THE

BIOLOGICAL BULLETIN

PUBLISHED BY THE MARINE BIOLOGICAL LABORATORY

THE MARINE BIOLOGICAL LABORATORY

SEVENTY–FIRST REPORT, FOR THE YEAR 1968—EIGHTY–FIRST YEAR

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I. TRUSTEES

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John Teal
Alberto Monroy
Leon P. Weiss
E. G. Butler
James W. Green
IV. 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.

[Seal]

Henry B. Pierce,
Secretary of the Commonwealth.
III. BYLAWS OF THE CORPORATION OF THE MARINE BIOLOGICAL LABORATORY

(Revised August 12, 1966)

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 nine 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 (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 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-six 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.

(B) Trustees ex officio, who shall be the Chairman, 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 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 annually and shall serve until his successor is selected and qualified. 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 officers. 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 state that an alteration of the bylaws will be acted upon.

RESOLUTIONS ADOPTED AT TRUSTEES' MEETINGS

EXECUTIVE COMMITTEE

I. RESOLVED:

(A) The Executive Committee is hereby designated to consist of not more than ten members including the 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. (August 11, 1967)

(B) The Chairman of the Board of Trustees shall act as Chairman of the Executive Committee, and the President as Vice President. 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. (August 12, 1966)

(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 law. (August 16, 1963)

(D) The Executive Committee shall keep appropriate minutes of its meetings, and its action shall be reported to the Board of Trustees. (August 16, 1963)

II. RESOLVED:

The elected members of the Executive Committee shall be constituted as a standing "Committee for the Nomination 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).
REPORT OF THE DIRECTOR

IV. REPORT OF THE DIRECTOR

To: THE TRUSTEES OF THE MARINE BIOLOGICAL LABORATORY

Gentlemen:

I. The Business of Scientists is Science

The business of the Marine Biological Laboratory is to serve scientists. To be sure, scientists are people with individual social responsibilities and preoccupations. In like fashion, the MBL is a unit of a community with community interests and obligations.

The MBL was founded as a place for scholars, old and young, to pursue scientific inquiry by experiment, by observation, by cogitation and by communication. It is not an operation speaking with a single voice; it has no institutionally controlled scientific programs and its management is one for service rather than for casting plans for the molding of its future.

These thoughts add up to describe a remarkable institution which unfortunately defies shorthand description in this modern organized society. This is especially true where one might wish to speak of the results of the scientific work and education. MBL facilities are used by some 500 good scientists and to paraphrase the Constitution, all good scientists are equal. It matters not that, to quote another authority, some are more equal than others. The best that can be done, in fairness and justice, is to state that last season, the 81st. Session, scientific activity was marked by accomplishment and innovation. There were highlights—but as parts of a bright picture. It was a good year.

2. Our Building Program

The MBL building program exhibits some peculiarly biological properties: These are: (1) heterogenic growth, (2) specificity of biological time and (3) territoriality (perhaps even the territorial imperative.)

The first attribute refers to the difficulty in keeping buildings, food, scientists and laboratories in phase. I regret that difficulties in regulating the overall growth pattern are all too apparent. The second property is attested by our failure to have the new training building ready on schedule. Committees, architects, building trades and supplies all clearly have different time constants and it is well nigh impossible to predict in advance specific growth rates. We offer our apologies for the inconvenience of the delay and extend our appreciation to the course heads for the resourceful way in which they responded.

The new dining-dormitory complex is delayed another year. I hope we can make that schedule. The causes of the delay, which clearly relate to territoriality, need not be reviewed again. However, the discussions relating to our plan to place the new living amenities on the Breakwater site were sufficiently vigorous to enlist the attention of a number of friends, especially in the Penzance Point area. With their support and encouragement and the wise and masterly efforts of Mr. Swope and Mr. Smith, funds were raised and land was purchased to enable MBL to place the dining-dormitory complex on the shores of Eel Pond. This site has notable logistic advantages over the Breakwater site, especially during periods of inclement weather, and the newly planned structure will serve our summer population well and be a boon to all the increasing number of fall, winter and spring users. The MBL owes a great debt of gratitude to those whose efforts made this plan possible. I especially wish to pay tribute to the fine cooperation of those who agreed to move their homes in order to allow MBL to develop its new plans. The new plan accomplishes the purposes so wisely set forth by Dr. Armstrong, Dr. Parpart and others, and adds the great advantage of immediate proximity to the rest of our operations. Plans will be available for inspection in the summer of 1969.
3. MBL Policy and the Future

The Marine Biological Laboratory exists to provide service to scientists to solve fundamental problems in life sciences and to give training to developing scientists. Due to its location and to the reasons for selecting the site, the MBL has always depended heavily on life in the oceans but has never been limited to the exclusive use of marine forms.

In the last twenty years or so, the importance of oceanic life forms as part of the marine environment has been favored with a great deal of public attention relating especially to such matters as pollution, productivity, fishing, extraction of chemicals and the like. Dramatic attention has been called to all these aspects most recently by the report of the Commission on Marine Science and Technology. What is the role of MBL, if any, to respond to the proposed program of the Commission? All of us as citizens, scientists and Corporate members of MBL need to do some heavy thinking.

At the outset, the MBL was founded as a user-supported operation. Major costs were met from the Laboratory fees contributed by investigators; expansive steps were accomplished by securing major bits of financial support for the specific items such as the Crane building, the Library addition and so forth. What are our plans for the future? What will be our funding pattern?

Over the years this pattern has changed quantitatively. User fees account for less than a third of the costs, endowment has risen somewhat but the major expansion in operating funds has come from the grants-and-contracts system, primarily from Federal sources. This increasing dependence on public funds, especially in the present political climate will demand and, indeed, is now demanding that the MBL make clearly understandable and visible its role in the rapidly expanding scientific effort, especially as related to marine sciences. Thus, it is imperative that we keep our objectives clearly in mind and that we stand ready to interpret them in terms of the development of science as a whole. We must be able to explain to a changing social scene why we exist and are worthy of public support.

Especially I urge attention to the extreme importance of keeping our overall management a matter of concern of all user-scientists and Corporation members. As the fraction of support contributed by users declines, there is an inevitable decline in the degree of user-responsibility. The phrase "why don't they do something about" recurs with distressing frequency, "they" referring to the visible management. The MBL can survive in its present form only if responsibility for the Institution is shared by all. Otherwise there will be an inevitable tendency to drift into the usual programmatic, managerial-oriented laboratory so characteristic of big science today.

4. The MBL and Community Responsibility

Some seventy years ago, Woods Hole was a thriving fishing and fertilizer community served by an active railroad, a large fleet of small boats, several assorted small businesses and including a few tourists and a few scientists. Over the years, commercial fishing has practically disappeared; fertilizer is imported, not manufactured; the railroad has gone; tourists have become a major seasonal factor; small business has virtually disappeared; and the scientific establishment has become a dominant economic and political factor.

All of us regret the passing of Woods Hole as a charming seaside fishing village and, therefore, share the responsibility for its future development as a major scientific center. It would be a grievous error to assume that Woods Hole, the community, must become only a collection of institutions overrun periodically with transient visitors. Rather, it behooves the MBL and its sister institutions to work with the other segments of the community, and even more important, it should be the responsibility of the members of
REPORT OF THE DIRECTOR

the scientific community to increasingly play a role as informed and concerned citizens of Woods Hole.

Last year the MBL became involved in community matters in a rather distressing fashion. Our wholly admirable plans for erecting a dining-dormitory complex on the Breakwater site suddenly became a symbol of the oppression of the individual citizen by an Institution. Happily, community awareness won on all sides with the result of the new building program already outlined.

It is quite apparent that MBL has another community problem on its hands—the beach. Stony Beach (including parking space and tennis courts) is wholly owned by MBL. In part, this land constitutes a legal trust for MBL to keep the beach open to Woods Hole users, including scientists; the moral trust is imperative.

Those of you who are curious about the history of beach rights in Woods Hole are urged to read the Collecting Net starting about 1930. At that time, there was danger that all of the beach would be fenced off except for a narrow stretch with a right-of-way set up in trust by Mrs. Fay. A Committee, apparently of the Woods Hole Protective Association, but including many MBL founding fathers, went to work, and as a result of much discussion coupled with the wise generosity of such individuals as Drs. Meigs, Strong and Clowes, titles to the present property were turned over to MBL, but with the strong implication of the moral obligation to maintain the beach of the commonweal. Sadly, there appears to be an appreciable number of individuals, residing nearby, who consider the beach a nuisance. As of now, MBL policy is to cooperate with town officials to the fullest extent to ensure an orderly public beach. The community problem emerging is one in which all members of the community—users, owners, neighbors—must share responsibility. The MBL institutional posture must be that the beach, along with such other amenities as the sundial park must be kept open for public use. Woods Hole, its beaches and its parks, must not be allowed to become the exclusive domain of a few.

5. Fund Drive

During the past year, because of the need of concentrating on the special funds needed for procuring and developing the Eel Pond site, the general fund drive has gone into slow motion; $137,000—having been pledged; $66,000—having been raised; amounting to a total of $203,000; and we now intend to renew our efforts. All Corporation Members are cordially invited to contribute and to proselytize any sympathetic friends you might have.

6. Personnel

The MBL has a plant valued at $4,246,441. The current building program amounts to about $7,000,000. We maintain 75 buildings counting cottages and other residences. Our staff manages all this and also takes care of supplying materials and equipment, feeding, housing and otherwise tending some 500 individualistic scientists and their dependents. Our staff, headed by our General Manager, is superb and we all owe our staff members a debt of gratitude. Their virtuosity is equalled only to their equanimity, poise and good humor.

The Laboratory bears a deep sense of gratitude to Dr. Donald P. Costello and Dr. Catherine Henley for service to THE BIOLOGICAL BULLETIN. We are fortunate in that Dr. W. D. Russell-Hunter was able to accept the Editorship of the BULLETIN. We are also indebted to Dr. Russell-Hunter for the years of service he has rendered to the Laboratory as Head of the Invertebrate Zoology Course. We look forward to the further innovations that will be introduced into the course beginning in 1969 under the leadership of Dr. James Case. Dr. William Hillman presented a stimulating
program in the Marine Botany course during the interim year of 1968 when he assumed responsibility for that course. Dr. Harold W. Siegelman is taking over the Botany course in 1969 and, likewise, we anticipate the future development of this course under Dr. Siegelman.

1. Memorials

FERDINAND J. M. SICHEL

BY RUDOLF T. KEMPTON

With the death of Dr. Ferdinand J. M. Sichel on April eleventh of this year, the Laboratory lost a devoted supporter who first worked here in the summer of 1927 and became a member of the Corporation thirty-five years ago. In his earlier years here he was very active in the MBL Club, and he served on the housing, library, apparatus and other committees. His was an interest that never flagged, and in those years in which he was not able to spend the summer at Woods Hole he always made at least a visit to the Laboratory, often at the time of the Corporation meetings, of which he missed only a few.

Dr. Sichel was born in Hamilton, Ontario, in 1906; he became a United States citizen in 1940. His undergraduate study was at McGill University. From 1928–1934 he carried on graduate study in the Biology Department at Washington Square College, New York University, where he took his master's degree and doctorate with Dr. Robert Chambers. His research for the doctorate dealt with the micromanipulation of single skeletal muscle fibers. He never lost his interest in excitable tissues, especially muscle.

By the time he took his doctorate in 1934, he already had had considerable teaching experience, enough to have developed a great interest in the education of young men and women. He had been a Demonstrator in Botany at McGill for one year, and an assistant instructor at New York University for five years. He added to this successively a year as instructor in the Zoology Department at the University of Pennsylvania; a year at the Johnson Foundation for medical physics as a Postdoctoral Fellow of the Royal Society of Canada; and a year of teaching physiology at the Howard University School of Medicine. In addition, from 1933–1944 he taught micromanipulation each summer in the MBL physiology course. Thus when he went to the University of Vermont School of Medicine in 1937 he was a teacher with experience beyond his years. He was destined to serve at that institution throughout the remainder of his life. Starting as instructor, he rose to a full professorship in 1944 when he was made chairman of the Department of Physiology. He was a member of many societies, biological, physical and medical, and was a thirty-second degree Mason.

Dr. Sichel had strong convictions concerning the necessity for medical students to receive rigorous basic training, to develop a feeling for the scientific approach, and to achieve a firm physiological foundation. Being a perfectionist, he took endless pains in the presentation of physiological material to the students. His lectures were known as perhaps the best given at the institution, meticulous in their logic, clearly with a step-by-step development, presented with the greatest possible clarity. Added to this was his deep interest in students as a group and as individuals. The combination produced a very high level of student respect and appreciation. Personally I have encountered a number of graduates from the medical school, and they were unanimous in their regard for "old Doc Sichel."

