>
<td>28,461</td>
</tr>
<tr>
<td>Library fees, Bulletins, subscriptions and other</td>
<td>49,393</td>
<td>43,952</td>
</tr>
<tr>
<td>Dormitories and dining income</td>
<td>133,759</td>
<td>129,486</td>
</tr>
<tr>
<td>Grants for support of institutional activities:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction and training</td>
<td>138,540</td>
<td>131,564</td>
</tr>
<tr>
<td>Support services</td>
<td>150,450</td>
<td>129,642</td>
</tr>
<tr>
<td>General</td>
<td>109,219</td>
<td>113,853</td>
</tr>
<tr>
<td>Reimbursements and allowances for direct and indirect costs on specific research grants</td>
<td>575,129</td>
<td>541,134</td>
</tr>
<tr>
<td>Gifts used for current expenses</td>
<td>22,135</td>
<td>29,285</td>
</tr>
<tr>
<td>Investment income used for current expenses</td>
<td>156,676</td>
<td>134,591</td>
</tr>
<tr>
<td><strong>Total Income</strong></td>
<td>1,566,192</td>
<td>1,498,390</td>
</tr>
</tbody>
</table>

| Excess current income | 21,779    | 62,559   |
| Current fund balance January 1 | 177,129    | 114,570  |
| **Current fund balance December 31** | **$198,908** | **$177,129** |
## MARINE BIOLOGICAL LABORATORY

**STATEMENT OF FUNDS**

**Year Ended December 31, 1964**

<table>
<thead>
<tr>
<th>Description</th>
<th>Balance January 1, 1964</th>
<th>Gifts and Other Receipts</th>
<th>Investment Income</th>
<th>Used for Current Expenses</th>
<th>Other Expenditures</th>
<th>Balance December 31, 1964</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invested funds</td>
<td>$1,708,433</td>
<td>$187,132</td>
<td>$164,448</td>
<td>$153,890</td>
<td>$16,250</td>
<td>$1,889,873</td>
</tr>
<tr>
<td>Unexpended plant funds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexpended research grants</td>
<td>$110,433</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$99,000</td>
</tr>
<tr>
<td>Unexpended gifts for designated purposes.</td>
<td>$13,531</td>
<td>29,687</td>
<td></td>
<td>22,135</td>
<td>3,088</td>
<td>$17,995</td>
</tr>
<tr>
<td>Current fund</td>
<td>$177,129</td>
<td>21,779(1)</td>
<td></td>
<td></td>
<td></td>
<td>$198,908</td>
</tr>
<tr>
<td>Gifts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grant for facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grants for research, training and support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriated from current income and other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net loss on sale of securities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess of current income over expenditures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expended for construction and renovation of facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1,802,303</td>
</tr>
<tr>
<td>Scholarship awards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>262,015</td>
</tr>
<tr>
<td>Payments to pensioners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4,124</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12,126</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,088</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$281,353</td>
</tr>
</tbody>
</table>
### Summary of Investments

**December 31, 1964**

<table>
<thead>
<tr>
<th>Securities held by Trustee:</th>
<th>Cost</th>
<th>% of Total</th>
<th>Market Quotations</th>
<th>% of Total</th>
<th>Investment Income 1964</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General endowment fund:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. S. Government securities</td>
<td>$92,310</td>
<td>8.9%</td>
<td>$91,086</td>
<td>4.6%</td>
<td>$4,449</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>528,638</td>
<td>51.1%</td>
<td>522,095</td>
<td>26.5%</td>
<td>21,177</td>
</tr>
<tr>
<td>Preferred stocks</td>
<td>54,422</td>
<td>5.3%</td>
<td>53,200</td>
<td>2.7%</td>
<td>2,186</td>
</tr>
<tr>
<td>Common stocks</td>
<td>358,452</td>
<td>34.7%</td>
<td>1,306,140</td>
<td>66.2%</td>
<td>42,950</td>
</tr>
<tr>
<td><strong>Total securities held by Trustee:</strong></td>
<td>$1,033,822</td>
<td>100.0%</td>
<td>$1,972,521</td>
<td>100.0%</td>
<td>$70,762</td>
</tr>
</tbody>
</table>

| **General Educational Board endowment fund:** |        |            |                   |            |                       |
| U. S. Government securities | 18,086 | 8.9%       | 17,836            | 4.5%       | 1,221                 |
| Other bonds                 | 107,310| 53.2%      | 109,091           | 27.4%      | 4,106                 |
| Preferred stocks            | 15,641 | 7.7%       | 15,100            | 3.8%       | 700                   |
| Common stocks               | 61,001 | 30.2%      | 256,342           | 64.3%      | 6,508                 |
| **Total securities held by Trustee:** | $202,038 | 100.0% | $398,369 | 100.0% | $12,535 |

| **Investments of other endowment and unrestricted funds:** |        |            |                   |            |                       |
| Pooled investments: |        |            |                   |            |                       |
| U. S. Government securities | 61,005 | 12.6%      | 59,730            | 10.3%      | 2,308                 |
| Corporate bonds            | 125,736| 25.9%      | 125,370           | 21.7%      | 4,782                 |
| Common stocks              | 298,331| 61.5%      | 394,061           | 68.0%      | 7,489                 |
| **Total: 485,072** | 100.0% |                       | $579,161 | 100.0% | 14,579 |

| Less temporary investment of current fund cash | (5,728) | (251) | 14,328 |
| **Total investments of other endowment and unrestricted funds: $598,232** | | | |

| **Total investment income:** | $165,392 | |

| **Custodian’s fees charged thereto:** | (944) | |

| **Investment income distributed to funds: 164,448** | |

| **Plant investments:** |        |            |                   |            |                       |
| U. S. Treasury bills, due 3/4/65. | 80,085 | | 684 | |
| Bank of New York acceptances, due January, 1965 | 112,275 | | 891 | |
| **Total: 192,360** | |

| **Current investments:** |        |            |                   |            |                       |
| U. S. Treasury bills, due March 4 and October 31, 1965 | 96,045 | | 2,686 | |

| Temporary investment in pooled securities | 5,728 | | 2,937 | |

| **Total: 108,960** | | | |