As Chairman of the Physiology Department he was responsible for the establishment and development of a program for the Master's degree, and subsequently a Ph.D. program. More recently he developed a program in Biophysics associated with the
Physiology Department. At the time of his death he had given up the chairmanship of the whole department and had become chairman of the Division of Biophysics in the Department of Physiology and Biophysics.

As a stimulator of research Dr. Sichel's influence was wider than his department. One example is seen in the statement of the Vermont Heart Association upon their establishment of the "Ferdinand J. M. Sichel Fellowship in Cardiovascular Disease. . . ." They said " . . . he was instrumental in establishing a vital heart cornerstone, the formulation of Vermont Heart Research Policies . . . a diligent and conscientious member of our Research Committee for more than seven years, and its chairman for three years . . . His pensive, alert mind stimulated purposeful discussion and debate, marking milestone after milestone . . . Very aptly our research fellowship is being designated in his honor."

He was a man of many facets, and one was his hobbies. He was an ardent and accomplished skier, a sport he was forced to discontinue in 1947 after suffering a coronary attack. He did continue dry-fly fishing, in which he was highly skillful. Some of his hobbies were less taxing physically. He found great relaxation in mathematical puzzles; he enjoyed working out electron circuitry for various purposes; and he would travel many miles for the opportunity to listen to good Scottish pipers. Above all, he loved good conversations with small groups of friends.

For those of us who know him for many years our memories are clear. His interest in people, his quiet voice, his very real but subdued sense of humor, his wide scientific interests, will remain with us for the rest of our lives. We believe we can understand something of the sense of loss being experienced by his widow Elsa Keil Sichel, and his daughter Enid, a graduate student in physics.

2. The Staff

EMBRYOLOGY

I. Instructors

MALCOLM S. STEINBERG, Professor of Biology, Princeton University, in charge of course

JOHN M. ARNOLD, Assistant Professor of Cytology, Pacific Biomedical Research Center, University of Hawaii

MAX BURGER, Assistant Professor of Biology, Princeton University

RALPH HINEGARDNER, Associate Professor of Biology, University of California at Santa Cruz

IRWIN R. KONIGSBERG, Professor of Biology, University of Virginia

JAMES W. LASH, Associate Professor of Anatomy, University of Pennsylvania

HANS LAUFER, Associate Professor of Zoology, University of Connecticut

RAYMOND RAPPAPORT, Professor of Biology, Union College

II. Consultant

EVERETT ANDERSON, Professor of Biology, University of Massachusetts

III. Laboratory Assistants

BURR G. ATKINSON, JR., University of Connecticut

NORMAN A. GRANHOLM, University of Oregon
IV. Lectures

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<td>Morphogenetic phenomena in sponges</td>
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<td>Coelenterates I</td>
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<td>Lewis Wolpert</td>
<td>Cellular basis of sea urchin morphogenesis</td>
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<td>J. Lash</td>
<td>Ascidians I</td>
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<td>Kirby Smith</td>
<td>RNA and protein synthesis during early ascidian development</td>
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<td>J. Lash</td>
<td>Ascidians III</td>
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<td>Lionel F. Jaffe</td>
<td>The early development of <em>Fucus</em>: prototype of localization</td>
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<td>Bernice Grafstein</td>
<td>Transport of materials in nerve fibers</td>
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<tr>
<td>Roger Milkman</td>
<td>Genetics and development of <em>Botryllus schlosseri</em> (Asciacea)</td>
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<td>Paul B. Weisz</td>
<td>The significance of larvae</td>
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<tr>
<td>Jack Collier</td>
<td>Biochemistry of the Ilyanassa embryo</td>
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<tr>
<td>Igor Dawid</td>
<td>The DNA components of amphibian oocytes</td>
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<tr>
<td>L. Dennis Smith</td>
<td>Protein synthesis in early cell division of amphibians</td>
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<tr>
<td>Gerald Weissman</td>
<td>Lysosomes and template changes in transforming lymphocytes</td>
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<tr>
<td>Earl Frieden</td>
<td>Biochemical approaches to the problem of amphibian metamorphosis</td>
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<tr>
<td>Maurice Sussman</td>
<td>The programmed accumulation and disappearance of enzyme activities</td>
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</table>
REPORT OF THE DIRECTOR

PHYSIOLOGY

I. Consultants

MERKEL K. JACOBS, Professor of Physiology, University of Pennsylvania
ALBERT SZENT–GYÖRGYI, Director, The Institute for Muscle Research, Marine Biological Laboratory
W. D. McElroy, Director, McCollum-Pratt Institute, The Johns Hopkins University
J. WOODLAND HASTINGS, Professor of Biology, Harvard University

II. Instructors

ANDREW G. SZENT–GYORGYI, Professor of Biology, Brandeis University, in charge of course
SYDNEY BRENNER, Medical Research Council, Laboratory of Molecular Biology, Cambridge, England
RODERICK K. CLAYTON, Professor of Biophysics, Cornell University
SEYMOUR S. COHEN, Professor of Biochemistry, University of Pennsylvania
HUGH E. HUXLEY, Medical Research Council, Laboratory of Molecular Biology, Cambridge, England
MAURICE SUSSMAN, Professor of Biology, Brandeis University
DAVID A. YPHANTIS, Professor of Chemistry, University of Connecticut

III. Special Lecturers

HARLYN HALVORSON, Professor of Bacteriology, University of Wisconsin
SHINYA INOUÉ, Professor of Biology, University of Pennsylvania
HANS KORNBERG, Professor of Biochemistry, University of Leicester, England
JOHN G. NICHOLLS, Associate Professor of Physiology, Yale University Medical School
K. E. VAN HOLDE, Professor of Physical Chemistry, University of Oregon

IV. Staff Associates

ANNE MARIE WEBER, Department of Biochemistry, St. Louis University
RAYMOND E. STEPHENS, Department of Biology, Brandeis University
JAMES R. BOLTON, Department of Chemistry, University of Minnesota
CELIA E. FREDA, Department of Therapeutic Research, University of Pennsylvania
RAQUEL SUSSMAN, Department of Biology, Brandeis University
ROBLEY C. WILLIAMS, JR., Department of Biology, University of Connecticut
MICHAEL K. REEDY, School of Medicine, University of California at Los Angeles

V. Research Assistants

B. J. CLAYTON, Department of Genetics Development and Physiology, Cornell University
RICHARD KESSIN, Department of Biology, Brandeis University
ROBERT M. LEVY, Washington University Medical School
ANNE McCONVILLE, Department of Therapeutic Research, University of Pennsylvania
ELLEN RAYNER, Department of Biology, Brandeis University

VI. Course Assistants

JOHN I. CLARK, Department of Biological Structure, University of Washington
MARGARET KETCHUM, College of Liberal Arts, Boston University
VII. Lectures

Andrew G. Szent-Györgyi

Muscle contraction I
Muscle contraction II

Bernard R. Baker

Active site directed inhibition of dehydrofolate reductase

Annemarie Weber

Control of contraction

R. K. Clayton

An outline of the photosynthetic mechanism
Physical processes in photosynthesis

George Klein

Brief survey of tumor immunology

J. M. Olson

Evolution of photosynthetic electron transfer

Seymour S. Cohen

Origin and properties of some phage-induced enzymes
Essential and inessential early functions in t-even phage infection

John R. Platt

Control of gene expression in t-even phage infection

G. Cantoni

First stage electrical effects in vision

Maurice Sussman

Structure and function of t-RNA

Slime molds XLVI
Slime molds XLVII
Slime molds XLIX

Boris Rotman

Skewed distribution of galactosidase among uninduced cells of E. coli and its possible relation to in vivo activity of m-RNA

Matthew R. Meselson

Replication of DNA

Harlyn O. Halvorson

Temporal control of enzyme synthesis in microorganisms

Shinya Inoué

Mitotic spindle

R. E. Stephens

Microtubules

Hugh E. Huxley

The structure of the filaments in striated muscle: X-ray and electron microscope evidence I
The structure of the filaments in striated muscle: X-ray and electron microscope evidence II

Michael K. Reedy

Arrangement and behavior of crossbridges in insect flight muscles

Sydney Brenner

Gene regulation I
Gene regulation II
Gene regulation III

Alfred Tissiére

Ribosomal proteins

John G. Nicholls

Electrical signalling in the nervous system
Neural organization in the visual system
Long-term changes in synaptic transmission

David A. Yphantis

Physical approaches in biochemistry I
Physical approaches in biochemistry II
Physical approaches in biochemistry III

Albert Szent-Györgyi

Bioelectronics: regulations, defense and cancer

K. E. Van Holde

Polynucleotide structure I. Circular dichroism studies of synthetic polynucleotides
Polynucleotide structure II. Sedimentation studies of monomer interactions

Howard Holtzer

Myosin synthesis, fusion and the mitotic cell

J. W. Hastings

The chemistry and biology of excited singlet oxygen

S. Roseman

Relationship between a bacterial phosphotransferase system and sugar transport

E. Kennedy

Biochemical study of lactose transport in E. coli
REPORT OF THE DIRECTOR

JACK Strominger
Role of the membrane in bacterial cell wall synthesis and its interaction with antibiotics

Henry R. Mahler
Structural proteins in membranes

L. Warten
Composition and metabolism of animal cell surface membranes

W. Loewenstein
Membrane functions: intercellular communication

E. Kravitz
Study of synaptic chemistry in single neurons

R. Levine
Mode of action of insulin

S. Luria
Colicines and the bacterial envelope

Paul Gallop
Maturation of connective tissue

Yngve Zotterman
Recording of the electrical response from human taste nerves: the relation between neural and perceptual intensity

George Wald
Molecular basis of visual excitation

J. Aschoff
Rhythms in humans

Hans Kornberg
Control of bacterial carbohydrate I
Control of bacterial carbohydrate II

B. Pullman
Aspects of the electronic structure of purine and pyrimidine bases and of their interaction

B. D. Davis
The role of a ribosome dissociation factor in the polysome cycle

J. Gross
Morphogenesis and collagen structure

VIII. Special Seminars

I. M. Klotz
Subunit structure and subunit interaction in proteins:

M. Moody
The structure and contraction of the tail of t-even phages

A. Oplatka
The application of irreversible thermodynamics to muscle contraction

David White
Mechanical studies of insect flight muscles

Robert M. Bock
Control of translation

Walter Hill
X-ray scattering and sedimentation: equilibrium studies of E. coli ribosomes

Margaret Miovic
Protein initiation and T-2 infection

S. Ebashi
Excitation contraction coupling I

M. Endo
Excitation contraction coupling II

EXPERIMENTAL BOTANY

I. Instructors

William S. Hillman, Brookhaven National Laboratory, in charge of course
Robert R. L. Guillard, Woods Hole Oceanographic Institution
John M. Olson, Brookhaven National Laboratory
Harold W. Siegelman, Brookhaven National Laboratory
Robert T. Wilce, University of Massachusetts, Amherst

II. Special Lecturers

G. B. Bouck, Yale University
P. B. Green, University of Pennsylvania
L. Provasoli, Haskins Laboratories, New York
III. Laboratory Assistant

Robert E. Lee, University of Massachusetts

IV. Lectures

R. T. Wilce
Chlorophyta
Phaeophyta
Rhodophyta
Cyanophyta

R. R. T. Guillard
Influence of environment factors on phytoplankton
Distribution of light, of plants and of plant pigments in the sea
The influences of light regime, temperature, salinity and of organic and inorganic nutrition on photosynthesis and other physiological responses on marine algae

J. M. Olson
Photosynthesis
Relationships between photosynthetic bacteria and blue-green algae
Pigment systems
Electron transport systems for generation of ATP

W. S. Hillman
Light quality in photomorphogenesis and photoperiodism: phytochrome
Phytochrome: in vivo assays and physiological interpretations
Endogenous circadian rhythms and the timing mechanism in photoperiodism
Speculations on evolution and comparative biology of photomorphogenesis and photoperiodism in algae, in higher plants, and in animals

H. W. Siegelman
Modern isolation and separation techniques for small and large molecules
Gel filtration, centrifugation, thin-layer chromatography and electrophoretic methods
Isolation, purification and properties of algal chromoproteins I
Isolation, purification and properties of algal chromoproteins II
Isolation, purification and properties of the algal bile pigments
In vivo, properties, isolation, purification and properties of protochlorophyll holochrome

INVERTEBRATE ZOOLOGY

I. Consultants

Frank A. Brown, Jr., Morrison Professor of Biology, Northwestern University
Libbie H. Hyman, The American Museum of National History
REPORT OF THE DIRECTOR

CLARK P. READ, Professor of Biology, Rice University
ALFRED C. REDFIELD, Woods Hole Oceanographic Institution

II. INSTRUCTORS

W. D. RUSSELL-HUNTER, Professor of Zoology, Syracuse University, in charge, of course
GEORGE G. HOLZ, Jr., Professor of Microbiology, State University of New York, Upstate Medical Center
NORMAN MILLOTT, Professor of Zoology, Bedford College, University of London, England
FRANK M. FISHER, JR., Associate Professor of Biology, Rice University
ROBERT K. JOSEPHSON, Associate Professor of Biology, Case Western Reserve University
JONATHAN P. GREEN, Assistant Professor, Division of Biological and Medical Sciences, Brown University
MEREDITH L. JONES, Curator-in-charge, Division of Worms, United States National Museum, Smithsonian Institute
IRWIN W. SHERMAN, Associate Professor of Zoology, Department of Life Sciences, University of California, Riverside

III. LABORATORY ASSISTANTS

DARRELL R. STOKES, University of Hawaii
ROBERT J. AVOIDI, Syracuse University

IV. LECTURES

W. D. RUSSELL-HUNTER
Darrell R. Stokes and Robert J. Avoidi
George G. Holz, Jr.

W. D. RUSSELL-HUNTER
George G. Holz, Jr.

Irwin Sherman
Robert K. Josephson
Frank M. Fisher, Jr.
W. D. Russell-Hunter
Frank M. Fisher, Jr.

Orientation, and functional homologies in invertebrates
Laboratory orientation

The nature of the Protozoa
Flagellates I

Littoral ecology: Theoretical and physiological
Flagellates II—Sarcodines I
Sarcodines II
Ciliates

Porifera

Cnidaria I—Introduction to the Cnidaria and Ctenophora
Cnidaria II—Nematocyst structure and function feeding
Nervous systems and behavior in jelly-fish and sea anemones
Seminar—nerve nets and conducting epithelia in Hydrozoa

Turbellaria and Trematoda
Cestoda and Rhynchocoela

Mollusca I—General molluscan organization—functioning of mantle-cavity in Gastropoda
Mollusca II—Gastropoda (continued): Mantle-cavity and feeding mechanisms in Bivalvia
Seminar—Some problems of mechanics in molluscs
Mollusca III—Adaptations in bivalves: Aspects of general physiology of gastropods and bivalves

What about rhynchocoels?
MARINE BIOLOGICAL LABORATORY

W. D. RUSSELL-HUNTER

Mollusca IV—Functional morphology in Cephalopoda and minor groups
Mollusca V—Functional morphology in Amphineura, Neopilina, archetypes and ancestors

FRANK M. FISHER, JR.

Aschelminthes
Entoprocta, Ectoprocta

MEREDITH L. JONES

ANNELIDA: Introduction, morphology, classification
ANNELIDA: Feeding, circulation, osmoregulation
ANNELIDA: Nervous system, reproduction
ARTHROPODA I

JONATHAN P. GREEN

ARTHROPODA II
ARTHROPODA III

MEREDITH L. JONES

On Caebangia, an aberrant fresh-water sabellid polychaete from southeast Asia

JONATHAN P. GREEN

ARTHROPODA IV

NORMAN MILLOTT

ECHINODERMATA I—Radiate forms (asteroids and ophiuroids)
ECHINODERMATA II—Globular forms (echinoids)—the functions of spines and podia
ECHINODERMATA III—Globular forms II (holothurians) stalked forms (crinoids)
ECHINODERMATA IV—Development and phylogeny

IRWIN SHERMAN

PROTOCHORDATA I—Introduction, feeding, digestion neuro-muscular system

A. FARMANFARMAIAN

Intestinal absorption in Thyone

NORMAN MILLOTT

DERMAL light sense

IRWIN SHERMAN

PROTOCHORDATA II—Circulation, respiration, excretion and reproduction

W. D. RUSSELL-HUNTER

ROBERT ROBERTSON

One approach to the zooplankton
Pyramidellids—ectoparasitic gastropods at Woods Hole

MARINE ECOLOGY

I. CONSULTANTS

MELBOURNE R. CARRIKER, Marine Biological Laboratory
EDWIN T. MOUL, Rutgers University
JOHN H. RYTHER, Woods Hole Oceanographic Institution

II. INSTRUCTORS

LAWRENCE B. SLOBODKIN, Department of Zoology, University of Michigan, in charge of course
EDWARD R. BAYLOR, Woods Hole Oceanographic Institution
DENNIS J. CRISP, Director, Marine Science Laboratories, University College of North Wales, U. K.
HOWARD L. SANDERS, Woods Hole Oceanographic Institution
W. ROWLAND TAYLOR, Department of Oceanography and the Chesapeake Bay Institute, The Johns Hopkins University
GOTRAM UHLIG, Biologische Anstalt Helgoland, Hamburg, Germany
III. Special Lecturers

Luigi Provasoli, Haskins Laboratories, New York
David C. Grant, Systematics-Ecology Program, Marine Biological Laboratory

IV. Laboratory Assistants

John F. Boyer, Department of Zoology, University of Chicago
Herman F. Bosch, Department of Oceanography, The Johns Hopkins University

V. Lectures

L. B. Slobodkin  
- Introduction

W. Rowland Taylor  
- The marine environment
- Productivity
- Phytoplankton I
- Phytoplankton II
- Phytoplankton III

E. R. Baylor  
- Formation of organic particles
- In situ abundance of zooplankton
- Zooplankters' response to light and chemicals
- Sound in the ocean

Ernest Mayr  
- Species diversity

Kevin Little  
- Searching behavior of Artemia

L. B. Slobodkin  
- How to succeed at evolution

David C. Grant  
- The ecology of Barnstable Harbor

L. B. Slobodkin  
- Population growth
- Ecology and people

L. Provasoli  
- Axenic culture of Crustacea

Howard L. Sanders  
- Animals, sediments and feeding types

D. C. Rhodes  
- Sediment-water interface and biological activity

Howard L. Sanders  
- Salinity, hydrography and distribution of estuarine animals

Roger H. Green  
- The structure of an intertidal community

Howard L. Sanders  
- The biology of the deep-sea benthos
- Benthic diversity—A comparative study

Gottam Uhlig  
- Introduction to the benthic microfauna
- Feeding types and food chains in the benthic microfauna
- Ecological relations of life cycles in the benthic microfauna
- Methods in studying interstitial microfauna

L. B. Slobodkin  
- Predation and energetics

Gottam Uhlig  
- Studies of the folliculinids (Ciliata)
- Ecology and life cycle of Noctiluca miliaris

E. O. Wilson  
- Experimental Biogeography

D. J. Crisp  
- Classification and significance of larvae
- Plankton shapes, behavior and nutrition
- Behavior of larvae at settlement
- Gregarious and territorial settlement
- Substrate selection by larvae of deposit—living species
- Chemical inducements to settlement and metamorphosis
SYSTEMATICS–ECOLOGY PROGRAM

The Staff

Director: Melbourne R. Carriker
Resident Systematist: Robert P. Higgins
Resident Ecologists: Roger H. Green and David K. Young
Assistant Ecologist: Katharine D. Hobson
Resident Biologist: David C. Grant
Postdoctoral Fellows and Research Associates: David G. Cook, Celia R. Haigh, Norman R. Sinclair and William C. Summers
Curator: Johanna M. Reinhardt
Technical Field Assistants: Paul A. Shave, Peter J. Oldham
Artist: Ruth von Arx
Captain, R/V A. E. Verrill: James P. Ostergard
Mate, R/V A. E. Verrill: Peter Graham
Administrative Assistant: Hazel W. Fermino
Program Secretary: Eva S. Montiero
Visitor: Mohamed Hyder

Seminars (winter included)

Ehrhard Voigt  Paleontological research at Hamburg University
Johanna M. Reinhardt  Behavior of Gastropteron pacificum
Nelson Marshall  Trophic studies on shoal benthic environments
Charles L. Wheeler  The Woods Hole Aquarium: old and new
Madeleine E. Pierce  The effects of several herbicides on plants and invertebrate animals in Nobska Pond
James E. Craddock  Comments on mesopelagic fishes
David G. Cook  Systematic studies on some oligochaeta
Robert E. Hillman  Mucus histochemistry of Mercenaria mercenaria mantle edge
Roland L. Wigley  Discussion of comparison between Van Veen and Smith-McIntyre grab samplers
Steven Obrebski  Parasite induced population fluctuations in Transennella and Gemma
Kenneth R. H. Read  Beneath New England waves
Sanford A. Moss  Recent research on physiological and behavioral interactions between fish schools and the environment
John M. Arnold  An analysis of the development of the squid Loligo pealei
William R. Cobb  The manner in which boring sponges (Clionidae) penetrate calcareous substrates
REPORT OF THE DIRECTOR

EDWARD B. CUTLER
Systematics, ecology and distribution of the western North Atlantic sipunculids

DAVID W. FRAME
Seasonal variation of biota attached to test panels in the Cape Cod Canal

SARAH HAIGLER
Boring behavior of Polydoroa websteri

ROBERT P. HIGGINS
Instant animal

ALFRED W. SENFT
Radioautograph studies on the uptake of carbon 14 proline in Schistosoma mansoni

ROBERT EDWARDS
The fisheries of the New England area

D. CRAIG EDWARDS
The ecology and behavior of some prosobranchs

PAUL A. SHAVE
Some problems concerning tropical collecting

WILLIAM D. HUMMON
An assessment of the Hutchinsonian Niche concept (or, a bit of niche—pickin’)

JOHANNA M. REINHART
The ALBATROSS seeks a snark

KENNETH J. BOSS
Systematics of the Vesicomyidae (Mollusca, Bivalvia)

D. GORDON MOTT
Dynamic population systems—model construction and analysis

WESLEY N. TIFFNEY
Tulostoma brumale Persoon, a new resident of the Cape Ann Dunes

WILLIAM C. SUMMERS
Early growth and size distribution of Loligo pealei

WILLIAM B. NUTTING
Parasitic mites (Demodex) of mammals—oceans unknown

JAN HAHN
Productivity in the ocean and sediments on the continental shelf

ROGER H. GREEN
Short tour of southern Africa

JOHN H. CROWE
Some aspects of the water relations of a bryophilous tardigrade

RALPH O. BRINKHURST
The role of amino acid and bacteria in the nutrition of tubifid oligochaetes

JAMES R. SEARS
Reproduction of several benthic marine algae with special reference to phytogeographic distribution

MEREDITH L. JONES
On the reproduction and reproductive morphology, inter alia, of Streblospio benedicti Webster

DAVID C. GRANT
The biotic census of Cape Cod Bay

ROBERT P. HIGGINS
The kinorhynch genus Cateria: its adaptations and evolutionary significance

RON KENNY
Some temperature relationships of intertidal species of Acmaea

DAVID K. YOUNG
Seston-sediment-invertebrate relationships in Buzzards Bay

THE LABORATORY STAFF

HOMER P. SMITH, general manager

MISS JANE FESSENDEN, Librarian
CARL O. SCHWEIDENBACK, Manager, Supply Department
JOHN J. VALOIS, Assistant Manager, Supply Department
FRANK A. WILDES, Accounting Manager

ROBERT KAHLER, Superintendent, Buildings and Grounds
ROBERT GUNNING, Assistant Superintendent, Buildings and Grounds
ROBERT B. MILLS, Manager, Department of Research Service
### MARINE BIOLOGICAL LABORATORY

#### GENERAL OFFICE

<table>
<thead>
<tr>
<th>Name</th>
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<tr>
<td>Edward J. Bender</td>
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<tr>
<td>Mrs. Vivien R. Brown</td>
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<td>Mrs. Florence Butz</td>
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<td>Mrs. Colleen P. Hall</td>
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<td>Mrs. Ann Loomis</td>
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<td>Mrs. Vivian I. Manson</td>
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<td>Miss Elaine Perry</td>
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<td>Mrs. Lois Roberts</td>
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<td>Miss Mary Tavares</td>
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#### LIBRARY

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<th>Name</th>
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<tr>
<td>Mrs. Virginia Brandenburg</td>
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<td>Miss Elizabeth A. Brown</td>
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<td>Mrs. Lenora Joseph</td>
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<tr>
<td>Albert K. Neal</td>
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<td>Mrs. Doris T. Ricker</td>
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#### MAINTENANCE OF BUILDINGS AND GROUNDS

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<th>Name</th>
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<tr>
<td>Eldon P. Allen</td>
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<td>John T. Brady</td>
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<td>Bernard F. Cavanaugh</td>
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<td>Cecil Costa</td>
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<td>John V. Day</td>
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<td>Manuel P. Dutra</td>
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<td>Richard E. Geggatt, Jr.</td>
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<td>Donald B. LehY</td>
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<tr>
<td>Ralph H. Lewis</td>
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<td>Russell F. Lewis</td>
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<td>Stephen A. Mills</td>
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<td>Robert A. Serrano</td>
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<td>Frederick E. Thrasher</td>
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<tr>
<td>Frederick E. Ward</td>
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<td>Edward J. White</td>
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#### DEPARTMENT OF RESEARCH SERVICE

<table>
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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Gail M. Cavanaugh</td>
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<td>Lowell V. Martin</td>
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<th>Name</th>
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<tr>
<td>Mrs. Juliette T. Morin</td>
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<td>Frank E. Sylvia</td>
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#### SUPPLY DEPARTMENT

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Donald P. Cheney</td>
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<td>David H. Graham</td>
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<td>Robert Hampton</td>
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<td>Robert M. Hebden</td>
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<td>Lewis M. Lawday</td>
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<tr>
<td>Robert O. Lehy</td>
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<tr>
<td>Miss Joyce B. Lima</td>
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<tr>
<td>Edward F. Matthews</td>
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<tr>
<td>Bruno F. Trapasso</td>
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#### DINING HALL AND HOUSING

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Robert T. Martin, Manager, Food Service</td>
</tr>
<tr>
<td>Norman Michaud, Head Chef</td>
</tr>
<tr>
<td>Mrs. Elizabeth Kuil, Supervisor, Dining Room</td>
</tr>
<tr>
<td>Mrs. Ellen T. Nickelson, Supervisor, Dormitories</td>
</tr>
<tr>
<td>Alan G. Lunn, Supervisor, Cottage Colony</td>
</tr>
</tbody>
</table>

#### 3. INVESTIGATORS: LILLIE, GRASS AND RAND FELLOWS; STUDENTS

**Independent Investigators, 1968**

- Abbott, Bernard C., Head and Professor of Biophysics and Physiology, University of Illinois
- Abrahamson, Edwin W., Professor of Chemistry, Case Western Reserve University
- Adelman, William J., Jr., Professor of Physiology, University of Maryland School of Medicine
- Allen, Robert D., Chairman and Professo. of Biological Sciences, State University of New York at Albany
REPORT OF THE DIRECTOR

ANDERSON, EVERETT, Professor of Zoology, University of Massachusetts, Amherst
APRIL, ERNEST W., Graduate Student, Columbia University, College of Physicians and Surgeons
ARMSTRONG, PHILIP B., Professor of Anatomy, State University of New York, Upstate Medical Center
ARNOLD, JOHN M., Assistant Professor of Cytology, University of Hawaii
AUCLAIR, WALTER, Associate Professor of Biology, Rensselaer Polytechnic Institute
AUSTIN, C. R., Charles Darwin Professor of Animal Embryology, University of Cambridge, England
BAI, ARYA KUMAR, Research Associate in Biology, University of Montreal
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TUTTLE, JOAN P., University of Rochester
WAXMAN, STEPHEN G., Albert Einstein College of Medicine
WEATHERLY, WM. PAUL, Yale University
WIDEMAN, CRYSTAL H., Illinois Institute of Technology
WOLIN, EDWARD, Reed College
YAMADA, MINORU, Duke University
YOUNG, JANICE E., Northwestern University
MARINE BIOLOGICAL LABORATORY

ZARLING, DAVID ALAN, Dartmouth College
ZIPSER, BIRGIT, Albert Einstein College of Medicine

Library Readers, 1968

ALLEN, GARLAND E., III, Assistant Professor of Biology, Washington University, St Louis
ALLEN, M. JEAN, Chairman and Professor of Biology, Wilson College
BALL, ERIC G., Professor of Biochemistry, Harvard Medical School
BERNE, ROBERT M., Chairman and Professor of Physiology, University of Virginia School of Medicine
BERNHEIMER, ALAN W., Professor of Microbiology, New York University
BERSOHN, RICHARD, Professor of Chemistry, Columbia University
BODANSKY, OSCAR, Vice President, Sloan-Kettering Institute for Cancer Research
BUCK, JOHN B., Chief, Laboratory of Physical Biology, National Institutes of Health
BUTLER, ELMER G., Osborn Professor of Biology, Princeton University
CARLSON, FRANCIS D., Professor of Biophysics, The Johns Hopkins University
CHASE, AURIN M., Emeritus Professor of Biology, Princeton University
CLARK, ARNOLD M., Professor of Biological Sciences, University of Delaware
COBB, JEWEL PLUMMER, Professor of Biology, Sarah Lawrence College
CRANE, ROBERT K., Chairman and Professor of Physiology, Rutgers Medical School
CROWELL, SEARS, Professor of Zoology, Indiana University
CURTIS, HELENA, Graduate Student, Columbia University
EDDS, M. V., JR., Professor of Biology, Brown University
EDER, HOWARD A., Professor of Medicine, Albert Einstein College of Medicine
FLEISCH, PETER, Research Professor of Dermatology, University of Pennsylvania
GABRIEL, MORDECAI L., Chairman, Department of Biology, Brooklyn College
GIBBS, MARTIN, Chairman and Professor of Biology, Brandeis University
GITLIN, DAVID, Professor of Pediatrics, University of Pennsylvania School of Medicine
GRANT, ROBERT J., Assistant Professor of Biological Sciences, Hunter College
GREEN, JAMES W., Professor of Physiology, Rutgers University
HANDLER, PHILIP, Professor of Biochemistry, Duke University
HARNER, RICHARD, Assistant Professor of Neurology, University of Pennsylvania
HILLMAN, ROBERT E., Assistant Director, William F. Clapp Laboratories
HOLTZMAN, ERIC, Assistant Professor of Biological Sciences, Columbia University
HURWITZ, CHARLES, Chief, Basic Science Research Laboratory, Veterans Administration Hospital, Albany
ISSELBACHER, KURT J., Chief, Gastrointestinal Unit, Massachusetts General Hospital
JACOBS, M. H., Emeritus Professor of General Physiology, University of Pennsylvania
KEMPTON, RUDOLF T., Emeritus Professor of Biology, Vassar College
KENNEDY, EUGENE P., Professor of Biochemistry, Harvard Medical School
KEOSIAN, JOHN, Professor of Biology, Rutgers – The State University
LEIGHTON, JOSEPH, Professor of Pathology, University of Pittsburgh School of Medicine
LEVINTHAL, CYRUS, Professor of Biophysics, Massachusetts Institute of Technology
LINEAWEAVER, THOMAS H., Marine Biological Laboratory
LOCHEAD, JOHN H., Professor of Zoology, University of Vermont
MARKS, PAUL A., Professor of Medicine, Columbia University
MORRISON, MARTIN, Chairman, Department of Chemistry, St. Jude Children’s Research Hospital
NACHMANSOHN, DAVID, Emeritus Professor of Biochemistry, Columbia University, College of Physicians and Surgeons
NASATIK, MAIMON, Chairman and Professor of Biology, The University of Toledo
NASON, ALVIN, Professor of Biology, The Johns Hopkins University
NOVIKOFF, ALEX B., Research Professor of Pathology, Albert Einstein College of Medicine
PEARLSTEIN, ROBERT M., Research Staff Member, Oak Ridge National Laboratory
ROSE, IRWIN A., Chairman of Biochemistry Division, Institute for Cancer Research, Philadelphia
ROSENKRANZ, HERBERT S., Associate Professor of Microbiology, Columbia University
ROTH, JAY S., Professor of Biochemistry, University of Connecticut
ROWLAND, LEWIS P., Chairman and Professor of Neurology, University of Pennsylvania
RUSSELL, HENRY D., Marine Biological Laboratory
SAGER, RUTH, Professor of Biological Sciences, Hunter College
REPORT OF THE DIRECTOR

SATCHELL, DAVID G., Research Associate, Columbia University, College of Physicians and Surgeons
SCHLESINGER, R. WALTER, Chairman of Microbiology, Rutgers–The State University
SCOTT, ALLAN, Chairman and Professor of Biology, Colby College
SHELDONSKY, THEODORE, Professor of Biophysics, The Rockefeller University
SONNENBLICK, B. P., Professor of Biology and Radiation Science, Rutgers–The State University
SPECTOR, ABRAHAM, Associate Professor, Columbia University
SPERELAKIS, NICK, Professor of Physiology, University of Virginia School of Medicine
STEFFAN, WALLACE A., Entomologist, Bishop Museum, Hawaii
STEPHENSON, WILLIAM K., Chairman and Professor of Biology, Earlham College
STETTEN, MARJorie R., Research Professor of Experimental Medicine, Rutgers Medical School
STRAUSS, ELLIOTT W., Associate Professor of Medical Science, Brown University
STROMINGER, JACK R., Professor of Biochemistry, Harvard University
WAINO, WALTER, Chairman and Professor of Biochemistry, Rutgers – The State University
WARKMAN, BYRON H., Chairman and Professor of Microbiology, Yale University
WHEELER, GEORGE E., Associate Professor of Biology, Brooklyn College
WHITING, ANNA R., Consultant, Oak Ridge National Laboratory
WICHITMAN, RALPH, Professor of Biology, Temple University
WILSON, THOMAS HASTINGS, Associate Professor of Physiology, Harvard Medical School
WITTENBERG, JONATHAN B., Professor of Physiology, Albert Einstein College of Medicine
WYNEMA, CHESTER L., Professor of Anatomy, State University of New York, Upstate Medical Center
YORKE, ELLEN D., Research Associate, University of Maryland
ZACKS, SUMNER I., Associate Professor of Pathology, Pennsylvania Hospital
ZIPSEN, DAVID, Assistant Professor of Molecular Biology, Columbia University

Students, 1968

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

*BELL, WAYNE HARRELL, Harvard University
CINTRON, GILBERTO, JR., University of Puerto Rico
CONWAY, JOAN ROSE, University of Massachusetts
*CROWE, JOHN HENRY, University of California, Riverside
*GERHART, DAVID Z., Lehigh University
*GILBERT, MARY ANN BEICHER, University of Massachusetts
*GILBERT, WILLIAM H., III, University of Massachusetts
*GLAUS, KAREN JANE, Yale University
LESLEY, DAVID EARL, Tulane University
*MAYNARD, NANCY GRAY, University of Miami, Institute of Marine Sciences
*NICOTRI, MARY ELIZABETH, University of Michigan
PIERCE, SIDNEY K., JR., Florida State University
REISA, JAMES JOSPEH, JR., Northwestern University
RUBINSTEIN, JEFFREY, Bates College
*SOUTHWICK, EDWARD E., Washington State University
TRUE, MERRILL ALLAN, Tulane University
WEST, RONALD ROBERT, University of Oklahoma
*YOUNG, LILY Y., Harvard University

EMBRYOLOGY

BARKLEY, DAVID S., Princeton University
*BERESFORD, GAIL, Washington University
*EROSHEVICH, KHRISTINE E., College of St. Mary of the Springs
*GREET, NANCY CAROLE, University of Michigan
34

MARINE BIOLOGICAL LABORATORY

*Haraway, Donna Jeanne, Yale University
*Kankel, Douglas Ray, Brown University
Ling, Lee-Nien Lillian, Yale University
Linsenmayer, Thomas F., University of Virginia
*Massover, William H., University of Chicago
*Noden, Drew Morrison, Washington University
*Pederson, Mary Lee, University of Wisconsin
*Rosenthal, Marsha Gail, University of Pennsylvania
*Rubin, Leo, State University of New York at Albany
*Samols, David R., University of Chicago
Shifrin, Sidney, National Institutes of Health
*Suddith, Robert Louis, Indiana University
*Thomas, David Dwight, University of Hawaii
*Turner, Robert Scott, Jr., University of Oregon
*Van Essen, David C., Harvard University
*Walker, Susan Louise, The Johns Hopkins University

EXPERIMENTAL BOTANY

*Brooks, R. Clarks, University of Chicago
Buckner, Robin Y., University of Kentucky
Carroll, Jackie W., University of Alabama
*Clayton, Marilyn, Wheaton College
*Gardner, Gary M., Harvard University
*Goff, Robert W., University of Massachusetts
*Hinman, Norman D., University of Connecticut
*Jenike, Michael A., University of Massachusetts
*Linkins, Arthur E., University of Massachusetts
*Monahan, Thomas J., University of Connecticut
*Moreth, Clarice M. C., Nova University
*Mullins, John Q., University of Tennessee
*Pecora, Richard A., Kent State University
*Redemske, Joyce, University of Illinois
*Roux, Stanley J., Yale University

PHYSIOLOGY

*Abramson, Maxwell, Massachusetts General Hospital
*Berry, Robert Wayne, University of Oregon
*Frank, Eric, Harvard University
*Freeman, Jeffrey Carl, University of Pennsylvania
*Haswell, John Robert, University of Connecticut
*Hitchcock, Sarah Ellen, Case Western Reserve University
*Hudspeth, Albert James, Harvard Medical School
*Kawai, Masataka, Princeton University
*Kirsch, Henry M., The Johns Hopkins University
*Kronstadt, Michael, Columbia University
*Laskowski, Michael B., University of Oklahoma Medical School
*Lazarow, Paul B., The Rockefeller University
*Lee, Yung-Keun, The Johns Hopkins University
*Linck, Richard Wayne, Brandeis University
Mancini, Particia Elena, Yale University
*Mazor, Eugene P., Marquette University
*Moran, George W., Princeton University
*Nicolson, Garth L., University of California, San Diego
Nissenbaum, Leonard, University of Oregon
*Plunkett, William K., University of Massachusetts
*Rando, Robert Richard, Harvard University
*Regenstein, Joe Mac, Brandeis University
REPORT OF THE DIRECTOR

*ROSE, Birgit, Columbia University, College of Physicians and Surgeons
*ROSETTI, Giuseppe Plinio, Oregon State University
*SHER, Carol Anne, Massachusetts Institute of Technology
*SORENSEN, Martha M., University of Washington
*STAFFORD, Walter Flemming, III, University of Connecticut
*TROTTER, Philip James, New England Institute for Medical Research
*WEINTRAUB, Harold, University of Pennsylvania Medical School
*SORENSON, Martha M., University of Washington
*STAFFORD, Walter Flemming, III, University of Connecticut
*WEISS, James Paul, University of Rochester
**BUDAY, Attila, University of Montreal, Canada
**Course Auditor

INVERTEBRATE ZOOLOGY

*ALTMAN, Morris D., New York University
*APPELHOF, Mary A., University of Iowa
AUDETTE, Valerie Anne, University of Vermont
BRANDON, Stacia Ruth, Mississippi State College for Women
BROTHERS, Edward Bruce, Brooklyn College
*CONNELL, Penny May, Tulane University
DIGGINS, Sister Kieran, Northwestern University
*EDDS, Kenneth Tiffany, University of Rhode Island
ERNAU, Mildred Claire, State University of New York at Albany
GALLUCCI, Betty Jane B., North Carolina State University
GINTZLER, Alan Richard, Hunter College
GLEYE, Linda Gibson, Sarah Lawrence College
*HALVERSON, Roger Conrad, University of California, Santa Barbara
HARMAN, Willard Nelson, Cornell University
HARPER, Elvin, Massachusetts General Hospital
HARTZBAND, David J., Syracuse University
*HENDERSON, David J., University of Glasgow, Scotland
HOLTZMAN, Seymour, Brooklyn College
JABLECKI, Cynthia Grace, Mount Holyoke College
*LOUNIBOS, Leon Philip, University of Notre Dame
LUBCHENCO, Jane Ann, Colorado College
*MARTIN, Alice Nina, University of Massachusetts
*MCFADIN, Margaret Smith, West Chester State College
*NICHOLS, Thomas Richard, Brown University
*NICKERSON, Richard Paul, Syracuse University
OAKS, John Adams, Tulane University
OTTESSEN, Eric Albert, Harvard Medical School
RESHNICK, Cecily Ann, University of Illinois
RHODES, Edwin W., Jr., U. S. Department of Interior, Bureau of Commercial Fisheries
RICHARDS, Anne Conway, Goucher College
ROMANO, Mary M., Goucher College
SCOTT, Dana M., Jr., Drew University
SHELDON, Robert Archer, University of Georgia
SHERMAN, Robert George, Michigan State University
SLADE, John Downey, Oberlin College
STILES, Edmund W., Oberlin College
VAN WIE, Donald Gary, Harvard University
WEATHERLY, W. Paul, Yale University
WOOD, Jackie Dale, University of Illinois
4. Fellowships and Scholarships, 1968

The Lucretia Crocker Scholarship:
ROBERT CLARKE BROOKS, Experimental Botany Course
LILY Y. YOUNG, Marine Ecology Course

The James Watt Major Scholarship:
DAVID J. HENDERSON, Invertebrate Zoology Course

The Gary N. Calkins Memorial Scholarship:
ROGER C. HALVORSEN, Invertebrate Zoology Course

The Turtox-Croasdale Scholarship:
ARTHUR E. LINKINS, III, Experimental Botany Course

5. Training Program

Fertilization and Gamete Physiology Research Training Program

I. Instructors
CHARLES B. METZ, University of Miami, Program Chairman
C. R. AUSTIN, Cambridge University, England
GERTRUDE W. HINSCH, University of Miami
HANS LINSKENS, University of Nijmegen, The Netherlands
ALBERTO MONROY, University of Palermo, Italy
LEONARD NELSON, University of Toledo

II. Secretary
LAURA HOSKIN

III. Trainees
ANGERER, LYNN MUSGRAVE, The Johns Hopkins University
ANGERER, ROBERT C., The Johns Hopkins University
CRANDALL, DAVID E., University of Rhode Island
FIRTEL, RICHARD A., California Institute of Technology
GOUDSMIT, ESTHER M., The Johns Hopkins University
HARTLEY, DAVID P., Duke University School of Medicine
JEFFREY, WILLIAM., University of Iowa
MIRKES, PHILIP E., University of Michigan
MOWBRAY, RODNEY C., Iowa State University
REPSIS, LYNN C., Yale University
SCHULTZ, GILBERT A., University of Calgary
UMPHERE, CARMEN C., Michigan State University
URBAN, PAUL, Yale University
VALLEAU, WILLIAM, University of Maine
VERHEY, CATHERINE, University of Illinois
WEITLAUF, HARRY M., University of Kansas Medical School
WILSON, HAROLD J., University of Arizona

IV. Lectures
F. LONGO The fine structure of pronuclear development and fusion in Arbacia punctulata
C. DODSON Pollination in orchids
L. MACILIS Gamete and zygote chemotaxis in the watermold Allomyces
L. H. KLEINHOLZ Crustacean hormones
G. W. HINSCH Reproduction in the spider crab Libinia emarginata
A. BLACKLER Embryonic origin of amphibian gametes
L. D. SMITH The formation of primordial germ cells in amphibians
D. EPEL The enzymatic basis of cell adhesion in sea urchin embryos
R. DIPPEL Development of basal bodies
R. BRINSTER Energy metabolism in the preimplantation mammalian embryo

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<td><strong>Investigators—Total</strong></td>
<td>512</td>
<td>572</td>
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<td>Research Assistants</td>
<td>192</td>
<td>227</td>
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<td><strong>Students—Total</strong></td>
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<td>Invertebrate Zoology</td>
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<td>Physiology</td>
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<td>Botany</td>
<td>19</td>
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<td>Ecology</td>
<td>17</td>
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<td>20</td>
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<td>18</td>
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<td><strong>Trainees—Total</strong></td>
<td>16</td>
<td>16</td>
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<tr>
<td><strong>Total Attendance</strong></td>
<td>668</td>
<td>734</td>
<td>710</td>
<td>738</td>
<td>667</td>
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<td>Less persons reported in two categories</td>
<td>7</td>
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<td><strong>Institutions Represented—Total</strong></td>
<td>140</td>
<td>218</td>
<td>198</td>
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<td><strong>Foreign Institutions Represented</strong></td>
<td>32</td>
<td>27</td>
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7. Institutions Represented, 1968

- Alabama, University of
- Albert Einstein College of Medicine
- American Medical Association
- American Museum of Natural History
- Amherst College
- Argonne National Laboratory
- Arizona, University of
- Bates College
- Battelle Memorial Institute
- Bell Telephone Laboratories
- Bishop Museum, Honolulu
- Boston University
- Brandeis University
- Brookhaven National Laboratory
- Brooklyn College
- Brown University
- California Institute of Technology
- California, University of, Davis
- California, University of, Los Angeles
- California, University of, Riverside
- California, University of, San Diego
- California, University of, San Francisco
- California, University of, Santa Cruz
- Case Western Reserve University
- Chicago, University of
- Cincinnati, University of
- City College of New York
- Clapp, W. F., Laboratories
- Colby College
- College of St. Mary of the Springs
- Colorado College
- Colorado, University of, Medical Center
- Columbia University
- Columbia University, College of Physicians and Surgeons
- Connecticut, University of
- Connecticut, University of, Medical School
- Cornell University
- Cornell University Medical College, New York City
- Dartmouth College
- Dartmouth Medical School
- Davidson College
- Delaware, University of
- Denison University
- Drew University
- Duke University
- Duke University Medical School
- Earlham College
- Emory University
- Florida Oceanographic Society
- Florida State University
- Georgia, University of
- Goucher College
- Hamilton College
- Harvard Medical School
- Harvard University
- Hawaii, University of
- Hunter College
- Illinois Institute of Technology
- Illinois, University of
- Indiana University
<table>
<thead>
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<th>Institution Name</th>
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<tbody>
<tr>
<td>Indiana University Medical School</td>
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<tr>
<td>Institute of Biomedical Research, Chicago</td>
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<tr>
<td>Institute for Cancer Research, Philadelphia</td>
</tr>
<tr>
<td>Institute of Molecular Evolution, Coral Gables</td>
</tr>
<tr>
<td>Institute for Muscle Research, Woods Hole</td>
</tr>
<tr>
<td>Iowa State University</td>
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<td>Iowa, University of</td>
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<tr>
<td>John Carroll University</td>
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<tr>
<td>Johns Hopkins Hospital, The</td>
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<td>Johns Hopkins University, The</td>
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<tr>
<td>Johns Hopkins University, The, School of Hygiene and Public Health</td>
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<td>Johns Hopkins University, The, School of Medicine</td>
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<td>Kansas, University of</td>
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<td>Kansas, University of, Medical Center</td>
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<td>Lehigh University</td>
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<td>Marine Biological Laboratory</td>
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<td>Marquette University</td>
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<td>Maryland, University of, School of Medicine</td>
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<td>Massachusetts General Hospital</td>
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<td>Massachusetts Institute of Technology</td>
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<td>Massachusetts, University of</td>
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<td>Medical College of Ohio at Toledo</td>
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<td>Mellon Institute of Carnegie-Mellon University</td>
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<td>Miami, University of</td>
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<tr>
<td>Miami, University of, Institute of Marine Sciences</td>
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<td>Miami University, Oxford, Ohio</td>
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<td>Michigan State University</td>
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<td>Mississippi State College for Women</td>
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<td>Mount Holyoke College</td>
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<td>National Institutes of Health</td>
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<td>New England Institute for Medical Research</td>
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<td>New York State Institute for Basic Research in Mental Retardation</td>
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<td>New York University Medical School</td>
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<td>New York University, Washington Square College of Arts and Sciences</td>
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<td>North Carolina, University of</td>
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<td>North Carolina State University, Raleigh</td>
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<td>North Dakota, University of</td>
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<td>Pennsylvania, University of, School of Medicine</td>
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<td>Peter Bent Brigham Hospital</td>
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<td>Queens College of the City University of New York</td>
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<td>Rochester, University of, School of Medicine and Dentistry</td>
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<td>Rutgers Medical School</td>
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<td>Rutgers-The State University</td>
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<td>St. Jude Children's Research Hospital</td>
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<td>Scripps Institute of Oceanography</td>
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<td>Single Cell Research Foundation</td>
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8. Friday Evening Lectures, 1968

June 28
Ernest Mayr ....................The study of biological diversity
The Agassiz Museum
Harvard University

July 5
Emanuel Margoliash ..........Evolutionary variability of cytochrome C
Abbott Laboratories, Chicago

July 11
Sir John Eccles ...............Postsynaptic inhibitory pathways of the central
Institute for Biomedical Research, nervous system
Alexander Forbes Lecturer at the
Marine Biological Laboratory

July 12
Sir John Eccles ...............Alexander Forbes—Neurophysiologist

July 12
Sir John Eccles ...............Integrative action of the nervous system with
special reference to the cerebellum
July 19
Edward O. Wilson.............Theory and experiment in zoögeography
Harvard University

July 26
Lewis Wolpert...............The cell in morphogenesis and pattern formation
Middlesex Hospital Medical School,
Lillie Fellow at the Marine
Biological Laboratory

August 2
Gerald Elliott..............The muscle fiber—A lyotrophic liquid crystal
Kings' College, London,
Rand Fellow at the Marine
Biological Laboratory

August 9
Roger Stanier.............Evolutionary significance of regulatory mech-
isms
University of California, Berkeley

August 16
H. Keffer Hartline.........Visual receptors and retinal interaction
The Rockefeller University

August 23
Seymour S. Cohen..........Sponges, comparative biochemistry and cancer
therapy
University of Pennsylvania
School of Medicine

9. Tuesday Evening Seminars, 1968

July 16
Seymour Zigman.............Sulfonation of rat lens proteins
Audrey E. V. Haschemeyer....Possible role of protein synthetic enzymes in the
control of protein synthesis in higher organisms
James R. Bolton.............Quantum efficiency of the light-induced bleaching
of P870 in Rhodopseudomonas spheroides
Roderick K. Clayton

July 23
Robert B. Hill.............The relationship between carbon atom chain
length and effectiveness of n-alkylammoniums in inducing rhythmicity of gastropod smooth
muscle
K. Ranga Rao...............Dimorphic variation of pigmented patterns in
the fiddler crab, Uca pugilator
Milton Fingerman
Daniel S. Grosch...........Reproductive performance of insects from U. S.
Biosatellite II

July 30
Albert Szent-Györgyi........Regulation of cell division
John M. Arnold..............Formation of the first cleavage furrow in a
telolecithal egg (Loligo)
REPORT OF THE DIRECTOR

ROGER MILKMAN ....................... On the distribution of genetic variation in nature
ROBERT K. JOSEPHSON ............... Rapidly contracting muscles used in sound produ-
Hugh Y. Elder  cution by a katydid

August 6
C. LLOYD CLAFF .................. Shark and dogfish studies: Pulsatile pressure
ARMAND CRESCENZI ............... extracorporeal blood oxygenation by means of
ARNOLD LANDÉ ...................... artificial silicone membrane heart-lung devices
and artificial kidney

JOHN L. ROBERTS ................. Thermal stress and gill ventilation by fishes
KATHARINE D. HOBSON .............. A sexual reproduction of Pygospio elegans
CLAIRE in Barnstable Harbor, Massachusetts

MARC H. DRESDEN ................. Limb regeneration in adult amphibians

August 13
J. METUZALS ...................... Configuration of a filamentous network in the
DANIEL SHEMIN ...................... axoplasm of the squid giant nerve fiber
MILTON LEVY ....................... The unreasonably high molar activity of nerve
growth factor
REV. J. C. CASSIDY, O. P. ......... Quantitative radioautography of vitellogenesis
L. J. BEAUREGARD in Artemia salina
C. F. STARMER

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Including Action of 1968 Annual Meeting

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SONNEBORN, Dr. T. M., Department of Zoology, Indiana University, Bloomington, Indiana 47401
SPECTOR, Dr. A., Department of Ophthalmology, Columbia University, College of Physicians and Surgeons, New York, New York 10032
SPIDEL, Dr. CARL C., 1873 Field Road, Charlottesville, Virginia 22903
SPIDEL, Dr. WILLIAM, Belfer Graduate School of Science, Yeshiva University, Amsterdam Avenue and 186th Street, Bronx, New York 10461
SPRITES, Dr. MORRIS ALBERT, Veterans Administration Hospital, Leech Farm Road, Pittsburgh, Pennsylvania 15206
SPRATT, Dr. NELSON T., Department of Zoology, University of Minnesota, Minneapolis, Minnesota 55414
STARR, Dr. RICHARD C., Department of Botany, Indiana University, Bloomington, Indiana 47401
STEINBACH, Dr. H. BURR, Director, Marine Biological Laboratory, Woods Hole, Massachusetts 02543
STEINBERG, Dr. MALCOLM S., Department of Biology, Princeton University, Princeton, New Jersey 08540
STEINHARDT, Dr. JACINTO, Georgetown University, Washington, D. C. 20007
STEPHENS, Dr. GROVER C., Division of Biological Sciences, University of California, Irvine, California 92650
STEPHENS, Dr. RAYMOND E. Department of Biology, Brandeis University, Waltham, Massachusetts 02154
STETTEN, Dr. DeWITT, Rutgers University Medical School, New Brunswick, New Jersey 08903
STETTEN, Dr. MAJORIE R., Rutgers University Medical School, New Brunswick, New Jersey 08903
STEWART, Dr. DOROTHY, 317 Arode Circle, High Point, North Carolina 27261
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STRITTmatter, Dr. PHILIPP, Department of Biochemistry, University of Connecticut, School of Medicine, Health Center, Hartford Plaza, Hartford, Connecticut 06105
STUNKARD, Dr. HORACE W., American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024
STURTEVANT, Dr. ALFRED H., California Institute of Technology, Pasadena, California 91109
SULKIN, DR. S. EDWARD, Department of Bacteriology, University of Texas, Southwestern Medical School, Dallas, Texas 75221
SUSSMAN, DR. MAURICE, Department of Biology, Brandeis University, Waltham, Massachusetts 02154
SWANSON, DR. CARL PONTIUS, Department of Biology, The Johns Hopkins University, Baltimore, Maryland 21218
SWOPE, MR. GERARD, JR., Croton-on-Hudson, New York, New York 10520
SZARÓ, DR. GEORGE, Department of Dermatology, Massachusetts General Hospital, Boston Massachusetts 02114
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TAYLOR, DR. ROBERT E., Laboratory of Biophysics, National Institutes of Health, Bethesda, Maryland 20014
TAYLOR, DR. W. RANDOLPH, Department of Botany, University of Michigan, Ann Arbor, Michigan 48104
TAYLOR, DR. W. ROWLAND, Department of Oceanography, Chesapeake Bay Institute, The Johns Hopkins University, Baltimore, Maryland 21218
TEWINKEL, DR. LOIS E., Department of Zoology, Smith College, Northampton, Massachusetts 01060
TRAGER, DR. WILLIAM, The Rockefeller University, New York New York 10021
TRAVIS, DR. D. M., Department of Pharmacology, University of Florida, Gainesville, Florida 32601
TRAVIS, DR. DOROTHY FRANCES, 1918 Northern Parkway, Greenberry Woods, Baltimore, Maryland 21210
TRINKAUS, DR. J. PHILIP, Department of Biology, Yale University, New Haven, Connecticut 06520
TROLL, DR. WALTER, Department of Industrial Medicine, New York University, College of Medicine, New York, New York 10016
TWEEDELL, DR. KENYON S., Department of Biology, University of Notre Dame, Notre Dame, Indiana 46556
TYLER, DR. ALBERT, Division of Biology, California Institute of Technology, Pasadena, California 91109
URETZ, DR. ROBERT B., Department of Biophysics, University of Chicago, Chicago, Illinois 60637
VAN HOLDE, DR. KENSAI EDWARD, Oregon State University, Department of Biochemistry and Biophysics, Corvallis, Oregon 97331
VILLEY, DR. CLAUDE A., Department of Biochemistry, Harvard Medical School, Boston, Massachusetts 02115
VINCENT, Dr. WALTER S., Department of Anatomy, University of Pittsburgh, Pittsburgh, Pennsylvania 15213
WAINIO, Dr. W. W., Bureau of Biological Research, Rutgers University, New Brunswick, New Jersey 08903
WALD, Dr. GEORGE, Biological Laboratories, Harvard University, Cambridge, Massachusetts 02138
WALLACE, Dr. ROBIN A., P. O. Box Y, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37890
WARNER, Dr. ROBERT C., Department of Chemistry, New York University College of Medicine, New York, New York 10016
WARREN, Dr. LEONARD, Department of Therapeutic Research, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania 19104
WATERMAN, Dr. T. H., 610 Klein Biology Tower, Yale University, New Haven, Connecticut 06520
WATKINS, Dr. DUDLEY TAYLOR, Department of Anatomy, University of Connecticut, Storrs, Connecticut 06268
WATSON, Dr. STANLEY WAYNE, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543
WEBB, Dr. H. MARGUERITE, Department of Biological Sciences, Goucher College, Towson, Maryland 21204
WEISS, Dr. LEON P., Department of Anatomy, The Johns Hopkins University, School of Medicine, Baltimore, Maryland 21205
WEISS, Dr. PAUL A., The Rockefeller University, New York, New York 10021
WERMAN, Dr. ROBERT, Department of Zoology, Hebrew University, Jerusalem, Israel
WHITAKER, Dr. DOUGLAS M., Las Palmas Apartment 204, 1800 Palm Boulevard, Brownsville, Texas 78520
WHITE, Dr. E. GRACE, 1312 Edgar Avenue, Chambersburg, Pennsylvania 17201
WHITING, Dr. ANNA R., 535 West Vanderbilt Drive, Oak Ridge, Tennessee 37830
WHITING, Dr. PHINEAS, 535 West Vanderbilt Drive, Oak Ridge, Tennessee 37830
WICHTERMAN, Dr. RALPH, Department of Biology, Temple University, Philadelphia, Pennsylvania 19122
WIERCINSKI, Dr. FLOYD J., Department of Biology, Northeastern Illinois State College, 5500 North St. Louis Avenue, Chicago, Illinois 60625
WIGLEY, Dr. ROLAND L., U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Woods Hole, Massachusetts 02543
WILBER, Dr. C. G., Department of Zoology, Colorado State University, Fort Collins, Colorado 80521
WILCE, Dr. ROBERT THAYER, Department of Botany, University of Massachusetts, Amherst, Massachusetts 01003
WILLIER, Dr. B. H., Department of Biology, The Johns Hopkins University, Baltimore, Maryland 21218
WILSON, Dr. J. WALTER, Department of Biology, Brown University, Providence, Rhode Island 02912
REPORT OF THE DIRECTOR

WILSON, DR. T. HASTINGS, Department of Physiology, Harvard Medical School, Boston, Massachusetts 02115
WILSON, DR. WALTER L., Department of Biology, Oakland University, Rochester, Michigan 48063
WINTERS, DR. ROBERT WAYNE, Department of Pediatrics, Columbia University College of Physicians and Surgeons, New York, New York 10032
WITSCHI, DR. EMIL, The Rockefeller University, New York, New York 10021
WITTENBERG, DR. JONATHAN B., Department of Physiology and Biochemistry, Albert Einstein College of Medicine, New York, New York 10461
WRIGHT, DR. PAUL A., Spaulding Building, Department of Zoology, University of New Hampshire, Durham, New Hampshire 03824
WRENCH, DR. DOROTHY, Department of Physics, Smith College, Northampton, Massachusetts 01060
WYTTENBACH, DR. CHARLES R., Department of Zoology, University of Kansas, Lawrence, Kansas 66044
YNTEMA, DR. C. L., Department of Anatomy, State University of New York, Upstate Medical Center, Syracuse, New York 13210
YOUNG, DR. DAVID KENNETH, Systematics-Ecology Program, Marine Biological Laboratory, Woods Hole, Massachusetts 02543
YOUNG, DR. D. B., Main Street, North Hanover, Massachusetts 02357
ZACK, DR. SUMNER IRWIN, The Pennsylvania Hospital, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania 19104
ZIGMAN, DR. SEYMOUR, University of Rochester School of Medicine and Dentistry, 260 Crittenden Boulevard, Rochester, New York 14620
ZIMMERMAN, DR. A. M., Department of Zoology, University of Toronto, Toronto 5, Ontario, Canada
ZINN, DR. DONALD J., Department of Zoology, University of Rhode Island, Kingston, Rhode Island 02881
ZIRKLE, DR. RAYMOND E., Department of Biophysics, University of Chicago, Chicago, Illinois 60637
ZORZOLI, DR. ANITA, Department of Physiology, Vassar College, Poughkeepsie, New York 12601
ZULLO, DR. VICTOR A., Department of Geology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118
ZWEIFACH, DR. BENJAMIN, c/o Department of AMES, University of California, San Diego, La Jolla, California 92037
ZWILLING, DR. EDGAR, Department of Biology, Brandeis University, Waltham, Massachusetts 02154
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REPORT OF THE DIRECTOR

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Levine, Dr. and Mrs. Rachmiel
Lillie, Mrs. Karl C.
Lobb, Professor and Mrs. John
Loeb, Dr. and Mrs. Robert F.
Lovell, Mr. and Mrs. Hollis R.
Marsland, Dr. and Mrs. Douglas
Marvin, Dr. Dorothy
Mast, Mrs. S. O.
Mather, Mr. Frank J., III
Mavor, Mrs. James W., Sr.
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McGillicuddy, Dr. and Mrs. John J.
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Newton, Miss Helen K.
Nichols, Mrs. George
Nickerson, Mr. and Mrs. Frank L.
Norman, Mr. and Mrs. Andrew
Normandie Foundation Inc.
Packard, Mrs. Charles
Park, Mr. and Mrs. Franklin A.
Park, Mr. Malcolm S.
Parpart, Mrs. Arthur K.
Patten, Mrs. Bradley
Pendleton, Dr. Murray E.
Pennington, Miss Anne H.
Perkins, Mr. and Mrs. Courtland D.
Philippe, Mr. and Mrs. Pierre
Putnam, Mr. and Mrs. William A., III
Ratcliffe, Mr. Thomas, Jr.
Redfield, Dr. and Mrs. Alfred
Reznikoff, Dr. and Mrs. Paul
Riggs, Mr. and Mrs. Lawrason, III
Robertson, Dr. and Mrs. C. W.
Robinson, Mr. Denis M.
Rogers, Mrs. Charles E.
Root, Dr. and Mrs. Walter S.
Rugh, Dr. and Mrs. Roberts
Saunders, Mr. and Mrs. Lawrence
Schwartz, Mrs. Victor A.
Shiverick, Mrs. Arthur
Smith, Mrs. Homer P.
Speidel, Mrs. Carl C.
Steinbach, Mrs. H. Burr
Stetten, Dr. and Mrs. DeWitt, Jr.
Stone, Mr. and Mrs. Leo
Stone, Mrs. Samuel M.
Stunkard, Dr. Horace W.
Swanson, Mrs. Carl P.
Swope, Mr. and Mrs. Gerard, Jr.
Swope, Mr. and Mrs. Gerard L.
Swope, Miss Henrietta H.
Tompkins, Mr. and Mrs. B. A. Whitney, Mr. G. G., Jr.
Waksman, Dr. and Mrs. Byron H. Wichterman, Mrs. Ralph
Waksman, Dr. and Mrs. Selman A. Wickersham, Mrs. James H.
Wallace, Dr. and Mrs. Stanley L. Wilhelm, Mr. and Mrs. Hilmar J.
Wang, Dr. and Mrs. An Wilson, Mrs. Edmund B.
Ware, Mr. and Mrs. J. Lindsay Wilson, Dr. May G.
Warren, Dr. and Mrs. Shields Witmer, Dr. and Mrs. Enos
Watt, Mr. and Mrs. John B. Wolfe, Dr. Charles
Webster, Mrs. Edwin S. Wolfensohn, Mrs. Wolfe
Whiteley, Mr. and Mrs. George C., Jr. Wrinch, Dr. Dorothy
Whiting, Dr. and Mrs. Phineas W. Yntema, Mrs. Chester L.

V. REPORT OF THE LIBRARIAN

The first annual report, 80 years ago, stated:

"A library is a necessity and it must be provided for in one way or another. Boston libraries are near enough to be of great service, but we cannot depend on them alone . . . we must have, as the minimum to begin with, all the important journals now printed in the four principal languages. It is most earnestly to be hoped that adequate means may be found to meet this all important requisite."

Adequate means were found. Today over 4,000 separate journal titles, in 30 languages, totaling 136,561 volumes are contained in the collection at Woods Hole. Boston libraries, as well as numerous libraries throughout the country and abroad depend on the Laboratory's library for service. In 1948 outside requests for journal articles totaled 180. This year we received 4,532 individual requests. As new colleges, industrial firms, and research laboratories are established, the MBL collection, 80 years in building, becomes increasingly valuable.

One of the main concerns of recent library committees has been the need for more space. Approximately 2,500 bound volumes and 1,000 unbound publications were added to the stacks annually and the journal sections of the library are now about to burst and pour down to the reprint floor. The committee recommended that the reprints should either be eliminated or removed to another area. A written vote of the members of the corporation at the annual meeting showed that the reprints must not be eliminated. Therefore a new location for this collection, totalling 243,000 reprints and covering one entire floor of the library, must be found.

Twenty years ago the library held 57,548 volumes. Today the total is 136,561.

Total number of journal titles received yearly in 1948 was 1,209. In 1968 the number received currently was 2,335.

Binding expenses in 1948 were $1,852. This year the library binding costs were $8,329.

In the past 20 years 100,000 reprints have been added to the reprint floor.
Twenty years ago the Woods Hole Oceanographic Institution budgeted $800 for the purchase of oceanographic material to be added to the collection. Today they are budgeting $15,000. Fortunately the Oceanographic has been adding their literature to the library since they were founded in 1930. The combined collection has led many to say that the most complete biological and oceanographical library in the world is here in Woods Hole.

If the MBL library is to continue to be of great service to the scientific community all new programs and techniques of information retrieval must be considered. The rapid development of xerography opens many possibilities. Future scientists may wish to purchase rare books individually rather than borrow, and the new technology may offer devices whereby this would not only be feasible but practical. This coming summer the library committee is planning working displays of computer retrieval equipment and hopefully many scientists will be drawn into discussion as to what they will want and expect of the MBL library in the years ahead.
VI. REPORT OF THE TREASURER

The market value of the General Endowment Fund and the Library Fund at December 31, 1968, amounted to $2,403,484 and the corresponding securities are entered in the books at a value of $1,575,096. This compares with values of $2,313,618 and $1,397,833 respectively, at the end of the preceding year. The average yield on the securities was 3.60% of the market value and 5.49% of the book value. Uninvested principal cash was $624. Classification of the securities held in the Endowment Fund appears in the Auditor's Summary of Investments.

The market value of the Pooled Securities at December 31, 1968, amounted to $824,502 as compared to book values of $666,202. These figures compare with values of $710,152 and $618,416, respectively, at the close of the preceding year. The average yield on the securities was 3.26% of the market value and 4.04% of the book value. Uninvested principal cash was in the amount of $7,653.

The proportionate interest in the Pool Fund Account of the various funds, as of December 31, 1968, is as follows:

<table>
<thead>
<tr>
<th>Fund</th>
<th>Proportionate Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pension Funds</td>
<td>22.492%</td>
</tr>
<tr>
<td>General Laboratory Investment</td>
<td>22.446%</td>
</tr>
<tr>
<td>F. R. Lillie Memorial Fund</td>
<td>2.447%</td>
</tr>
<tr>
<td>Anonymous Gift</td>
<td>.839%</td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Bio Club Scholarship Fund</td>
<td>.638%</td>
</tr>
<tr>
<td>Rev. Arsenius Boyer Scholarship Fund</td>
<td>.772%</td>
</tr>
<tr>
<td>Gary N. Calkins Fund</td>
<td>.728%</td>
</tr>
<tr>
<td>Allen R. Memhard Fund</td>
<td>.142%</td>
</tr>
<tr>
<td>Lucretia Crocker Fund</td>
<td>2.649%</td>
</tr>
<tr>
<td>E. G. Conklin Fund</td>
<td>.446%</td>
</tr>
<tr>
<td>Jewett Memorial Fund</td>
<td>.236%</td>
</tr>
<tr>
<td>M. H. Jacobs Scholarship Fund</td>
<td>.319%</td>
</tr>
<tr>
<td>Herbert W. Rand Fellowship</td>
<td>22.637%</td>
</tr>
<tr>
<td>Mellon Foundation</td>
<td>10.685%</td>
</tr>
<tr>
<td>Mary Rogick Fund</td>
<td>2.342%</td>
</tr>
<tr>
<td>Swope Foundation</td>
<td>5.879%</td>
</tr>
<tr>
<td>Clowes Fund</td>
<td>4.303%</td>
</tr>
</tbody>
</table>

Donations from MBL Associates for 1968 amounted to $8,360 as compared with $8,010 for 1967. Unrestricted gifts from foundations, societies and companies amounted to $1,378.
REPORT OF THE TREASURER

During the year we administered the following grants and contracts:

<table>
<thead>
<tr>
<th>Investigators</th>
<th>Training</th>
<th>MBL Institutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 NIH</td>
<td>3</td>
<td>2 NIH</td>
</tr>
<tr>
<td>5 NSF</td>
<td>1</td>
<td>3 NSF</td>
</tr>
<tr>
<td>1 Ford</td>
<td></td>
<td>1 Ford</td>
</tr>
<tr>
<td>1 Whitehall</td>
<td></td>
<td>1 AEC</td>
</tr>
<tr>
<td>1 ONR</td>
<td></td>
<td>1 ONR</td>
</tr>
<tr>
<td>---</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

The rate of overhead on continuing grants from Federal agencies is effectively 20% of the amounts expended. For new Federally funded research grants a provisional rate of 25% has been negotiated. However, the Laboratory is required to make an identifiable contribution to the total cost of each research project. The overhead on those grants wherein therefore was made in the funds awarded within the year, amounted to $96,482 as compared with $95,874 for the preceding year. A proposal to NSF for determining an indirect cost rate for 1968 and 1969 is under consideration.

The 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, 1968, the related statement of operating expenditures and income 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 of the year ended December 31, 1967.

In our opinion, the accompanying financial statements present fairly the assets, liabilities and funds of Marine Biological Laboratory at December 31, 1968 and 1967 and the results of its operations 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 to the financial statements, taken as a whole.

Boston, Massachusetts
March 29, 1969

Lybrand, Ross Bros. and Montgomery

It will be noted from the operating statement that the Laboratory activities for the year under review, amounted to a figure of a little over 1.5 million dollars, which amount is comparable to last year’s results.

Alexander T. Daignault,
Treasurer
### Investments

<table>
<thead>
<tr>
<th></th>
<th>1968</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investments held by Trustee:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Securities, at cost (approximate market quotation 1968—$2,403,484)</td>
<td>$1,575,096</td>
<td>$1,397,833</td>
</tr>
<tr>
<td>Cash</td>
<td>624</td>
<td>4,728</td>
</tr>
<tr>
<td></td>
<td><strong>1,575,720</strong></td>
<td><strong>1,402,561</strong></td>
</tr>
</tbody>
</table>

| Investments of other endowment and unrestricted funds: |              |              |
| Pooled investments, at cost (approximate market quotation 1968—$824,502) less $5,728 temporary investment of current fund cash | 660,474      | 612,688      |
| Other investments | 2,282,150   | 2,803,850   |
| Cash               | 7,653       | 387         |
| Accounts receivable | 33          | 54          |
| Due from current fund | 53,276    | 87,542      |
|                      | **$4,579,306** | **$4,907,082** |

### Plant Assets

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Land, buildings, library and equipment (note)</td>
<td>5,732,782</td>
<td>5,695,732</td>
</tr>
<tr>
<td>Less allowance for depreciation (note)</td>
<td>1,711,311</td>
<td>1,624,698</td>
</tr>
<tr>
<td></td>
<td><strong>4,021,471</strong></td>
<td><strong>4,071,034</strong></td>
</tr>
<tr>
<td>Construction in progress</td>
<td>1,316,468</td>
<td>110,042</td>
</tr>
<tr>
<td>Investments at cost which approximates market</td>
<td>842,629</td>
<td>50,000</td>
</tr>
<tr>
<td>Due from current funds</td>
<td>38,531</td>
<td>15,365</td>
</tr>
<tr>
<td></td>
<td><strong>$6,219,099</strong></td>
<td><strong>$4,246,441</strong></td>
</tr>
</tbody>
</table>

### Current Assets

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>251,061</td>
<td>107,483</td>
</tr>
<tr>
<td>Temporary investment in pooled securities</td>
<td>5,728</td>
<td>5,728</td>
</tr>
<tr>
<td>Inventories of supplies and bulletins</td>
<td>47,036</td>
<td>46,372</td>
</tr>
<tr>
<td>Other assets</td>
<td>7,146</td>
<td>8,698</td>
</tr>
<tr>
<td>Due to plant funds</td>
<td>(38,531)</td>
<td>(15,365)</td>
</tr>
<tr>
<td>Due to endowment funds</td>
<td>(53,276)</td>
<td>(87,542)</td>
</tr>
<tr>
<td></td>
<td><strong>$349,667</strong></td>
<td><strong>$205,145</strong></td>
</tr>
</tbody>
</table>
REPORT OF THE TREASURER

MARINE BIOLOGICAL LABORATORY

BALANCE SHEETS

December 31, 1968 and 1967

Invested Funds

<table>
<thead>
<tr>
<th></th>
<th>1968</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endowment funds given in trust for benefit of the Marine Biological Laboratory</td>
<td>$1,575,720</td>
<td>$1,402,561</td>
</tr>
<tr>
<td>Endowment funds for awards and scholarships:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principal</td>
<td>427,663</td>
<td>427,663</td>
</tr>
<tr>
<td>Unexpended income</td>
<td>39,394</td>
<td>32,738</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestricted funds functioning as endowment</td>
<td>2,336,190</td>
<td>2,857,890</td>
</tr>
<tr>
<td>Retirement fund</td>
<td>192,543</td>
<td>169,833</td>
</tr>
<tr>
<td>Pooled investments—accumulated gain</td>
<td>7,796</td>
<td>16,397</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4,579,306</td>
<td>$4,907,082</td>
</tr>
</tbody>
</table>

Plant Funds

<table>
<thead>
<tr>
<th></th>
<th>1968</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funds expended for plant, less retirements</td>
<td>6,886,046</td>
<td>5,805,774</td>
</tr>
<tr>
<td>Less allowance for depreciation charged thereto</td>
<td>1,711,311</td>
<td>1,624,698</td>
</tr>
<tr>
<td>Accounts payable</td>
<td>163,204</td>
<td>4,181,076</td>
</tr>
<tr>
<td>Unexpended plant funds</td>
<td>881,160</td>
<td>65,365</td>
</tr>
<tr>
<td></td>
<td>$6,219,099</td>
<td>$4,246,441</td>
</tr>
</tbody>
</table>

Current Liabilities and Funds

<table>
<thead>
<tr>
<th></th>
<th>1968</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts payable and accrued expenses</td>
<td>44,737</td>
<td>1,947</td>
</tr>
<tr>
<td>Advance subscriptions</td>
<td>23,712</td>
<td>15,210</td>
</tr>
<tr>
<td>Unexpended grants—research</td>
<td>28,727</td>
<td>32,353</td>
</tr>
<tr>
<td>Unexpended balances of gifts for designated purposes</td>
<td>23,764</td>
<td>23,899</td>
</tr>
<tr>
<td>Current fund</td>
<td>231,727</td>
<td>131,736</td>
</tr>
<tr>
<td></td>
<td>$ 349,667</td>
<td>$ 205,145</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.
# Marine Biological Laboratory

## Statement of Operating Expenditures and Income

Years Ended December 31, 1968 and 1967

<table>
<thead>
<tr>
<th>Operating Expenditures</th>
<th>1968</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries and Wages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td>$13,160</td>
<td>$8,905</td>
</tr>
<tr>
<td>Research</td>
<td>29,810</td>
<td>59,596</td>
</tr>
<tr>
<td>Dormitories</td>
<td>$19,932</td>
<td>37,929</td>
</tr>
<tr>
<td>Dining</td>
<td>21,188</td>
<td>39,000</td>
</tr>
<tr>
<td>Library</td>
<td>30,430</td>
<td>11,470</td>
</tr>
<tr>
<td>Back sets, serials and binding</td>
<td>37,051</td>
<td>37,051</td>
</tr>
<tr>
<td>Biological Bulletin</td>
<td>3,231</td>
<td>36,988</td>
</tr>
<tr>
<td>Support services:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparatus</td>
<td>47,042</td>
<td>41,172</td>
</tr>
<tr>
<td>Supply</td>
<td>84,600</td>
<td>52,587</td>
</tr>
<tr>
<td>Administration</td>
<td>81,338</td>
<td>65,936</td>
</tr>
<tr>
<td>Plant operation</td>
<td>127,089</td>
<td>90,778</td>
</tr>
<tr>
<td>Grant expenditures for support services</td>
<td>38,082</td>
<td>38,082</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$414,850</strong></td>
<td><strong>$493,963</strong></td>
</tr>
</tbody>
</table>

### Notes

- The table above shows the operating expenditures and income for the Marine Biological Laboratory for the years ended December 31, 1968 and 1967.
- The expenditures include salaries and wages, other costs and expenses, depreciation, and grants charged to operating expenses.
- The total includes all the above components for the year.
### MARINE BIOLOGICAL LABORATORY

**Statement of Operating Expenditures and Income**

**Years Ended December 31, 1968 and 1967**

<table>
<thead>
<tr>
<th>Income</th>
<th>Fees</th>
<th>Other</th>
<th>Total</th>
<th>Charged to Grants</th>
<th>Total</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>37,680</td>
<td>37,680</td>
<td>195,800</td>
<td></td>
<td>233,480</td>
<td>226,747</td>
</tr>
<tr>
<td>Research</td>
<td>128,415</td>
<td>128,415</td>
<td>416,231</td>
<td></td>
<td>544,646</td>
<td>548,022</td>
</tr>
<tr>
<td>Dormitories</td>
<td>82,833</td>
<td>82,833</td>
<td></td>
<td></td>
<td>82,833</td>
<td>72,007</td>
</tr>
<tr>
<td>Dining</td>
<td>73,135</td>
<td>73,135</td>
<td></td>
<td></td>
<td>73,135</td>
<td>69,210</td>
</tr>
<tr>
<td>Library</td>
<td>20,391</td>
<td>26,228</td>
<td>46,619</td>
<td></td>
<td>46,619</td>
<td>36,688</td>
</tr>
<tr>
<td>Biological Bulletin</td>
<td>38,451</td>
<td>38,451</td>
<td></td>
<td></td>
<td>38,451</td>
<td>38,119</td>
</tr>
<tr>
<td><strong>Support services:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparatus</td>
<td>31,409</td>
<td>31,409</td>
<td></td>
<td></td>
<td>31,409</td>
<td>33,833</td>
</tr>
<tr>
<td>Supply</td>
<td>45,602</td>
<td>45,602</td>
<td></td>
<td></td>
<td>45,602</td>
<td>42,247</td>
</tr>
<tr>
<td>Administration</td>
<td>12,769</td>
<td>12,769</td>
<td></td>
<td></td>
<td>12,769</td>
<td>11,909</td>
</tr>
<tr>
<td>Investments income</td>
<td>244,364</td>
<td>244,364</td>
<td></td>
<td></td>
<td>244,364</td>
<td>180,954</td>
</tr>
<tr>
<td>Gifts used for current expense</td>
<td>13,224</td>
<td>13,224</td>
<td></td>
<td></td>
<td>13,224</td>
<td>27,868</td>
</tr>
<tr>
<td>Allowance for indirect costs</td>
<td>96,482</td>
<td>96,482</td>
<td></td>
<td></td>
<td>96,482</td>
<td>95,874</td>
</tr>
<tr>
<td>Grants for general support</td>
<td>78,160</td>
<td>78,160</td>
<td></td>
<td></td>
<td>87,644</td>
<td>132,097</td>
</tr>
<tr>
<td>Grants for support services</td>
<td>3,212</td>
<td>3,212</td>
<td></td>
<td></td>
<td>43,584</td>
<td>43,584</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>3,212</td>
<td>3,212</td>
<td></td>
<td></td>
<td>3,212</td>
<td>8,085</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>224,937</td>
<td>707,418</td>
<td>932,355</td>
<td>665,099</td>
<td>1,597,454</td>
<td>1,612,888</td>
</tr>
</tbody>
</table>

Excess of current expenditures and depreciation
over current income: 63,071
Reduction in plant funds for depreciation: 86,613
Excess current income: $23,542
Year Ended December 31, 1968

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Invested funds</td>
<td>$4,907,082</td>
<td>$194,483</td>
<td>$265,049</td>
<td>$244,123</td>
<td>$543,185</td>
<td>$4,579,306</td>
</tr>
<tr>
<td>Unexpended plant funds</td>
<td>$65,365</td>
<td>812,396</td>
<td>3,399</td>
<td></td>
<td></td>
<td>$881,160</td>
</tr>
<tr>
<td>Unexpended research grants</td>
<td>$32,353</td>
<td>1,436,906</td>
<td>839,358</td>
<td>604,174</td>
<td></td>
<td>$25,727</td>
</tr>
<tr>
<td>Unexpended gifts for designated purposes</td>
<td>$23,899</td>
<td>9,126</td>
<td>8,360</td>
<td>901</td>
<td></td>
<td>$23,764</td>
</tr>
<tr>
<td>Current fund</td>
<td>$131,736</td>
<td>521,700</td>
<td></td>
<td></td>
<td></td>
<td>$231,727</td>
</tr>
</tbody>
</table>

($415,024) (4)  

Gifts:  
821,522  
Grant for facilities construction:  
604,174  
Grants for research, training and support:  
832,732  
Appropriated from current income and other:  
29,925  
Net gain on sale of securities:  
164,558  
(1) Excess of current income over expenditures:  
23,542  
(2) Adjustment of prior years' support grants:  
(30,227) (2)  
(3) Transfer from invested funds:  
521,700  
(4) Expended for new laboratory and dormitory:  
(415,024)  

$2,552,902  

Expended for new laboratory and dormitory:  
1,019,198  
Scholarship awards:  
8,025  
Payments to pensioners:  
13,417  
Expended for current operations:  
106,676  
Other:  
944  

$1,148,260
### Summary of Investments

**December 31, 1968**

<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 1968</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>$25,065</td>
<td>2.0%</td>
<td>$24,360</td>
<td>1.2%</td>
<td>$1,250</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>712,367</td>
<td>57.4%</td>
<td>595,270</td>
<td>30.4%</td>
<td>30,256</td>
</tr>
<tr>
<td>Preferred stocks</td>
<td>113,044</td>
<td>9.1%</td>
<td>155,657</td>
<td>7.9%</td>
<td>4,142</td>
</tr>
<tr>
<td>Common stocks</td>
<td>390,974</td>
<td>31.5%</td>
<td>1,185,185</td>
<td>60.5%</td>
<td>36,216</td>
</tr>
<tr>
<td><strong>Total securities held by Trustee:</strong></td>
<td>$1,241,450</td>
<td>100.0%</td>
<td>$1,960,472</td>
<td>100.0%</td>
<td>71,864</td>
</tr>
</tbody>
</table>

| **General educational board endowment fund:** |      |            |                   |            |                      |
| U. S. Government securities | 53,112 | 15.9% | 51,642 | 11.7% | 2,650 |
| Other bonds                 | 184,745 | 55.4% | 157,965 | 35.7% | 6,909 |
| Preferred stocks            | 47,323 | 14.2% | 83,480 | 18.8% | 980 |
| Common stocks               | 48,466 | 14.5% | 149,925 | 33.8% | 4,117 |
| **Total securities held by Trustee:** | 333,646 | 100.0% | 443,012 | 100.0% | 14,656 |

| **Investments of other endowment and unrestricted funds:** |      |            |                   |            |                      |
| Pooled investments: |      |            |                   |            |                      |
| U. S. Government securities | 13,795 | 2.1% | 14,000 | 1.7% | 765 |
| Corporate bonds             | 217,194 | 32.6% | 199,395 | 24.2% | 10,343 |
| Common stocks               | 435,213 | 65.3% | 611,107 | 74.1% | 15,792 |
| **Total securities held by Trustee:** | 666,202 | 100.0% | $824,502 | 100.0% | 26,900 |

| Less temporary investment of current fund cash | (5,728) | (241) |                      |            |                      |
| **Total investments of other endowment and unrestricted funds:** | 660,474 | 26,659 |                      |            |                      |

| **Other investments:** |      |            |                   |            |                      |
| U. S. Government securities | 27,938 | | 1,133 | | |
| Other bonds                 | 15,029 | | 750 | | |
| Preferred stocks            | 3,448 | | 135 | | |
| Common stocks               | 46,186 | | 2,483 | | |
| Real estate                 | 17,549 | | | | |
| Short-term commercial notes | 2,172,000 | | 146,074 | | |
| **Total investments of other endowment and unrestricted funds:** | 2,282,150 | | 150,575 | | |

| **Total investments of other endowment and unrestricted funds:** | $2,942,624 | 177,234 |                      |            |                      |

<p>| <strong>Total:</strong> |      |            |                   |            | 263,754 |</p>
<table>
<thead>
<tr>
<th>Cost</th>
<th>Income 1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custodian's fees charged thereto</td>
<td>(3,080)</td>
</tr>
<tr>
<td>Adjustment of prior years' income</td>
<td>4,375</td>
</tr>
<tr>
<td>Investment income distributed to invested funds</td>
<td>265,049</td>
</tr>
<tr>
<td>Plant investments:</td>
<td></td>
</tr>
<tr>
<td>Federal agency and corporate bonds</td>
<td>340,000</td>
</tr>
<tr>
<td>Common stock</td>
<td>502,629</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$ 842,629</td>
<td></td>
</tr>
<tr>
<td>Current investments:</td>
<td></td>
</tr>
<tr>
<td>Temporary investment in pooled securities</td>
<td>$ 5,728</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Total investment income</td>
<td>$268,689</td>
</tr>
</tbody>
</table>